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and integrated development of the
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BACKGROUND STUDY

This document was prepared by the Ocean Economics and Technology Branch of the United Nations, Department of International Economic and Social Affairs. It should be regarded as a PRELIMINARY text, subject to comments and suggestions which will be incorporated in the final text.

PREFACE

This document was prepared as a background paper for the Seminar/ Workshop on Coastal Area Management and Integrated Development to be held in Guayaquil, Ecuador, in May 1981. The Seminar is organized at the request of Ecuador with the assistance of the United Nations and in compliance with Economic and Social Council resolution 1970 (LIX), Uses of the Sea and Coastal Area Development of 30 July 1975, and in response to Recommendation TEMA II.13 issued during the Second Session of the Working Committee for Training, Education and Mutual Assistance (TEMA) of the UNESCO Intergovernmental Oceanographic Commission, which was held in New York, 18-23 July 1977.

The Seminar has four main objectives:

To familiarize government planners and policy makers with the concept of coastal development and thus to acquaint them with the basic elements and prerequisites of an integrated approach to the management of the coastal area in the context of national planning;

To promote an awareness at all levels of government, the scientific community and private enterprise of the importance of the coastal area in the country's over-all problems in economic, social, ecological and political terms;

To provide a forum for informal discussion where the people directly responsible for coastal area development will have an opportunity to discuss and exchange information of great value not only to the citizens of Ecuador, but to other developing countries which may want to benefit from that experience;

To consider the linkage between the coastal area and other development regions and to explore methods for the harmonious development of resources, regional complementarity and the integration of the coastal area in the context of national planning.

The present arrangement of Ecuador's space, the socio-political situation and the immediate and potential availability of resources (natural, human and capital) point to the coastal area as one of outstanding interest destined to play a predominant role in national development in the short, medium and long term.

Ecuador is starting to be aware of the importance of the coastal area and has great expectations regarding the contribution of coastal resources to economic and social development. That awareness is reflected in a number of chapters of the text of the National Development Plan, which indicates the necessity for and the intention to "formulate a national policy for coastal area development and management".^{1/}

The importance which the Government attributes to this Seminar is the result of various determining factors and circumstances, namely,

(i) The Seminar is being held concurrently with the beginning of the 1980-1984 Development Plan, which defines the aims, objectives and global strategies to be implemented in the five-year period and the sectoral policies and programmes to be carried out by the State through the competent administrative departments.

(ii) In that context, a Seminar on Coastal Area Integrated Development and Management helps to create the necessary conditions for the analysis and discussion of the problems of the area and enables the participants to study the specific coastal problems of concern to the country.

(iii) It will therefore promote the professional development of the participants by providing an opportunity for them to become familiar with the theoretical and practical aspects of coastal management and planning with the coastal development programmes being carried out in various countries.

(iv) Since the formulation of coastal area development and management strategies is not confined to rigid models, the participants will be able to benefit from the diversity of experience offered by the international experts,

^{1/} Ecuador, Plan Nacional de Desarrollo del Gobierno Democrático (1980-1984), Segunda Parte, Tomo V. Políticas y programas sectoriales: recursos naturales, infraestructura física y desarrollo urbano, pág. 148.

compare and evaluate the results in the light of national needs and point out the possibilities and limitations of the alternatives presented.

This document was prepared by Mr. Luis Capurro, UNESCO consultant, and by Miss Stella Maris A. Vallejo, Economic Affairs Officer of the Ocean Economics and Technology Branch of the United Nations Department of International Economic and Social Affairs.

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1. INTRODUCTION

Purpose of the study

The purpose of this study is to present a comprehensive and integrated analysis of conditions in the coastal area of Ecuador, involving a review of the physical features of the coastal environment and its actual and potential resources, how they are being used and developed, as well as the short- and medium-term trends and prospects imposed by the National Development Plan which are likely to modify their utilization. Thus, it should serve as an information document to be circulated to the national and international experts and to the participants prior to the Seminar.

Methodology

Three broad interrelated subjects will form the common denominator for this study: the ecosystem linking man with the coastal environment; the spatial system linking the coastal area with other regions of the country in a complex interchange of economic, cultural, political and social currents; and the institutional framework within which several government and private sectors and levels, with varying degrees of responsibility, are seeking to promote sectoral development and are directly influencing the future development of the area.

This basic background will enable the reader with no previous experience in coastal management to focus on the coastal area and to have an over-all view, noting the most significant problems, and to evaluate its future prospects in the broader context of national planning.

The study partially discards traditional subject approaches to the problem and gives special attention to the relationship between man and the coastal environment, the spatial consequences and environmental impact of human intervention and the regional structures which develop and progressively alter and condition the linkage between the coastal area and other regions of the country.

Since it would be impossible in a single study to describe and discuss the many aspects which characterize the coastal area and determine its development, this approach focusses on those fields of knowledge which are basic to a systems analysis of the coastal environment and on the increasingly important topics relating to the future development of the region.

To achieve that end, data and information will be summarized on three levels: first, to provide an over-all picture of the most outstanding features of the coastal physical environment which require special attention in coastal management. Secondly, to examine the principal economic activities taking place in the coastal area and their positive and/or negative effects on the coastal environment; and third, to integrate the coastal environment as a whole in the national picture.

The information contained in this document is synthetized in the following issues:

- The coastal physical environment
- Man and the coastal environment
- The physical infrastructure
- Principal economic activities
- Problems of degradation of the environment and environmental protection
- The coastal area in the structure of Ecuador's space
- The institutional framework.

The conceptual framework

The first question the reader may ask is whether the process of integrated coastal area development and management is sufficiently different from the development of other populated areas of the country to justify separate treatment.

Although the principles and procedures of coastal area management are basically similar to those which would apply to other populated areas, the coastal area has certain special characteristics which make it subject to special treatment, such as:

The concentration of population in the coastal area and its hinterland. Any world population map will confirm that fact. For obvious reasons of human geography, people tend to settle in the coastal area because it offers a wide range of opportunities for development.

From the ecological point of view, the coastal area is a frontier or boundary zone, in other words, a "bridge" between the land and marine environments. That implies that its natural and other phenomena are generally much more complicated to understand, predict and control. It constitutes a geographical space, limited in area, with distinctive environmental characteristics. The biophysical processes, which depend on the interaction of land, sea and air, are extremely intense and create ecological conditions exclusively applicable to the coastal area. Those conditions include its fragility and vulnerability to external forces, that is, to physical, chemical or biological changes in its components.

There is usually a wider gamut of human activities in the coastal area than in any other geographical land area. The fact is that the seafront offers advantageous conditions for the utilization of renewable and non-renewable resources, particularly oil, for recreation, urbanization, transshipment of raw materials and manufactured goods, industry, etc.

However, the development of natural resources and other intensive uses of the coastal area are not always complementary, thus giving rise to a broad range of conflicts between activities and to negative interactions with what is already a highly complex environment.

Coastal management problems have been classified in three groups: (a) those resulting from the interaction between various activities; (b) those resulting from the modification of coastal processes or the destruction of critical environmental components, and (c) those resulting from pollution of coastal waters and estuaries.

Accordingly, the basic objective of coastal management is to ensure a level and type of development of the area and its resources which allowed the maximum utilization of its resources, without altering the ecological systems on which the productivity of the area is based. An integrated approach to management of those resources has proved extremely useful in making important environmental and socio-economic decisions which would not have been given due weight if they had been regarded strictly as sectoral decisions.

Definition of the geographical-political scope of the study

For purposes of this study, the coastal area is defined as a strip of land and the adjacent marine space (water and submerged land), varying in width, in which the interaction between the land environment and the marine and submarine environments is most intense and where the ecology of the land and human activities affect the ecology of the ocean space, vice versa.

The geographical definition of the interior (landward) boundary is extremely difficult. Administratively, comprises 16 cantons with outlets to the sea. This statistical, legislative and political unit has been used as a point of departure for the collection of information, as has the aggregation of cantons when it defines, for example, agricultural zones for integrated programming.

Unfortunately, much of the basic data on resources is not organized like the data on population, production, income, etc. The political-administrative boundaries have proved to be extremely rigorous for purposes of identifying and examining resources and uses as well as natural systems, which have flexible boundaries, sometimes determined by economic forces and sometimes by particular environmental conditions.

While the external (seaward) boundary, although is easier to determine scientifically either by the chemical composition of the waters or by the edge of the continental shelf, several factors should be considered in its determination, like the influence of the main rivers, in this case the Guayas River, and the Esmeraldos which can be felt to a great distance ashore.

Consequently, for purposes of this study, the definition of the geographical and political scope of the coastal area is necessarily arbitrary and/or vague because it can vary widely depending on physical, administrative, economic, ecological and political criteria.

Data collection and processing

The nature of this study, which deals with various national sectors direct or indirectly dependent on the coastal and marine environment and how they are interrelated - in space and time - with other complementary sectors of the economy, is such that there were often difficulties in obtaining information.

The replies to the "Outline of Basic Information" prepared by the United Nations as a questionnaire addressed to the various government and private agencies concerned with the development of Ecuador's coastal area constituted one of the most important sources of information used in preparing this study.

The outline was divided into four basic areas: (i) principal trends, problems and prospects of each sector in the coastal area; (ii) identification of causes and effects of coastal problems; (iii) plans and instruments of action; and (iv) institutional aspects. The largest possible volume of information was extrapolated and incorporated in the study, wherever possible without change, particularly when it dealt with the definition of coastal problems.

Quantitative and qualitative data on resources and uses relating to the coastal or marine environment were not always available. While in some cases, tabulations could be derived for the coastal area, in others, it proved very difficult to break down the information and a breakdown could not be justified given the nature of the study. Among the available data were many reports

or studies on questions relating to coastal problems, but they were sometimes extremely specialized or contained information which was out of date or irrelevant to the purposes of the study. In view of its objective, this study should be regarded as a prelude to an understanding of the whole area and to much more detailed and rigorous future studies. However, it is hoped that this synthesis in a single document of the vast amount of varied information which was available will provide the participants with a broad picture of the coastal area of Ecuador, its problems and prospects and its role in the wider context of national development.

Acknowledgements

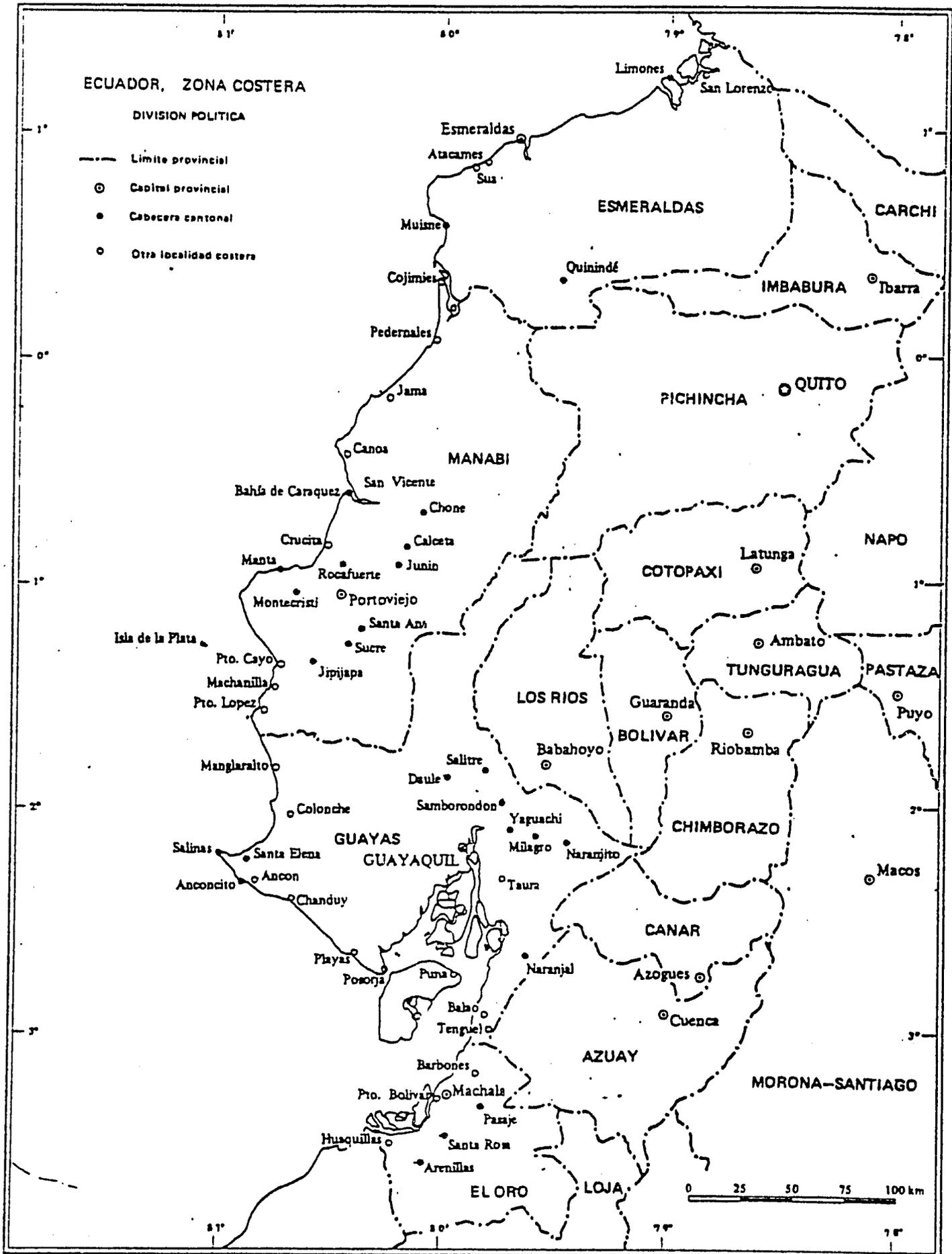
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Ministerio de Obras Públicas (Ministry of Public Works)
Ministerio de Recursos Naturales y Energéticos (Ministry of Natural
Resources and Energy)
Ministerio de Relaciones Exteriores (Ministry of Foreign Affairs)
Ministerio de Salud (Ministry of Health)
Subsecretaría de Recursos Pesqueros (Undersecretary for Fishing Resources)

ECUADOR, ZONA COSTERA

DIVISION POLITICA

- Limite provincial
- ⊙ Capital provincial
- Cabecera cantonal
- Otra localidad costera



II. THE COASTAL PHYSICAL ENVIRONMENT - THE BASIS FOR SUSTAINING LIFE

The coastline

The coastline of Ecuador is 950 km long from the Mataje River, which forms the border with Colombia on the north, to the Boca de Capones, the border with Peru on the south (see Map 1). The north-south coast is broken line or curve; the most easterly point of the coast ($78^{\circ} 47' W$) lies at the mouth of the Mataje River, and the most westerly point ($80^{\circ} 59' W$) at Puntilla de Santa Elena. The coast is a succession of alternating bays and capes; to that extent only, it is irregular. This monotony is broken only in the south by the Gulf of Guayaquil, the principal geographical feature not only of Ecuador but of the entire west coast of South America. In the north, the mouths of the Capayas, Santiago and Mataje Rivers form an intricate network of estuaries, mangroves and marshes. In the north, the Jambelí Archipelago, which comprises a large portion of the coast of El Oro Province, is the most notable feature.

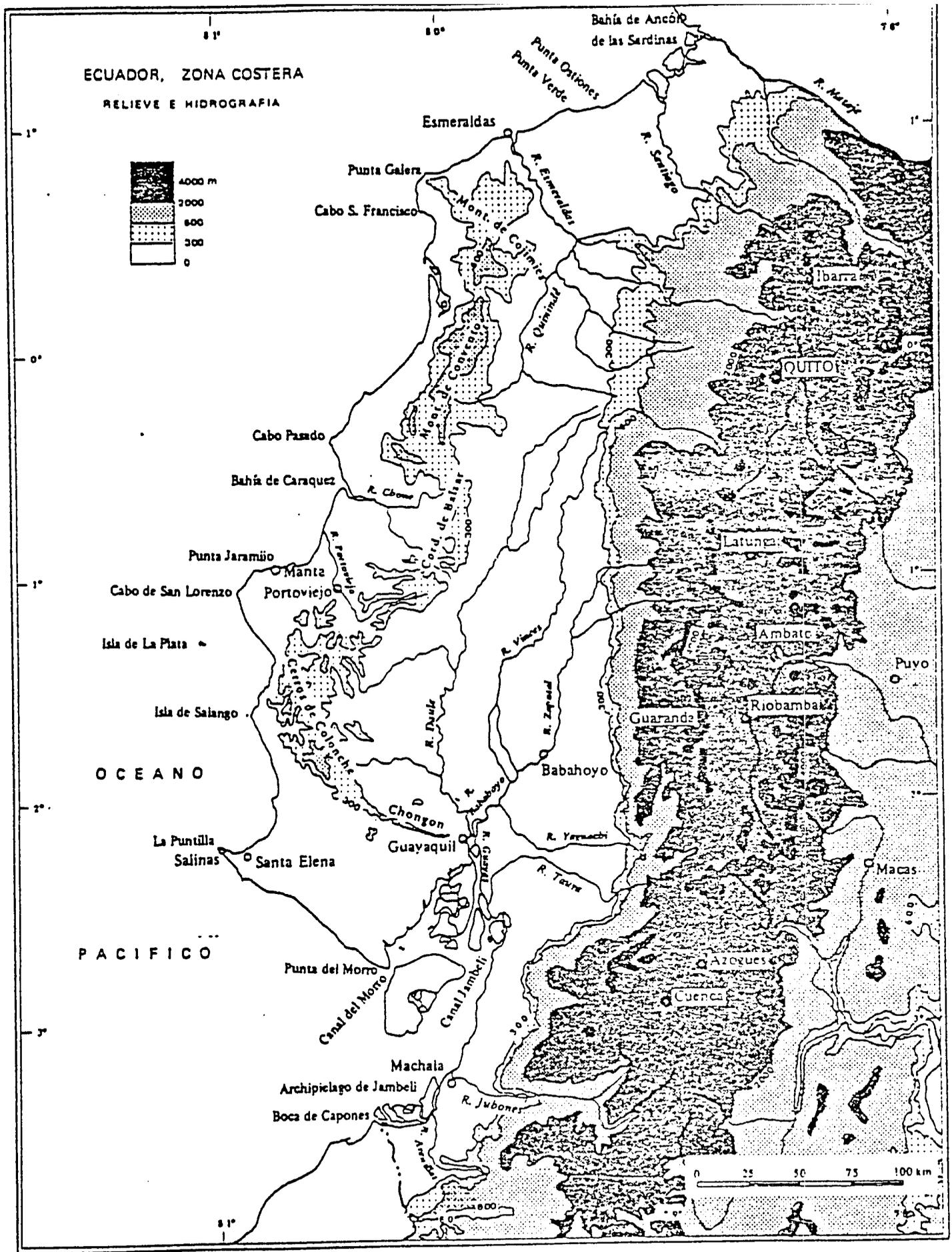
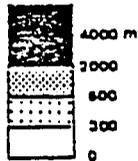
Basic characteristics of the landward coastal area

The long Ecuadorian coast shelters a broad range of geographical environments, diversified mainly by the topography and, particularly, the climatic conditions. Whereas, in a broader sense, the coastal plain includes a wide natural area which exceeds the geographical limits imposed by this study, the topography of the coast shows a low, rolling plain, with rises ranging from 20 m to 700 m above sea level, and relatively flat land with an incline of less than 5 per cent.

This plain is intersected by the Coastal Range (Cordillera) made up of Chongon, Colonche, etc. Mountains and the Intermediate Depression. The latter is topographically divided by a low plateau in El Carmen, Manabí Province, which gives rise to the two big river basins of western Ecuador: the Guayas River basin, which flows south and empties into the Gulf of Guayaquil, and the basin

ECUADOR, ZONA COSTERA

RELIEVE E HIDROGRAFIA



The Guayas River basin occupies most of the "Coast". It is made up of the catchment area of the river system formed by the Daule, Vinces and Babahoyo Rivers and their tributaries, which converge north of Guayaquil into a single collector, the Guayas River, which has an annual discharge averaging 30 million cubic m, after draining an area of 34,000 sq km. It is the principal artery of the most important agricultural zone of the country.

It has a strong impact on the coastal and adjacent marine area and vice versa; the tidal effect penetrates up to 80 km north of Guayaquil from the Guayas estuary when it is low tide and drops to 40 km during the rainy season.

Many small torrential rivers rise in the Coastal Range and flow to the sea only during the rainy season.

In the south, the lesser basins of the Jubones, Santa Rosa and Arenillas Rivers empty into an area of streams which are gradually drying up as a result of sedimentation washed along by the river.

The most important diversifying factor in the coastal plain is the climate. It has been pointed out that the coastal area of Ecuador is one of the smallest transition zones of all of South America.^{1/} Within a few degrees of latitude, the land changes from tropical jungle in the north to desert in the south. The north shares the dual rainy season with Colombia, with enough annual rainfall to support the rain forest. South of the Esmeraldas River, in the south central zone, the climate is marked by a rainy season known in the vernacular as "winter", which runs from December to May, and a dry season known as "summer" which runs from May to December, with the rainy season starting later and getting shorter as you go south (see table).

^{1/} Preston, James. "Latin America". Odyssey Press, New York, p. 150. 1959.

<u>Place</u>	<u>Latitude</u>	<u>Longitude</u>	<u>Altitude</u> (metres)	<u>Average</u> <u>temperature</u> (degrees)	<u>Annual rainfall</u> (cubic metres)
San Lorenzo	1°04'N	80°54'W	6	25,6	Ranging from 1.800 to 3200
Limones (Valdéz)	1°15'N	79°00'W	4	27	Ranging from 2.500 to 4200
Esmeraldas	0°59'N	79°42'W	4	24,5	Ranging from 600 to 1300
bañia de Caraquez	0°36'S	80°25'W	4	24,8	Ranging from 300 to 700
Portoviejo	1°03S	80°27'W	44	24,5	Ranging from 400 to 750
Salinas	2°13'S	80°58'W	6	23,4	Ranging from 100 to 300
La Libertad	2°14'S	80°57'W	4	24,2	Ranging from 100 to 300
Guayaquil	2°10'S	79°50'W	5	25,2	Ranging from 900 to 1400
Taura	2°20'S	79°49'W	17	25	Ranging from 600 to 1800
Puná (City)	2°44'S	79°55'W	4	25,2	Ranging from 900 to 1500
Puerto Bolívar	3°16'S	79°59'W	4	24,8	Ranging from 900 to 1600

In the predominantly arid central zone of the coast, the south of Manabi Province and north of Guayas Province are especially dry, with the highest aridity in the Santa Elena Peninsula (see map 3).

Towards the east, this aridity diminishes in the southern Guayas River Basin, where there are moderate temperatures, high humidity and high precipitation during the rainy season. But towards the south, the arid zone reappears; however, although it is an extension of the climate of the Peruvian Coast, it does not get as dry as that coast.

The natural vegetation reflects the transition in climates and the ecological (soil) conditions of the coastal area itself. There are hydrohalophilic shrubs or mangroves in San Lorenzo Bay, Boca de Cojimies, Caraquez Bay, the Gulf of Guayaquil and Puerto Bolivar as far as the Peruvian border.

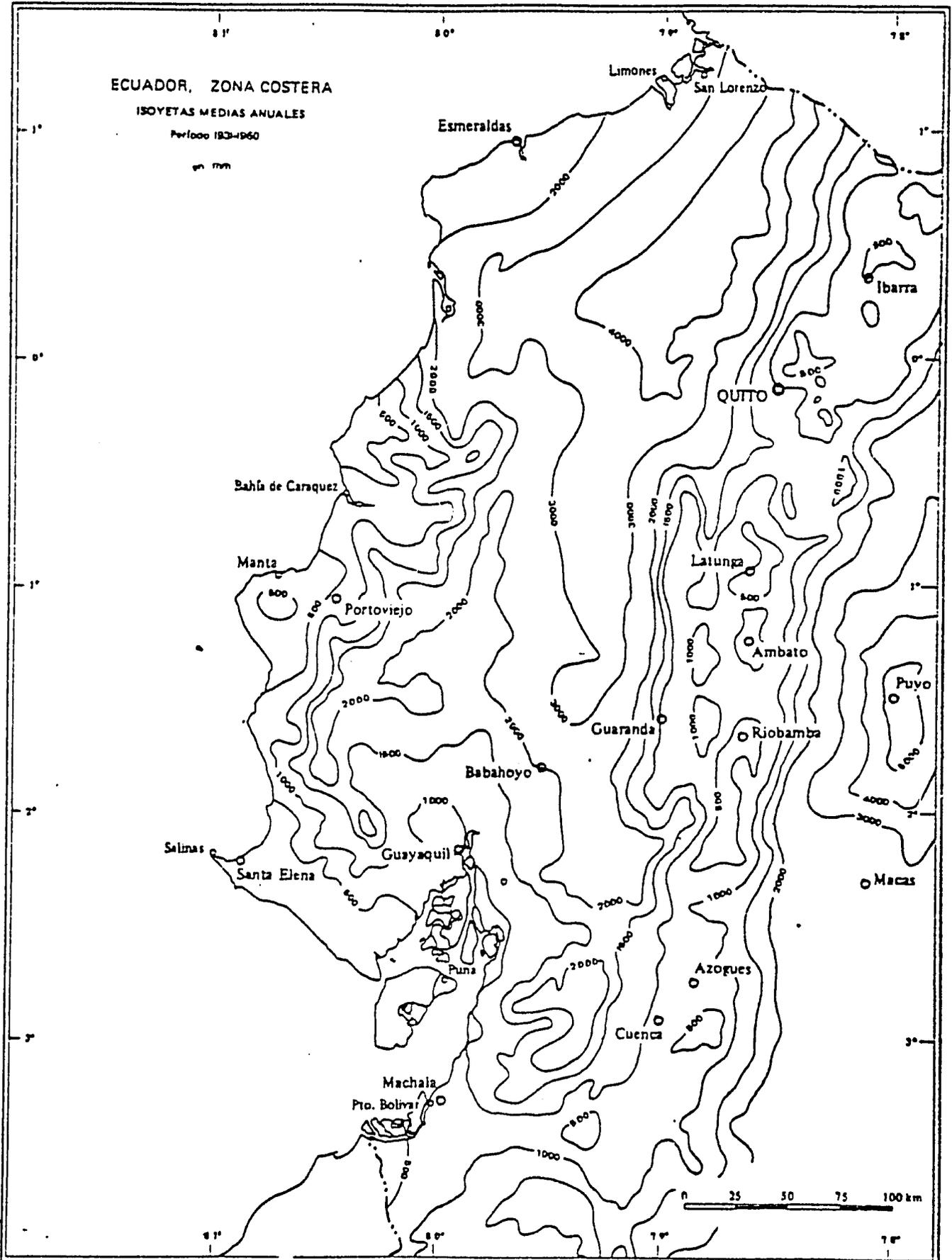
The Esmeraldas coast, which is very humid, hot and rainy, harbours the macrothermal rain forest. Towards the centre and south of the coast, the aridity creates alternately savannahs, deciduous forests and xerophilic flora. The halophilic shrubs are found along the coastal sand dunes and in salt-penetrated soils.

ECUADOR, ZONA COSTERA

ISOYETAS MEDIAS ANUALES

Periodo 1931-1960

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Basic features of the estuarine and marine zone

There is very little known about the nature of the Ecuadorian coast and the coastal processes. Ayon^{2/} notes that "no detailed studies have been made in Ecuador for purposes of the practical planning of the use of the coast in accordance with prevailing geological and oceanographic conditions...." The documentation available in the country describes a few types of coast^{3/} with similar characteristics but makes no reference to integrated processes (atmospheric, terrestrial and marine) which produce a diversity of coastal environments.

Two major types of coasts have been identified:^{4/}

(1) Steep or craggy coasts, developed from the outcroppings of the Coastal Range. They are made up of a combination of volcanic rock and volcanic sediments, with high outcroppings of tertiary sand and clay sediments resulting from a series of quaternary tectonic upheavals. The continental shelf in those areas is narrow or non-existent, with the topography of the continent continuing under the sea. In terms of coastal processes, marine erosion takes precedence over sedimentation. This type of coast is found at Cabo San Francisco, Puntilla de Santa Elena, Manglaralto, etc.

(2) Low-lying coasts, which are characterized by a topography of not very steep inclines, formed lithologically by sedimentary rock, which show the effect of recent marine, river-marine and river inflows or fills. The river-marine inflows - forming estuaries and deltas - are irregular, very low, flat, with islands, canals

^{2/} Ayon, H. "Engineering geology for planning the use of the coasts of Ecuador". Working paper, 1978, p. 2.

^{3/} Geomorphological, with regard to coastal processes, and according to types of coast.

^{4/} A summary has been made on the subject according to: The division used by the National Agrarian Regionalization Programme, Ministry of Agriculture and Livestock of Ecuador. Miró, M., Ayón, E. and Benitez, B. Morphology and structure of the continental shelf of Ecuador, INOCAR, 1976. Zapata Navarro, Barnardo. "Utilization of the coastal area for marine crops in Ecuador": In Latin American Seminar on the application of ocean and coastal engineering to the priority problems of Latin America. Polytechnic Institute of the Litoral/Organization of American States. Guayaquil, Ecuador, 1978.

and swamps reflecting an unstable balance between sedimentation and oceanic circulation, and a tendency to deposition. They are linked to alluvial plains with a large sediment content. The inflow of fresh water from the rivers forms a large highly productive area. The bank is covered with mangroves, which define the intertidal zone and remain above water at low tide and under water at high tide. The mouths of the Guayas, Santiago, Cayapas and Mataje Rivers are most representative of this type of coast.

The coasts formed by sea and wind deposits are broad and sandy. They are linked with an alluvial plain, and lagoons dot the landscape behind the coastal cordon, which is very straight and sandy. Between Manta and Punta Jaramijó, the dunes of the beach are clearly visible; they form an unbroken cordon a few km in length. In Colonche, the coasts are very low and straight; the adjacent land is very flat, formed by the alluvial deposits of the Colonche River.

Submarine morphology

The main feature of Ecuador's submarine topography is the trench at the foot of the continental shelf, which is the continuation of the one that traverses Chile and Peru. In plate tectonics terms, pre-continental Ecuador sits over a subduction area where the Nazca ocean plate plunges under the Andes.

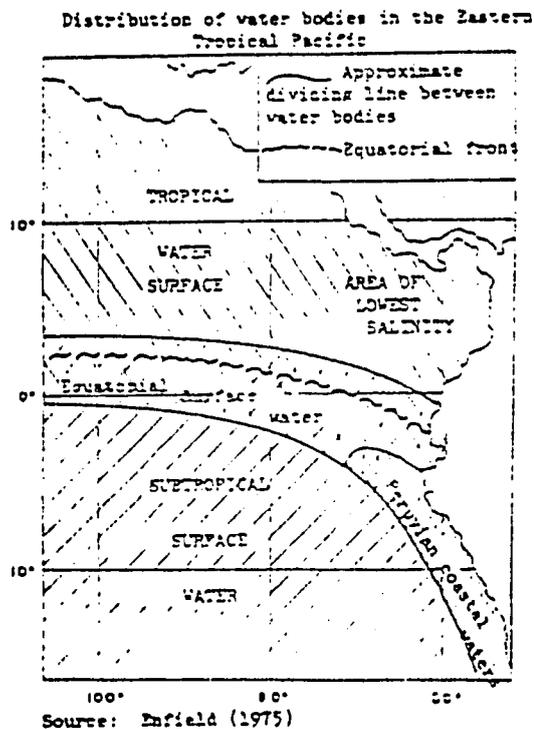
The Ecuadorian coast is a transition zone between the model represented by the coasts of Chile and Peru and the delta-dotted coasts with large amounts of sediment which stretch towards the shelf of Ecuador and Colombia.

Ecuador's continental shelf does not run parallel to the coast. At three points, opposite Punta Galera, Cabo San Lorenzo and Puntilla Santa Elena, the shelf is very narrow. The entire length of the shelf is about 24,000 sq km, which is only one tenth of the present land area of Ecuador. Its average width is 47 km, its average

Ecuador's continental slope is 43 km wide and has a maximum depth of between 2,000 and 4,000 m. Its incline is 7 per cent, or 4° .

Oceanographic aspects

The movement of the ocean, by its very nature, cannot easily be limited to the Ecuadorian coast since its regime is conditioned by its circulation in a much wider region. The characteristics of that circulation will therefore have to be explained in a broader context. Map 2 shows the approximate distribution of water bodies in the region.



The coast of Ecuador is bathed by the warm and relatively salt-free Tropical Surface Water Body of the North Pacific, which normally runs in latitude from the Equator to 13° N and is characterized by temperatures exceeding 25°C and a salt content below $33^{\circ}5$ per mil, the latter caused by excess precipitation and river discharge over evaporation. Below the Equator as far as the border of Perú,

Pacific and the Surface Water of the Equator, with an infusion of cold and salt water from the Peruvian Current. These water bodies converge to form the intense Equatorial Front. The Front occupies a strip about 3° latitude in width; it lies between 0° and 5° S, close to the land, and flows in a west-northwesterly direction near the Galapagos Islands, where it is situated from 0° to 3° N. The Front contains water with temperatures ranging from 19° to 25°C , with a salt content ranging from 35 to 33.5 parts per mil, from south to north respectively. This mixture of tropical waters and Peruvian coastal waters makes up the eastern part of Ecuador's surface water.

It should be noted here that the Gulf of Guayaquil is bathed by the mixture of the different water bodies, which, together with the inflow of fresh water from the Guayas basin, may explain the high fertility of this zone.

The water bodies described above, because of their different densities, flow in what is called thermohaline circulation; the action of the strong winds on the water bodies affects their circulation and the combined action of the two factors determines the circulation in this region. Consequently, the climatic aspects of the ocean region deserve mention in general terms.

Within this region, and occupying a large segment, is the great entrance, the Gulf of Panama, located between 9°N and 1°S latitude and 81°N up to the coast. The main climatological feature is the Intertropical Convergence Zone (ZCIT), with an average annual position near 5°N in the centre of the Gulf, turning east-southeast to 3°N on the coast of Colombia.

The greatest northerly displacement of this convergence reaches the north of Panama (8° - 10°N) from July to September, whereas the ZCIT convergence is in its most southerly position in February, near 0° to 1° S.

Surface circulation

Two clearly-defined phases have been identified for the region: the period of strong SE trade winds is the major force, lasting from May to December, while the period of strong NE trade winds begins at the end of December and lasts until April. The oceanic circulation follows a similar annual cycle in response to wind action.

The main features of the region's circulation have been summarized by Wyrztki (1965) and may be outlined as follows:

- A. The eastern edge of the North Equatorial Countercurrent
- B. The eastern part of the North Equatorial Current
- C. The cyclonic whirlpool or vortex (flowing clockwise) around the Thermal Dome of Costa Rica
- D. An anticyclonic vortex south of the Thermal Dome of Costa Rica
- E. A cyclonic whirlpool in the Gulf of Panama, associated with the Colombia Current and in some cases with the "water spout" in the Gulf of Panama
- F. The transition from the Peruvian (Humbolt) Current to the South Equatorial Current

The dynamics and variability of those phenomena determine the characteristics of the water bodies and currents which bathe the shores of Ecuador and convert the region into one of the most productive fishing zones of the Global Ocean. The variation in oceanic circulation has implications for the climate of Ecuador.

An anomaly which often affects this regime and has considerable impact on the ecosystem is the phenomenon known as El Niño which has been and continues to be the subject of intensive research by the countries of the region and others outside the region.

Biological aspects

The fertility of the Ecuadorian sea, as reflected in the characteristics of the marine phytoplankton and primary output data, is extremely important because this is the first link in the marine food chain and, to some extent, determines the abundance of the other organisms which directly or indirectly feed on it.

The available information may be summarized as follows:

- (1) The phytoplankton biomass consists mainly of Diatoms, Coccolithopores, Dinoflagellates and Silicaflagellates and Ciliates. The first two are predominant in the biomass.
- (2) The greatest concentration of Phytoplankton and Chlorophyll is found in the Gulf of Guayaquil, where the count is 332,000 per litre.
- (3) The highest concentrations of phytoplankton cells are generally found at a depth of between 10 and 20 m for all parts of the Ecuadorian coast.
- (4) Primary output is high. The productivity index or the number of milligrams of carbon assimilated per milligram of chlorophyll and per hour/day has been as high as 4.3 mg C/mg Cla/h, which is slightly higher than the output found on the Peruvian coast and in the Gulf of Panama.
- (5) The high rates of photosynthesis in Ecuadorian waters are due to the rapid multiplication of the small monoplankton cells, especially the coccolithofunds, which have higher rates of multiplication and metabolism than the larger cells of the phytoplankton.

III. MAN AND THE COASTAL ENVIRONMENT: THE SOCIO-CULTURAL BASIS FOR COASTAL MANAGEMENT

According to the III Population Census, 1974, the oceanfront provinces - Esmeraldas, Manabí, Guayas and El Oro - had a total population of 2,796,014 inhabitants. However, that figure is meaningless unless it is seen in relation to the growth of the population of the coastal provinces over the period 1950-1962-1974, the years of population censuses in Ecuador, and to annual population growth rates in those provinces in that period and compared with the rest of the country (see table).

POPULATION GROWTH OVER THE PERIOD 1950-1974

PROVINCE	1950	1962	1974		Annual growth rate (%)			
	(November)	(November)	TOTAL (3)	Urban	Rural (3)	Total	Urban	Rural
TOTAL ALL OF ECUADOR	3,202,757	4,476,007	6,521,710	2,698,722	3,822,988	3.0	4.6	2.3
Alekhá	1,856,445	3,271,345	3,146,565	1,202,746	1,943,769	2.2	3.8	1.4
Azuay	250,975	274,642	367,324	117,493	249,831	1.5	3.6	7.0
Bolívar	109,309	131,651	144,593	19,044	125,549	1.1	2.3	1.0
Cañar	97,661	112,733	146,570	19,521	127,049	1.6	1.8	1.7
Carchi	76,595	94,649	120,857	38,094	82,763	1.9	2.5	1.6
Cotacachi	165,602	154,971	236,313	32,378	203,935	1.4	2.1	1.3
Ciudad Real	218,130	276,668	304,316	78,171	226,145	1.3	2.2	1.1
Imbabura	146,693	174,039	216,027	69,664	146,423	1.6	3.4	0.9
Laguna	216,802	265,446	342,339	75,732	266,607	1.9	3.9	1.5
Pichincha	326,520	507,035	688,306	658,791	329,515	3.9	2.2	3.0
Tungurahua	107,942	178,709	279,920	93,668	186,252	1.6	3.7	0.9
COAST	1,298,495	2,127,358	3,179,446	1,470,591	1,708,855	3.8	5.3	2.8
Oceanfront Provinces								
El Oro	89,306	160,650	262,564	126,407	136,157	4.6	7.3	3.0
Esmeraldas	75,407	124,681	203,151	72,146	131,005	4.2	6.7	3.3
Guayas	582,144	979,223	1,512,333	956,601	555,732	4.0	5.1	2.7
Manabí	401,378	612,542	817,966	218,003	599,963	3.0	4.5	2.2
Province with no ocean front								
Los Rios	150,260	250,062	383,432	97,434	285,998	3.9	6.6	3.3
EASTERN AREA (ORIENTE)								
Morona Santiago	21,046 (1)	25,503	53,325	9,520	43,805	3.9	4.6	3.7
Napo	25,425 (2)	24,253	62,106	4,260	57,846	3.8	1.2	4.1
Pastaza	-	13,693	23,465	5,361	18,104	2.0	3.8	2.0
Zamora Chinchipe	-	11,464	34,495	3,836	30,659	4.8	2.8	5.2
GALAPAGOS	1,346	2,391	4,037	2,356	1,681	5.9	-	2.9

(1) Includes the population of Zamora Chinchipe

(2) Includes the population of Pastaza.

(3) Includes the population of the zone under discussion.

Source: Population Censuses 1951, 1962, 1974.

Source: Central Bank of Ecuador, Department of Economic Indicators, Yearbook no. 2, 1979 (modified).

The census figures given in the above table indicate that in the interval between the 1950 and the 1974 censuses, the population of the coastal provinces more than doubled. When that growth is compared with the figures for the sierra highlands, it will be seen to have amply surpassed the latter except for Pichincha where the capital is, and which is a political-administrative commercial-industrial and educational-cultural centre. In the eastern provinces, the high rate of growth can be attributed partly to the fact that the oil industry exerts a strong attraction for the people of the sierra.

Distribution of the population in the coastal provinces

For a more realistic measurement of the population living near the coast, the census data was used to identify the cantons with an outlet to the sea and those which directly influence the coastal area for economic reasons as, for example, Portoviejo Canton, whose proximity to the oceanfront and economic relevance to the region require its inclusion in the tabulations.

The region as a whole has one of the lowest population densities in the country, with a substantial percentage of rural population (see table on next page).

The totals for each canton, however, show that the coastal strip has a large percentage of the total population of each province. That is partly due to the concentration of population in urban centres and their contiguous areas, which serve as foci for intensive occupation of the space all along the coast, but are disconnected from other population centres. At the same time, there are large uninhabited spaces in the interior of the coastal provinces, as in Esmeraldas, the north and northeast of Manabí, in the Santa Elena Peninsula and in El Oro Province. That creates a strikingly unequal distribution of population, which is directly

POPULATION OF THE COASTAL CAPTURES
(by province)

Province	Total	Rural parishes	Rural population
Esmeraldas			
Esmeraldas	102,971	42,375	41
El Cajas	41,332	34,381	36
Milagro	15,660	1,094	69
Nariño			
CAPTURES			
Perovito	126,917	60,211	48
San Juan	72,258	44,233	37
Palma	70,213	2,432	3
Montecristi	29,404	4,403	17
Neaquer	44,731	25,999	33
Auca	29,764	19,799	69
Quayas			
CAPTURES			
Quayas	907,213	79,523	5
Maripal	30,209	19,222	25
Salinas	44,283	31,651	31
Santa Elena	61,714	42,494	31
El Oro			
CAPTURES			
Macoma	25,204	25,378	27
Arenillas	27,134	15,273	17
Santa Rosa	33,097	9,436	21
TOTAL	1,748,129	526,768	
PROVINCE	TOTAL FOR THE PROVINCE	COASTAL CAPTURES	
Esmeraldas	199,963	78,160	49
Nariño	479,339	216,289	49.2
Quayas	1,041,219	171,290	16.6
El Oro	153,788	52,869	34

Source: IEC Population Census, 1974. Final results. National summary. National Statistics and Census Institute, Ecuador, pp. 22-26.

Population density in the coastal strip is extremely low, with 10 to 20 inhabitants per sq km. It is higher in areas close to urban plants and up to 80 or more inhabitants per sq km in areas of rapid urbanization, as in some parts of the coast of Santa Elena Peninsula. Along the remainder of the coastline, the urban centres are isolated and surrounded by a very sparse population net.

Migratory movements

The study of migratory movements to and from the coastal provinces over the period 1961-1974 (see table) indicates that in the four census periods, the general trends of migration were maintained, with differences only in magnitude. After an initial strong migratory movement prior to 1962, there is a decline over the period 1962-1964, but after that, migration regained momentum, which is being maintained up to the present.

MIGRATORY FLOWS TO AND FROM THE COASTAL PROVINCES
IN THE PERIOD 1961-1974, BY YEARS OF HABITUAL RESIDENCE
(excluding internal migrations in the provinces)

PROVINCE	Less than 5 years		5-9 years		10-12 years		13 years and over		TOTAL MIGRATION	TOTAL MIGRATORY BALANCE
	Emigration	Immigration	Emigration	Immigration	Emigration	Immigration	Emigration	Immigration		
Esmeraldas	14.709	21.570	5.209	0.264	2.073	3.301	3.968	6.023	60.199	+ 13.120
Manabí	50.607	14.113	32.972	5.027	16.491	1.914	23.079	4.695	157.778	-106.220
Guayas	46.277	104.264	18.479	50.763	8.535	26.094	19.715	79.031	353.958	+167.046
El Oro	15.749	20.389	8.085	12.420	2.725	7.166	7.316	13.958	95.808	+ 28.058

Source: III Population Census, 1974. Final results, National summary
National Statistics and Census Institute.
National Planning and Co-ordination Board, Ecuador, pp. 30-37.

Most emigration movements are to other coastal provinces, except for Pichincha, which acts as a centre of attraction in the sierra highlands, whereas the bulk of emigration is to Guayas Province, with its population concentration focus at Guayaquil.

The volume and distribution of emigration would appear to be motivated by two main factors: first, the economic opportunities offered by the receiving province, that is, in all cases, the bulk of the migration is to the two large centres of population polarization, namely, Guayaquil and Quito. Secondly, the factor of distance: for example, in Esmeraldas province, emigration obeys the following order of priority: (1) Guayas; (2) Pichincha; (3) Manabí; (4) Los Ríos; and (5) El Oro. Similarly, people emigrating from El Oro Province go to (1) Guayas; (2) Pichincha; (3) Loja; (4) Azuay; and (5) Los Ríos. This is the pattern for the other two provinces as well.

On the other hand, the volume and distribution of immigration movements to the coastal provinces has none of the homogeneity which distinguishes emigration. They are determined not only by the relative importance and proximity of the centres of attraction, but by the retention capacity of the large centres of population concentration. Thus, Pichincha is not a primary source of population in any of the periods studied. On the contrary, the bulk of emigration is from Guayas Province to Manabí and others. That phenomenon reflects the socioeconomic strength of Guayas province, which shows the largest volume of population movement and also has the highest migratory balance. This applies to all the coastal provinces except for Manabí, which shows a negative balance throughout the period.

Human settlements and the resource base

The relationship between man and the natural environment is determined by the geographical conditions in the coastal area and by the existing economic and services infrastructure. The high percentages of rural population in the coastal cantons are indicative of a demographic vacuum. It should be noted, however, that in so extensive an area, there is a large measure of heterogeneity which produces a very varied mosaic of types and intensities of population concentration and land use.

The coastal strip of Esmeraldas Province is notable because it has rural population densities of 1-20 inhabitants per sq km and even lower, and small communities all along the coast. With a very sparse population in the San Lorenzo-Valdez-Ancon zone, there is more emigration than settlement in Muisne and labour is scarce in Esmeraldas because urban jobs are increasingly preferred.

In the city of Esmeraldas, port development, the Balao refinery tourism in Súa and Atacames and construction of the highway linking Esmeraldas with Súa and Nuisne play a key role in vitalizing the economy of this subregion.

The coastal area of Manabí Province, from the border of Esmeraldas Province to the Bay of Caraquez, has very low population densities and poor communications. The populated areas are widely scattered, isolated from one another, and linked by summer roads, with the beach in many places as the most convenient way of getting from place to place. In the northwestern cantons - Pedernales and Cогimies - the literacy rate is one of the highest on the coast. The population is young, emigration is low; moreover, this zone was settled comparatively recently.

While the sector of the coast which runs from the Bay of Caraquez to the border with Guayas Province is similar to the one before geographically - it is a dry area with serious water shortages all year long - it is distinguished by large urban communities in the hinterland and ports along the coast. The average density of the rural population is 20-40 inhabitants per sq km, rising to 40-80 inhabitants per sq km at Fortoviejo, Río Chico and Jipijapa, whereas Machanilla, Puerto Lopez and Jaramijó have very low population densities.

The valley of the Fortoviejo River, where irrigation permits intensive farming, is the economic axis of the region. On the coast, Manta is the ranking urban-industrial centre and seaport of the central coast of Ecuador. Since the valley is overpopulated, emigration to the cities of Manta and Fortoviejo is favoured. Jobs in the cities, the fishing industry in Manta and Jaramijó

of the rural sector in this area. The same is true of Puerto Cayo, Manchanilla and Puerto Lopez further south.

The western coast of Guayas Province has a very low rural population density, which becomes more marked on the northeastern coast. Only in the parishes of Anconcito, Colonche and Libertad has there been a significant increase in the rural population between 1962 and 1974. The population is concentrated in certain coastal sectors mainly associated with tourism (Salinas, Plazas), fishing, salt mining and refining, oil refining, etc. In Taura, there are newly settled zones. Projects for agrarian reform and water and infrastructure development offer great promise of change. The school enrolment rate in both areas is very high.

Towards the south, the population density increases. It is a recently settled zone where the population is younger than the national average. The school enrollment rate is one of the highest in the country and immigration continues to show a strong trend. At the southwestern end of the coastal area of Ecuador, the population density is very low. Huaquillas is also a settlement zone with a young population and very high school enrollment. The rural population increased between 1962 and 1974 by more than 90%.

Urban development in consolidating the coastal area

Although Ecuador has the general characteristics of the countries colonized by Spain, where the original populated settlements were established in the highlands of the interior, Guayaquil (and ultimately "the Coast" in general) became important for geographical, historical and economic reasons.

During the Colonial period (1740-1822), Guayaquil became the major port and shipbuilding centre on the west coast of South America because it was strategically located for purposes of international and local trade. In addition, it was the centre of an export economy based on the cultivation of cacao on large plantations in the Guayas River Basin, the present-day El Oro Province and some areas in Esmeraldas and Manabí. It was the focal point for settlement (it absorbed the migrants from the sierra, the north of Perú and other parts of the coast)^{1/}

The fact is, however, that the distribution and relative growth of the urban centres along the coast have not changed; their growth continues to be uneven and they are dominated by one city - Guayaquil - which is growing out of control (see table).

^{1/} JUNAFILA. "Regional Planning - Structure of Ecuador's Space". Division of Regional Studies, 1977, pp. 17-19.

URBAN POPULATION		
Province/ Sector	Total	Capital of Sector and Territorial Area
ECUADOR		
COSTA		
Esmeraldas	102,971	50,429
El Oro	41,192	3,272
Manabí	13,260	4,104
SIERRA		
COSTA		
Portoviejo	125,957	56,126
Cajaluma	75,258	32,471
Imbabura	75,215	37,383
Montecristi	25,424	21,201
San Jacinto	14,122	25,722
Guano	23,754	13,795
SIERRA		
COSTA		
Guayaquil	307,213	187,100
Yaguajay	10,320	10,767
Salinas	64,583	12,432
Santa Elena	51,754	15,360
EL ORO		
COSTA		
Yumbala	95,203	49,825
Arenalina	27,434	3,429
Santa Rosa	12,297	21,561
SIERRA		
COSTA		
Esmeraldas	139,161	54,203
Manabí	439,195	222,272
Guayas	1,041,023	166,764
El Oro	155,754	102,915

Source: VII Population Census, 1974. Final results. National Institute of Statistics and Census Institute, Ecuador, pp. 10-19.

Many factors have shaped present-day urban systems, the most significant being migration and the job structure. The first has already been briefly analysed. Suffice it to add that they determine and are determined by the relative standing of urban centres and its effect on the concentration of economic activity, basic infrastructure, consumer goods and amenities and services, location of industry, job generation, etc. On the other hand, through the settlement processes, they enlarge the area actually occupied and the input of natural resources in the economy.

As far as the job structure is concerned, the oceanfront provinces contain 40.8% of the economically active population of the country^{2/}; of that total, 49.5% live in the urban area and 50.4% in the rural area.

^{2/} It represents 28.3% of the total population of the coastal provinces.

In the urban area, 25-30% of the population is engaged in service-related activities and commerce, whereas no more than 15%, or less, of the urban population work in industry.

The job problem is closely related to rural-urban migration and urban-metropolitan movements and it is reaching critical proportions in Guayaquil. While on the one hand, Guayaquil is a magnet for rural migrants seeking better job opportunities, high income and a better life, the job categories have reached saturation point, with direct impact on the supply of jobs, since the city is not capable of absorbing the available human resources at the required rate. The problem of unemployment - and especially under-employment - which means that workers are intermittently idle and hold low-productivity jobs - results in large-scale marginality. In Guayaquil, the size of the city and the proportion of its population crowded into its marginal sections as a result of the unreasonably large population concentration, the very rapid growth of the city and the corresponding demand for services and equipment, creates serious economic and social imbalances.

Solution of this problem is to be sought beyond the limits of the metropolitan area because given its crucial position in the national picture and the extent of its sphere of influence, its problems are implicitly and directly related to the development of a very large regional space and the regional development projects to be carried out within that space (coastal tourism, fishing centres, building of a steel complex) are key factors in urban and regional planning.

The urban centres

The order of rank of the urban centres, their spheres of influence^{3/} and the polarity indexes^{4/} of urban communities with over 10,000 inhabitants in 1962 were determined in a study made by the National Planning Board (now CONADE).^{5/}

Four of the 19 centres covered in the study are situated on the coast. The study produced the following findings. All the centres had relatively large spheres of influence. Since Guayaquil is easily accessible from various production centres, has the most concentrated road network and daily vehicular traffic flow, in addition to being the country's major maritime port, its sphere of influence extends beyond that of any other centre. Manta, Machala and Esmeraldas are also fortunate to have a concentration of first-rate roads, although the network is extremely rudimentary for Esmeraldas. Their spheres of influence are further extended because they are ports and serve as links with communications centres. Accessibility and the volume of vehicular traffic between Manta and Portoviejo have had the effect of merging the respective spheres of influence of the two cities, thus constituting a more extensive development region.

As for the major factors by centre (see table), the demographic factor has been the decisive element in Guayaquil's rise to prominence, that is,

^{3/} Determined on the basis of vehicular traffic and degree of accessibility. It was defined as "a space smaller than the polarized zone in which closer inter-relations are established between the centre and the immediate environs".

^{4/} Determined on the basis of relative relevance to specific indicators: (i) economic, (ii) services, (iii) consumer goods and (iv) demographic.

^{5/} Ibid 1/, pp. 163-175.

the size of the population and its annual growth rate. That factor, combined with the economic factor, that is, the substantial labour force working in industry and commerce, makes Guayaquil the most dynamic city in economic and population terms and the greatest attraction after Quito. It has been noted that Guayaquil, as the nucleus of a polarized system, exerts a direct influence on the ring of territories surrounding it in Guayas Province and outside it. Essentially this influence is manifested in the development of Santa Elena Peninsula, Puntilla-Samborandon and the Guayas Basin.^{6/}

DOMINANT FACTORS BY CENTRE AND POLARITY INDEX

<u>Centre</u>	<u>Polarity index</u>	<u>Dominant factors in order of priority</u>
Guayaquil	2.0	1. Demographic 2. Economic 3. Basic services 4. Equipment
Manta	1.3	1. Economic 2. Demographic 3. Equipment 4. Basic services
Machala	1.2	1. Economic 2. Demographic 3. Equipment 4. Basic services
Esmeraldas	1.0	1. Basic services 2. Demographic 3. Economic 4. Equipment
Portoviejo	1.0	1. Basic service 2. Equipment 3. Demographic 4. Economic

Note: Indicators used in defining the dominant factors:

- (a) Economic: volume of sales and personnel employed in commerce (business); volume of production and personnel working in industry and credit given by the national banking system.
- (b) Basic services: number of students enrolled in secondary schools and universities; number of hospital beds; number of beds per hotel.
- (c) Equipment: number of radio and television stations; index of calls in and out in telecommunications; number of households with drinking water and sewage facilities; and
- (d) Demographic: size of the population and its rates of growth.

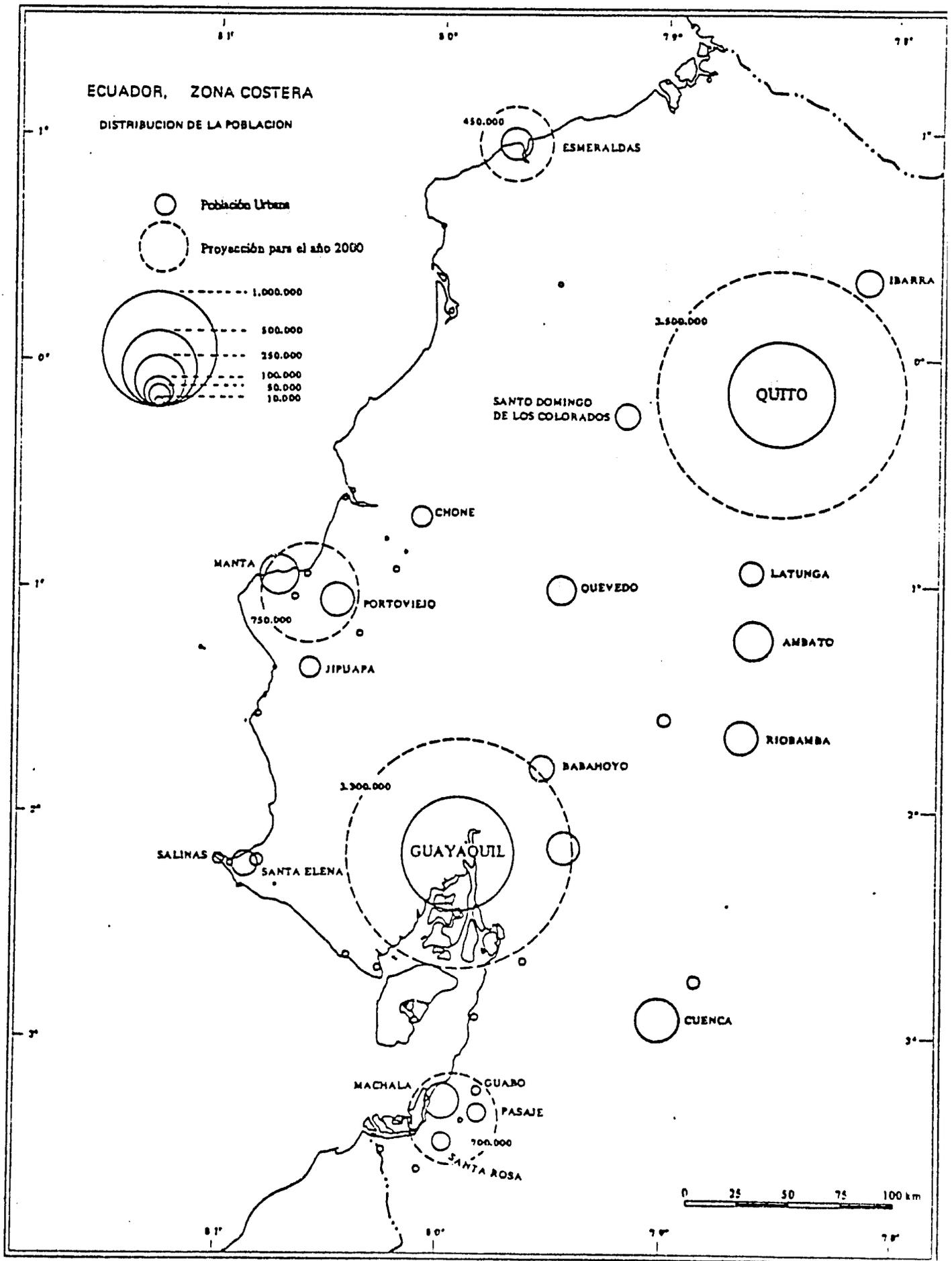
Source: J. Zapla, "Regional Planning - Structure of Ecuador's Space". Division of Regional Studies, 1977, pp. 165-167.

^{6/} DP/UN/ECU-72-019/1 "Urban Development Plan of Guayaquil. Project conclusions and recommendations". United Nations, New York, 1977, p.21.

The polarity index of the other cities is much lower than that of Guayaquil. In Manta, the predominant force is the economic factor because of the manpower employed in industry and the sales volume in commerce. Machala has similar indicators, primarily credit, industrial output and sales volume in commerce. Services, and in particular, secondary and higher education, are the predominant factors in Esmeraldas and Portoviejo, which have smaller spheres of influence. Although the polarity indexes of Manta and Portoviejo are considered average in the national context, they become very significant in the coastal area and have an important bearing on the planning of the region.

Other urban centres of importance on the coast are Salinas, in Guayas Province, and Bahia de Caraquez in Manabi. Salinas is the largest beach resort in the country and is very active in the "winter season" as a tourist centre; Guayaquil, to which it is linked by highway, is the primary beneficiary of that activity. La Libertad, a town a little further north, is virtually part of Salinas urban district, so that both cities benefit from intensive commercial activity owing to the presence of oil refineries, salt mining and refining and tourism.

Bahia de Caraquez is the mandatory shipping port of the central coast of Ecuador for agricultural and forestry products, and it is becoming an active tourist centre (see map 5).



IV. THE PHYSICAL INFRASTRUCTURE

Characterization and composition of the physical infrastructure system

The composition, arrangement and functioning of the physical and service infrastructure constitute one of the most relevant indicators of the level of development of the coastal area. Not only does it reflect the capacity of the system in relation to its present and future impact on the development of the coastal area and its sphere of influence, but its effectiveness in supporting the physical linking of the coastal area with the other regions of the country and its economic integration with those regions.

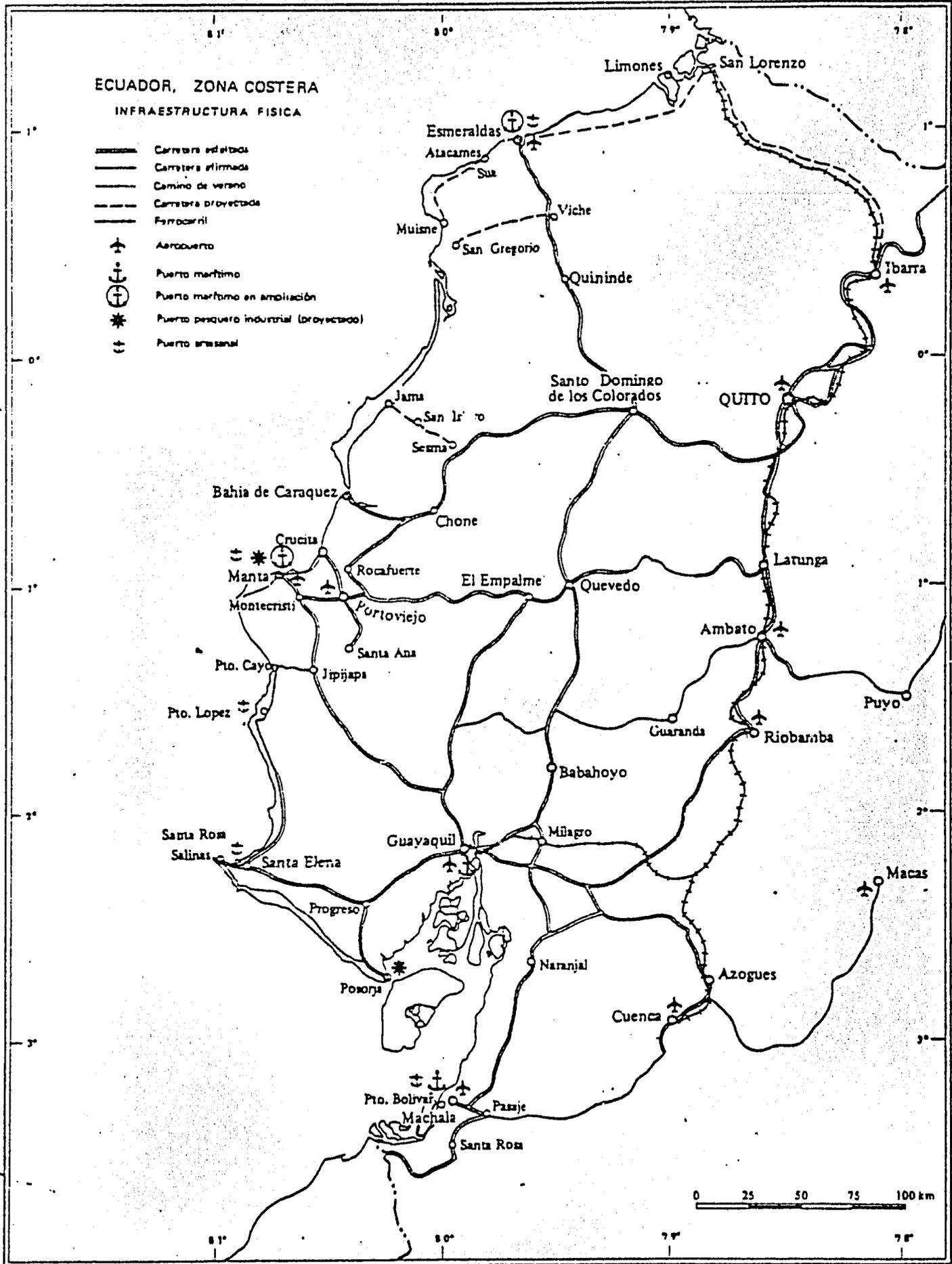
There follows a brief review of the structure of the infrastructure and services network, its major problems and the tremendous importance of expansion of the sector based on the projections shown in the national development plan (see map 6).

As it developed over time and as it is now constituted, the transportation network of the coastal region is the product of the predominant characteristics of the socioeconomic system which means that it is largely aimed at facilitating the export and import of goods moving through the main ports, connecting centres of production, consumption and industry with those ports and establishing the best possible connexion between the metropolises of Quito and Guayaquil. This road traffic corridor absorbs about 80% of the volume of cargo moved in the country, while about 95% of exports and imports are shipped out of its ports.

The oil-producing sector, with its system of pipelines for the transportation of oil and petroleum by-products, complemented by coastal traffic, completes the transportation system. In short, the system is built on five means of transportation: roads, water, rail, air and pipelines, considering that the participation of rail and air transport is limited.

ECUADOR, ZONA COSTERA
 INFRAESTRUCTURA FISICA

-  Carretera asfaltada
-  Carretera afirmada
-  Camino de verano
-  Carretera proyectada
-  Ferrocarril
-  Aeropuerto
-  Puerto marítimo
-  Puerto marítimo en ampliación
-  Puerto pesquero industrial (proyectado)
-  Puerto artesanal



The coastal highways

While the highway network of Ecuador has three north-south axes (highlands/sierra coast, foothills and eastern area) and three transverse axes which link the mountains with the coast and also with the eastern region, the coastal road network is made up of highways running mainly east-west and connecting the principal ports with cities in the interior and with the western trunk line (coast-foothills) which is the main north-south axis running through the broader area known as the Coast.

The table below indicates the relative importance of the various roadways in terms of vehicular flows and type of traffic offering a wide variety of cargo and passenger motor transportation services. This network is vital to the movement of export and import commodities, as shown by the percentage of heavy traffic. Moreover, one of the chief trends in the sector's development is the annual growth rate of 10-14% in primary network traffic.^{1/} One very significant indicator is the flow of vehicular traffic of the Manta-Montecristi-Portoviejo highway, one of the heaviest in the area, which drops sharply from Portoviejo towards the interior (Portoviejo-El Empleo).

From Bahia de Caraquez to Manta, there is a high density of road infrastructure and the communities in the interior or hinterland have good communication. However, the coastal stretch from Manta to Puerto Cayo has only summer roads which link San Lorenzo and Las Cañas with Montecristi. Puerto Lopez, Machánilla and Puerto Cayo are isolated; they are only linked to the parish seat by all-weather roads.

Unfortunately, no data was available on traffic flows for the stretch from Esmeraldas to Santo Domingo de los Colorados, which is the only means of transportation to the interior of the country on the northern coast of Ecuador. The road infrastructure of the shore of Esmeraldas Province is very rudimentary.

^{1/} Reply to the basic information outline on the transportation sector, 1980, p.1.

VEHICULAR FLOW AND TYPE OF TRAFFIC IN SOME COASTAL CORRIDORS

SECTION	LENGTH (Km)	DAILY TRAFFIC (vehicles)	HEAVY TRAFFIC (%)
Santo Domingo- Bahía de Caraquez	206	1000	60
El Empalme-Portoviejo	98.3	180	70
Portoviejo-Montecristi Manta	34	3500 (1000 via Jipijapa-Daule)	36
Montecristi-Jipijapa Ncchol-Guayaquil	144.8	1400	Mainly light vehicles
Guayaquil-Santa Elena 1/	144	1730	38
Santa Elena- La Libertad-Salinas	15	Saturated with vehicles in Summer, up to 90% of capacity	—
Babanoyo-Guayaquil	64	1500	55
Quevedo-Baltar Daule-Guayaquil	177	6000	55

Source: Ministry of Public Works and Communications of Ecuador

1/ This secondary coastal network serves a corridor averaging 60 km x 300 km in length, that is an area of 18,000 sq km, with a population of 1 million, not including traffic entering and leaving the ports and other services provided by this zone.

Communications with the capital of the Province, Esmeraldas, are possible only by asphalt road up to 35-50 km; behind that, communication between the towns is by summer roads or there is none at all. In the Muisne area, the towns are farther apart and isolated, with poor communication roads running along the rivers and in the mouth of the rivers towards the sea. No detailed information was available on the road network south of Guayaquil which feeds the south coast and links Puerto Bolivar-Machala with the interior and ends in the paved highway linking Guayaquil-Naranjal-Machala. It runs parallel to the shore and has a few, short offshoots (summer roads) which do not go as far as the shore. In El Oro Province, the road network branches out quite a bit although there are no roads to the Archipelago of Jambeli and the shore from Puerto Bolivar to Huaquillas.

The coastal road network^{2/} in the national context and present and future impact of development projects

A comparison of the coastal highways with those of the rest of the country shows that:

-The roads on the coast and in the sierra constitute 95% of the country's total road system.

-Road mileage between the coast and the sierra is about the same, with 46.7% for the coast and 47.8% for the sierra.

-On the coast, most are dirt roads and there are 7793.1 km of such roads. In terms of all-weather roads, the coast has 28.4% and the sierra 64.0%. There are five times fewer paved roads than dirt roads, which indicates the importance of the so-called summer roads on the coast for they account for the very high percentage of over-call mileage.

-The percentage of total road mileage on the coast is 63.4%, and 39.3% in the sierra; the sharp difference is again explained by the summer roads.

Between 1970 and 1978, the coastal road network showed a sharp increase in paved roads (50%) and dirt roads (60%), with the highest percentage of that type of road in Manabí and Esmeraldas Provinces (see table on next page).

The National Development Plan calls for the establishment of new traffic corridors in Esmeraldas and Manabí provinces. The primary highway network is to be extended by 769 km, thus giving the two provinces access to the main or trunk line on the Coast and incorporating some 350,000 hectares of agricultural land (see table).

^{2/} The coastal area would be part of the large natural area called the Coast, from which the statistics which follow have been taken.

SUMMARY OF THE NATIONAL ROAD NETWORK, 1978

REGION	PROVINCE	LENGTH AND TYPE OF DRIVING SURFACE			SUB-TOTALS		TOTALS
		ASPHALT	PAVED	DIRT			
					%		
ESMERALDAS	R.F.	158.5	104.6	-	263.1	19.55	1.345.2 (11.16)
	C.V.		277.6		277.6	20.59	
	C. VER.			804.5	804.5	59.77	
MANABI	R.F.	542.9	276.8		819.7	15.11	5.417.3 (44.96)
	C.V.	32.6	317.8		350.4	6.46	
	C. VER.			4.247.2	4.247.2	78.40	
GUAYAS	R.F.	813.3	151.0		964.3	24.12	3.913.5 (32.48)
	C.V.	109.1	595.7		704.8	17.99	
	C. VER.			2.244.5	2.244.5	57.3	
EL ORO	R.F.	298.7	73.2		371.9	27.06	1.370.7 (11.19)
	C.V.	6.7	495.6		502.3	36.64	
	C. VER.			496.9	496.9	36.20	
TOTAL	R.F.	1813.0	605.6		2418.6	20.07	
TOTAL	C.V.	148.4	1606.7		1755.1	15.23	12.046.7
TOTAL	C. VER.			7793.1	7793.1	64.69	
TOTAL COAST R.F.+C.V.+C. VER.							

R.F.: Primary road
C.V.: Local road
C. VER.: Summer road

Source: Ministry of Public Works and Communications, Ecuador

INVESTMENTS FOR BASIC PROJECTS
SUBSECTOR: HIGHWAYS

Projects	Length (km)	Investments over the five-year period
FUNDAMENTAL ROAD NETWORK ESMERALDAS-MANABI		
- Súa Misne	52.0	50.2
- Esmeraldas-San Lorenzo	150.0	400.0
- Tbarra-San Lorenzo	200.0	500.0
- Sesme-San Isidro-Jama	60.0	205.0
- Vienne-San Gregorio	70.0	178.0
TOTAL:	562.0	1333.2

Source: National Development Plan (1980-1984), Part II, vol. 7, p.117

These projects will fill large gaps in the present network, for the Coast has a very low accessibility index, with very few connexions between the adjacent provinces and virtually no connexion between the ports along the coast. The network of local and penetration roads is not sufficiently developed to establish links between the various growing areas or potentially agricultural areas and the consumer markets, so that there is damage and losses

in the productive sectors, especially the agricultural areas.^{3/} In the chapter on coastal agriculture, repeated reference is made to the impact that the opening of new corridors will have and what they will mean to the economy of the region.

The rail network

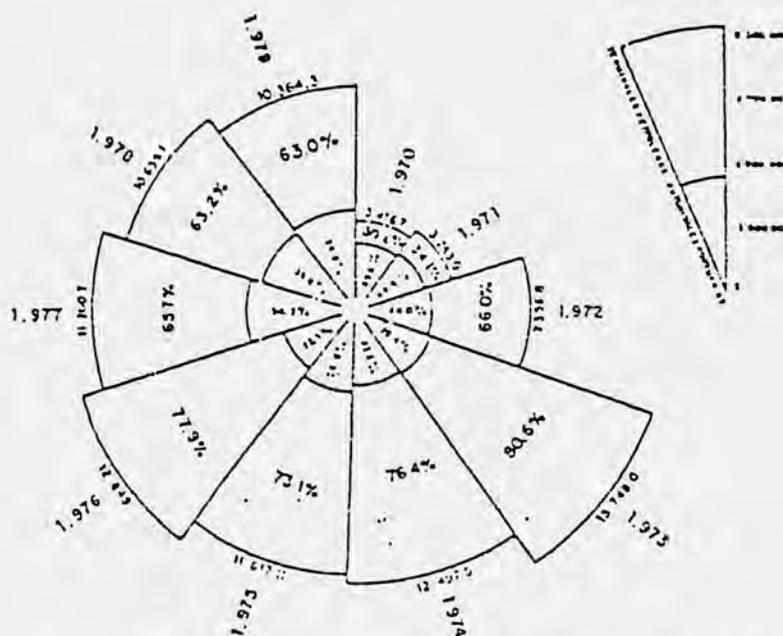
Railroads play a very minor role in the coastal transportation system except in the Ibarra-San Lorenzo corridor, which is the only transportation route in 200 km, although the port facilities of San Lorenzo are very limited. It should also be noted that no port is directly served by the railroad. The National Development Plan calls for pre-investment studies and the beginning of construction of a rapid, mass transit system which would link the coastal area, the ports and the main cities of the interior and use electricity instead of liquid fuels.

Transportation by water

The water transportation network, made up of the port system, maritime shipping, coastal shipping and river ports, is an important element of the coastal infrastructure. The effect of this type of infrastructure on the country's development has been and continues to be decisive. Ecuador moves about 95% of its export and import goods by sea, so that maritime shipping is the main system for the international carriage of its foreign trade.

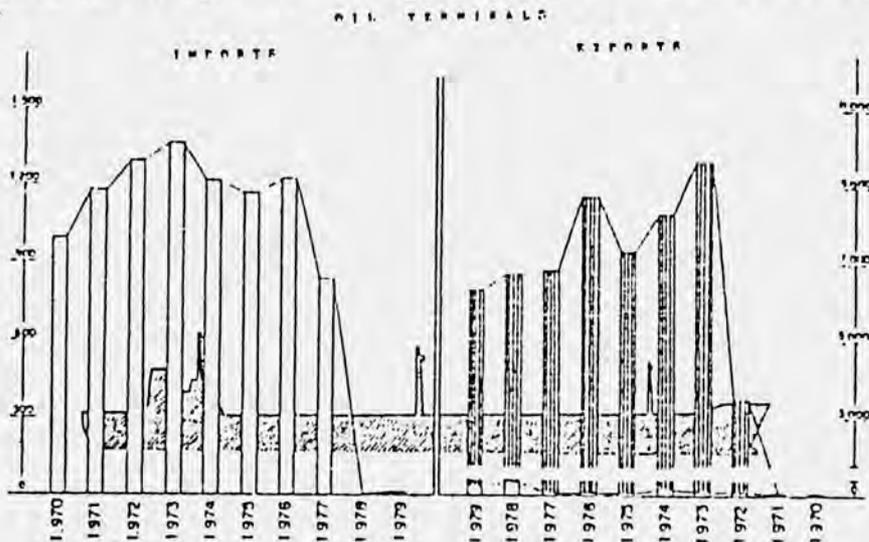
Maritime and coastal shipping is done through four main ports (Guayaquil, Puerto Bolivar, Manta and Esmeraldas) and two oil terminals (Balao and La Libertad).

3/ Ibid. 1/



Source: Navy of Ecuador, Department of Merchant and Coastal Shipping
Port structure of Ecuador, June 1980.

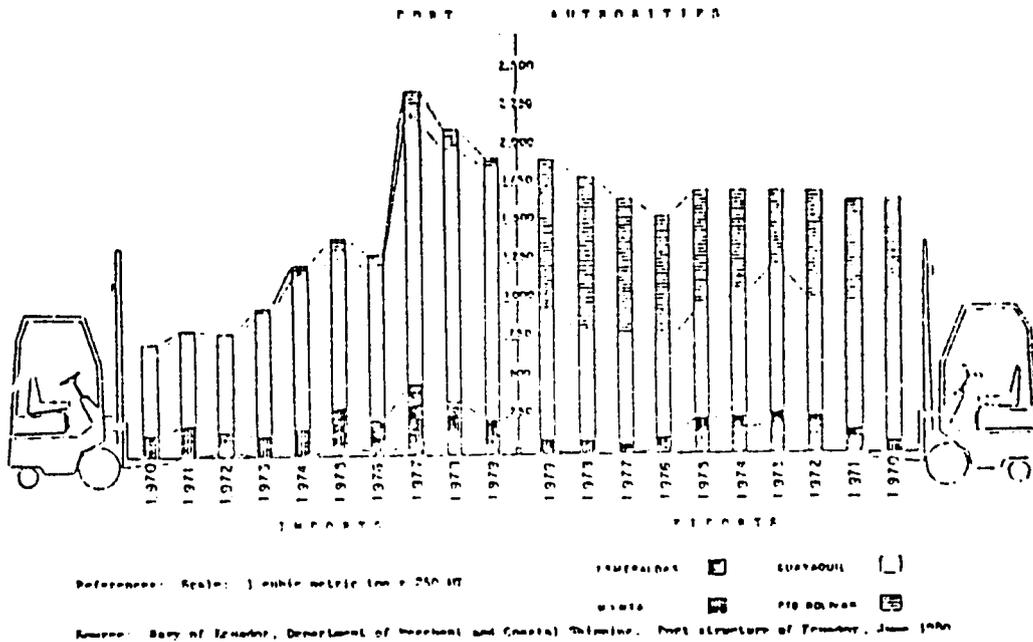
The diagram shows the huge volume of cargo moved by the oil terminals beginning in 1972 and reaching its maximum in 1973, with this kind of cargo making up 80.6% of foreign trade. This huge rise in the volume of petroleum products exported reflects the sudden expansion of the petroleum sector and the beginning of large-scale production and export in 1972, which has become one of Ecuador's major economic activities. Up to 1971, oil imports constituted no more than 34% of the total volume of cargo shipped. Now, exports of crude oil and fuel oil come to 6,524,395 tons, 96.6% of which go through the Balao Oil Terminal and only 3.4% through the Oil Terminal of La Libertad (see table).



Referencias: Balao: Importe: 150,000 MT - 1.2%

LA LIBERTAD □

The percentage of cargo moved by the Port Authorities showed a substantial increase beginning in 1977, a year when imports exceeded exports (see table).



Projections to the year 1992 indicate a sustained increase in the movement of cargo and it is anticipated that the Port Authorities, with the installations they now have and those to be built according to the development plans, will be able to handle the volumes of cargo they will have to move in future efficiently.

With regard to the participation of each port in moving export cargo (sugar, bananas, cacao, coffee, fish meal, fish, seafood, shellfish, molasses, etc.) and imports (fertilizer, cement, fuels and fuel byproducts, iron, steel and other metals, paper, wheat, vehicles and machinery, chemicals, etc.), it can be seen that Puerto Bolivar is primarily an export port, since the largest volume of the country's banana production is shipped through that point. In 1979, it shipped the largest volume of exports, all of it, bananas.

Guayaquil is mainly engaged in import traffic. After Puerto Bolivar, it ranks second in volume of export cargo, which includes a wide variety of products. The port of Manta acts as a complement to Guayaquil and is also engaged in shipping a variety of products abroad. Imports far exceed exports and expansion of the port will enhance its operational capacity, although it

The port of Esmeraldas ranks lowest in the total volume of cargo moved by the Port Authorities and is used mainly for the export of regional products. Its link with Quito by the present highway is vital to its future development and it can be regarded as the natural port of Quito and its whole sphere of influence (central sierra, north and east).

Present port infrastructure and plans for its expansion

The growth of the economy created a need for an integrated port system and development policies adapted to the increase in shipping and to the new technological requirements of transportation by water. In 1973, the first national study was made of port capacity and short-, medium- and long-term needs. It formed the basis of the Port Development Plan which is being implemented, with projections up to 1991 (see investments programme 1980-1984).

According to that Plan, Ecuador's port system would consist of:

- 4 commercial ports
- 4 petroleum terminals
- 2 industrial fishing ports
- 4 artisanal fishing bases

The Plan is aimed, inter alia, at achieving a more equitable distribution of cargo, especially import cargo, among the ports of the national system, and to ensure that the port infrastructure has the facilities required to ship primary commodities and increased output.

Below is a summary of port facilities, their location and present characteristics as well as those called for in the National Development Plan,^{4/} which are determined by their areas of influence and the production and consumption needs of those areas. It is estimated that with the expanded infrastructure, the Port System of Ecuador will be able to handle the normal shipping requirements up to the year 1990 and that its installations will be capable of berthing the most modern ships now in use.

^{4/} Navy of Ecuador, Department of Merchant and Coastal Shipping. Port Structure of Ecuador, pp. 12-16, 19-22.

Port Authority of Esmeraldas

General observations The Port Authority's installations are located in the northern part of the country, in the province of Esmeraldas, beside the mouth of the Esmeraldas River.

There is direct access to the port from the sea, from a natural depression in the sea floor which comes up to about 200 metres from the entrance to the port. The dock area is protected by jetties, which enclose an inner harbour measuring 42 hectares.

The port has:

- one floating pier
- two marginal piers of 175 m. each
- one specialized pier for Roll-on Roll-off
- one service pier
- uncovered warehouses of 7.200 m²
- storage sheds of 8 hectares

Future Installations

Construction of the following facilities is planned in the port area:

A new access road because the land approach to the port cuts across the most densely populated sector of the city of Esmeraldas;

Since it is expected to have to move containers in future, two more deep water piers are to be built for the port as well as transfer warehouses.

Industrial Fishing Port

The jetties enclosing an inner harbour dredged to a depth of 7.5 m are already built. This port will have specialized piers for the unloading of the different types of fish caught for consumption and for the fishing industry.

Gas Terminal

As part of the infrastructure of the port, a loading quay for liquid propane gas (LPG) with a minimum depth of 7.5 m is being built; it will be able to moor ships of 6,000 tons deadweight.

Port Authority of Manta

General observations: The Port Authority of Manta is located in the central part of the Ecuadorian coast, in the province of Manabi, 25 miles from the international shipping route and there is direct access to it. The wharf area is protected by a causeway jetty 7 m wide and about 1600 m long which also serves as a highway for vehicular traffic.

The port of Manta has:

two breakwater (jetty) piers with two piers of 200 m of length each;
three marginal piers;
a specialized pier for Roll-on Roll-off;
covered warehouses with a total area of 13.860 m²; and
storage sheds.

Future Installations

Two more open-air storage sheds measuring a total of 50,000 sq m in length are now being built.

The master plan for the port calls for the construction of complementary facilities, a pier for containers and dredges and a public relations building.

Port Authority of Guayaquil

General observations: The Maritime Terminal of the Port Authority of the city of Guayaquil is located in the Estero del Muerto, opposite Isla Trinitari

The access route for ships to the port is through the Morro Channel parallel to the coast of Data, enabling ships to arrive at any time without regard for the level of the tide in the Estero Salado or the prevailing weather conditions. The access channel, from the ocean buoy to the port, is 46 nautical miles long, 121.92 m wide and has a minimum depth averaging 9.45 m. At the foot of the quays, the minimum depth is 35 feet and the channel is 230 m wide.

The port installations are connected with the Guayas River by a shipping canal for small vessels and a lock situated in the Estero Cobina designed to facilitate the transportation of cargo en route to the port, chiefly bananas for export. The lock of the canal was built to regulate the different levels of the Estero Salado and the Guayas River (0.65 m), the velocity of the current created by that difference and the possible sedimentation of the port by suspended materials carried by the river.

The port facilities and installations in the Port of Guayaquil include:

- a marginal pier, 925 m length and five piers;
- 3 piers (covered) of 185 m each, one for containers and banana;
- a pier for small boats;
- 2 piers for heap cargo;
- covered warehouses with an area of 79.453 m²;
- open-air storage sheds with a total area of 147.800 m²;
- an area of 2.500 m² for storage of refrigerated containers (open air);
- warehouses for the consolidation of containers;
- areas with capacity for 4,000 containers;
- three silos for storage of wheat, 20.000 TN;
- a warehouse for storage of sugar, 30.000 TN; and
- one warehouse for dangerous cargo.

Port Authority of Puerto Bolívar

Puerto Bolívar, located in Machala, Province of El Oro, services the southern port of the country, dealing mainly with exports of banana and imports for industry and commerce. The port terminal is located in a very deep canal.

The port facilities and installations of the Puerto Bolívar include:

- one breakwater (jetty) pier with two piers (259.2 m long);
- one marginal pier of 372 m long with two piers;
- a pier for small boats;
- covered warehouses with a total area of 14.526 m²; and
- uncovered warehouses with a total area of 16.926 m².

Provisional Terminal of the Esmeraldas Refinery (TEPRE)

TEPRE is located between the Commercial Port and the Balao Oil Terminal and is used for shipping the refinery's products. The maritime installations of TEPRE are as follows:

A conventional system of mooring buoys designed for vessels of between 6,000 and 20,000 DWT. Maximum draught: 11 m in the buoy field.

An underwater manifold set on the ocean floor at a depth of about 14 m below the MLWS, with valves to be operated by divers.

The manifold has three flexible pipes or hoses for loading and one for discharging ballast water. The loading rate is 4,400 to 6,900 barrels per hour.

Eight underwater lines 3,950 m long for gasoline, jet fuel, kerosene-diesel, C.P.G. Return of white products, Return of black products, Fuel oil and ballast release line.

La Libertad Oil Terminal

General observations: The Oil Terminal of La Libertad is located on Santa Elena Peninsula 140 km from the city of Guayaquil.

It has a system of buoys designed with a pumping capacity of about 550 tons an hour. It is located 2 1/2 miles from La Libertad Beach Resort. The mooring facilities can accommodate vessels up to 40,000 DWT with a draught of 34 feet.

The Terminal Pier can accommodate ships up to 10,000 deadweight tons. It has seven types of hoses for lifting fuel, four for refined products, one for residues, one for water and the other for ballast release.

Industrial fishing ports

Upon completion of a final study of the ports and their design, Manta and Posorja were selected as the sites of the industrial fishing ports. The third phase of the project will begin shortly, that is, the actual construction of the ports. A brief description of each port is given below.^{5/}

Industrial fishing port of Manta Situated in the central part of the Ecuadorian coast, with direct access to the sea. It is now a commercial port with modern system for the movement and clearance of export and import cargo, and a natural fishing port par excellence.

Industrial fishing port of Posorja: Situated at the entrance to the access channel to Puerto Nuevo, city of Guayaquil, it flanks the Morro channel and the town of Posorja to the north.

Among the port and other facilities, both ports will eventually have unloading piers, supplies of ice and fuel, synchro-lift systems for the repair and maintenance of ships, refrigerating plants, an ice factory, workshops for the maintenance and repair of machinery and a building for the administration and supervision of fishing ports.

The project on port facilities for the development of fishing for direct human consumption calls for the construction of unloading and support facilities in the following localities:

Port of Esmeraldas: As a complement to the construction of the Commercial Port of Esmeraldas.

Puerto Lopez: Situated half way between the ports of Manta and Salinas. It is a broad bay between the points of San Lorenzo on the north and Salango on the south; it embraces the commercial fishing ports of Cayo, Machanilla, Puerto Lopez and Salango.

There are no port facilities of any kind in Puerto Lopez so that the fishing boats are provisioned and their catch of fish is unloaded on the beach using rudimentary systems consecrated by custom.

Port of Santa Rosa: This fishing port lies between Salinas and La Libertad. It has no port facilities of any kind, but it is a traditional fishing cove and provides a good natural shelter for small fishing boats.

Puerto Bolivar: Situated in El Oro Province, with direct access to the Gulf of Guayaquil. It is a commercial port with a substantial port infrastructure, but it has no facilities for fishing.

The Plan calls for the construction of port facilities for fishing in the Estero de Huaylan, adjacent to the Commercial Port.

Among the port and other facilities those ports will have are piers, fuel stocks, water reservoirs, ice machines, rooms for preserving food, repairs workshops, etc.

PRINCIPAL ECONOMIC ACTIVITIES

- V. AGRICULTURE, LIVESTOCK AND FORESTRY RESOURCES
- VI. FISHERIES
- VII. NON-RENEWABLE RESOURCES
- VIII. INDUSTRIAL ACTIVITIES
- IX. TOURISM

V. AGRICULTURE, LIVESTOCK AND FORESTRY RESOURCES

The coastal area's agricultural prospects

Studies conducted by PRONAREC/ORSTOM* and regional development groups indicate that the coastal area as a whole has a great agriculture and livestock potential. No serious restrictions on their development have been found in any of the various agricultural zones of the coast: for example, that the soil is not deep enough, that it is rocky and not very fertile or has too much sand or clay, etc. The soils are healthy physically, chemically and topographically and there is a high percentage of usable areas for mechanized farming and irrigation as well as a likelihood of finding groundwater.

Since the soil as a resource is not being exploited by man, there is a marked under-utilization of human and economic resources. The agriculture-livestock potential is such that those resources could be used more intensively; the existing agricultural frontier leaves most of the land uncultivated. It has been pointed out that this poor utilization of resources, and particularly of the soil as a resource, is due, inter alia, to the following problems:

-The lack of irrigation systems which would increase productivity and counteract the severe droughts which have led to sharp declines in output;

-The lack of a road infrastructure to facilitate the movement of products and the lack of basic facilities for the storage and marketing of the sector's output;

-The shortage of economic resources for the granting of medium- and long-term credit, which has limited credit assistance on favourable terms, especially for small and medium owners; and

-The low level of technical assistance, which has limited the development of certified seeds and fertilizers and their use as well as other systems for improving agriculture and livestock production.^{1/}

* National Programme of Agrarian Regionalization/ Office for Scientific and Technical Research of Overseas France.

^{1/} National Development Bank. "Reply to the basic information outline to be formulated on coastal area integrated development and management".

Among the most important factors restricting agricultural development are such natural phenomena as severe droughts, structural flaws like the low yield index and institutional drawbacks such as restrictions on the loans granted by the banking system, which are insufficient to satisfy the large demand of the sector and have been geared mainly to commercial and industrial activity.^{2/}

The absence of incentives in the agriculture and livestock sector causes people to emigrate from the country to the city in search of new sources of work, with adverse effects on production, and leads to the concentration of productive activity in a few zones, particularly in the cities of Guayaquil, Esmeraldas and Machala.

The prospects for agricultural development depend on integrated development projects in which mechanization will be an important factor as well as irrigation, timely credit, a marketing system which creates the infrastructure of silos and warehouses to store and preserve surplus output and price stability. In addition, the projects call for increased yields of such traditional export crops as bananas, cacao and coffee as well as other products designed to strengthen agro-industry in the processing of intermediate products as import substitutes.

Present and future prospects for livestock breeding are based on available pastureland, which is now being under-utilized. The number, quality and size of pasturelands, if fully utilized, would open up opportunities for increasing the livestock population. Forestry resources, particularly mangroves, are under great pressure because of the competing demands for the intertidal space used for shrimp-growing, which have led to the indiscriminate cutting down of mangroves.

^{2/} Ibid., p.2

Present contribution of coastal agriculture to national development

The agricultural sector's primary role in the economic and social development of the coastal area has always been linked with traditional exports. Suffice it to say that up to 1972, bananas were the main export, together with such commodities as coffee, cacao and sugar. Bananas, cacao, sugar cane and cotton originated in the coastal area, as did such important products for domestic consumption as rice, maize, tropical fruits, short-cycle oilseeds, etc.

The variety of climates along the coast - humid zones in the province of Esmeraldas, the north of Manabí and the lower Guayas River Basin and arid zones in part of Manabí Province, the Santa Elena Peninsula and El Oro Province - favour different types of agriculture. In the highly diversified Guayas River Basin and the Esmeraldas River system, an important agricultural and forestry base for the development of agro-industry; in the Manabí area and Santa Elena Peninsula, agriculture dependent on potential water resources; and in the southern part of the coast, a highly specialized type of agriculture geared to export crops.

On the basis of the diversity of present and potential land use, a preliminary identification can be made of agricultural-livestock subregions along the coast.^{3/}

^{3/} The information given below was taken from the study on Agricultural Zones for Integrated Programming prepared by the National Programme of Agrarian Regionalization (unpublished), Quito, 1980.

Northwest coast of Manabí Province

There are large cattle ranches in the northwestern part of Manabí Province. It is a relatively humid area and despite fertility problems (salinity) in Cojimíes, the soils have a good potential. There are large flat expanses, which can be mechanized and irrigated by machinery. Much of the area used for farming grows fodder, cacao, fruit and subsistence crops. In the Cojimíes area on the border of Manabí and Esmeraldas Provinces, the indentation of the coast and the inflow of fresh and salt water form an estuarial regime favouring the development of extensive mangrove swamps. Mangroves lie near the mouth of the Jama River.

The zone is cut off from other coastal sectors and has very rudimentary means of communication, except for the summer road which runs along the coast. Improvement of that road could have beneficial effects on the rural economy of the area because it would make it easier for small growers to market their products. It has been recommended that cacao plantations should be developed in the coastal area, particularly in Cojimíes (an area of saline soils), but with grazing land so close by, they might be invested with pests.

Central coast of Manabí Province as far as the Bahía of Caraquez

Farther south, the area becomes more arid and most of the crops require irrigation. While the soils are fertile, there are some drawbacks. Livestock breeding is the main rural activity. The flatlands near the coast have the most artificial pasture. The Jama irrigation project is most vital to this area because it will enable 200 medium and small owners to develop cotton and rice crops and it will improve the pastures. About 4000 hectares will be brought under cultivation. In Bahía de Caraquez, where the Chone River flows out to the sea, there are about 2300 hectares of mangroves where shrimp is grown.

Southwest coast of Manabí Province

The coastal parishes south of Bahía de Caraquez have perfectly usable soils, often flatlands, but with few serious drawbacks. The low precipitation and severe

water shortages all year round make irrigation indispensable and the relatively numerous layers of groundwater could be used for that purpose. There is very little cultivated area, less in Jaramijó and the relatively humid sectors of San Lorenzo and Montecristi, where yearly subsistence crops are grown, coffee and citrous fruits (San Lorenzo), cotton (Montecristi), fodder (Manta) and some bananas. This zone was considered to be without significant farming potential. Reforestation and the use of groundwater, which could in turn be reclaimed in the industrial zone of Manta, were recommended as general guidelines for resource use.

Portoviejo subregion

Since the Portoviejo subregion is made up of a number of parishes with a single outlet to the sea (Charapoto, included in the previous zone) and closely linked with the agricultural and urban development of the Portoviejo and Manta zones, it should be regarded as part of the sphere of influence of the immediate coastal area. It is a very dry zone circling the valley of the Portoviejo River where there is intensive farming. The objective of the CRM's "Portoviejo project" is to overhaul the irrigation system and the use of the water from the Poza Honda Dam in order to reorganize the farming system and adapt it to intensive horticultural production for neighbouring urban markets and for agro-industry, which will have a very strong impact in Manta if it is developed.

At present, large areas are growing short-cycle subsistence crops and industrial crops (cotton, castor-oil plants), coffee, various fruits and, to a lesser degree, bananas. The areas used for pasture are considered an under-utilization of the valley's resources.

South coast of Manabí Province and northwest of Guayas

The coastal parishes of the south of Manabí Province and northwest of Guayas have limited agricultural potential. In a general region of severe dryness and contrasts in topography, agriculture becomes precarious even though the soils present no serious problems. The cultivated area is small, with the exception of Jipijapa, which uses up to 60% of the total area for artificial pasture, coffee, cacao, fruit trees and subsistence crops. In Machanilla, Puerto Cayo and Puerto Lopez Manglaralto, the land is used mostly for subsistence crops.

West coast of Guayas Province

The features common to the coastal parishes of the west coast of Guayas Province are dryness and low soil use. The potential of the soil as a resource and the prospect of irrigation works which will make it possible to store the water of small basins (small hydraulics) and to divert water from the Daule River offer a number of possibilities for this zone. The irrigation works in the Peninsula would make it possible to reclaim large relatively flat areas on which to grow vegetables for the Guayaquil markets and, to a lesser extent, those of Santa Elena and Salinas. The present cultivated area is negligible and used only for subsistence crops.

Coast at the mouth of the Guayas River and adjacent zones

The parishes of the lower Guayas River Basin form a more or less flat area with poor drainage, subject to periodic flooding. This is due to the shallow capacity of the rivers, which overflow their banks, and poor drainage of the soil. The floods have been increasingly destructive to the villages and extensive cultivated areas. The Commission on Studies for the Development of the Guayas River (CEDEGE) has investigated possible methods of flood control as part of an integrated programme for control of the water resources of the Basin.^{4/} The mangroves which cover the shore south as far as Guayas Province extend for 87,360 hectares.^{5/} Shrimp are bred in the outer estuary.

^{4/} For further information, see CEDEGE "Flooding in the Guayas River Basin", March, 1975.

^{5/} Department of Merchant and Coastal Shipping. "Shrimp nurseries, mangroves and shrimp culture by species". In Izaca, R.G. and Arena, P.O., op. cit.

East coast of Guayas Province

The parishes of the east coast of Guayas Province have a drier climate than the zone described above, but there are more facilities for irrigation and water management projects. The subzone of Taura has large areas of cultivable land, where farming can be mechanized and irrigated, although its soils, used mainly for rice, fodder and subsistence crops, are clay-bearing, poorly drained and have salinity problems in some places. However, large agricultural projects are under way; it is a newly-settled zone in the process of total change.

Farther south, parallel to the coast, the climate varies from zone to zone, but is especially dry along the seashore. Similarly, the soil quality varies, with saline soil found at the seashore. Irrigation is widespread. Present forms of land use fail to take advantage of particularly favourable natural conditions. The soil is used mainly to grow bananas, cacao, fruit trees and subsistence crops and, to a lesser extent, for pastureland.

Coast of El Oro Province

The coast of this province has two subregions. The Machala zone is flat, nearly all of it can be mechanized, the soil is deep and of good texture, although too saline near the ocean, and irrigation is necessary. Its potential yield is good because of its good soil and easily usable groundwater. A large area is cultivated and used for bananas, cacao and subsistence crops, with cattle-raising and artificial pasture in Barbones, which is considered an under-utilization of agricultural potential.

The southwestern end of the El Oro coastal plain is dry, so that irrigation projects are essential to the incorporation of new areas in agricultural and livestock development. Moreover, there are probably groundwater resources which can be tapped in Huaquillas and Jambelí. The soil is used for artificial pasture, rice and subsistence crops. Predesur has considered large irrigation projects for the development of this zone. The most important forestry resource is the mangrove, which covers 22,260 hectares, although 2500 hectares have been stripped by in-

VI. FISHERIES

Principal characteristics of the sector

Fishing and related activities increased beginning in the early 70s and gained even more momentum from 1975 on as a result of the efforts of the private sector and the Government legal support provided by the "Fishing and Fishing Development Act" which provides a series of economic, tax and legal incentives to promote the development of the sector. The following basic statistics are a measure of the sector's dynamism:

TOTAL CATCHES		CATCHES BY SPECIES, 1978	
Year	Metric tons (gross weight)	Species	Metric tons
1965	55.500	Pinchagua and similar	550.000
1966	52.100	Tuna	24.000
1967	64.950	White Fish	25.000
1968	76.050	Shrimp	10.000
1969	86.500	Crustaceans	2.500
1970	91.400	Mollusks	4.000
1971	106.700	Turtle	1.000
1972	108.200	Lobster	50
1973	153.900		
1974	174.400		
1975	222.033		
1976	295.268		
1977	433.950		
1978	616.550		

EXPORT OF FISH PRODUCTS

In metric tons (net weight), thousands of dollars and percentages

1974-1978

PRODUCT	1974				1978			
	M.T.	%	US\$	%	M.T.	%	US\$	%
Tuna (frozen and canned)	14.106.10	39.1	9.122.10	31.6	14.758.00	13.9	14.013.00	15.3
Shrimp (frozen)	2.717.90	7.5	8.755.20	30.3	4.757.00	4.5	31.286.00	34.2
Pinchagua (canned)	6.404.20	17.8	5.324.30	18.4	18.783.00	17.7	18.791.00	20.5
Fishmeal	12.177.00	33.8	3.974.80	13.8	58.112.00	54.7	18.931.00	20.7
Fish oil	-	-	-	-	7.800.00	7.3	3.364.00	3.7
Sub-total	35.405.20	98.2	27.176.40	94.1	104.210.00	98.1	86.385.00	94.4
TOTAL (including other lesser products)	36.043.00	100	28.848.20	100	106.172.00	100	915.522.00	100

Source: Ministry of Natural Resources and Energy, Ecuador, Office of the Undersecretary for Fishing Resources, "Diagnosis of the Fishing Sector", 1980.

Fishing has become one of the most important activities of the agricultural sector, especially the fishing industry and fish product exports. Fishing products account for about 6% of the country's total exports and ranked fifth in 1977-1978 after oil, cacao, coffee and bananas.

Four species of fish figure in foreign trade: tuna, canned and frozen; Shrimp, frozen pinchagua, canned and fish flour and fish oil, which were worth a total in 1978 of \$86,385 or 94.4% of the value of all fish product exports compared with \$35,405.20 in 1974. It is also interesting to note the relative decline in the share of tuna in the export market and the sharp increase in the output of fish flour, which was the major export in terms of weight.

Fishing resources can be decisive in improving the nutritional levels of the population, providing new sources of food, generating jobs, contributing significantly to the Gross Domestic Product (GDI) and providing large amounts of foreign exchange. However, the development of fishing has been uneven. Commercial fishing has reached a plateau in its development and commercial fishermen are facing problems of low productivity, low income, lack of basic services and infrastructure, not to speak of the danger of overfishing some species while others are still insufficiently exploited.

Management of the resource is difficult because not enough is known about the potential of the various species, how plentiful they are, their biology and their maximum sustained yield and because there is a lack of reliable statistics. There is also a shortage of skilled workers, a problem aggravated by the absence of economic incentives. Fishing itself has taken precedence over research, so that

In the fishing industry, research is most urgently needed to assess how abundant and how extensive are the resources of shrimp, small pelagic fish, and lobster (for further details on the industrial fishing sector, see the chapter on industry).

Fish resources

The resources of the Ecuadorian coast have been divided into three large categories: fish, crustaceans, mollusks and turtles, on the basis of volume caught, economic value and relative importance (see table).

The fishing areas with the greatest potential yield are briefly outlined below.—

1/ The data given has been excerpted from Aubray, Roger "Considerations for a possible development programme for the fishing sector in Ecuador". Quito, 1979.

SPECIES OF FISH CAUGHT OFF THE ECUADORIAN COAST BY ECONOMIC VALUE, TYPE AND LOCATION

SPECIES	COMMON NAME	TYPE OF FISHING		LOCATION
		Commercial	Industrial	
TUNA	Yellow fin			Area of Manta
	Albacore		x	Gulf of Guayaquil
	Barrel Bonito		x	"
	Pataseca Bonito		x	"
	Sierra Bonito		x	"
	Bottlefish		x	"
	Mackerel, horse mackerel or moray		x	Santa Elena Bay
	Pinchaqua	x	x	Gulf of Guayaquil
	Chub	x	x	Santa Elena Bay
	Chum	x	x	"
WHITE FISH	Bladefish	x		"
	Carita	x		Coast of Esmeraldas
	Corrina	x		Manabí y Guayas
	Watery Flat	x	x	"
	Cod	x	x	"
	Beruzate	x	x	"
	Striped fish	x	x	"
	Monkfish	x	x	"
	Redfish	x	x	"
	Porgy	x	x	"
	Huayaibe	x	x	"
	Dorado	x	x	"
	Savfish	x	x	"
	Red murrard			"
	MOLLUSKS	Clam	x	
Conch		x		"
Oyster		x		"
Mussels		x		"
CRUSTA- CEANS	Shrimp	x	x	Gulf of Guayaquil
	Lobster	x	x	Manabí and Esmeraldas
	Crayfish	x		"
	Squid	x		"
TURTLES	King Crab			"
	Turtle	x		"

Source: Ministry of Natural Resources and Energy, Ecuador, Office of the Undersecretary of Fishing Resources. "Diagnosis of the Fishing Sector", 1980.

Tuna fishing

Ecuador lies in one of the world's richest tuna zones. This resource has been thoroughly studied by the Inter-American Commission on Tropical Tuna for the Eastern Pacific (CIAT), according to which the total catch of yellow fin and barrel tuna from a million sq km of Ecuador's exclusive zone comes to 85,000 tons a year. These species have been fished intensively by a large fleet of tuna boats, circular nets (seines) and "palangres" of various countries.

Of that total, 25,000 tons are caught by boats flying the Ecuadorian flag and 60,000 tons by foreign boats to which Ecuador has issued a total of some 220 licenses, more than 50% of them Japanese "palangreros".

Exports of frozen and canned tuna were valued in 1978 at \$14 million, representing 15% of all fishing exports, although the size of the catch in the national total has fallen off compared to 1974. Nevertheless, this industry is one of the most developed and prosperous in the fishing sector of Ecuador.

Studies seem to indicate that, subject to the availability of resources and the co-operation of Ecuadorian boats plying the whole inter-tropical area, the total catch of the main species of tuna could exceed 85,000 tons before the end of the next five year plan.

It should be noted that in addition to the barrel and yellow fin tuna, there are many other scombroids and related species in Ecuador's maritime zone, such as the merlin (little hake), swordfish and dorado. Although they do not command as high a price on the world market, they still are an important resource which has not been overfished regionally.

Shrimp fishing

In Ecuador, where the white shrimp is very plentiful, the industry has become a principal economic activity of the fishing sector. In 1978, total shrimp exports came to \$32 million, or 34% of all fishing exports.

In addition to the catches brought in by the shrimp fleet, shrimp is grown on a commercial scale in tanks or pools. This has created a serious problem: the exploitation of a shared resource and the growing competition between the shrimp boat catches and the growing of shrimp in tanks or pools.

Shrimp-growing is an industrial activity begun in El Oro Province in 1968 and has been steadily growing since 1971. Total output increased from 45 tons in 1972 to 1,144 in 1976 and is expected to reach 4,500 tons in 1978-1979.

The system consists of digging out large tanks in salt-bearing terrain called "salitrales" or "pampas" or in mangrove areas at sea level, into which are cast the larvae caught by commercial fishermen, 30,000 larvae on an average per tank hectare.

The main shrimp fishing grounds are the mangrove swamps of the estuary and the species best suited to the environmental conditions in which the shrimp are grown are P. vannamei and P. stylirostris (see map 7).

These are some of the most important problems in the growing of shrimp:^{2/}

- Oversaturation of the area available for shrimp nurseries, it being very unevenly distributed;
- Lack of co-ordination between the competent agencies so that there is no control over the development of shrimp-growing;
- Alteration of the ecology of the mangrove as a result of indiscriminate cutting aimed at converting the mangrove area to such other uses as the extraction of charcoal, industrial uses (briquettes) and chemicals (tannin).
- Lack of knowledge or partial knowledge of the reproductive cycle and early life stages of shrimp;

Lack of technical advisory services to backstop development of this activity.

There is also a good deal of concern about the effects of massive, uncontrolled catches of young shrimp in the larval areas of the coast and the commercial fishing zones in which the shrimp fleets operate. Moreover, owing to the lack of reliable data on the actual potential of the ocean shrimp banks and of shrimp-growing, there is an urgent need to study the principal commercial species and to experiment with the artificial production of larvae and post-larval forms of white shrimp.

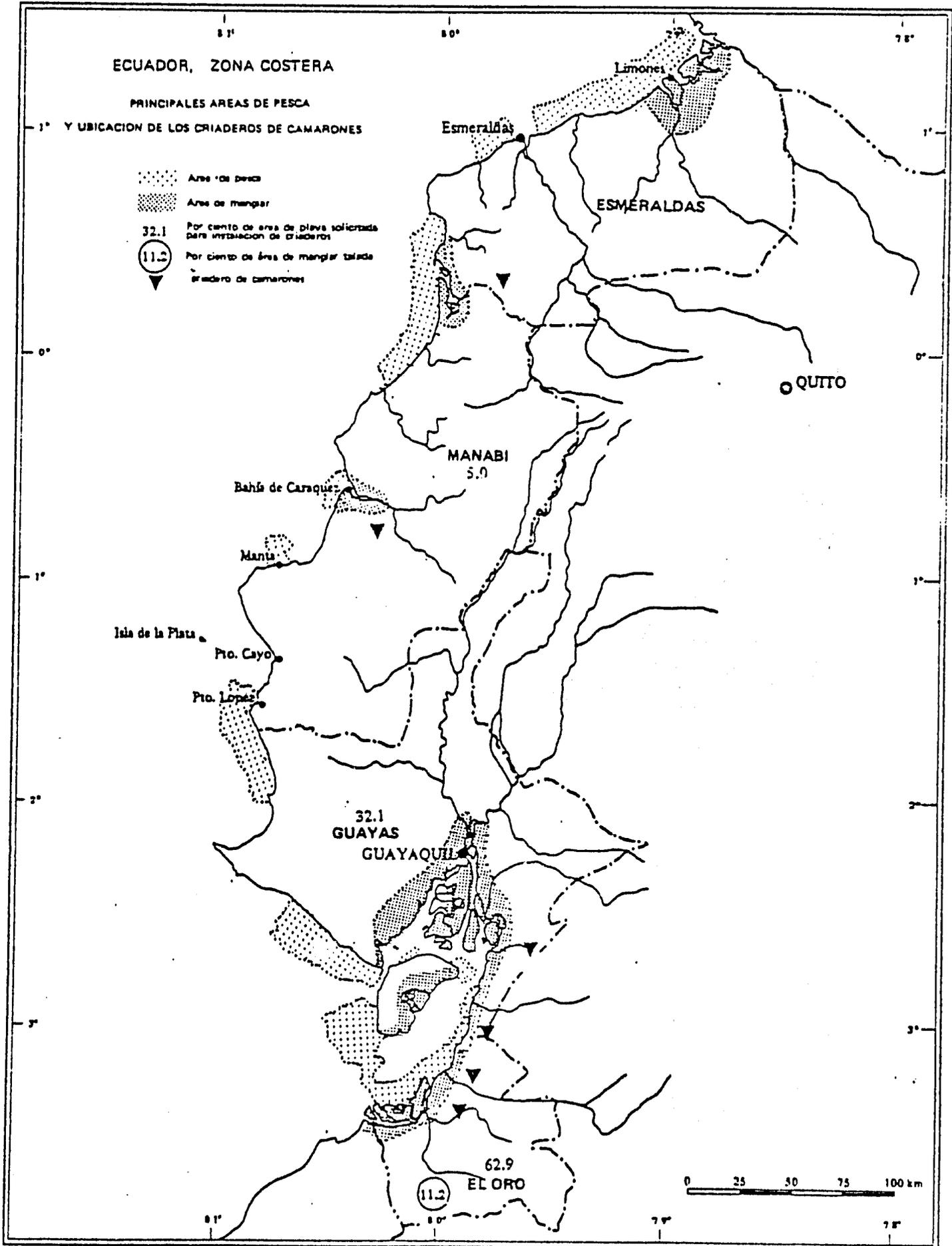
Fishing for pelagic fish

Under the general heading of pinchagua, a number of species of clupeids, engraulides and herring are traditionally caught off Ecuador, together with such other species as the sardine and various kinds of archoveta.

Since 1972, production of these fish, which had remained at the same level with an annual catch of about 50,000 tons, increased at a rate of 50% to 80% a year to reach an unprecedented level in 1978 of 550,000 tons, or 90% of Ecuador's total fish production. Pelagic fish catches in 1978 were worth over \$20 million, which represents 24% of the total exports of fish products. Only 10% of that total output was canned and 90% ground into fish flour (fishmeal). However, under the regulations, pinchagua must be used exclusively for direct human consumption or canning.

At the present time, yearly catches of small pelagic fish exceed the target of 150,000 tons provisionally set as the maximum sustainable potential. There are indications of overfishing and several proposals have been made to set nets because of the danger that stocks may be exhausted.

2/ Icaza, Raul G. and Arana, Patricio. "Shrimp nurseries: diagnosis and recommendations". National Fishing Institute. Fishing Information Series No. 09/78, Guayaquil, 1978, pp. 35-44.



Proper regulation of this type of fishing requires a scientific evaluation of the resource and the sustainable output since there are no reliable data on the total potential.

Deep sea fishing

Annual output has been estimated at approximately 20,000 tons of deep water fish, 4,000 tons of mollusks and 2,000 tons of crustaceans, excluding shrimp. Some 10,000 to 15,000 tons of white fish are caught by commercial fishing and 5,000 tons by the shrimp fleet. According to evaluations of the haul, it contains many varieties and species of considerable commercial value.

Studies indicate that the maximum sustainable yield inside the 100-m deep zone would be 20,000 tons; at depths of 200 to 300 m, it would be 30,000 tons of hake and other species. It has further been shown that there are good supplies of squid on all of Ecuador's continental shelf.

However, no industry has been developed in Ecuador based on deep sea fishing or trawling. A group of private companies and the State-owned company EPNA recently started to develop deep water fishing.

It has also been pointed out that before this type of fishing can be developed, a study must be made to assess the stock and intensive research must be conducted together with an economic analysis to ascertain the prospects for developing a deep sea fishing industry for export.

The small-scale fishery sector

Fishing in Ecuador was traditionally a small-scale fishing activity. It persists as such in many communities along the coast. The total number of commercial fishermen fluctuates between 10,000 and 13,000 individuals and the number of fishing boats of various sizes between 4,000 and 5,000.

It is an individual or family enterprise, using equipment and low-yield fishing skills and fishing boats without a motor. The total annual catch is estimated at between 15,000 and 20,000 tons of fish and crustaceans, although the level of productivity is very low and it is subsistence production or for personal consumption or, in some cases, consumption of the freshly-caught fish in the market.

There is no infrastructure for individual small-scale fishing. The absence of commercial fishing centres, an adequate road network, electricity and services impedes the marketing of the catch. Moreover, the lack of working capital makes the fishermen dependent on middlemen who market the catch and grant them credit at very high interest. Although the National Fishing Enterprise does provide some marketing assistance, those services are not sufficient and should be expanded so that more individual fishermen can benefit.

Efforts to improve the situation of individual commercial fishermen have been directed towards forming fishing co-operatives and the largest number of such co-operatives are found in El Oro and Manabi Provinces.

In addition, the IDB/IFAD project on human consumption of fish was signed in 1979; the concept is original and it is one of the best attempts made in Ecuador to assist individual fishermen and to improve the management of EPNA.

It will promote the establishment of four small-scale fishing centres in Esmeraldas, Puerto Lopez, Santa Rosa and Puerto Bolivar, together with loading platforms and processing plants equipped to handle an output of 5,000 tons of fish for distribution mainly in Quito and Guayaquil.

The fishing programme

The 1980-1984 National Development Plan calls for the following basic projects:

-Exploration of the waters adjacent to the coast, the lowest part of the continental shelf and the Colón Archipelago. This project is to be carried out on the basis of an agreement between the National Fishing Institute and the Government of the United Kingdom. It includes a study and analysis of fishing resources, their characteristics, distribution, maximum sustainable yield, utilization and marketing. It also envisages the advising and training of Ecuadorian technical personnel.

-In the training field, the Manta School will extend its instruction to individual fishermen and train them in their own communities.

-Optimization of production and marketing by establishing a sound production and marketing infrastructure and issuing the relevant regulations.

VII. NON-RENEWABLE RESOURCES

Very little information was available for the preparation of this chapter. The subject is so important in the context of the integrated development of coastal resources as to require more detailed knowledge about this sector.

While most of the oil is not produced in the coastal area, it is the site for the processing, transport and distribution of petroleum resources. Similarly, mining, which is of secondary importance in the national context, particularly surface mining of minerals or extraction of minerals lying near the surface or in shallow waters, could nevertheless have great impact on the ecology of the coastal area

Petroleum

Background

Ecuador has 192,000 sq km of petroleum deposits consisting of sedimentary formations clustered in the coastal basin (73,200 sq km), in the Napo or Oriente basins (97,500 sq km) and in other less important areas. In addition, the continental shelf (on the coast) also consists of sedimentary rock formations.

The share of the coastal deposits in the production of crude oil can be seen from the table below. Exploitation of shallow deposits for commercial purposes began in 1925 in Santa Elena Peninsula.

PRODUCTION OF CRUDE OIL
(Thousands of barrels)

1966-1978

Year	Crude oil		TOTAL	Petroleum for refining
	Coast	ORIENTE (1)		
1966	2,640.1	-	2,640.1	8,769.4
1967	2,271.6	-	2,271.6	8,095.8
1968	1,818.1	-	1,818.1	7,355.6
1969	1,607.6	-	1,607.6	7,727.3
1970	1,480.0	-	1,480.0	8,719.0
1971	1,384.4	-	1,384.4	9,884.8
1972	1,344.6	27,434.4	28,879.0	10,117.0
1973	1,021.8	76,189.2	77,211.0	11,245.6
1974	837.8	63,878.1	64,715.9	12,784.3
1975	837.4	67,921.4	68,758.8	14,844.7
1976	708.1	67,893.7	68,601.8	18,484.7
1977	688.4	66,263.6	66,952.0	14,168.3
1978	632.2	73,023.0	73,655.2	30,062.9

Initially, average output per well was 10 barrels a day, and up to 1964, 2,887,000 barrels a year were produced from 1,063 working wells.

Beginning in 1964 and for the period 1964-1970, the acreage allotted for petroleum exploration on the coast was increased from 187,983 hectares (1903-1964) to 2,749,069 hectares, with 12 companies working in Santa Elena Peninsula and the Gulf of Guayaquil. The results obtained in that part of the coast until 1970 have been evaluated as follows:

(a) The Gulf of Guayaquil zone is of great interest because a large accumulation of gas was discovered in the structure of the Amistad well, and also because a well drilled by Tenneco-Union Co. yielded good results - it was drilled on the Peruvian continental shelf at a point near the international border with Ecuador;

(b) The area of Manabí is interesting because of the thickness of its rudimentary rock layers;

(c) The central and southern parts of Esmeraldas Province are of no interest because the layers of rudimentary rock are too thin. ^{1/}

Beginning in May 1974, general geological studies were begun between the Bahía de Caraquez and Esmeraldas to assess the potential of various areas. In 1975 reports on the technical-economic basis for offshore geological prospecting were prepared and reviewed and between 1975 and 1976, the seismographical data on Ecuador's Pacific coast was analysed. In 1976, the continental shelf was blocked out with a view to exploration and exploitation^{2/}.

Production and refining of petroleum

The Santa Elena Peninsula is the only petroleum-producing region on the coast. Its output is about 44,000 barrels a month from 721 working wells located in three fields: Ancon (535 wells), Carpet (72 wells) and Cautivo (114 wells), most of them operating by artificial systems.

^{1/} DP/UN/ECU-72-011/2. "Strengthening of the Petroleum Sector", Project conclusions and recommendations". United Nations. New York, 1978. p. 1.

^{2/} Ibid. 1/. p. 16.

The output of natural gas from the fields on the peninsula is approximately 105,844,000 cubic feet a month and the gasoline extracted from natural gas, about 7,000 barrels a month. Total gross output of crude oil on the coast in 1979 was 492,469 barrels, and of natural gas over the same period 1,117,247 thousand cubic feet, while in Oriente, the production figures were 71,144,534 barrels of oil and 12,392,411 thousand cubic feet, respectively.

Petroleum is prepared for industrial use in four refineries, three of them located on the coastal area: State Refinery of Esmeraldas (Esmeraldas) Anglo Company Refinery (Santa Elena) and Gulf Oil Refinery (Santa Elena).

The State refinery of Esmeraldas is the only one with conversion machinery so that its output is better suited to domestic demand for white products. Its refining plants are new, modern and highly automated.

On the other hand, the refineries of the Anglo Company and Gulf Oil on Santa Elena Peninsula are designed to process light or reconstituted crude and cannot work with Ecuadorian crude from Oriente because it has a high residue content. That limits the actual supply of white petroleum products: there is not enough to satisfy domestic demand and since 1978, the deficit has to be made up by imports. Among the identified causes of the disparity between supply and demand are the physical-chemical composition of Oriente crude, the demand structure of the domestic market and the production structure of the peninsula refineries.^{3/}

The capacity of each of the refineries is shown in the table below.

<u>Refinery of Esmeraldas - Esmeraldas</u>		<u>Refinery of the Anglo-Co. - Santa Elena</u>	
UNITS	BPDO Capacity	UNITS	BPDO Capacity
Air distillation	55.600	Air distillation (Parson)	24.900
Vacuum Distillation	28.500	Air distillation (Universal)	6.000
Catalytic cracking	12.600		30.900
Viscosity reducer	12.600	<u>Gulf Oil Refinery - Santa Elena</u>	
Catalytic converter	2.700	Air distillation	7.000
Merox Jet fuel	1.500		
Merox Gasoline	9.300		
Merox LPG	2.200		
	<u>125.000</u>		

Source: Ministry of Natural Resources and Energy. Notes appended, 1980.

Gas resources of the Gulf of Guayaquil

The discovery of natural gas in the Gulf of Guayaquil in 1970 introduced a new dimension in the development of the region and particularly, of the coastal area. Future exploitation of natural gas is linked with its industrial uses, that is, the extraction of ammonia, urea and fertilizer.

A number of national and private organizations have conducted studies to evaluate reserves since there have been indications that the Gulf has significant amounts of natural gas.

Plans for using the gas include construction of a two-unit plant: one unit for the manufacture of ammonia and the other, for urea, with a capacity of 1,000 MT/day and 400 MT/day respectively. Most of the ammonia manufactured would be used to produce urea and for ammonia exports if the domestic market for pharmaceuticals does not absorb the surplus.

There have been differences of opinion about where this complex should be located. The study conducted by the Ecuadorian State Petroleum Corporation (CEPE) recommends Puerto Bolivar, Isla Puná and Posorja whereas Northwest's proposal eliminates the latter two because they do not have a good supply of fresh water, which is a requirement for any petrochemical complex. Another characteristic favouring Puerto Bolivar is the possibility of constructing a pier to serve the plant and load the product for export. Another proposal was to build a pipeline from Isla Santa Clara to Machala and from there to Guayaquil, which would be the major consumption and distribution centre. The gas would be for domestic and industrial use because it could be used for the reduction of iron ore if Ecuador's steel plant was located in the area of Machala or Puerto Bolivar.

Exploitation of gravels and clay

Gravels and clay are worked on a small scale in the coastal area of Guayas Province, and exploration is going on in Esmeraldas and Manabí Provinces (see table).

TABLE OF THE AREAS REGISTERED WITH THE DEPARTMENT OF GEOLOGY AND MINING
FOR GRAVELS AND CLAY IN THE COASTAL AREA

<u>Area</u>	<u>Mineral</u>	<u>Phase</u>	<u>Company</u>	<u>Province</u>	<u>Canton</u>	<u>Parish</u>	<u>Remarks</u>
María	Gold in gravel	exploration contract signed	Gowanda Mining	Esmeraldas	Eloy Alfaro	Selvalegre Rio Santiago	Located at the height of the towns of Timbire and Selvalegre. Gold left in gravel washed up by Santiago River. Exploration continuing. No production yet.
Eugenia	Gold in gravel. Gold sluice	Prospecting Contract being processed	Jose Herrerra,	Esmeraldas	Eloy Alfaro	Atahualpa Rio Cayapas	Located on the Cayapas River butaries, Agua Clara and Roja Blanca, flow into it near the town of Telimbi. Prospecting continuing. First phase of investigation. No production
Uriyacu	Gold in gravel Gold sluice	Exploration Contract being processed.	Dr. Ricardo Martinos	Esmeraldas	Eloy A	aro Selvalegre Rio Santiago	Located above the towns of Playa-Rica on the Santiago River. Second phase of investigation. No pro- duction
María Mercedes	Clay	Prospecting Contract being processed	Miguel Rivas	Guayas	Balzar	Balzar	Permission to prospect being processed. First phase of investigation of non-metallic minerals. No production.
Guilmodar	Gypsum	Exploitation Contract signed	Elicio Darquea	Guayas	Buayaquill	El Morro	Gypsum being extracted. Used for stucco and to make cement. Produces about 90 tons/month.
Punta Carnero	Gypsum	Exploitation Contract signed	Telesforo Villa- creses	Guayas	Salinas	Anconclito	Gypsum being extracted. Used for stucco and to make cement. Produces about 90 tons/month.
Canoa	Sands containing titanium ore	Exploitation Contract being processed	Selvalegre Cement Co.	Manabí	Sucre	Canoa	Exploitation being processed therefore no production. Used to make cement

VIII. INDUSTRIAL ACTIVITIES

Description of the sector

The manufacturing sector in Ecuador grew in real terms over the period 1972-1978 at a rate of 11.9%, higher than the growth rate of the world economy which was 10.5%. In absolute figures and at yearly prices, the manufacturing product rose from 7.824 million sucres in 1972 to 30.076 millions in 1978, which means that it quadrupled over the six-year period. ^{1/}

Food and non-metallic minerals were the most dynamic sub-branches of industry, followed by textiles, clothing and leather, and hard ware. As far as job generation is concerned, in 1977 employment in the manufacturing industry represented 15.2% of total employment in the country and absorbed 14.6% of the economically active population.

Traditionally, Ecuadorian industry has been concentrated in the metropolitan areas of Quito (Pichincha Province) and Guayaquil (Guayas Province) with a few lesser industries in Ambato, Cuenca and Manta (see map). This polarization of industrial development led to the enforcement of a policy of decentralization of industry under which tax incentives are given to promote investments in various parts of the country outside those provinces.

At the core of this strategy, and playing a major role in terms of its direct impact on the planning of the coastal area, is the List of Directed Investments (LID). It comes within the framework of the programme for the integration of industry and was preceded by the decrees on the promotion of regional industry, the Act on the Development of National Industrial Parks and the decree promoting the formation of regional financial companies. This List (see table) is made up of 85 different projects corresponding to 60 industrial activities, and about 100 entrepreneurial units which it would be feasible to set up in the alternative locations given for each activity.

^{1/} Industrial Development Centre, Ecuador. "Ecuador's Industrial Sector".
Quito, 1979. p. 7.

Of the total number of projects to be located in the coastal provinces (30), there are twelve (12) relating to agricultural-industrial integration. The others relate to sectors of the chemical industry (4), automobile industry (3), cement industry (3), pulp and paper (4) and the great steel project and its supporting hard ware industry (metal machinery), as well as naval shipyards.

INDUSTRIAL PROJECTS CONTAINED IN THE LIST OF DIRECTED INVESTMENTS (LID)
WITH ALTERNATIVE LOCATIONS IN OCEANFRONT PROVINCES

I ALTERNATIVE LOCATION: COASTAL PROVINCE				
Industrial activity	No. of plants	Location	Minimum installed capacity	
Castor oil	1	El Oro	14,000 tons/year	
Ripe banana powder	1	El Oro	600 "	
Nylon 6	1	Esmeraldas	3,500 "	
Fertilizers	1	El Oro	600 tons/day	
Integrated steel mill	1	El Oro	350,000 MT/year	
Non-ferrous smelting (foundry) of parts and spare parts for the automobile sector	1	El Oro	1,000 MT/year	
Trucks	1	Manabí	8,000 units/year	
Hydraulic presses	1	Manabí	120 MT/year	
Naval shipyards	1	Manabí	Ships over 150 tons	

II ALTERNATIVE LOCATION: ONE OR MORE COASTAL PROVINCES AND IN ONE OR MORE PROVINCES WITH NO OCEANFRONT				
Industrial activity	No. of plants	Location	Minimum installed capacity	Type of enterprise
Extraction and refining of edible oil	2	El Oro and Loja	24,000 MT/year	Agro-industrial complex
Canned foods in general and fruit juices	3	Esmeraldas, Manabí, El Oro, Los Ríos, Imbabura, Tumburakha, Chimborazo and Carchi	Not specified	Partially integrated from the agricultural stage on
Dried onions	2	Manabí and Chimborazo	4,000 MT/year	Partially integrated from the agricultural stage on
Sugar mills	2	El Oro and Los Ríos	4,000 MT/day	Integrated in the form of a complex
Brown sugar mills	4	Bolívar, Imbabura, Pastaza and El Oro	500 MT/year	Integrated with the agricultural stage
Germ-free mashed bananas	2	El Oro and Los Ríos	3,000 MT/year	Not specified
Instant soluble coffee and/or tea	1	Manabí, El Oro and Pastaza	50 KR/hr	To be structured from the agricultural stage on
Green banana flour	3	Esmeraldas, El Oro, Los Ríos	2,000 tons/year	Not specified
Industrialization of maize (corn)	2	Manabí, Imbabura and Bolívar	1,000 tons/year	Not specified
Pressed wood board or fiberboard	2	Esmeraldas and Cotacachi	18,000 cubic m/year	Not specified
Structural wood modules for construction	2	Esmeraldas, Napo and Pastaza	7,500 cubic m/year	Not specified
Wooden toys and ornaments	2	Esmeraldas, Loja and Imbabura	525 MT/year	Not specified
Kraft pulp and paper	2	Los Ríos and Esmeraldas	70,000 MT/year	Not specified
Citrous essential oils	2	Esmeraldas, Bolívar and Manabí	10,000 KR/year	Not specified
Ascorbic Acid	1	Manabí, Los Ríos	500 tons/year	Not specified
P.V.C. polymerization	1	Esmeraldas and Manabí	10,000 MT/year	Different stages of integration
Portland cement	6	Manabí, El Oro, Coto- paxi, Cotacachi, Loja Imbabura	300,000 MT/year	Not specified
Cement slabs and wood shavings for construction	2	Esmeraldas, Napo and Pastaza	6,000 cubic m/year	Integrated forest development
Gear-boxes	1	Los Ríos and Manabí	75,000 units/year	Not specified
Gears	1	Los Ríos or Manabí		

With regard to the number of plants and where they are located (see table), the agro-industrial projects include the largest number of plants to be located mostly in El Oro Province and to concentrate activities relating to the industrialization of bananas, sugar and milling.

INDUSTRIAL ACTIVITIES	NUMBER OF PLANTS			
	<u>El Oro</u>	<u>Esmeraldas</u>	<u>Manabí</u>	<u>Total</u>
Agriculture and livestock	9	3	5	17
Chemicals	1	2	2	5
Pulp and paper	-	4	-	4
Cement	1	1	1	3
Automobile	-	-	3	3
Hardware (metal-machinery; includes the steel industry)	2	-	2	4
Naval shipyards	-	-	1	1
TOTAL	13	10	14	37

There are two reasons for the distribution and type of industrial projects outside the agricultural and livestock sector: first, it is consistent with the industrial development planning in the context of the Andean Pact, to which Ecuador is a party, and the implementation of the sectoral industrial development programmes, particularly approval of the metal-machinery programme, the automobile and the petro-chemical programmes under which Ecuador has been assigned to introduce new industries and this has opened up broad prospects for establishing a metals-steel infrastructure and a chemicals industry.

Secondly, it is designed to support the productive sectors and the development of natural energy resources to supply the domestic market, the subregional market and foreign trade. For example, the pulp and paper projects to be located in Esmeraldas province not only satisfy the demand for Kraft and corrugated paper, but also promote the integrated utilization of the forest and have substantial impact on the generation of jobs and new projects for the mechanical uses of wood, the multiplier effect of which contributes to the development of a heretofore depressed area and helps to incorporate it in the national economy.^{2/}

^{2/} National Financial Corporation. "Designation of the pulp and paper plant project". Quito, 1980.

The large-scale industrial infrastructure projects now under way - steel industry petrochemicals, hard ware (metal-machines), automobiles and naval shipyards - are also located in the coastal area. The installation of terminal plants, basic industries and support infrastructure will have a profound effect on the region's development. The gas from the Gulf of Guayaquil is the key factor in this industrial scheme: it would be used in the steel plant, in an ammonia-urea plant and in a thermal power plant.

The industrial coastal area and its future prospects

The foregoing summary shows that industry is destined to play an important part in the development of the coastal area.

In broad terms, the development of coastal industry will be determined by the following economic scheme^{3/}: (a) The system of the Guayas Basin with two distinct subsystems: the lower basin with a strong industrial component, but also with very diversified agriculture and the upper basin with an economy based on export lines; (b) the system of the Esmeraldas, Santiago and Mira River basins, with an agriculture and forestry base allowing the introduction of a few large agro-industries; (c) the system of Manabí, supported by the construction of a naval-port and fishing complex, will also allow for considerable agricultural and livestock development and will have a hard ware (metal-machine) support industry; (d) the system of the south coast, with its highly specialized agriculture geared to exports, will be combined with an industrial conglomerate of a few heavy industries.

Among the Basic Projects, the following warrant mention:

1. In El Oro Province, located in the Machala-Puerto Bolivar area, plants producing nitrogenous fertilizers based on the power derived from the gas in the Gulf of Guayaquil. Capacity for production of ammonia: 500 MT/day, urea 750 MT/day. Investment: 1,694 million sucres.

^{3/} According to the spatial structure of economic development around various regional systems, each with a relative degree of specialization. In JULIAPLA. "Ecuador, Development Strategy (outline). pp. 60-61.

2. The integrated steel project located in El Oro Province, with a capacity of 400,000 tons of steel a year. It will operate on the basis of imported iron ore, but it would also use local scrap. Electric furnaces and the gas from the Gulf of Guayaquil would be used.

3. Construction of shipyards in the Port of Manta. This project is included in the Fishing Ports Project referred to earlier.

The fishing industry

Under the protection of the law on incentives for fishing, the industrial fishing sector has expanded rapidly in the last five years, leaping ahead of the commercial fishing sector (see table).

INDUSTRIAL FISHING PRODUCTION
(metric tons)

1974-1978

Type of product	1974	1975	1976	1977	1978
Frozen	16.737	26.286	86.995	124.112	110.233
Canned	17.886	12.994	16.088	28.865	24.350
Flour and oil	17.540	34.153	52.651	74.143	100.300
Others	58	105	152	225	386
TOTAL	52.221	73.538	86.995	124.112	150.233

<u>Industrial Fishing Enterprises</u>		<u>Geographical location of fishing enterprises</u>		
		Province	No. of enterprises	Percentage
Freezing plants (shrimp, tuna, white fish)	40 enterprises	Guayas	64	66.6%
Canning plants plus fish flour (tuna, sardine, moray)	38 enterprises	Manabi	19	20 %
Freezing plus canning (Plus fish flour)	11 enterprises	El Oro	7	7.4%
Others (dry, salted, etc..)	7 enterprises	Esmeraldas	2	2 %
		Pichincha	2	2 %
		Los Rios	1	1 %
		Azuay	1	1 %

Source: Ministry of Natural Resources and Energy, Ecuador, Office of the Undersecretary for Fishing Resources. "Diagnosis of the Fishing Sector", 1980.

Whereas 66.3% of the cargo brought in by the fishing fleet was industrialized in 1970, in 1978, that figure had risen to 97.3%, with most of the catches (80.3%) reduced to fish flour and much lower percentages canned (9.7%) and frozen (5.8%).

The major problems of the sector may be summarized as follows:

Low efficiency of canning plants, which are not utilizing installed capacity fully
Lack of co-ordination between fishing companies and those producing inputs
(tomato paste, oils, cans, etc..)

Lack of continuity in the production process;

Lack of technological development enabling it to exploit other species
and placing of products on the local market which are more suitable to meet the demand
of the external market.

The problems noted, added to the different utilizations of the catches - with a high rate of reduction to fish flour (fishmeal) - could lead to overfishing of the scarce small pelagic fish unless there is an evaluation of the resources and regulation of the catches. At the national level, the importance of the industrial fishing sector is reflected in its contribution to the total exports of the agricultural sector (7.5% in 1978), but it also has substantial impact on coastal development. Present and future prospects are based on job generation and on the possibility of carrying out complementary projects with other sectors of the economy. Moreover, the decentralization of the fishing industry, which now has 66% of its companies concentrated in Guayas Province, would help to strengthen other coastal industrial centres.

IX. TOURISM

The present and future role which the coastal area will play as a source of tourist resources will be examined in the light of the present state of development of those resources based on medium- and short-term supply and demand, the general objectives of the 1980-1984 National Programme of Tourism and the limitations imposed on the tourism sector by other economic sectors.

Major socioeconomic factors

The Government of Ecuador is aware of the enormous potential benefits of the integrated planning of tourism resources and of the great importance of the coastal area for their present and future development. It has not underestimated two key elements, which are often not present in other countries, namely, the availability of large, undeveloped areas for recreation and leisure activities which are still virtually untouched, and a burgeoning tourist market which is only beginning to feel the restrictive effects of other activities competing for the coastal space.

Recreation has become a major economic force within the framework of coastal area management. It imposes the need to develop existing resources on a scale compatible with present and future demands. In that connexion, two fundamental economic forces must be taken into account: (1) the growth of the population; and (2) the mobility of the population with the increase in available transportation and access to tourist areas.

The size, composition and distribution of the population are basic factors in assessing the demand for renewable natural resources for recreation.

The trend in the distribution of the population has been for it to concentrate in a large metropolitan area and in small coastal urban centres, some of which are growing rapidly. Moreover, in the past few years, the urban component of the population has increased as a result of internal migration. The social concomitants of urbanization are producing a growing appreciation of green spaces and the outdoors life which is, in turn, creating incentives for the conservation of unspoiled areas or the protection of natural attractions so they can be used for recreation and leisure, preferably by the urban population.

The prospect of industrial settlements in the coastal cities that the coast will have to provide recreation for the local population, a function which has not hitherto been seriously considered. The principle is that the recreation industry will primarily have to serve the resident local population for fear that other activities, like industry and commerce, may undercut the recreational potential of the coastal area. There are many instances where lack of proper planning left a stretch of coast without a single attraction, with no access roads to the oceanfront and with its entire space filled by activities bearing no relation to recreation and tourism.

It is also to be expected that present patterns of population distribution will not change substantially in the near future, but will become even more marked owing to economic growth trends and how the coastal space will be filled by the development of industry based on coastal and marine resources and the market advantages of the coastal location. In addition, improved transportation facilities in the form of new access roads to beaches and previously inaccessible spots and the increased use of the automobile for transportation by more and more local inhabitants, with its strong impact on habits of recreation and tourism, are producing changes in the tourist market. These trends have a direct bearing on the location and distribution of tourist areas and major urban centres. With Salinas two hours by car from Guayaquil and the beaches of the central coast about six hours from Quito, the importance of combining the three factors - market, infrastructure and transportation - in such a way as to give effective support to the develop-

Role of the coastal area in Ecuador's tourist space - tourist zones

In terms of physical structure, the tourist space of the coast has been divided into zones, centres and corridors^{1/} (see map), and the various attractions have been classified according to category and rank in importance.^{2/}

Zone 4 Playas Sur is considered to have the greatest variety of attractions. With an asphalt highway linking it to Guayaquil, this zone accommodates local tourists from Guayaquil and is soon expected to become part of the international tourist market as a stop in package trips. For the medium-term, it is limited by its hotel capacity, which is the smallest of all the zones in the coastal area (see table).

TOTAL HOTEL CAPACITY: BY TOURIST ZONES AND TOURIST CENTRES OF THE COASTAL AREA

Zone or Centre	No. of establishments	%	No. of rooms	%	No. of accommodations	%
Zone 2 (Playas Norte)	40	20.5	592	11.5	1.266	15.1
Zone 3 (Playas Centro)	21	10.8	445	8.6	994	11.9
Zone 4 (Playas)	14	7.2	479	9.3	713	8.5
Zone 5 (Janabelf)	34	17.4	896	17.3	1.275	15.2
Guayaquil tourist centre	86	44.1	2.753	55.0	4.184	49.3
Total for the area	195	100%	5.165	100%	8.372	100%

Source: General analysis of the use of Ecuador's coast - Tourism Sector, Preliminary paper, Ecuador, Department of Tourism, Studies Division, March 1980.

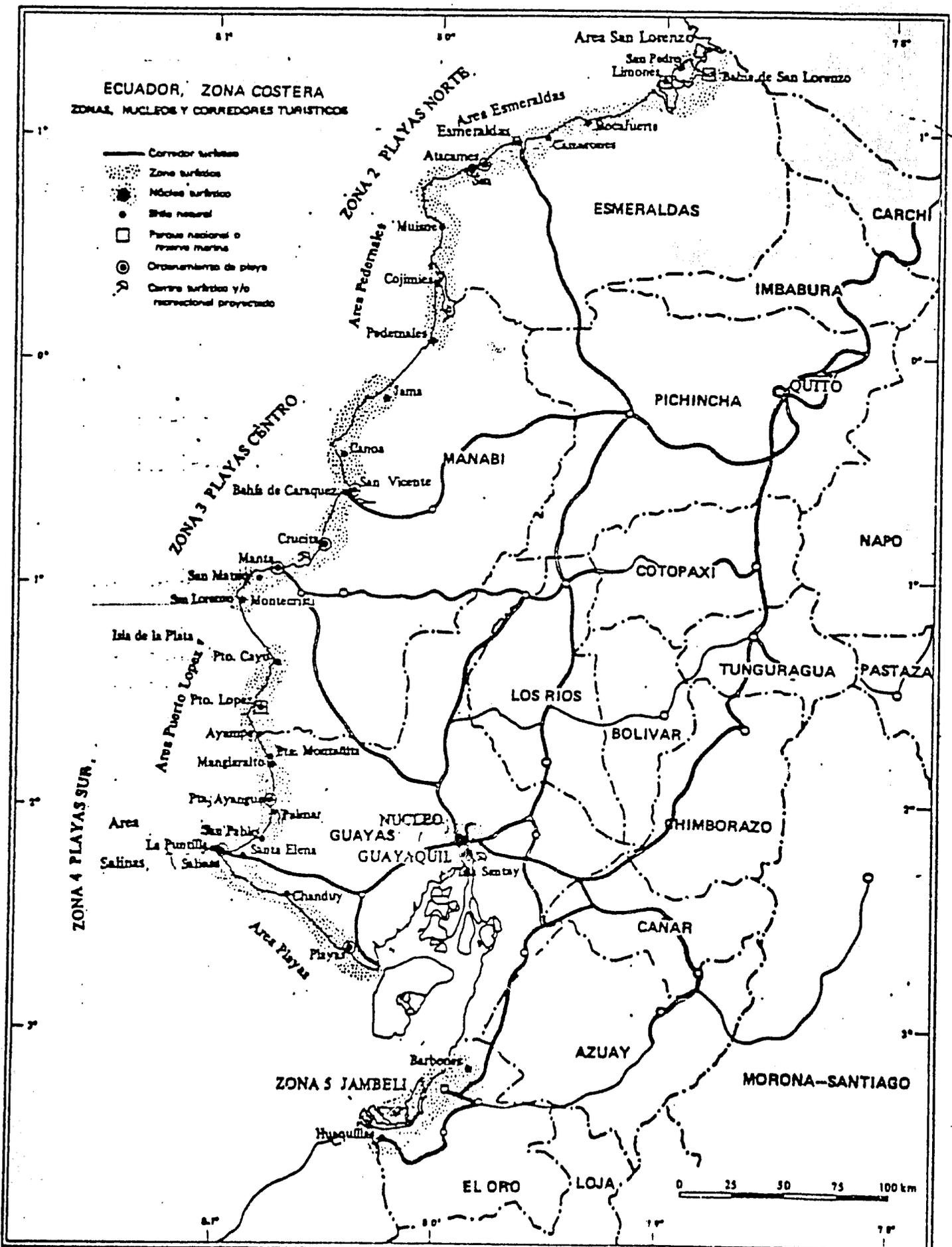
Provided it is justified by internal or international demand, a new beach resort is expected to be developed to complement Salinas and prevent it from becoming saturated, given its limited beach capacity. The National Development Plan envisages the development of the beaches of Ayangua, Manglasalto and Playas on Santa Elena Peninsula; the establishment of San Vicente Beach resort and a summer camp in Santa Elena.

^{1/} Department of Tourism. "Preliminary draft. General analysis of the use of Ecuador's coast - Tourism sector". Quito, 1980.

^{2/} Order of importance based on OAS methodology.

ECUADOR, ZONA COSTERA
ZONAS, NUCLEOS Y CORREDORES TURISTICOS

- Corredor turístico
- Zona turística
- Núcleo turístico
- Sitio natural
- Parque nacional o reserva marina
- ⊙ Organismo de playa
- ⊗ Centro turístico y/o recreacional proyectado



Zone 2 - Playas Norte is well-endowed with tourist attractions, the most important of them being the beaches of Atacames, Sua and Muisne. The city of Esmeraldas is the focal point of this zone, but although its present hotel capacity ranks second to that of Guayaquil, it is not sufficient to accommodate either present or projected demand.^{3/}

In reality, Esmeraldas, unlike the rest of the coast, is effectively connected to Quito. Although at present, they are hampered by the limited system of communications, once the highway linking Muisne with Esmeraldas and with good roads to the nearby beaches is completed, the tourist areas mentioned above will become the targets of tourist demand. In the short- and medium-term, they will depend essentially on internal demand, and particularly, the demand generated by the city of Quito. An international airport could be built to accommodate tourists en route to the Galápagos by air and sea, who have to transfer at Esmeraldas. This is a promising factor which will require the construction of the necessary facilities and equipment for international tourists from Quito or to the Galápagos via Esmeraldas.

Under the National Development Plan, the beaches of Las Palmas, Atacames, Sua and Muisne are to be developed, a hotel is to be built in Esmeraldas and a summer camp in San Lorenzo.

Zone 3 Playas Centro is taking shape as the receiving area of the internal demand originating in Quito, and also helping to diversify the supply of beaches for international tourism. Under the National Development Plan, the beaches of Manta, Bahía and Crucita are to be developed, and a summer camp and national hotel are to be built in Bahía.

^{3/} For further information, see "Summary of the pre-feasibility study for the hotel for the city of Esmeraldas". National Financial Corporation, Quito, Ecuador, December 1978.

Zone 5 Jambel is considered marginal because its tourist attractions are regarded as minor. Within the time-limits fixed in the present strategy, its role is limited to satisfying the recreational needs of the people of the principal cities situated within the radius of the beaches. The National Development Plan envisages tourist development of "La Tembladera" lagoon and a Government-operated tourist hotel in Huaquillas.

Principal problems of coastal tourism

No effective analysis can be made of the structure and composition of global tourist demand because there is no reliable record of international migratory movements, almost no figures on the flow of Ecuadorians to the country's tourist centres and the information supplied by tourist establishments on their installed capacity and the extent to which it is being used by Ecuadorians and foreigners is inadequate.

Similarly, no census of hotels has yet been taken which would yield very reliable data, so that for the time being, only a rough estimate of available hotel capacity can be made. In that connexion, it should be pointed out that the coastal area has a high proportion of third and fourth category hotel establishments which are not suitable for tourism because they lack the essential services, thus impeding the development of tourism in the area.

The chief disadvantages of using the coastal area for recreation arise primarily from the competing interests of other users of the coastal space, namely, industry, commerce, port installations, urban development, etc. and from the limitations they impose by restricting access to the oceanfront.

The possibilities of expanding the petroleum industry and refining operations in the Esmeraldas area will create problems of incompatibility with the beach resorts of Atacames and Súa, which would have to yield space for petroleum production, an activity of much greater strategic value to the Ecuadorian economy. In addition, there is the problem of speculation in land use.

In view of the need to build a model tourist centre as a pilot project to satisfy the growing national demand for beach resorts, two alternatives have been suggested as possible solutions of the problems described above.

- (a) To rezone the existing urban developments with a view to carving out a clearly-defined tourist centre whose size would be directly related to the demand and recreational habits of the potential users; or
- (b) To allow those developments to expand spontaneously and have the State take over ownership of an uncommitted land area where it would develop a coherent urban project in one way or another.^{4/}

The same problem arises for Zone 4 (Ayangué, Rinconada and Playas), where the high degree of uncontrolled urban sprawl makes it imperative to redefine the urban limits, control speculation and provide essential services for the area regarded as the urban zone.

Lastly, emphasis should be placed on the restrictions imposed by the limited physical and service infrastructure of the coastal area in general, the effect of which is to isolate or cut off many parts of the coast with substantial tourism potential.

4/ Ibid 1/ p. 21

X. PROBLEMS OF DEGRADATION OF THE ENVIRONMENT AND ENVIRONMENTAL PROTECTION

Three kinds of agents: household waste, industrial residues and oil - have been held responsible for pollution of Ecuador's coastal areas.

Household waste

It has been pointed out that most cities and towns do not have proper sewage treatment or, if they have, it is inadequate or incomplete. Sewage is emptied directly onto the shore, except in the city of Esmeraldas, which disposes of its sewage through an underwater pipe about 600 m long. Manta and Bahía de Caraquez are building sewage canals and garbage-burning dumps for the treatment of household waste (see table).

Household waste dumped directly into the ocean (Ecuador)

Coastal city	Treated	Untreated	On the shore	Through pipes	Approx. No. of tons (1974)
San Lorenzo		x	x		9,000
Esmeraldas		x		x	80,000
Bahía de Caraquez		x	x		11,000
Manta		x	x		64,000
Manabí		x	x		13,000
La Libertad		x	x		26,000
Salinas		x	x		12,000
Playas (General Villamil)		x	x		11,000
Puerto Bolívar		x	x		10,000

Source: Flores, Armando H. "Descriptive summary of resources and ecology of the coastal area of Ecuador", in Proceedings of the Interregional Seminar on Development and Management of Coastal Areas, DSE/UN, 1976, p. 86.

In addition, there is indirect dumping by cities situated along riverbeds, mainly in the Esmeraldas and Guayas basins, carrying physical, chemical and biological pollutants and in the absence of sewage treatment, they are adversely affecting the quality of the coastal ecosystem and ultimately human health. The only city with garbage-burning dumps is Portoviejo^{1/} (see table).

^{1/} Flores, Armando H. "Descriptive summary of the resources and ecology of the coastal area of Ecuador" in Proceedings of the Interregional Seminar on Development and Management of Coastal Areas. DSE/UN. Ed. K.H. Szekielda - B. Breuer. 1976. This information has not been updated.

Population of the water basins (Ecuador)

River basin	No. of cities with populations of					Estimated pop. of river basin
	under 10,000	>10,000 <100,000	>100,000 <500,000	>500,000 <1,000,000	>1,000,000	
Rio Santiago	4	-	-	-	-	19,000
Rio Esmeraldas	37	1	-	-	-	835,000
Rio Chone	10	-	-	-	-	104,000
Rio Portoviejo	17	1	-	-	-	162,000
Rio Guayas ^{1/}	109	1	-	1	-	1,730,000
Rio Balao	3	-	-	-	-	11,000
Rio Jubones	26	-	-	-	-	104,000
Rio Santa Rosa	3	-	-	-	-	31,000
Rio Arenillas	4	-	-	-	-	12,000

^{1/} Includes the Taura and Marañón rivers.

Source: Flores, Armando H. "Descriptive summary of resources and ecology of the coastal area of Ecuador", in Proceedings of the Interregional Seminar on Development and Management of Coastal Areas, DGE/UN, 1976, p. 87.

As a result of that situation, the coastal waters contain "an appreciable amount of germs, particularly of the coliform and salmonella group, which cause diseases of the digestive system. Pathogenic viruses, which produce a variety of diseases resistant to medical treatment were also found. There is a danger that there may be fungi (spores which produce irritations, especially of the skin) and parasites which contaminate seafood".^{2/}

The most serious problem is the contamination of the Estero Salado (Salt Marsh) of Guayaquil resulting from the dumping of high concentrations of pollutants in the sewage water produced by the urban and industrial centre in the Guayaquil area.^{3/} The most intensive studies have been conducted in the Estero Salado and some solutions have been suggested to alleviate the serious contamination of the marsh. There is a Plan for the Reclamation of the Salt Marsh financed by the Government and now in its first experimental stage in which various research organizations are involved.

^{2/} Moreno Loor, Humberto. Office No. 094. IPSM. Ministry of Public Health. Manabí Health Department.

^{3/} For further information, see Holden, Robert B. "Solutions to the problem of pollution of the Estero Salado" in Latin American Seminar on the Application of Ocean and Coastal engineering to priority problems in Latin America. Polytechnic Institute for Coastal Studies Organization of American States, Guayaquil, Ecuador, 1978. Pp. 275-293.

Industrial residues (waste)

The industrial installations and refineries along the coast are polluting the area with untreated or partially treated industrial waste such as heavy metals, acids, alkali and residual plastics. Similarly, the run-off of pesticides from the farming areas adjacent to the coast adversely affects the estuarial ecosystems and their effect, added to that of other industrial pollutants and coastal waste, has been felt particularly in the shrimp nurseries.

In a study made by the Navy Oceanographic Institute^{4/}, analysis of the pollution from industry along the coast indicates the following:

The surface temperature of the water ranges from 20⁰ to 25⁰C from south to north, with a seasonal variation of about 5⁰ C. The thermal effluent from certain installations affected temperatures at three points on the coast, namely: (a) Guayaquil Thermal Power Plant (El Salitral Plant, with an initial temperature of 80⁰ C and 30⁰ C at the end of the marsh); (b) Protinac Factory (Chenduy, Guayas Province) with 60⁰C discharges into coastal waters; and (c) La Libertad Refinery (Santa Elena Peninsula), with 55⁰ C discharges directly into the ocean. The other parameters measured such as pH, salinity, dissolved oxygen, biological oxygen demand (BOD) putrefaction index, hydrogen sulfide and nutrients showed anomalies in the estuarial zone near Guayaquil.

This study was approached in geographic zones of the coast and includes a list of factories which are discharging their waste water onto the beaches; the contaminants it contains; the physical-chemical analysis of concentrations of some pollutants; the sources of chronic pollution by hydrocarbons, cases of large oil spills and a review of household pollution by sewage contamination of the water mains serving the city of Guayaquil.

^{4/} Valencia, Manuel T. and Trejos de Sues um, Rocio. "Analysis of problems of marine pollution in Ecuadorian waters". Navy of Ecuador, Oceanographic Institute-Merchant Marine Division. Guayaquil, 1979.

Petroleum

The exploitation and transportation of hydrocarbons has caused problems of oil pollution resulting from occasional small or large oil spills. Between 1973 and mid-1978, there were a total of 133 oil spills in the ocean, four of them quite large. In all cases, the spill was cleaned up and there was no way of assessing its ecological impact.

The systems used to clean up oil spills have depended on the size of the spill and the area affected. Small spills affecting ports and recreational beaches were treated first by using dust or straw to absorb the concentrated layers of oil (barley dust, wheat chaff, etc.). The last layer, which resists absorption by the straw, is broken up with the chemical B.P. 1,100 W.D., but it is not used in estuarial zones where the use of break-up agents is counterindicated and the spill has to be absorbed by straw, balsa residues, polyethylene and polyester fibers.^{5/}

Chronic pollution by oil and petroleum products is due mainly to the operations of the oil terminals, refineries and natural emissions from old oil wells.

National plan to combat oil spills

Oil spill treatment materials and equipment are placed at various stations as part of the plan and a staff of emergency personnel is available to be sent to the site of any disaster. The oil terminals also have good preventive measures.

Through various research organizations, the Ecuadorian Government is implementing short-, medium- and long-term programmes in preparation for a frontal attack on pollution and its causes aimed at predicting, controlling and minimizing the deleterious effects of marine pollution.

As part of a complex of measures, research programmes dealing with pollution in the Gulf of Guayaquil, the Guayas River and the marshes around the city are now being implemented and the different sources of petroleum, industrial and household pollutants along the Ecuadorian coast are being updated.

^{5/} For further details on the treatment of specific oil spills, see Campana, Nicolas G. "Marine pollution by oil..."

Tidal waves

Ecuador lies in a tidal wave (tsunami) area; beginning in 1946, its seismographs recorded tidal waves from time to time which struck Chile, Japan, Alaska and Peru. Fortunately, they have not yet struck the coast of Ecuador with the intensity registered in other countries.

With a view to preventing disaster, material damage and the loss of life that follow a tidal wave, the country has a Tidal Wave Alert System, with its alert centre in the Navy Oceanographic Institute (INOCAR) where the information received from the tidal wave stations situated on the coast and offshore islands is processed and analysed. If it warrants any concern about a possible tidal wave, the alert goes out to Civil Defence and Naval Zones for dissemination to the public information media.^{6/}

Through INOCAR, Ecuador participates as a member of the International Group of the Alert System for Tsunamis in the Pacific.

^{6/} For further information on the subject, see Risso, Pastor, Pedro. "Catalogue of Tsunamis on the coast of Ecuador and its offshore islands". Navy of Ecuador, Navy Oceanographic Institute. Guayaquil, Ecuador, 1977.

XI. THE COASTAL AREA IN THE STRUCTURE OF ECUADOR'S SPACE

Background

Any examination of the development patterns of the coastal area should not be confined to an analysis of economic activities by sector, but should consider the area in the broader framework of an historical process and as part of the country's regional structure. A series of internal factors weighed heavily in that historical process, such as geography, cultural idiosyncrasies, forms of social and political organization and, most importantly, the evolution of the external sector.

The coast only began to become economically important following the crisis in textile manufacturing, when agriculture on the coast achieved unprecedented success with the production and export of cacao, which formed the base of Ecuador's economy from 1740 to 1922. That surge of economic activity made it possible, from the point of view of the structuring of the country's space, to bring large areas located in the Río Guayas Basin, the present El Oro Province and to a lesser degree in Manabí and Esmeraldas into the economic mainstream. The growing importance of the city of Guayaquil is due both to its agro-export activities and to its function as a port.

Within those broad lines, the coastal space was consolidated and tipped towards the external sector in response to expanding waves of export activity, which had started with the production of cacao by applying a land-extensive technology, the export of cacao and an embryo industry. Subsequently, that same development pattern was applied to other crops like coffee, bananas, rice, balsa reeds, taqua nuts, etc. From the point of view of the use of space, banana-growing involved unexpectedly vast stretches of coastal land in the production process, from Esmeraldas to El Oro, excluding only the semi-desert areas of Manabí and the Santa Elena Peninsula.

The discovery of oil created a marked change in the structure of Ecuador's economic space. Its penetration into the coastal area led to oil exploration and exploitation in the Santa Elena Peninsula and to the emergence of a petroleum processing and marketing infrastructure the length of the coast. In the last few decades, the economy became more and more diversified, subsequently with the development of fishing resources, tourism and recreation and the development of small and medium-sized industry.

The coastal area in regional development

On the basis of present modalities of coastal development, future trends outlined in the National Development Plan 1980-1984 and the Development Strategy, which extends to the end of the century, an over-all rough picture can be drawn of the coastal area in the broader context of national planning.

While its special characteristics and the phenomena and processes which take place in the coastal area make it distinctive, there are significant factors which distinguish it from the basic regional variations in the country - the degree of development of different natural resources in relation to needs, the linkage in space of the coastal area with other regions, regional complementarity, etc. - all of which create differences and ultimately produce distinctive features by which the different geographical environments along the coast are defined.

It should be noted that no attempt is being made to delimit geographical regions, for that is a much more complicated task. The point is to establish a rough identity for the outstanding coastal sectors - which may be part of much wider geo-economic regions - but because they are situated on the coast, have a strong individuality rooted in the biophysical characteristics of the coastal environment as a whole and in the need for each individual coastal space to co-exist with the others.

The description given below will be confined to the most outstanding physical-geographical characteristics, the incidence of economic activities on local and regional development and the role the area is destined to play in the Development Strategy up to the year 2000.

i. Northwest coast, including the coastal strip of Esmeraldas Province and the northern part of Manabí Province. It is characterized by a humid, coastal plain crossed by the Santiago and Esmeraldas river basins, which embrace large areas of valuable land for the development of the agricultural and forestry base. Its essentially rural economy is complemented by activities relating to the processing and transport of oil from Oriente and urban port and tourism development. At the present time, the area is inadequately linked with other coastal sectors and with its hinterland because of poor communications. The Esmeraldas - San Lorenzo and Suá-Muisne road projects will greatly strengthen those communications and establish a link between all the activities going on along the coast. The coastal shipping route will also remain important as a means of communication and transportation. In the long run, Esmeraldas is expected to be one of the eight major cities which, together with its sphere of influence, will determine regional development on the north coast. In the medium term and in terms of industrial development over the next five-year period, Esmeraldas is regarded as one of the most favourable sites for a wood and wood byproducts complex and a petrochemical complex.

ii. Central Pacific strip. Comprises two sharply differentiated zones: the first, which extends from around Punta Jama to Punta San José has very little rainfall and water is so short as to make irrigation imperative. The northern part is sparsely populated, but not the Portoviejo-Montecristi-Manta area, where, with the Port of Manta (equipped to move container cargo), it has an effective economic-industrial resource, however insufficiently exploited and developed on a national scale.

Its economy is basically rural, supplemented by tourism, urban development and industrial activities in Manta connected with the processing and canning of fish, oils, soaps and food products. After Guayaquil, it is the only industrial centre on the coast, but it ranks much lower.

The area is efficiently connected to other coastal sectors and to its hinterland by a road network which integrates the major centres (Manta, Montecristi Portoviejo) with the interregional connecting systems.

However, there is still a need to create a few new urban centres in the northern part of the strip to structure its territorial space and provide services to developing agricultural zones. The long-term prospect is that Manta, Montecristi and Portoviejo will become the metropolitan area of the central coast. In the medium term, its large-scale industrial projects include the automobile complex and the metallurgy and metal-machinery project, whose development would depend mainly on the demand generated by the naval-port complex. The siting of shipyards in the port of Manta with facilities for maintenance, repair and construction, apart from contributing to the growth of port activity, will offer new employment opportunities and an opening for new specialized branches of industry

The second zone extends to the south up to Punta Ancón. It is a generally very dry area with contrasts in topography. The agriculture is extremely precarious, of a subsistence type and it cannot realize its potential without irrigation. The Daule-Santa Elena interchange will make it possible to irrigate 50,000 hectares in Santa Elena Península. The proposal for the joint programming of the Peninsula's development with the participation of regional agencies (CEDEGE, CRM) may be one of the most notable initiatives that can be taken in the context of medium- and long-term regional planning.

At present, Santa Elena Península is the site of a variety of strictly coastal activities and uses such as tourism, oil refining and transport, fishing ports, salt mining and refining, urbanization, the fishing industry and military use. The proximity and efficiency of the system of communications with Guayaquil makes this coastal sector highly important.

iii. Coast at the mouth of the Guayas River and adjacent zones.

The lower basin of the Guayas River and the metropolitan centre of Guayaquil constitute the axis on which the development of the region revolves. The space is densely occupied because it is rich in resources and suitable for agriculture and, as the largest urban concentration in the country, it has to withstand high population pressure.

Through a combination of circumstances, it has become the epicentre of the coastal area and the most outstanding zone in Ecuador. First, its position as the gateway to the interior through the broad inlet of the Gulf of Guayaquil and the Guayas River. Secondly, its producing and settlement capacities; and third, the economic and industrial supremacy of Guayaquil sustained by a substantial energy and road infrastructure.

For all those reasons, it constitutes the most powerful geo-economic system in Ecuador, although it has drastic imbalances and socioeconomic inequalities which seriously hamper the fuller occupation of the space.

iv. Coast of El Oro Province Region with a semi-humid, tropical climate for the most part, dry in the south (less than 1,000 mm of precipitation), with an agricultural potential that is still only partially developed. The economy is essentially rural and is supplemented by the salt industry and a beginning of tourism.

It is considered the richest banana-growing area on the coast and suffers from ecological deterioration due to the cutting of mangroves to make room for the large tanks in which shrimp are grown.

The central part is relatively populated and the south has a low population density. Machala-Puerto Bolivar, which are growing rapidly in population and economic activity, represent the focal point of the south coast of Ecuador. The long-term prospect is that it will develop as the metropolitan area of the south coast, with Machala-Santa Rosa-Puerto Bolivar forming the basic urban framework. It is in a privileged geographical position as a regional and international connecting point because it borders on the Gulf of Guayaquil on the west, the frontier with Perú on the south, the Guayas basin on the north and in the east, it has comparatively good communications with the central and south highlands.

Under the National Development Plan and the long-term Strategy, it is to enjoy the prerogative of hosting the first steel complex in Ecuador, which will be located in Puerto Bolivar-Madela. It is to be an integrated complex and will include a fertilizer plant. Both projects depend on the use of the gas from the Gulf, which is expected to be in full production by the end of the century.

XII. THE INSTITUTIONAL FRAMEWORK

Ecuador is a unitary State with a national Constitution. It has a republican form of government with three separate functions: the legislative, exercised by the National Chamber of Representatives; the executive, exercised by the President of the Republic; and the judicial, exercised by the courts and judges.

The territory of the State is indivisible, but for purposes of local government, it is divided into provinces, cantons and parishes.

Planning

The planning tradition of the Government of Ecuador goes back to 1954, with the establishment of the National Planning and Economic Co-ordination Board (JUNAFPLA), now known as the National Development Council (CONADE). This body, chaired by the Vice-President of the Republic, is responsible for establishing the general economic and social policies of the State and developing the relevant development plans, which have to be approved by the President before they can be implemented. It is multisectoral in composition and the highest-level planning body.

The policies laid down by the Government and the economic and social plans which may be developed, once they are approved by the President of the Republic, shall be executed and carried out mandatorily by the respective Ministries and organs of the public sector. The heads of those organs shall be responsible for their implementation (Art. 91).^{1/}

The provinces and municipalities have very little autonomy, although the municipality in many ways has broader powers which embrace those relating to the physical and town planning of the territory of the canton and include:

- (1) formulation of plans regulating the physical development of the canton; and
- (2) formulation of plans regulating urban development.

^{1/} De Andrade Azevedo, Enrico. "Analysis of the legal and institutional situation of planning in Ecuador". (Final report of the Mission).

The regional institutions have given effect to the regional scope of development. At the present time, the regional bodies dealing with part of the coastal area are the Study Commission on the Development of the Guayas River (CEDEGE), the Centre for the Rehabilitation of Manabí (CRM) and the Programme for the Development of the South (PREDESUR). These institutions differ in powers, organization and financial resources. Their geographic orbit is restricted and they have different jurisdictions. CEDEGE is an autonomous body which developed from water resources planning and then adopted a scheme for regional planning, whereas CRM is under the Ministry of Agriculture and Livestock and its functions are to prepare development plans, programmes and projects and execute works in priority sectors (water resources, irrigation, drinking water and environmental sanitation) within the framework of regional programming. PREDESUR is a socioeconomic development programme with such mixed aims as the exploitation of water basins and the execution of integrated development projects in various provinces.

The National Planning Board has in turn set up a regional division made up of seven land regions^{2/} and one island region, of which the coastal provinces form part. The grouping has no continuity in space and it would be very difficult to incorporate the coastal area.

Other public sector bodies are regionally decentralized depending on their particular requirements. The National Programme of Agrarian Regionalization (PRONAREG) of the Ministry of Agriculture and Livestock is very important to coastal management. Its function is to identify agricultural regions throughout the country, divide it into Agricultural Zones for Integrated Programming (ZAPI) and subdivide those zones into agricultural, cattle-raising and forestry areas.

Region 1: Provinces of Carchi, Imbabura and Esmeraldas; Region 2: Provinces of Pichincha and Napo; Region 3: Province of Manabí; Region 4: Provinces of Cotopaxi, Tungurahua, Bolívar, Chimborazo and Pastaza; Region 5: Provinces of Guayas and Los Ríos; Region 6: Provinces of Canar, Aguarun and Morona Santiago; Region 7: Provinces of El Oro, Loja and Zamora Chinchipe; Region 8: Province

For that purpose, the renewable natural resources, the human and the economic resources in the rural sector were inventoried, evaluated and quantified. From the outset, the Office for Scientific and Technical Research of Overseas France (ORSTOM) provided assistance in that undertaking. It began in 1970 and included a broad programme of basic research in such fields as soils, water, vegetation, present and potential soil use, land tenure system, hydrology and hydrogeology, meteorology, ecology, sociology, economics, geography, rural sector infrastructure, population and human resources. These data are available for all the coastal provinces with some limitations for Esmeraldas Province (soil studies, now under way).

The institutional legal framework

The institutions and/or organs with responsibilities in the coastal area are distributed by field of competence among a number of administrative units as a result of the application of the principle of specialization (see table). This is a system of vertical integration under which each ministry or ministerial department, acting separately, performs functions in its specific field of competence. The effect of this type of administrative structure is that the horizontal connexions, which are key in the execution of integrated management projects virtually do not exist. There is no institutionalized machinery for carrying out joint programmes.

Ecuador has many legal rules (laws, decrees, regulations, ordinances, etc.) which apply either nationally or locally, promulgated with different objectives and covering specific or sectoral problems relating to various aspects of coastal management.^{3/} Since the concept is relatively new, there is no law that deals

^{3/} No inventory was taken of legislation or institutions related to coastal management because it was not considered necessary for the purposes of that general study and because the means of preparing it were not available.

specifically with that subject. The laws in force were promulgated for other reasons than coastal management (the laws on ports, roads, industrial development, etc) which often leads to apparent, potential or real conflict; in many cases, the aims of development, conservation of natural resources and preservation of the environment are not compatible. In short, while there are plenty of laws regulating coastal resources and uses, there is no unified legal approach which would integrate present fragmentary rules and the different administrative bodies.

In the light of those considerations and closely related to the establishment of a coastal policy which would be implemented by an integrated development programme, the question arises: what should be the chief policy-making body? And what should be the role of the provinces and the municipality?

Before that question can be adequately answered, a study would have to be made of the public, semi-public and private bodies at all levels (national or central, provincial, municipal, regional and the private sector) with responsibilities in the coastal area, the gaps in responsibility and the overlapping. That would provide a clear picture of each organ's activities, the area of management for which it is responsible and the extent to which the organs at each level are dependent on the next higher body.

On the other hand, economic and social planning in Ecuador today points to the advisability of a gradual but systematic introduction of the regional view into the process of public sector planning and programme execution. This aspect of the problem was noted in a number of documents prepared by the National Planning Board, from which the relevant information was excerpted and incorporated in the chapters of this study. In the outline of a development strategy for Ecuador^{4/} there is a mention of the need to strengthen the national planning system by establishing effective liaison and co-ordination between CONADE, regional planning bodies and local planners. That could be done by setting up decentralized planning offices located in the urban centres selected by the strategy to stimulate regional

PRINCIPAL ORGANS AND/OR BODIES WITH RESPONSIBILITIES IN THE COASTAL AREA*

<u>Organ and/or Body</u>	<u>Main functions</u>	<u>Coastal use and/or resource for which it is responsible</u>	<u>Principal legal instrument</u>
National Development Council (CONADE)	Global planning		
Ministry of Natural Resources and Energy Division of Hydrocarbons	Technical-administrative supervision, planning	Hydrocarbons	Hydrocarbons Act
State Petroleum Corporation (CEPE)	Prospecting, exploitation, marketing, and industrialization	Hydrocarbons	State Petroleum Corporation Act
National Council for Development of Fishing	To establish fishing policy	Fish	Interagency Body
Office of the Undersecretary for Fishing Resources	Execution and Control of fishing policy, direction and evaluation of activities and programmes	Fish	Fishing and Fishing Development Act
National Fishing Institute	Research	Fishing Resources	"
National Fishing Enterprise	Catching, processing and marketing	Fish	"
Maritime Fishing School	Technical training	Fish	"
Ministry of Industry, Commerce and International	Execution of industrial policy administration	Industry	Industrial Development Acts
Center for Industrial Development (CEMID)	To promote investments, studies industrial projects, technical assistance	Industry	"
National Department of Tourism (DITURIS)	Planning, execution, supervision regulation, promotion of tourism	Tourism, beaches	Tourism Promotion Act
Ministry of Agriculture and Livestock Ecuadorian Institute of Agrarian Reform and Settlement National Programme of Agrarian Regionalization (PRONAREG)	Land-use system Evaluation of agricultural resources, research	Mangrove Agriculture, Livestock, forestry	Agrarian Development Act "
Ministry of Public Works and Communications	Co-ordination, financing, planning	Road network	Roads Act
Navy of Ecuador National Council of the Merchant Marine and Ports Department of Merchant and Coastal Shipping	Shipping and Ports Policy Execution, control and co-ordination of technical and administrative activities	Ports, shipping, port infrastructure " "	Ports Act " "
Navy Oceanographic Institute (INOCAR)	Oceanographic and hydrographic research	Estuarine and marine zone	
Polytechnic Institute of the Littoral School of Fishing	Technical training	Fishing	
Department of Marine Engineering and Marine Sciences	Professional training	Coastal engineering and port works	
National Polytechnic School Department of Fishing	Training	Fishing	
University of Guayaquil National Science Faculty	Guidance, advice and assistance	Marine geology	

* This list has to be completed and revised

With that organizational scheme in mind, a second question which must be raised is: on the basis of what has been said regarding the nature of the coastal area and the uses to which it is being put by man, what would be the role of the regional bodies? How would the coastal area as a whole fit into the institutional organization for regional planning?

The existing legal-institutional framework is composed chiefly of a planning body at the highest level (CONADE) and of the sectoral and regional executing agencies for programmes and projects (ministries, regional organs). Within that framework, it has been suggested that the province might be the most appropriate territorial unit for regional planning since it has something of a tradition in Ecuadorian political life and might serve as a powerful link between the central Government and municipalities. But would that be effective for coastal management? What would be the regional liaison unit with the central Government? Would it have powers to plan, programme and execute?

It is extremely difficult to find a satisfactory reply to those questions, quite apart from this study, which merely seeks to raise the basic questions. The experience of other countries shows that there are many different government mechanisms for regulating economic development and protecting the coastal area. In some countries, it is considered part of the over-all national development, with the urban or regional planning agency or organization assuming responsibility. Others assign different responsibilities relating to specific coastal problems to specific departments dealing with natural resources and the environment; in some cases, in fact, permanent government agencies have been established for the environment, with special reference to the coastal area.

Regardless of the government mechanism selected and the responsibilities assigned to the various agencies, it should be borne in mind that:

(1) A basic prerequisite for a coastal management programme is a national policy for the coastal environment and the development of its resources and other uses. In that respect, the National Development Plan states the intention of "formulating a national policy for the development and management of the coastal areas, since there are absolutely no rules regulating the use of those areas by industries, fisheries, tourist complexes, State and private housing developments, etc. and the effects of all those sectors on the ecological balance".^{6/}

(2) Since there is no model of an integrated development programme for the coastal area which would apply to any country whatsoever, such a programme should grow out of the environmental conditions of the different coastal ecosystems and how the latter are distributed spatially, taking into account the broad guidelines of national and regional planning. In that way, the development problems of each coastal sector could be identified and the action taken could be adapted to the specific needs and priorities.

(3) The natural processes as well as the uses of the coastal environment by man and his impact upon it take place throughout the coastal area. They cut across the different government jurisdictions. In reality, activities on the land, the waters and underwater land involve all jurisdictions and decision-making levels of Government.

(4) The jurisdictions of the various levels of government come into contact on the coast. While the municipality has certain executive and regulatory powers in the land area, the central Government also exercises those same powers in the marine zone. That raises a basic problem for coastal management: the lack of continuity in jurisdiction across the coastal area. That lack of continuity, added to the division of authority among different government levels creates difficulties in decision-making power and creates wide gaps, overlapping and confusion in applying regulations.

(5) Another aspect to be considered is the geographical scope of the jurisdictions of the cantons and parishes^{7/} Since those administrative and political units are not responsible for the problems of the coastal area or the uses to which it is put, the spatial arrangement of the cantons and parishes often hampers the management process. Since there is no other more flexible unit, they should be brought into the process and an attempt should be made to arrive at a compromise between the geographical zoning resulting from the distribution of the coastal ecosystems and the priority problems, on the one hand, and the political, decision-making and regulatory division of power, on the other.

To sum up: the problem of the interrelationship between the different levels of government will be settled by co-ordination and accommodation of interests between the central Government, the coastal provinces and the regional and municipal authorities. The spatial and sectoral arrangements will have to be made, taking into consideration the need of an adequate inter-institutional arrangement and the effective legal backing, which will make it possible to carry out a programme of management and integrated development of the area.

^{7/} A canton is made up of parishes, which are the smallest political-administrative units.

XIII. SUMMARY AND CONCLUSIONS

1. The purpose of this study was to present a general picture of the coastal area of continental Ecuador, its present status and its development potential in the light of the medium-term projections of the National Development Plan and the long-term Strategy. Nothing in this paper pretends to be the last word on the subject. On the contrary, the examination of each of the topics should serve as a point of departure for the discussions at the Seminar/Workshop and as an aid in identifying and defining areas of research which should be further explored. The study simply represents a necessary pause to observe and examine the role of the coastal area in the country's development in retrospect and in prospect.

2. The way in which the coastal area is conceptualized in the framework of national development may be summed up as follows : It is an area traditionally involved in the export of traditional products and, more recently, of processed fish and seafood, labour-intensive activities which generate new sources of employment. The process of urbanization reaches a zenith in the coastal area, with the population concentrated in a single metropolis which constantly attracts migrants from other parts of the country. According to the National Development Plan and the long-term Strategy, heavy industry and most large-scale development projects will be located in the coastal area.

3. Although those development modalities have influenced and shaped the evolution of the area and sought to define it as a unit within the national context, it is not distinguishable as such, but is regarded as an integral part of a system of regions created by development trends.

4. The information available on the coastal environment is very uneven. While there is a very detailed inventory of environmental conditions, the agricultural resource base and its potential at the level of the parishes which helps to limit agricultural/rural development areas fairly accurately, the estuarine and marine environment has not been the object of a comparable study. Despite the fact that a few individual aspects have been singled out for study, as, for example, the ecology of the mangrove, there is no basic data on the distinctive characteristics and biophysical attributes of the estuarine and marine zone. Very little is known about the interrelationship between the major components of the coastal environment (air, sea and land) to permit an identification of homogeneous coastal segments for purposes of planning and management. The only existing classification, at the continental level^{1/} while of little value at the local level given its scale, could serve as a point of departure for future studies.

One of the most crucial needs in the way of information is for "ecological guidelines", i.e. knowledge of the present condition of the ecosystem at those points in the coastal area where the plan is to launch or expand economic activities, and for a systematic monitoring or surveillance of that coastal ecosystem. At present, there is not enough knowledge about its components and the biological, physical and chemical processes to understand and predict the changes which may be brought about by a modification of the coastal environment. A number of areas are being pressured by the irrational use of resources and occupation of the space, and the extent of the damage to the coastal ecosystem, the resources potential or the resources capacity for maintenance and renewal is not yet known.

^{1/} Dolan, Robert y otros. Classification of the coast environments of the world. Part 1. The Americas. Technical Report No. 1. Office of Naval Research, Geography Programs, 1972.

5. There is a high quotient of natural resources in the continental, estuarial and marine segments of the coastal area, but the means of exploiting their potential and absorbing them into the production process have not yet been fully utilized. Although agriculture was responsible for the economic take-off of the area, fishing, tourism, town planning and port development subsequently became the most dynamic sectors and they have the greatest impact on the coastal environment. Those activities have set off land occupation and monopolization practices which have brought them into conflict, competition for coastal space and have disturbed the coastal ecosystems. The need to evaluate the environmental impact is greatest where the greatest pressures are being exerted to extend use activities and urban metropolitan development to relatively less developed areas. In that connexion, it is vitally important to be able to foresee the ecological damage which may be done by locating industry in the area, exploiting the offshore resources (gas in the Gulf of Guayaquil) and installing support facilities and transfer points for products (ports).

6. Problems of degradation of the coastal environment have started, although ocean pollution resulting from oil spills has been brought under control and the methods used to handle the problem have proved efficient. Other types of pollution - industrial effluents, household sewage and agricultural residues - not only inflict severe damage on a limited area of the coast (Estero Salado), but affect surrounding areas, depriving them of development opportunities. The scientific information available does not allow for an evaluation of the coastal area's capacity to assimilate that pollution; it is closely related to the transport, dispersion and recycling of nutrients and chemical substances which affect the functioning and stability of the coastal ecosystems.

7. A look at the areas being considered in the medium or long term as the sites of large industrial complexes with an eye to the future suggests the urgency of a judicious study based on an assessment of the project requirements of their impact on the environment and on other present and potential uses of the space, and of incorporating environmental parameters in project design and planning. Although those complexes would benefit from being sited on the coast or adjacent to the coast because they would have a source of water and waste disposal, and although they would constitute a healthy economic infusion into only relatively developed areas, the uncontrolled proliferation of facilities and subsidiary industries can produce irreversible conflicts unless integrated planning criteria are enforced. Moreover, the volume and type of residual materials emptied into the ocean can be expected to increase, together with their potential environmental impact.

8. The development trends described above reflect a diversity of needs, capacities and possibilities. To find the middle way which will lead to a balance among the multiple demands being made on the coastal space is not an easy task. Moreover, although there is concern in Ecuador about coastal problems which acts as a common denominator of the many agencies and individuals involved in managing resources and regulating their use, there is no communication between the planners, the users of coastal lands and waters and the scientific community which might contribute to an understanding of the ecological principles governing resource productivity and development. The interaction between those major interest groups should be channelled, co-ordinated and focussed on the development of medium- and long-term guidelines for the most effective and efficient use of resources.

9. The importance which the National Development Plan attributes to the coastal area by selecting it as the site of large development projects (heavy industry, naval industry, energy, etc.) is indicative of the need to establish

a Management and Integrated Development Programme for the area. To that end, there must be a clear coastal policy fostering co-ordination among the competent agencies and ensuring an effective flow of information, resources and experience from all levels of government and from the private and academic sectors.

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