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PORT PLANNING PARAMETERS

of the

Caribbean Basin

Prepared

by

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PORT PLANNING PARAMETERS of the Caribbean Basin

Introduction

How much ocean cargo should be anticipated in a master development plan is a knotty question that often must be answered, at least temporarily, without the benefit of a detailed analysis such as should be made by transportation economists. In the final analysis the amount of cargo to be put through a seaport is the result of careful evaluations of the probable quantities of materials to be produced and consumed within identifiable zones and sub-zones of the island or the hinterland to be served by the port in question. The analysis is properly performed by economists who are especially skillful in relating the trends of population, and of production and consumption of industrial, forest, mineral and agricultural products to the quantities of materials that need to move from point to point. Mathematical modelists assist the economists in reaching conclusions as to how much of what kind of cargo will need to move through the port.

In the absence of a specific projection of future movements of cargo through the port or ports in question, what can be said of the requirement? It is presumed that all physical planning is based upon available estimates of certain basic criteria such as population, land area and national production, and even though such estimates may not be precise, it is reasonable to expect that estimates of total port traffic could be made of approximately similar validity. Thus, if it were believed that the gross national product would become a particular amount within a stated period, it might be possible to imply with equal confidence how the port traffic would change within the same period.

Scope of Investigation

In the quest for port planning parameters that may be useful for physical planning in the Caribbean Region, a search was made of available statistics concerning:

- (1) Population;
- (2) Land area;
- (3) Gross national product (GNP);
- (4) Gross domestic product (GDP);
- (5) Electric energy production; and
- (6) Ocean Cargo for each of thirty-five countries comprising the Caribbean Basin.

The amount of cargo moving through ports was considered in two scopes, including and excluding petroleum cargo. Thus seven factors were collected for each country and these are presented in the matrix of Table No. 1.

Source of Data

Statistics published by the United Nations and by the World Bank have been used to the extent available. These include mainly the World Bank Atlas 1971, the United Nations Statistics Yearbook 1971, and the United Nations Yearbook of National Accounts 1971. These and other sources are identified in the footnotes of Table No. 1.

Population figures and land areas were taken mainly from the World Bank Atlas 1971 for conditions existing in 1970. Gross domestic product data were taken mainly from Table No. 18 of the United Nations Statistical Yearbook 1971. Gross domestic product statistics were taken mainly from Table No. 14, Vol. III of the United Nations Yearbook of National Accounts 1971, for conditions existing in 1969 or 1970. Electrical energy production statistics were taken mainly from Table 139 of the United Nations Statistical Yearbook 1971 showing the latest data available, either in year 1969 or 1970. The amount of ocean cargo was taken from Tables 150 and 151 of the United Nations Statistical Yearbook 1971 for the latest year available, either in year 1969 or 1970. Where the aforementioned sources failed to provide the required data, statistics were obtained from documents and papers available in the UN ECLA Port of Spain files, as indicated in the footnotes of Table No. 1. There were some instances where none of the cited sources provided the desired information. There were 23 such instances within the matrix comprising 245 items of information, about nine per cent. In these instances judgement values were assigned by comparison with available

data. For example: if the gross national product figure was available and the gross domestic product figure was missing, the latter was assigned a value in approximately the ratio observed in other cases where both items are available.

Validity of the Data

The available ocean cargo statistics are for years 1969 or 1970, and the data for the other criteria are also mainly for years 1969 and 1970 but in any given comparison between ocean cargo and another planning criterion there are instances where the two components are not of the same year. It is considered that the out-of-phase displacement, to the extent of one year, in some instances, has little, if any, significant effect on the overall conclusions that may be drawn.

The Analysis

The current relationship between the annual volume of ocean cargo and each of the five aforementioned planning criteria was examined for each of the thirty-five countries of the Caribbean Basin, and this was done for two different scopes of ocean cargo, including or excluding petroleum cargoes. The tons of cargo per capita, per thousand square kilometers of gross area, per thousand US Dollars of GNP and of GDP, and per thousand kilowatt-hours of electrical energy was calculated for each country. The results are presented in Table No. 2 for the case of ocean cargo excluding petroleum, and in Table No. 3 for the condition when all cargo is included.

The extent that each of the five chosen planning criteria is correlated with the volume of ocean cargo is presented graphically in Figures I - V, inclusive, where the amount of ocean cargo excluding petroleum, is plotted against each of the five other criteria. Similar presentations could be made for the cases including petroleum.

Conclusions

The study indicates that for the region as a whole, none of the five planning criteria considered provides a specific parameter that would be valid for estimating the future amount of ocean traffic for

any unidentified island or hinterland of a port, for which the history of shipping is not previously known. However, the results may be useful because in most situations the history of shipping is available. The findings for each of the five criteria are discussed separately in the following paragraphs.

Population. The correlation between population and ocean cargo, less petroleum, is quite low, as may be seen on Figure II. The parameters range from 0.126 tons per person (Colombia) up to fourteen tons per person (Netherlands Antilles) and the correlation is much less when petroleum is included. The upper, lower and composite parameters are tabulated below for ocean cargo with or without petroleum.

TONS OF OCEAN CARGO PER PERSON

	<u>Excluding Petroleum</u>	<u>Including Petroleum</u>
three lowest cases	0.126 (Colombia) 0.169 (Guatemala) 0.185 (Haiti)	0.211 (Haiti) 0.334 (Guatemala) 0.400 (Colombia)
three highest cases	7.41 (Bermuda) 9.71 (US Vir. Is.) 14.0 (Neth. Ant.)	36.1 (Trinidad & Tobago) 130 (US Vir. Is.) 185 (Neth. Ant.)
Composite of All	1.28	5.57
High/Low Ratio	111	877

Area. The correlation between ocean cargo and gross area of the respective countries seems to be the least useful of the parameters considered, as may be seen on Figure I. Tons-per-square-kilometer vary over a very great range as shown below.

TONS OF OCEAN CARGO PER SQUARE KILOMETER

	<u>Excluding Petroleum</u>		<u>Including Petroleum</u>	
three lowest cases	1.58	(French Guiana)	1.89	(French Guiana)
	5.02	(Nicaragua)	7.55	(Colombia)
	8.04	(Guatemala)	8.12	(Nicaragua)
three highest cases	2,150	(US Vir. Is.)	8,260	(Bermuda)
	3,240	(Neth. Ant.)	28,700	(US Vir. Is.)
	7,580	(Bermuda)	89,300	(Neth. Ant.)
Composite of All	29.0		131	
High/Low Ratio	4797		47,249	

Gross National Product. There is significant correlation between the amount of ocean cargo and the gross national product throughout the region, as may be seen on Figure III, although the parameter varies over a wide range as shown below:

TONS OF OCEAN CARGO PER 000\$US G.N.P.

	<u>Excluding Petroleum</u>		<u>Including Petroleum</u>	
three lowest cases	0.371	(Colombia)	0.929	(Guatemala)
	0.470	(Guatemala)	1.17	(Colombia)
	0.758	(Nicaragua)	1.23	(Nicaragua)
three highest cases	10.3	(Jamaica)	42.0	(Trinidad & Tobago)
	14.9	(Guyana)	42.9	(US Vir. Is.)
	25.8	(Surinam)	278	(Neth. Ant.)
Composite of All	2.35		10.6	
High/Low Ratio	69.5		299	

Gross Domestic Product. The correlation between ocean cargo and gross domestic product is quite similar to the case of gross national product, as may be seen on Figure IV. The extreme cases are tabulated below:

TONS OF OCEAN CARGO PER 000\$US G.D.P.

	<u>Excluding Petroleum</u>		<u>Including Petroleum</u>	
three lowest cases	0.315	{ Colombia }	0.917	{ Guatemala }
	0.464	{ Guatemala }	0.994	{ Colombia }
	0.765	{ Nicaragua }	1.24	{ Nicaragua }
three highest cases	9.43	{ Guyana }	39.4	{ US Vir. Is. }
	11.8	{ Neth. Ant. }	41.7	{ Trinidad & Tobago }
	25.3	{ Surinam }	323	{ Neth. Ant. }
Composite of All	2.22		10.0	
High/Low Ratio	80		352	

Electrical Energy Production. The correlation between ocean cargo and electrical energy production is the highest among the five parameters considered, as is shown on Figure V. The extreme cases are tabulated below:

TONS OF OCEAN CARGO PER THOUSAND KILOWATT-HOURS

	<u>Excluding Petroleum</u>		<u>Including Petroleum</u>	
three lowest cases	0.218	{ Br. Vir. Is. }	0.983	{ Colombia }
	0.311	{ Colombia }	1.81	{ Costa Rica }
	1.18	{ Nicaragua }	1.92	{ Nicaragua }
three highest cases	13.1	{ Grenada }	30.8	{ Trinidad & Tobago }
	13.1	{ French Guiana }	68.0	{ Neth. Ant. }
	14.8	{ Costa Rica }	172	{ Antigua }
Composite of All	2.11		9.52	
High/Low Ratio	68		175	

General Conclusion. Although the port planning parameters that have been considered would probably be found to have limited value for estimating the amount of ocean cargo to be expected in an hypothetical situation (such as planning the development of "AIPOTU ISLAND"), the parameters applicable to each particular existing country may well be found useful for making the preliminary estimates prior to the realization of more detailed analyses.

SELECTED STATISTICS - COUNTRIES OF THE CARIBBEAN BASIN

Country	POPULATION Thousands Persons ^{b/}	GROSS AREA Thou- sands Square Kilo- meters ^{f/}	GROSS NATIONAL PRODUCT Millions US Dollars ^{b/}	GROSS DOMESTIC PRODUCT Millions US Dollars	ELECTRICAL ENERGY PRODUCTION Millions Kilowatt Hours ^{g/}	TOTAL OCEAN CARGO Metric Tons ^{c/}	OCEAN CARGO LESS PETROLEUM Thousands Metric Tons ^{c/}
Antigua	64	442	20	25 d	4 j	685	40
Bahamas	170	13,955	390	410 j	439	3,370	2,651
Barbados	256	430	150	150 d	149	754	395
Belize	120	22,965	70	62 d	22	225	186
Bermuda	54	53	190	200 j	208	438	401
Cayman Islands	10	259	4 j	5 j	4	36 a	24 a
Colombia	21,632	1,138,914 h	7,350	8,648 h	8,750	8,600	2,724
Costa Rica	1,727	50,700	970	944 h	1,028	1,861	1,522
Cuba	8,390	114,524	4,440	5,000 j	4,266	15,430	9,624
Dominica	75	751	20	22 d	7	79	72
Dominican Republic	4,068	48,734	1,430	1,377 h	855	3,683	2,968
El Salvador	3,534	21,393	1,070	1,015 h	671	1,505	1,101
French Guiana	47	91,000	40	45 j	11	172	144
Grenada	105	344	22 j	25 d	8	118	105
Guadeloupe	327	1,779	250	224 h	98	759	662
Guatemala	5,179 i	108,889	1,860	1,886 h	591	1,728	875
Guyana	745	214,969	280	441 h	323	4,620	4,160
Haiti	4,867	27,750	520	550 j	115	1,025	899
Honduras	2,520	112,088	710	714 h	310	2,447	1,620
Jamaica	1,888	10,962	1,086	1,264 h	1,550	13,100	11,206
Martinique	338	1,102	310 f	273 h	87	736	628
Montserrat	15 f	98	12 j	14 d	6 j	24 a	16 a
Netherlands Antilles	222	961	310	265 h	1,256	85,255	3,113
Nicaragua	1,984	130,000	860	853 h	551	1,055	639
Panama	1,464	75,650	1,049 h	974 e	250 j	5,757	1,417
Puerto Rico	2,842	8,897	5,463 h	6,000 j	8,027	20,000 j	15,000 j
St.Kitts-Nevis- Anguilla	57	357	34 j	36 d	16	96	83

Note: See footnotes on continuation of page 2.

TABLE NO. 1

SELECTED STATISTICS - COUNTRIES OF THE CARIBBEAN BASIN

COUNTRY	POPULATION Thousands Persons <u>b/</u>	GROSS AREA Thousands Square Kilo- meters <u>f/</u>	GROSS NATIONAL PRODUCT		GROSS DOMESTIC PRODUCT	ELECTRICAL ENERGY PRODUCTION	TOTAL OCEAN CARGO	
			Millions US Dollars <u>b/</u>	Millions US Dollars			Thou- sands Metric Tons <u>c/</u>	Thousands Metric Tons <u>c/</u>
St. Lucia	112	616	40	63 d	20 j	179	167	
St. Vincent	96	338	20	41 d	9	102	96	
Surinam	393	163,265	196 h	200 j	1,242	5,500	5,041	
Trinidad & Tobago	1,027	5,128 b	880	888 d	1,202	36,950	2,251	
Turks & Caicos Is.	6 a	430	4 j	5 j	2 j	13	11	
Venezuela	10,399	912,050	10,210	10,180 h	12,631	203,018	24,733	
Br. Virgin Is.	11 d	153	10 j	12 d	2 j	27 a	18 a	
US Virgin Is.	76	344	230	250 j	388	9,841	738	
Composite	74,820	3,280,290	40,504	43,061	45,098	429,188	95,401	

Notes to Table No.1

a Data for year 1972, collected by ECLA Caribbean Regional Adviser in Ports and Harbours.

b Except as otherwise indicated, the population is for year 1970 as shown in the World Bank Atlas 1972.

c Except as otherwise indicated, the data are for year 1969 as found in Tables 150 and 151 of the United Nations Statistical Yearbook 1971.

d UN ECLA, Port of Spain, Statistical Section Files.

e UN ECLA, Port of Spain E/CN.12/933, 4 May 1972.

f Except as otherwise indicated the source of data is Table No.18 of the United Nations Statistical Yearbook 1971.

g Except as otherwise indicated, the source of the data is Table No. 139 of the United Nations Statistical Yearbook 1971 and reflects the latest year shown, generally 1969 or 1970.

h United Nations Yearbook of National Accounts 1971, Vol. III, Table 1A.

i CEPAL, Centroamericano de Demografia, Boletín Demografico, ano 2, Vol. III, Santiago de Chile, enero 1969.

j Estimate based on available related data.

TABLE NO. 2

Ocean Cargo -vs- Various Parameters. (Petroleum excluded).

Country	Tons per Person	Tons per Thousand Square Kilometers	Tons per Thousand US Dollars G.N.P.	Tons per Thousand US Dollars G.D.P.	Tons per Thousand Kilowatt Hours
Antigua	1.67	90.0	2.00	1.60	10.0*
Bahamas	1.56	190	6.80	6.45*	6.02
Barbados	1.54	918	2.63	2.63	2.65
Belize	1.55	8.10	2.66	3.00	8.47
Bermuda	7.41	7,580	2.11	2.00*	1.93
Cayman Islands	2.40	92.5	5.99*	4.81*	5.99
Colombia	0.126	2.39	0.371	0.315	0.311
Costa Rica	0.881	30.0	1.57	1.61	14.8
Cuba	1.15	84.0	2.17	1.92*	2.31
Dominica	0.960	96.1	3.60	3.27	10.3
Dominican Rep.	0.729	61.0	2.07	2.16	3.47
El Salvador	0.312	51.5	1.03	1.08	1.64
French Guiana	3.07	1.58	3.60	3.30*	13.1
Grenada	1.00	30.5	4.76*	4.20	13.1
Guadeloupe	2.02	37.2	2.65	2.96	6.76
Guatemala	0.169	8.04	0.470	0.464	1.48
Guyana	5.59	19.4	14.9	9.43	12.9
Haiti	0.185	32.4	1.73	1.63*	7.81
Honduras	0.647	14.6	2.29	2.28	5.26
Jamaica	5.95	1,020	10.3	8.85	7.25
Martinique	1.86	570	2.02	2.30	7.19
Montserrat	1.07	163	1.33	1.14	2.67*
Netherlands Antilles	14.0	3,240	10.1	11.8	2.48
Nicaragua	0.329	5.02	0.758	0.765	1.18
Panama	0.964	18.7	1.35	1.45	5.65*
Puerto Rico	5.29*	1,690*	2.75*	2.50*	1.87*
St.Kitts-Nevis- Anguilla	1.46	233	2.44*	2.30	5.18
St.Lucia	1.49	271	4.17	2.65	8.33*
St.Vincent	1.00	284	4.81	2.34	10.7
Surinam	12.8	30.9	25.8	25.3*	4.07
Trinidad & Tobago	2.19	439	2.56	2.54	1.87
Turks & Caicos Islands	1.83	25.6	2.75*	2.20*	5.49*
Venezuela	2.38	27.2	2.43	2.43	1.96
Br. Virgin Is.	1.64	118	1.80*	1.50	0.218*
US Virgin Is.	9.71	2,150	3.21	2.95*	1.90
Composite	1.28	29.0	2.35	2.22	2.11

Source: Table No. 1

* Based on estimates.

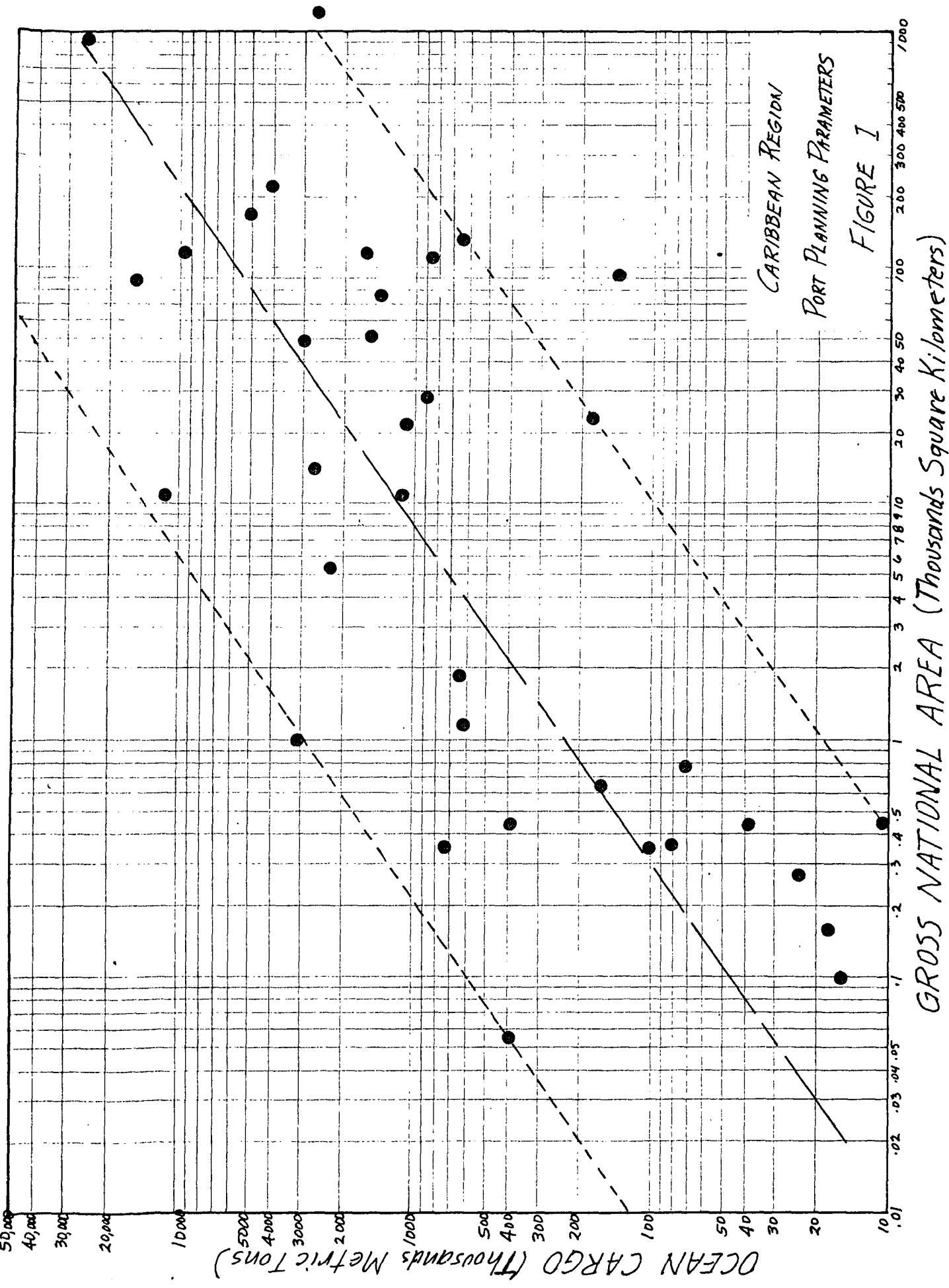
TABLE NO. 3

Ocean Cargo -vs- Various Parameters. (Petroleum included).

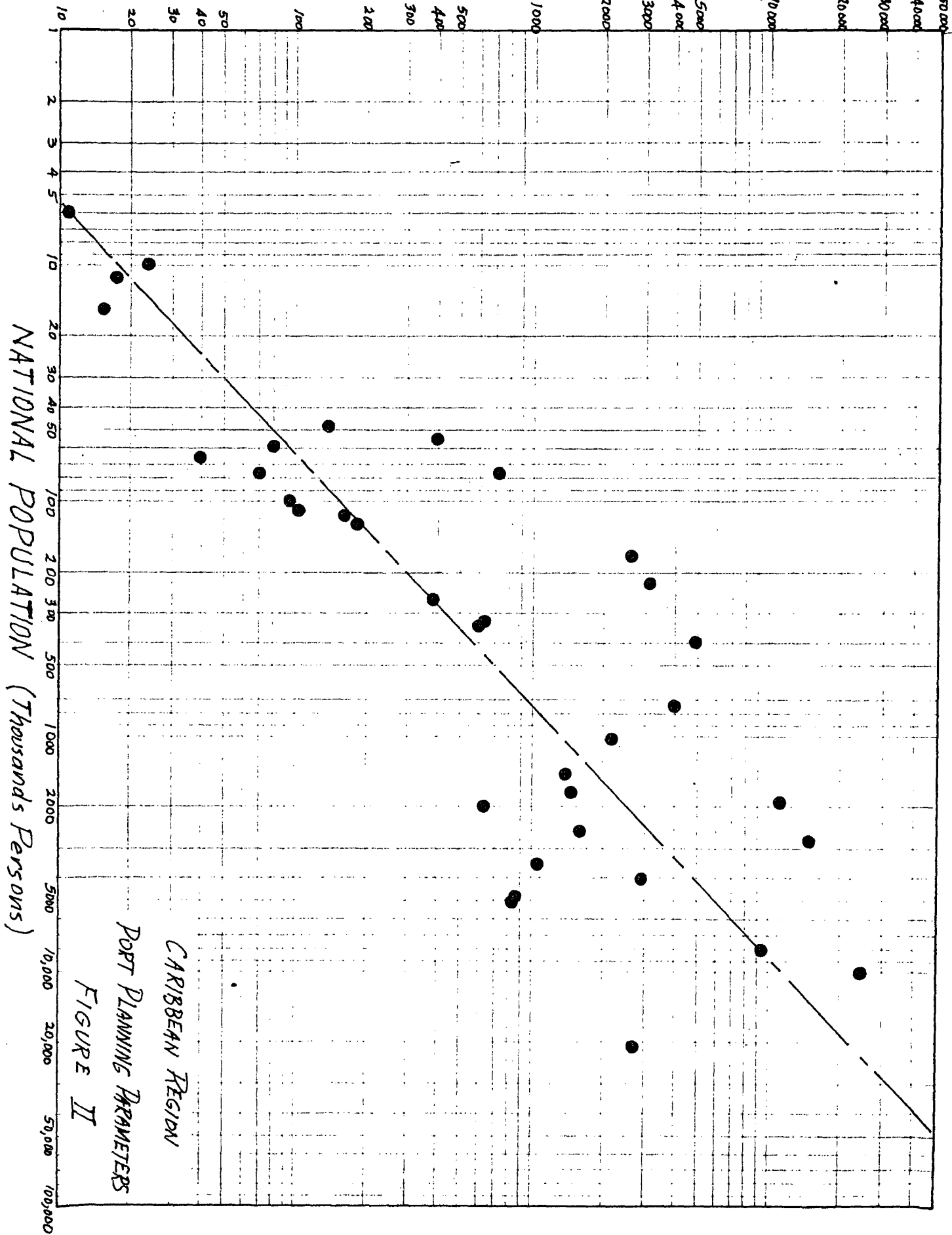
Country	Tons per Person	Tons per Thousand Square Kilometers	Tons per Thousand US Dollars G.N.P.	Tons per Thousand US Dollars G.D.P.	Tons per Thousand Kilowatt Hours
Antigua	1.07	1,550	3.44	27.5	172*
Bahamas	1.98	242	8.62	8.20*	7.69
Barbados	2.94	1,750	5.03	5.03	5.05
Belize	1.88	9.79	3.22	3.62	10.2
Bermuda	3.13	8,260	2.30	2.19*	2.11
Cayman Islands	3.60	139	9.01*	7.19*	9.01
Colombia	0.40	7.55	1.17	0.994	0.983
Costa Rica	1.03	1,080	1.92	1.97	1.81
Cuba	1.84	135	3.47	3.09*	3.62
Dominica	1.05	105	3.95	3.60	11.3
Dominican Rep.	0.905	75.8	2.58	2.67	4.31
El Salvador	0.426	70.4	1.41	1.48	2.24
French Guiana	3.66	1.89	4.29	3.82*	15.6
Grenada	1.12	342	8.38*	4.72	14.8
Guadeloupe	2.32	427	3.04	3.39	7.75
Guatemala	0.334	15.9	0.929	0.917	2.92
Guyana	6.21	21.5	16.4	10.5	14.3
Haiti	0.211	36.9	1.97	1.86	8.93
Honduras	0.971	20.0	3.45	3.42*	7.87
Jamaica	6.94	1,190	12.1	10.4	8.47
Martinique	2.18	668	2.38	2.70	8.47
Montserrat	1.60	245	2.00	1.72	4.00*
Netherlands Antilles	385	89,300	278	323	68.0
Nicaragua	0.532	8.12	1.23	1.24	1.92
Panama	3.94	76.3	5.49	5.92	23.0*
Puerto Rico	7.04*	2,250*	3.66*	0.333*	2.49*
St.Kitts-Nevis- Anguilla	1.68	269	2.82*	2.67	5.99
St.Lucia	1.60	291	4.48	2.84	8.93*
St.Vincent	1.06	302	5.10	2.49	11.3
Surinam	14.0	337	28.1	27.5*	4.42
Trinidad & Tobago	36.1	7,190	42.0	41.7	30.8
Turks & Caicos Islands	2.16	30.2	3.25*	2.60*	6.49*
Venezuela	19.5	223	19.9	20.0	16.1
Br. Virgin Is.	2.46	176	2.70*	2.25	13.5*
US Virgin Is.	130	28,700	42.9	39.4*	25.4
Composite	5.75	151	10.6	10.0	9.52

Source: Table No.1

* Based on estimates.



OCEAN CARGO (Thousands Metric Tons Annually)

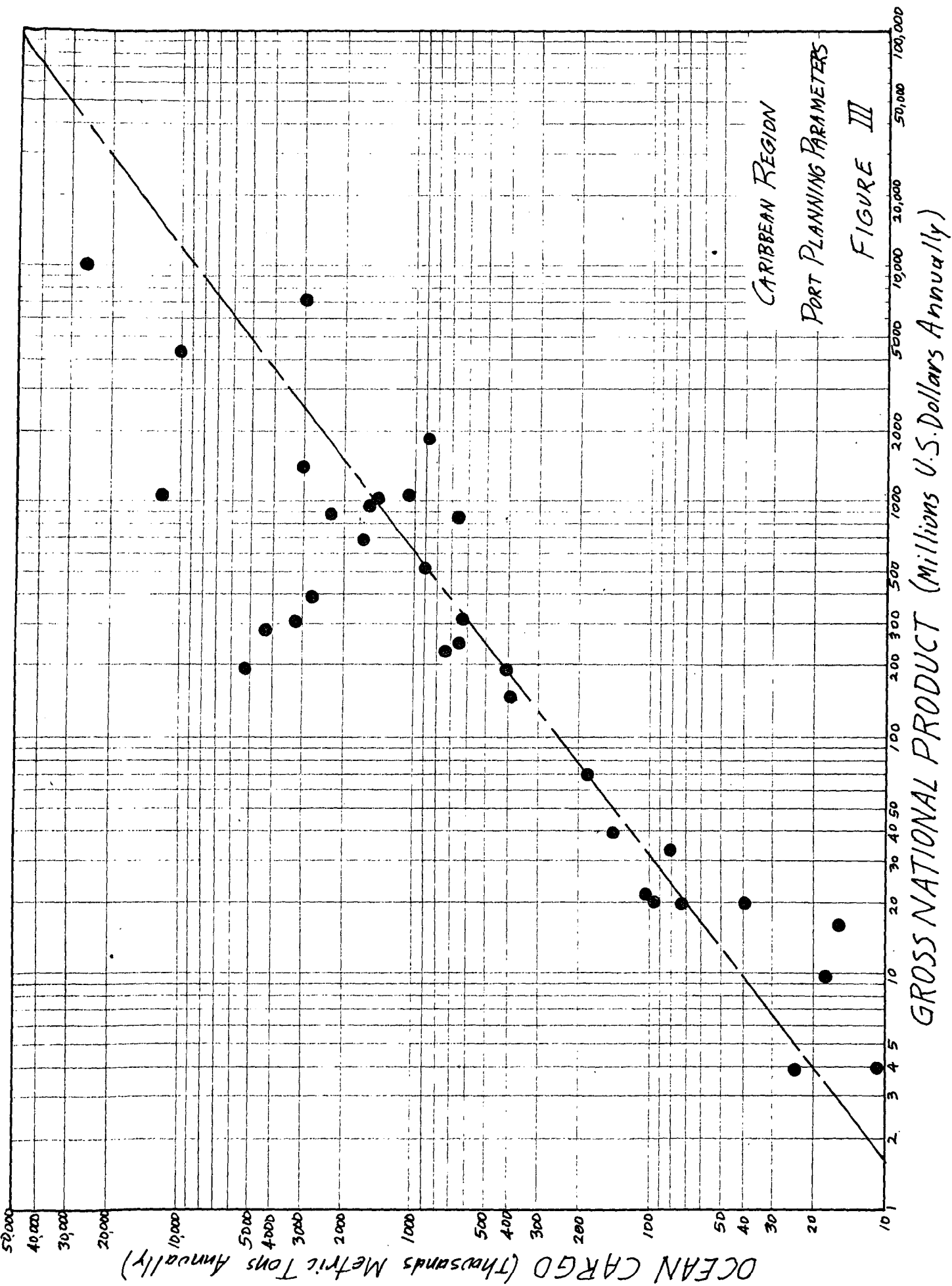


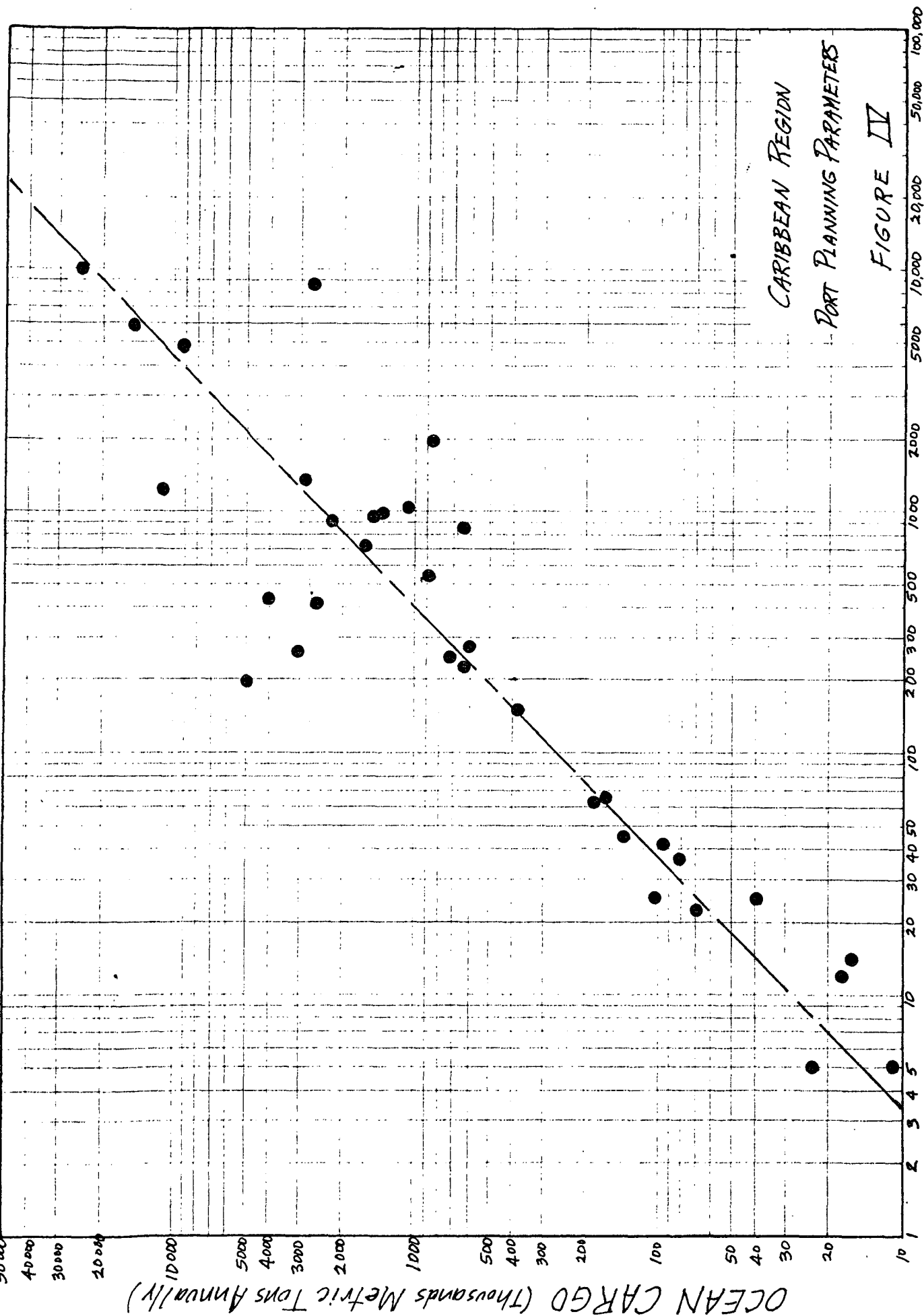
NATIONAL POPULATION (Thousands Persons)

CARIBBEAN REGION

PORT PLANNING PARAMETERS

FIGURE II





CARIBBEAN REGION
PORT PLANNING PARAMETERS
FIGURE IV

GROSS DOMESTIC PRODUCT (Millions U.S. Dollars Annually)

