Property of CSC Library

U. S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Weather Service

HURRICANE EXPERIENCE LEVELS OF COASTAL COUNTY POPULATIONS FROM TEXAS TO MAINE

Paul J. Hebert and Glenn Taylor
National Hurricane Center

U.S. DEPARTMENT OF COMMERCE NOAA
COASTAL SERVICES CENTER
2234 SOUTH HOBSON AVENUE
CHARLESTON, SC 29405-2413

NWS Community Preparedness Staff
and
NWS Southern Region
July, 1975

QC944 .H43 1975
16258-73
APR 10 1997
AUTHENTICATED U.S. GOVERNMENT INFORMATION GPO

CONTENTS

Page

Abstract. 1
Introduction. 1
Data Sources. 3
Purpose 3
Procedure 3
Discussion 8
Summary 17
Acknowledgements. 17
References. 18
Appendix A: The Saffir/Simpson Hurricane Scale 19
Appendix B: Individual Coastal County Hurricane Climatology/Population Graphs, Texas to Maine 21
Appendix C: A Tabular Hurricane Climatology by Counties, Texas to Maine, 1900-1974. . . 118
Appendix D: State Coastal County Populations and Percentage of State Populations in Coastal Counties, Texas to Maine 125
Appendix E: Gulf and Atlantic Coastal Population Distribution - 1970 144

LIST OF TABLES

Table 1. - Saffir/Simpson Hurricane Scale Ranges 2
Table 2. - Coastal County Population by State, 1970, and at the Time of the Last Major Hurricane 4
Table 3. - Examples of Hurricane Classifications on the Saffir/Simpson Hurricane Scale. 6
Table 4a.- Number of Hurricanes (Direct Hits) Affecting U. S. and Individual States 1900-1974 according to Saffir/Simpson Hurricane Scale . . .11
Table 4b.- Chronological List of All Hurricanes Which Affected the U. S. 1900-1974, Including Category by States 12

HURRICANE EXPERIENCE LEVELS OF COASTAL COUNTY POPULATIONS FROM TEXAS TO MAINE

by

Paul J. Hebert and Glenn Taylor

ABSTRACT

Population graphs for the period 1900-1970 have been prepared for coastal counties from Texas to Maine which could be affected significantly by hurricane winds and/or tides. The Saffir/Simpson Hurricane Scale[1] (range 1-5) has been used to develop a hurricane climatology for each county for the period 1900-1974. The combined statistics graphically illustrate that over 75 percent of all Atlantic and Gulf coastal residents of the United States have never experienced the effects of a direct hit by a major[2] hurricane.

INTRODUCTION

A series of hurricane workshops was conducted during the Spring of 1974 by Dr. Neil Frank, Director, National Hurricane Center (NHC), and his staff. The basic purpose of these workshops was to exchange ideas and information with National Weather Service officials representing all Gulf and Atlantic coastal stations and to discuss operational hurricane problems. Some of the materials prepared for the workshops are the basis for this paper.

Population statistics indicate a trend in recent years of rapid population increases along Atlantic and Gulf coastal areas. This trend, along with the relatively low frequency of hurricanes and low hurricane experience level of several million coastal residents, has become an item of major concern at the National Hurricane Center.

---

[1] See Table 1 and Appendix A .

[2] A major hurricane is in category 3, 4 or 5 on the Saffir/ Simpson Hurricane Scale, and is comparable to a Great Hurricane in several other referenced publications.

Table 1. Saffir/Simpson Hurricane Scale Ranges

Scale Number (Category)	Central Pressure		Winds (Mph)	Surge (Ft.)	Damage
	Millibars	Inches			
1	≥ 980	≥ 28.94	74 - 95	4 - 5	Minimal
2	965 - 979	28.50 - 28.91	96 - 110	6 - 8	Moderate
3	945 - 964	27.91 - 28.47	111 - 130	9 - 12	Extensive
4	920 - 944	27.17 - 27.88	131 - 155	13 - 18	Extreme
5	< 920	< 27.17	> 155	> 18	Catastrophic

DATA SOURCES

Population statistics were obtained from the U. S. Department of Commerce, Bureau of the Census, publications. Hurricane information was obtained by checking conventional data sources plus available materials in NHC files and some material from local station files.

PURPOSE

The primary purpose of this study is to illustrate the increase in Gulf and Atlantic coastal populations in recent years and to indicate the low hurricane experience level of a large majority of these coastal residents. While many people have experienced fringe conditions of a major hurricane or the direct effects of a weaker hurricane, it will be pointed out that a relatively small percentage of the coastal population have experienced a direct hit by a major hurricane.

It is hoped that the information in this paper will help coastal residents and disaster groups to substitute education for hurricane experience. A simple comparison of numbers (Saffir/Simpson Hurricane Scale Numbers 1-5) relating hurricanes of recent experience to major or historical hurricanes of the past has been found to be most effective by NHC personnel in addressing various groups concerning hurricane disaster potential.

PROCEDURE

Population statistics for each coastal county from Texas to Maine were obtained from the U. S. Bureau of the Census publications for the period 1900-1970. This information was plotted on individual graphs for each county, 175 in all. A hurricane climatology, described below, was entered along the bottom of each graph indicating the year and severity of each hurricane affecting the county from 1900 through 1974. The complete collection of county graphs is included as Appendix B.

A tabulation was made for each Gulf and Atlantic coastal state listing coastal county populations in 1970 and at the time of the last major hurricane (Scale numbers 3-5) since 1900. This is illustrated in Table 2. The population differences were listed for each state and percentages calculated giving an indication of hurricane experience levels for Gulf and Atlantic coastal residents.

Table 2. Coastal county population by state showing percentage of residents who have never experienced a direct hit by a major hurricane (≥3 on Saffir/Simpson Hurricane Scale).

STATE	1970	AT LAST[1,2] MAJOR HURRICANE	INCREASE	% OF 1970 TOTAL
TEXAS	2,899,895	1,365,430	1,534,465	52.9
LOUISIANA	1,385,438	1,145,440	239,998	17.3
MISSISSIPPI	239,944	167,463	72,481	30.2
ALABAMA	376,690	136,330	240,360	63.8
FLORIDA	5,414,868	1,144,571	4,270,297	78.8
GEORGIA	281,108		281,108	100.0
S. CAROLINA	429,900	344,700	85,200	19.8
N. CAROLINA	414,850	356,327	58,523	14.1
VIRGINIA	1,170,349	28,901	1,151,448	98.5
MARYLAND	2,263,152		2,263,152	100.0
DELAWARE	548,104		548,104	100.0
NEW JERSEY	3,498,389		3,498,389	100.0
NEW YORK	11,341,996	666,784	10,675,212	94.1
CONNECTICUT	1,882,926	1,108,374	774,552	41.1
RHODE ISLAND	946,725	818,933	127,792	13.5
MASSACHUSETTS	2,862,290	926,619	1,935,671	67.6
NEW HAMPSHIRE	138,951		138,951	100.0
MAINE	464,883		464,883	100.0
ALL	36,560,458		28,360,586	77.5

[1]State totals are based on individual county populations at time of last major hurricane since 1900 (different years).

[2]Significant changes in Texas, Florida, New York, and Massachusetts from a preliminary version of this table are a result of a more detailed study of individual counties.

A hurricane climatology, based upon the Saffir/Simpson Hurricane Scale (with atmospheric pressure ranges adapted), was prepared for the 75-year period 1900-1974 based on the following guidelines:

1. Scale numbers (1-5), as indicated in Table 1, were assigned to hurricanes primarily based on estimated central pressure values at the time of landfall. A certain amount of subjectivity is inherent in this type of classification, particularly with hurricanes during earlier years and with those moving inland in sparsely-settled areas. In view of this, some hurricanes near the borderline between two scale numbers might be classified one way or the other based on various considerations, such as storm surge.

   It should be pointed out that flooding from excessive rainfall during the life of a hurricane was not a criterion in selecting scale numbers. Hurricanes DIANE 1955 and AGNES 1972 for example, relatively weak hurricanes, were disastrous flood-makers and resulted in widespread flood damage in several states; however, based on central pressures at the time of landfall, both hurricanes were in category 1.

   In some cases, hurricanes traversing a long path across many states may change scale numbers one or more times before dissipating. A good example of this is Hurricane DONNA of 1960, which changed from category 4 all the way down to category 1 during its journey between Florida and Maine (see Table 3).

   Examples of hurricanes in each category of the Saffir/Simpson Hurricane Scale are listed in Table 3. The five most recent hurricanes are listed for categories 1-3 for Florida and the remainder of the Atlantic and Gulf coasts. Three additional dates are indicated for category 3 on the Atlantic coast in order to include the hurricanes of 1938 and 1944, memorable storms for that region. The hurricanes listed for scale numbers 4 and 5 are totals for the 75-year period 1900-1974, inclusive. (NOTE: Prior to 1950, names were not used in connection with hurricanes. For three years, 1950-1952, the phonetic alphabet was used for naming hurricanes, e.g., ABLE, BAKER, CHARLIE, etc... Girls' names have been used for naming hurricanes from 1953 to the present.)

2. After each hurricane had been assigned a scale number, all coastal counties from Texas to Maine were examined to determine which counties received direct hits and which received indirect hits by hurricanes near to, or crossing the coast since 1900.

Table 3. - Examples of Hurricane Classifications on the Saffir/Simpson Hurricane Scale

Category	Gulf Coast	Florida	Atlantic Coast
1	FERN 1971 (TX) CINDY 1963 (TX) ETHEL 1960 (MS) DEBRA 1959 (TX) ABLE 1950 (AL)	AGNES 1972 (NW) INEZ 1966 (Keys) FLOSSY 1956 (NW) FLORENCE 1953 (NW) 1947 (Keys,SE)	AGNES 1972 (NY,CT) GINGER 1971 (NC) GERDA 1969 (ME) DONNA 1960 (MA,NH,ME) CINDY 1959 (SC)
2	EDITH 1971 (LA) FLOSSY 1956 (LA) 1949 (TX) 1947 (LA) 1945 (TX)	GLADYS 1968 (NW) ALMA 1966 (NW) ISBELL 1964 (SW) CLEO 1964 (SE) DORA 1964 (NE)	DONNA 1960 (CT,RI) CAROL 1954 (NC) HAZEL 1954 (MD) 1947 (GA,SC) 1944 (MA)
3	CARMEN 1974 (LA) CELIA 1970 (TX) BEULAH 1967 (TX) BETSY 1965 (LA) HILDA 1964 (LA)	BETSY 1965 (Keys) EASY 1950 (W-CNTRL) KING 1950 (SE) 1949 (SE) 1948 (SW,Keys)	DONNA 1960 (NC,NY) GRACIE 1959 (SC) CONNIE 1955 (NC) IONE 1955 (NC) CAROL 1954 (NY,CT,RI) EDNA 1954 (MA) 1944 (NC,VA,NY,CT, RI) 1938 (NY,CT,RI,MA)
4	CARLA 1961 (TX) AUDREY 1957 (LA) 1932 (TX) 1919 (TX) 1915 (TX) 1915 (LA) 1909 (LA) 1900 (TX)	DONNA 1960 (Keys,SW) 1947 (SE) 1928 (SE, Lake Okeechobee) 1926 (SE) 1919 (Keys)	HAZEL 1954 (SC,NC)
5	CAMILLE 1969 (MS)	1935 (Keys - "Labor Day Storm")	NONE

As with the assignment of scale numbers, a certain amount of subjectivity was inescapable at times in determining which counties received direct or indirect hits during the various hurricane situations. However, certain arbitrary guidelines for these classifications were used as indicated below:

Direct Hit - When the innermost core region, or "eye", moved over a county, it was counted as a direct hit. Using "R" as the radius of maximum winds in a hurricane (the distance in miles from the storm's center to the circle of maximum winds around the center), all or parts of counties falling within approximately 2R to the right and R to the left of a storm's landfall point were considered to have received direct hits. (This assumes an observer at sea looking toward shore.) On the average, this direct hit zone extended about 50 miles along the coastline (R≈15 miles). Of course, some hurricanes were smaller than this and some, particularly in higher latitudes, were much larger. Cases were judged individually, and many borderline situations had to be resolved.

Indirect Hit - These were based primarily on a hurricane's strength and size and on the configuration of the individual county coastline. Here again, much subjectivity was necessary in many cases which were complicated by storm paths and geography. Generally, those areas on either side of the direct hit zone which received hurricane force winds and/or tides of 4 to 5 feet or more above normal were considered to be indirect hits.

The complete hurricane climatology, 1900-1974, for all coastal counties from Texas to Maine is included in tabular form as Appendix C. It is comprised of a series of five fold-outs with counties listed in approximate geographical order from the lower Texas coast to the upper coast of Maine.

The procedures described above comprise the main thrust of this paper. Several other graphs and tables were prepared, using the same basic information, as follows:

1. State Population Graphs (coastal county populations only) were plotted by decades from 1900-1970 for each of the 18 Gulf and Atlantic coastal states. A second set of state graphs was prepared illustrating the percentage of each state population in the coastal counties for the same period. This complete set of graphs is included as Appendix D.

2. Gulf and Atlantic Coastal Population Distribution, 1970: This set of graphs, included as Appendix E, was designed as a quick reference to indicate approximately how many people are involved in coastal counties along any particular stretch of coastline from Texas to Maine. The graphs were prepared for approximately 300 to 400 mile segments using the same distance scale for all states. Individual county populations were plotted in a position roughly at the mid point of each county along the coast. County names are indicated above the curves, while various coastal locations from Brownsville, Texas, to Eastport, Maine, are listed below the curves.

3. Tables 4a and 4b were prepared in the process of developing the Saffir/Simpson Hurricane Scale climatology. Comments concerning these tables are included in the following section.

DISCUSSION

The purpose of this statistical summary is to graphically demonstrate the low hurricane experience level of most U.S. coastal residents. The 175 county graphs in Appendix B are considered to be the primary data presented. Almost all of the data presented in the other Appendixes and Tables are contained within these graphs. However, while it may appear redundant in some instances, the data have been presented in these forms to allow for an easier statistical interpretation on a county, state and national basis. Some of this interpretation has been included briefly in the sections under Procedures and the forewords of the Appendixes. The remainder of the discussion will attempt to clarify further the data presented in the various tables and appendixes, and to point out some of the more significant facts which can be inferred.

Reference Table 1. An important point here is that the central pressure ranges will agree quite well with the wind ranges, but that the surge is strongly dependent on the slope of the continental shelf (shoaling factor). This can change the height of the surge by a factor of two for any given scale number.

Reference Table 2. This table was designed as a general illustration of population increases in Gulf and Atlantic coastal states since the last direct hit by a major hurricane. It should be emphasized that the population figures refer to coastal sections only for each state and are a summation of individual coastal county population values. Population totals at the time of the last major hurricane in each state since 1900

are for different years. No entry for a particular state indicates that there have been no direct hits by major hurricanes since 1900.

Combined population increases since the last major hurricane for each area indicate that over 28 million people along the Gulf and Atlantic coasts have never experienced a direct hit by a major hurricane. This is over 75% of the Gulf and Atlantic coastal residents of the United States. Six states have not had a single direct hit by a major hurricane in this century, while almost 80% of the coastal population of Florida - the most hurricane prone state - have a low hurricane experience level.

The main point to be made here (and throughout this paper) is that most of the people who go through hurricanes experience either a relatively weak hurricane (categories 1 and 2), or an indirect hit (fringe conditions) by a major hurricane. Generally less than 25% have actually felt the most intense central core region of a major hurricane. This breeds potential disaster by creating a sense of false security for 75% or more of the "experienced" coastal residents during the next major hurricane situation.

Considering the growth rate of most coastal counties, as indicated in the graphs in Appendix B, it is felt that the figures presented are conservative. In the five years since 1970, the only major hurricane to strike the U. S. (Carmen, 1974) hit in an area with one of the highest experience levels.

Reference Table 3. As indicated in Table 1, the terms "Scale Number" and "Category" are used interchangeably. In addition to DONNA 1960, Table 3 also shows several other hurricanes which affected different areas with different scale numbers (e.g., HAZEL 1954, CAROL 1954), or the same scale number (e.g., BETSY 1965, 1919).

It will be noted that only two category 5 hurricanes have affected the U. S. coastline this century - the "Labor Day Storm" of 1935 in the Florida Keys, and Hurricane Camille of 1969 on the Mississippi/Louisiana coast. Of the 13 hurricanes listed in category 4, only one (HAZEL 1954) affected the Atlantic coast north of Florida. (In 1919, the same category 4 hurricane affected the Florida Keys and Texas.)

Reference Table 4a. Many hurricanes affect more than one state (reference Table 3). In addition, Florida and Texas have been sub-divided into sections because of their extensive coastlines. In Florida, the north-south dividing line is roughly from Cape Canaveral to Tarpon Springs. In Texas, south is roughly from

Brownsville to Corpus Christi, central is from north of Corpus Christi to Matagorda Bay, and north is from north of Matagorda Bay to the Louisiana border. As a result, entries in Table 4a may be made more than once for the same hurricane. In other words, Florida and Texas sectional totals may not equal state totals, and state totals cannot be summed to get regional or national totals. However, the first line in the table is an actual count of all hurricanes which have affected the United States, where only the highest category of any state affected has been tabulated. This total indicates that 126 hurricanes have affected the U. S. coast during the period 1900-1974. Of this total, 52, or about 41% were major hurricanes.

While it has been stated that a direct hit by a major hurricane in any one locality is a rare event, the sobering statistics of the top line in Table 4a illustrate that on the average so far this century: 1) two major hurricanes (capable of causing damage in the billions of dollars and killing hundreds) cross the U. S. coast somewhere every three years; 2) a category 4 hurricane crosses the U. S. coastline somewhere once every six years.

This table gives a quick reference to the hurricane climatology of individual states. The table reveals that 39% of all hurricanes hit Florida. A few other noteworthy statistics are that Florida and Texas combined have been hit by 67% of category 4 or higher hurricanes, and that approximately one out of every two hurricanes is a major one along the middle Gulf coast, southern Florida, and New York and southern New England.

Reference Table 4b. This table is a chronological list of all 126 hurricanes including categories by states. Also included in the table is a list of estimated central pressures at the time of landfall for the highest U. S. category. Pressure values are not available for several earlier years and a few hurricanes in recent years which moved inland in sparsely settled areas. By comparing the central pressure of a given hurricane to the range of pressures for each scale number, it is possible to see how close that hurricane came to falling into a higher or lower category. In addition, the effect of extreme forward speed (indicated by an asterisk beside a number), as for most hurricanes north of Cape Hatteras, must be considered.

Reference Appendix A. This scale has been referred to as the Simpson Disaster Potential Scale in some earlier publications.

Table 4a. - Number of Hurricanes (Direct Hits) Affecting U. S. and Individual States 1900 - 1974 according to Saffir/Simpson Hurricane Scale.

Area	Category Number					All	Major Hurricanes
	1	2	3	4	5		(≥ 3)
U. S. (Texas to Maine)	45	29	37	13	2	126	52
Texas	9	9	7	6	0	31	13
(North)	4	3	2	4	0	13	6
(Central)	2	2	1	1	0	6	2
(South)	3	4	4	1	0	12	5
Louisiana	3	6	6	3	1	19	10
Mississippi	1	1	2	0	1	5	3
Alabama	3	1	3	0	0	7	3
Florida	18	11	14	5	1	49	20
(Northwest)	9	6	4	0	0	19	4
(Northeast)	1	5	0	0	0	6	0
(Southwest)	5	3	5	2	1	16	8
(Southeast)	4	8	7	3	0	22	10
Georgia	1	3	0	0	0	4	0
South Carolina	4	3	2	1*	0	10	3
North Carolina	9	3	6	1*	0	19	7
Virginia	1	1	1*	0	0	3	1*
Maryland	0	1*	0	0	0	1*	0
Delaware	0	0	0	0	0	0	0
New Jersey	1	0	0	0	0	1	0
New York	2	0	4*	0	0	6	4*
Connecticut	2	1*	3*	0	0	6	3*
Rhode Island	0	1*	3*	0	0	4*	3*
Massachusetts	2	1*	2*	0	0	5	2*
New Hampshire	1*	0	0	0	0	1*	0
Maine	4	0	0	0	0	4	0

* Indicates all hurricanes in this category were moving greater than 30 mph.

Table 4b. - Chronological List of All Hurricanes Which Affected the U.S. 1900 - 1974 Including Category by States.

Year	Month	States Affected and Category by States	Highest Category U.S.	Minimum Sea Level Pressure (Mb.)
1900	Sept.	Tex. 4N	4	931
1901	July	N.C. 1	1	-
1901	Aug.	La., Miss. 2	2	972
1903	Sept.	Fla. 2SE, 1NW	2	976
1903	Sept.	N.J., N.Y., Conn. 1	1	990
1906	June	Fla. 1SE	1	-
1906	Sept.	S.C., N.C. 3	3	947
1906	Sept.	Miss., Ala. 3	3	958
1906	Oct.	Fla. 2SE	2	967
1908	July	N.C. 1	1	-
1909	July	Tex. 3N	3	958
1909	Aug.	Tex. 2S	2	-
1909	Sept.	La. 4	4	931
1909	Oct.	Fla. 3SE (Keys)	3	957
1910	Sept.	Tex. 2S	2	965
1910	Oct.	Fla. 3SW	3	955
1911	Aug.	Fla. 1NW; Ala. 1	1	-
1911	Aug.	Ga., S.C. 2	2	-
1912	Oct.	Tex. 1S	1	-
1913	June	Tex. 1S	1	-
1913	Sept.	N.C. 1	1	-
1915	Aug.	Tex. 4N	4	945
1915	Sept.	Fla. 1NW	1	988
1915	Sept.	La. 4	4	931
1916	July	Miss., Ala. 3	3	948
1916	July	Mass. 1	1	-
1916	July	S.C. 1	1	980
1916	Aug.	Tex. 3S	3	948
1916	Oct.	Ala. 2; Fla. 2NW	2	972
1916	Nov.	Fla. 1SW (Keys)	1	-
1917	Sept.	Fla. 3NW	3	958
1918	Aug.	La. 3	3	955
1919	Sept.	Fla. 4SW (Keys);Tex. 4S	4	927
1920	Sept.	La., 2	2	975
1920	Sept.	N.C. 1	1	-
1921	June	Tex. 2C	2	979
1921	Oct.	Fla. 3SW, 2NE	3	952

Table 4b. (Cont'd.)

Year	Month	States Affected and Category by States	Highest Category U.S.	Minimum Sea Level Pressure (Mb.)
1923	Oct.	La. 1	1	985
1924	Sept.	Fla. 1NW	1	985
1924	Oct.	Fla. 1SW	1	980
1925	Nov.	Fla. 1SW	1	-
1926	July	Fla. 1NE	1	980
1926	Aug.	La. 3	3	955
1926	Sept.	Fla. 4SE, 3SW, 3NW; Ala. 3	4	935
1928	Sept.	Fla. 4SE, 2NE; Ga., S.C. 1	4	929
1929	June	Tex. 1C	1	982
1929	Sept.	Fla. 3SE, 2NW	3	948
1932	Aug.	Tex. 4N	4	941
1932	Sept.	Ala. 1	1	979
1933	July/ Aug.	Fla. 1SE; Tex. 2S	2	975
1933	Aug.	N.C., Va. 2	2	971
1933	Sept.	Tex. 3S	3	949
1933	Sept.	Fla. 3SE	3	948
1933	Sept.	N.C. 3	3	957
1934	June	La. 3	3	962
1934	July	Tex. 2S	2	975
1935	Sept.	Fla. 5SW (Keys), 2NW	5	892
1935	Nov.	Fla. 2SE	2	973
1936	June	Tex. 1S	1	987
1936	July	Fla. 3NW	3	964
1936	Sept.	N.C. 2	2	-
1938	Aug.	La. 1	1	985
1938	Sept.	N.Y., Conn., R.I., Mass. 3*	3*	946
1939	Aug.	Fla. 1SE, 1NW	1	985
1940	Aug.	Tex. 2N; La. 2	2	972
1940	Aug.	Ga., S.C. 2	2	970
1941	Sept.	Tex. 3N	3	958
1941	Oct.	Fla. 2SE, 2SW, 2NW	2	975
1942	Aug.	Tex. 1N	1	992
1942	Aug.	Tex. 3C	3	950
1943	July	Tex. 2N	2	969
1944	Aug.	N.C. 1	1	990
1944	Sept.	N.C., Va., N.Y., Conn., R.I. 3*; Mass. 2*	3*	947
1944	Oct.	Fla. 3SW, 2NE	3	962

Table 4b. (Cont'd.)

Year	Month	States Affected and Category by States	Highest Category U.S.	Minimum Sea Level Pressure (Mb.)
1945	June	Fla. 1NW	1	985
1945	Aug.	Tex. 2C	2	967
1945	Sept.	Fla. 3SE	3	951
1946	Oct.	Fla. 1SW	1	980
1947	Aug.	Tex. 1N	1	992
1947	Sept.	Fla. 4SE, 2SW; La. 2	4	940
1947	Oct.	Fla. 1SE; Ga., S.C. 2	2	974
1948	Sept.	La. 1	1	987
1948	Sept.	Fla. 3SW, 2SE	3	963
1948	Oct.	Fla. 2SE	2	975
1949	Aug.	N.C. 1	1	980
1949	Aug.	Fla. 3SE	3	954
1949	Oct.	Tex. 2N	2	972
1950	Aug.	Ala. 1	1	980
1950	Sept.	Fla. 3NW	3	958
1950	Oct.	Fla. 3SE	3	955
1952	Aug.	S.C. 1	1	985
1953	Aug.	N.C. 1	1	987
1953	Sept.	Me. 1*	1*	-
1953	Sept.	Fla. 1NW	1	985
1954	Aug.	N.C. 2; N.Y., Conn., R.I. 3*	3*	960
1954	Sept.	Mass. 3*; Me. 1*	3*	954
1954	Oct.	S.C., N.C. 4*; Md. 2*	4*	938
1955	Aug.	N.C. 3; Va. 1	3	962
1955	Aug.	N.C. 1	1	987
1955	Sept.	N.C. 3	3	960
1956	Sept.	La. 2; Fla. 1NW	2	975
1957	June	Tex. 4N; La. 4	4	945
1959	July	Tex. 1N	1	984
1959	July	S.C. 1	1	993
1959	Sept.	S.C. 3	3	950
1960	Sept.	Miss. 1	1	981
1960	Sept.	Fla. 4SW (Keys), 2NE; N.C., N.Y. 3*; Conn., R.I. 2*; Mass., N.H., Me. 1*	4	930
1961	Sept.	Tex. 4C	4	931
1963	Sept.	Tex. 1N	1	996
1964	Aug.	Fla. 2SE	2	968
1964	Sept.	Fla. 2NE	2	966
1964	Oct.	La. 3	3	950

Table 4b. (Cont'd.)

Year	Month	States Affected and Category by States	Highest Category U.S.	Minimum Sea Level Pressure (Mb.)
1964	Oct.	Fla. 2SW, 2SE	2	974
1965	Sept.	Fla. 3SE; La. 3	3	948
1966	June	Fla. 2NW	2	982
1966	Oct.	Fla. 1SW, (Keys)	1	983
1967	Sept.	Tex. 3S	3	950
1968	Oct.	Fla. 2NW	2	977
1969	Aug.	La., Miss. 5	5	909
1969	Sept.	Me. 1	1	980
1970	Aug.	Tex. 3S	3	945
1971	Sept.	La. 2	2	978
1971	Sept.	Tex. 1C	1	979
1971	Sept.	N.C. 1	1	993
1972	June	Fla. 1NW; N.Y., Conn. 1	1	980
1974	Sept.	La. 3	3	952

Reference Appendix B. A note of caution is needed to avoid misinterpretation of these graphs. Because of the different population ranges from graph to graph, the total increase in a county with a large population but relatively slow growth rate may be larger than a more sparsely populated county with a rapid growth rate. One other point - if the core (direct hit) of a major hurricane affected only a sparsely populated section of a heavily populated county (e.g., Dade County, Florida - BETSY 1965), it was considered to be an indirect hit in these graphs, but that portion directly affected was included in Table 2.

While these graphs give a complete hurricane climatology on a county-by-county basis, it would be quite difficult to determine how the individual hurricanes affected larger areas if one had to compare county graphs. Appendix C has been prepared to readily supply this information.

Reference Appendix C. This appendix has been designed so that each foldout is a geographical area likely to be affected solely by a given hurricane. However, foldouts can be combined into a single, continuous display for the entire Gulf and Atlantic coasts.

With the data from the individual graphs of Appendix B combined in this form, many facts can be derived easily on a county, state, or regional basis. For example, an idea of the size of a hurricane can be obtained by the number of counties affected (although tracks relative to geographical configurations can be misleading in a few instances). Also, one can readily count how many direct or indirect hits of any category have occurred, or how long it has been between any hurricanes, or those of a particular category.

Reference Appendix D. See Procedure.

Reference Appendix E. As in Appendix C, these graphs were prepared so that each adjacent section can be combined into a single, continuous graph for the entire Gulf and Atlantic coastline by placing the zero distance scale over the right hand limit of the previous graph. These graphs can be used to estimate the impact (direct and indirect) of future hurricanes on coastal sections affected.

SUMMARY

Populations continue to increase along most sections of the Gulf and Atlantic coasts of the United States. This trend, along with the relatively low frequency of hurricanes in recent years and low hurricane experience levels of some 28 million coastal residents, has become an item of major concern at the National Hurricane Center. It is hoped that this report will help to some degree in substituting education for hurricane experience.

When a hurricane crosses the coast, many persons feel its effects; however, only a small percentage of the coastal residents experience a direct hit by its intense inner core, the major death and damage producer of the hurricane. Most residents experience indirect hits, or fringe effects, during hurricane situations (or direct hits by relatively weak hurricanes - categories 1 and 2) and can be lulled into a false sense of security by feeling that they have experienced the worst part. In view of this, the disaster potential of subsequent hurricane situations might be inaccurately assessed by many coastal residents.

While the increase in coastal populations is alarming, it is felt that the figures presented in this report are conservative. Since 1970, unofficial estimates indicate that most Gulf and Atlantic coastal populations have continued to increase, sharply in some areas. In addition, these population statistics are for permanent residents and do not take into account summer tourism which may increase some county population totals tenfold during weekends or holidays. Another major concern, not discussed in this report, is that many thousands of the coastal county residents live in mobile homes which are extremely vulnerable to hurricanes of any category.

Acknowledgements. Dr. Neil Frank, Director, NHC, conceived the idea of combining population graphs and hurricane climatology and suggested the preparation of this report. Mr. John Hope, Principal Hurricane Specialist, contributed significantly to the preparation of many of the materials used. Ms. Mary Watson did virtually all of the drafting work, and Ms. Lilias Wilson did the typing. Many miscellaneous but important tasks were performed by Ms. Dottie Mixon, Ms. Wanda Lund, Mr. Norman Nixon and Mr. Bill Drybala, all of NHC.

REFERENCES

Cry, G.W., 1965: "Tropical Cyclones of the North Atlantic," Technical Paper, No. 55, U. S. Weather Bureau, Washington D.C., 148pp.

Dunn, G.E., and B. I. Miller, 1964: "Atlantic Hurricanes," Revised Edition, Louisiana State University Press, Baton Rouge, Louisiana, 377pp.

Kraft, R.H.: "Great Hurricanes, 1955-1965," Mariners Weather Log, Vol. 19, No. 6, Nov. 1966, pp. 200-202.

Ludlum, D.M., 1963: "Early American Hurricanes 1492-1870," American Meteorological Society, Boston, Massachusetts, 198pp.

Simpson, R.H., and M.B. Lawrence, 1971: "Atlantic Hurricane Frequencies Along the U. S. Coastline," NOAA Technical Memorandum NWS SR-58, U. S. Department of Commerce, National Weather Service, Southern Region Headquarters, Fort Worth, Texas, 14pp.

Sugg, A.L., L.G. Pardue, and R.L. Carrodus, 1971: "Memorable Hurricanes of the United States Since 1873," NOAA Technical Memorandum NWS SR-56, U. S. Department of Commerce, National Weather Service, Southern Region Headquarters, Forth Worth, Texas, 52pp.

Tannehill, I.R., 1956: "Hurricanes," 9th Edition, Princeton University Press, Princeton, N.J., 308pp.

U. S. Department of Commerce, 1970: "Census '70," Bureau of the Census Pamphlets (18 States - Population Statistics for Earlier Years), Washington, D.C.

U. S. Department of Commerce, 1971: "1970 Census of Population, Number ofInhabitants - Texas, etc...," Final Report PC(1)-A45 Texas, etc... (18 States), U. S. Bureau of the Census, Washington, D.C.

APPENDIX A

THE SAFFIR/SIMPSON[3] HURRICANE SCALE

The Saffir/Simpson Hurricane Scale is used by the National Weather Service to give public safety officials a continuing assessment of the potential for wind and storm-surge damage from a hurricane in progress. Scale numbers are made available to public-safety officials when a hurricane is within 72 hours of landfall.

Scale numbers range from 1 to 5. Scale No. 1 begins with hurricanes in which the maximum sustained winds are at least 74 miles per hour, or will produce a storm surge 4 to 5 feet above normal water level, while Scale No. 5 applies to those in which the maximum sustained winds are 155 miles per hour or more, or has the potential of producing a storm surge more than 18 feet above normal.

Dr. Neil Frank, present NHC Director, has adapted atmospheric pressure ranges to the Saffir/Simpson scale. These pressure ranges, along with a numerical break-down of wind and storm surge ranges, are listed in Table 1.

The Weather Service emphasizes that the scale numbers are not forecasts, but are based on observed conditions at a given time in a hurricane's lifespan. They represent an estimate of what the storm would do to a coastal area if it were to strike without change in size or strength. Scale assessments are revised regularly as new observations are made, and public-safety organizations are kept informed of new estimates of the hurricane's disaster potential.

The Saffir/Simpson Hurricane Scale indicates probable property damage and evacuation recommendations as listed below:

Scale No. 1 - Winds of 74 to 95 miles per hour. Damage primarily to shrubbery, trees, foliage and unanchored mobile homes. No real damage to other structures. Some damage to poorly constructed signs. And/or: storm surge 4 to 5 feet above normal. Low-lying coastal roads inundated, minor pier damage, some small craft in exposed anchorage torn from moorings.

---

[3]Developed by Herbert Saffir, Dade County, Florida, Consulting Engineer, and Dr. Robert H. Simpson, former National Hurricane Center Director.

Scale No. 2 - Winds of 96 to 110 miles per hour. Considerable damage to shrubbery and tree foliage, some trees blown down. Major damage to exposed mobile homes. Extensive damage to poorly constructed signs. Some damage to roofing materials of buildings; some window and door damage. No major damage to buildings. And/or: storm surge 6 to 8 feet above normal. Coastal roads and low-lying escape routes inland cut by rising water 2 to 4 hours before arrival of hurricane center. Considerable damage to piers. Marinas flooded. Small craft in unprotected anchorages torn from moorings. Evacuation of some shoreline residences and low-lying island areas required.

Scale No. 3 - Winds of 111 to 130 miles per hour. Foliage torn from trees, large trees blown down. Practically all poorly constructed signs blown down. Some damage to roofing materials of buildings; some window and door damage. Some structural damage to small buildings. Mobile homes destroyed. And/or: storm surge 9 to 12 feet above normal. Serious flooding at coast and many smaller structures near coast destroyed; larger structures near coast damaged by battering waves and floating debris. Low-lying escape routes inland cut by rising water 3 to 5 hours before hurricane center arrives. Flat terrain 5 feet or less above sea level flooded inland 8 miles or more. Evacuation of low-lying residences within several blocks of shoreline possibly required.

Scale No. 4 - Winds of 131 to 155 miles per hour. Shrubs and trees blown down, all signs down. Extensive damage to roofing materials, windows and doors. Complete failure of roofs on many small residences. Complete destruction of mobile homes. And/or: storm surge 13 to 18 feet above normal. Flat terrain 10 feet or less above sea level flooded inland as far as 6 miles. Major damage to lower floors of structures near shore due to flooding and battering by waves and floating debris. Low-lying escape routes inland cut by rising water 3 to 5 hours before hurricane center arrives. Major erosion of beaches. Massive evacuation of all residences within 500 yards of shore possibly required, and of single-story residences on low ground within 2 miles of shore.

Scale No. 5 - Winds greater than 155 miles per hour. Shrubs and trees blown down, considerable damage to roofs of buildings; all signs down. Very severe and extensive damage to windows and doors. Complete failure of roofs on many residences and industrial buildings. Extensive shattering of glass in windows and doors. Some complete building failures. Small buildings overturned or blown away. Complete destruction of mobile homes. And/or: storm surge greater than 18 feet above normal. Major damage to lower floors of all structures less than 15 feet above sea level within 500 yards of shore. Low-lying escape routes inland cut by rising water 3 to 5 hours before hurricane center arrives. Massive evacuation of residential areas on low ground within 5 to 10 miles of shore possibly required.

APPENDIX B

INDIVIDUAL COASTAL COUNTY HURRICANE CLIMATOLOGY/POPULATION GRAPHS, TEXAS TO MAINE

The set of population graphs in this appendix illustrates population trends along the Gulf and Atlantic coasts of the United States during the period 1900-1970. Indications are that this increasing trend in coastal populations has continued into 1975 in most areas; however, no estimates are included here. Assuming this to be the case, hurricane experience levels and the disaster potential for many areas are even more critical than indicated in the following county climatology/population graphs.

Hurricane climatology along the bottom of each graph is indicated by arrows and Saffir/Simpson scale numbers for the period 1900-1974. Each hurricane is represented by either a solid or a dashed arrow along with the appropriate scale number and is entered at the year of occurrence. Solid arrows indicate direct hits, and dashed arrows denote indirect hits. For direct hits of category 3 hurricanes or higher, a vertical dashed line has been inserted between the arrowhead and the population curve. This gives a convenient, quick reference to the number and frequency of direct hits in each county by major hurricanes (scale numbers 3, 4 and 5) since 1900.

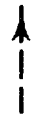
The key to symbols used in connection with hurricane climatology along the bottom of each graph, along with examples, is shown below.

Key for Symbols used in Hurricane Climatology

(NOTE: Dual symbols were needed when using scale numbers in tabular form, without arrows, such as in Appendix C.)

- Direct Hit

( ) or



- Indirect Hit

__ or ◯ - Exiting or Inland

* - Forward Speed 30 mph or Greater (In effect, may increase/decrease Saffir/Simpson scale number by as much as one on strong/weak side, respectively.)

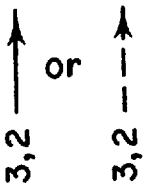
Examples (Symbols used in Hurricane Climatology/Population Graphs)

- Direct Hit by a Category 2 Hurricane

- Indirect Hit (or fringe hit) by a Category 2 Hurricane

- Direct Hit by an inland or exiting (moving from land to water) Category 3 Hurricane

- Direct Hit by Hurricane Carol, Category 3, moving 30 mph or greater



- Two direct or indirect hits in the same year, with the Category 3 hurricane occurring first. (If a direct and indirect hit both occurred in the same year, they were offset slightly and plotted adjacent to one another.)

- Direct Hit by a Category 4 Hurricane in the eastern part of Monroe County, Florida. (Note: W indicates the western part of Monroe County. No letter designation indicates the entire county was affected. This notation is used only in Monroe County - the Florida Keys - because of geographical configurations and hurricane frequencies.)

NOTE: Names of hurricanes are entered beside arrows 1950 - present.

INDEX OF INDIVIDUAL COASTAL COUNTY GRAPHS

(NOTE: The 175 graphs in this appendix are arranged in approximate geographical order from the Lower Texas coast to the upper coast of Maine. Major cities or well-known locations are indicated for some counties.)

1. TEXAS (17)

   Cameron (Brownsville), Willacy, Kenedy, Kleberg, Nueces (Corpus Christi), San Patricio, Aransas, Refugio, Calhoun (Port O'Connor), Jackson, Matagorda, Brazoria, Galveston (Galveston), Harris (Houston), Chambers, Jefferson (Port Arthur, Beaumont), Orange.

2. LOUISIANA (11)

   Cameron, Vermilion, Iberia, St. Mary (Morgan City), Terrebonne, Lafourche, Jefferson, Plaquemines, St. Bernard, Orleans (New Orleans), St. Tammany.

3. MISSISSIPPI (3)

   Hancock (Bay St. Louis), Harrison (Biloxi), Jackson (Pascagoula).

4. ALABAMA (2)

   Mobile (Mobile), Baldwin.

5. FLORIDA (38)

   Escambia (Pensacola), Santa Rosa, Okaloosa, Walton, Bay (Panama City), Gulf, Franklin (Apalachicola), Wakulla, Jefferson, Taylor, Dixie, Levy (Cedar Key), Citrus (Homosassa), Hernando, Pasco (New Port Richey), Pinellas (St. Petersburg), Hillsborough (Tampa), Manatee (Bradenton), Sarasota (Sarasota), Charlotte (Punta Gorda), Lee (Fort Myers), Collier (Naples), Monroe (Key West), Dade (Miami), Broward (Fort Lauderdale), Palm Beach (West Palm Beach), Hendry (Clewiston), Glades (Moore Haven), Okeechobee, Martin (Stuart), St. Lucie (Fort Pierce), Indian River (Vero Beach), Brevard (Cape Canaveral), Volusia (Daytona Beach), Flagler, St. Johns (St. Augustine), Duval (Jacksonville), Nassau (Fernandina Beach).

6. GEORGIA (6)

   Camden, Glynn (Brunswick), McIntosh, Liberty, Bryan, Chatham (Savannah).

7. SOUTH CAROLINA (5)

Beaufort (Hilton Head, Colleton, Charleston (Charleston), Georgetown (Georgetown), Horry (Myrtle Beach).

8. NORTH CAROLINA (17)

Brunswick, New Hanover (Wilmington), Pender, Onslow, Carteret (Moorehead City), Pamlico, Beaufort, Hyde, Dare (Cape Hatteras), Tyrrell, Washington, Bertie, Chowan, Perquimans, Pasquotank (Elizabeth City), Camden, Currituck.

9. VIRGINIA (15)

(NOTE: Several independent cities are listed instead of counties. See notes in Virginia table, Appendix C.)

Virginia Beach, Chesapeake (Chesapeake, Norfolk and Portsmouth Cities), Nansemond (Suffolk City), Isle of Wight, Surry, James City (Williamsburg City), York (Hampton City, Newport News City) Gloucester, Mathews, Middlesex, Lancaster, Northumberland, Westmoreland, Northampton, Accomack.

10. MARYLAND (14)

Worcester (Ocean City), Somerset, St. Marys, Calvert, Anne Arundel (Annapolis), Baltimore (includes Baltimore City), Harford, Cecil, Kent, Queen Annes, Talbot, Caroline, Dorchester, Wicomico.

11. DELAWARE (3)

Sussex (Rehoboth Beach), Kent, New Castle (Wilmington).

12. NEW JERSEY (10)

Salem, Cumberland, Cape May (Ocean City), Atlantic (Atlantic City), Burlington, Ocean, Monmouth (Asbury Park), Middlesex (Perth Amboy), Hudson (Jersey City), Bergen.

13. NEW YORK (8)

Richmond (Staten Island), New York (Manhattan), Kings (Brooklyn), Queens, Nassau (Jones Beach), Suffolk (Westhampton), Bronx (Bronx), Westchester.

14. CONNECTICUT (4)

New London (New London), Middlesex, New Haven, Fairfield (Bridgeport).

15. RHODE ISLAND (5)

Newport (Newport), Bristol (Bristol), Providence (Providence), Kent, Washington (Narragansett Point).

16. MASSACHUSETTS (8)

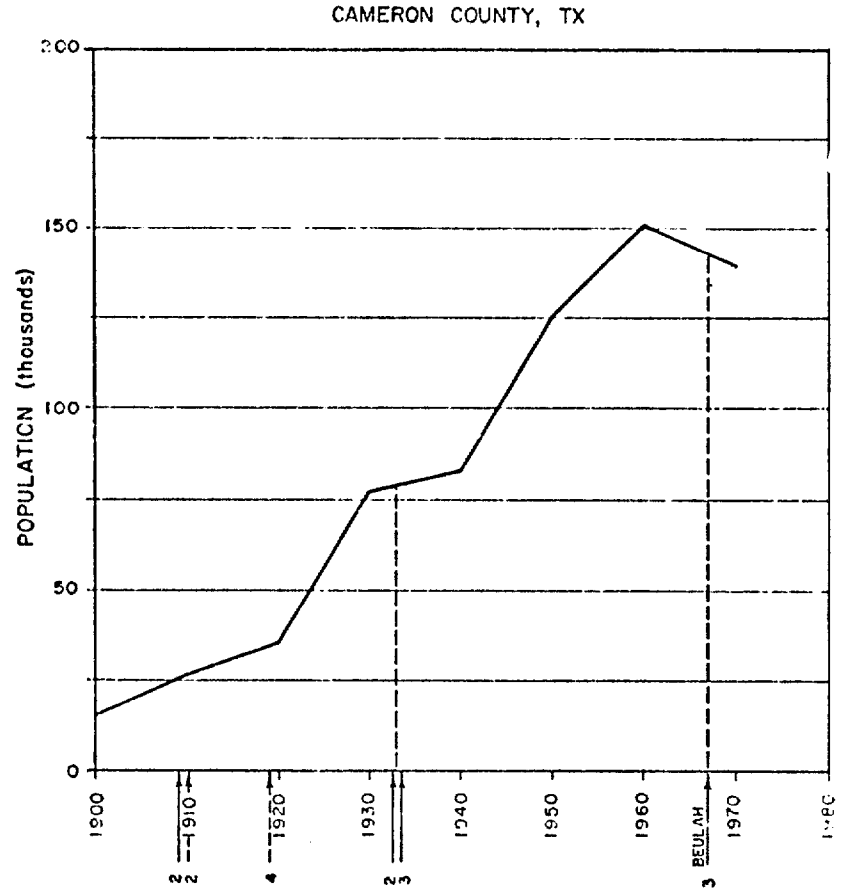
Bristol (New Bedford), Dukes (Martha's Vineyard), Nantucket (Nantucket), Barnstable (Cape Cod), Plymouth (Plymouth), Norfolk, Suffolk (Boston), Essex (Gloucester).

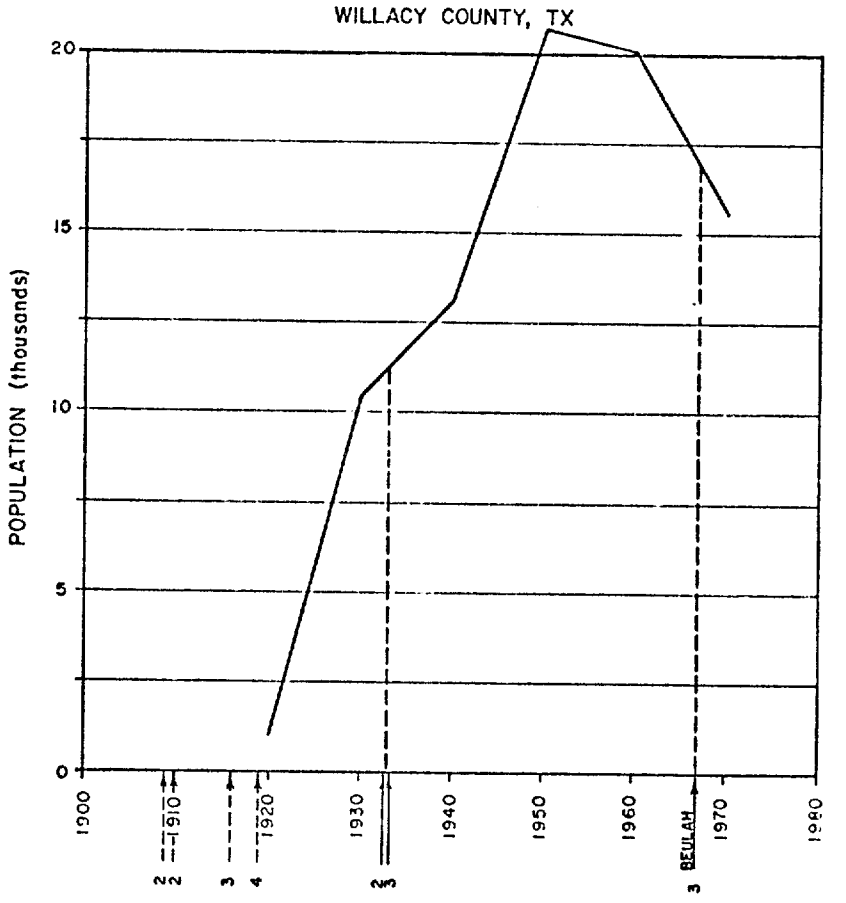
17. NEW HAMPSHIRE (1)

Rockingham (Portsmouth).

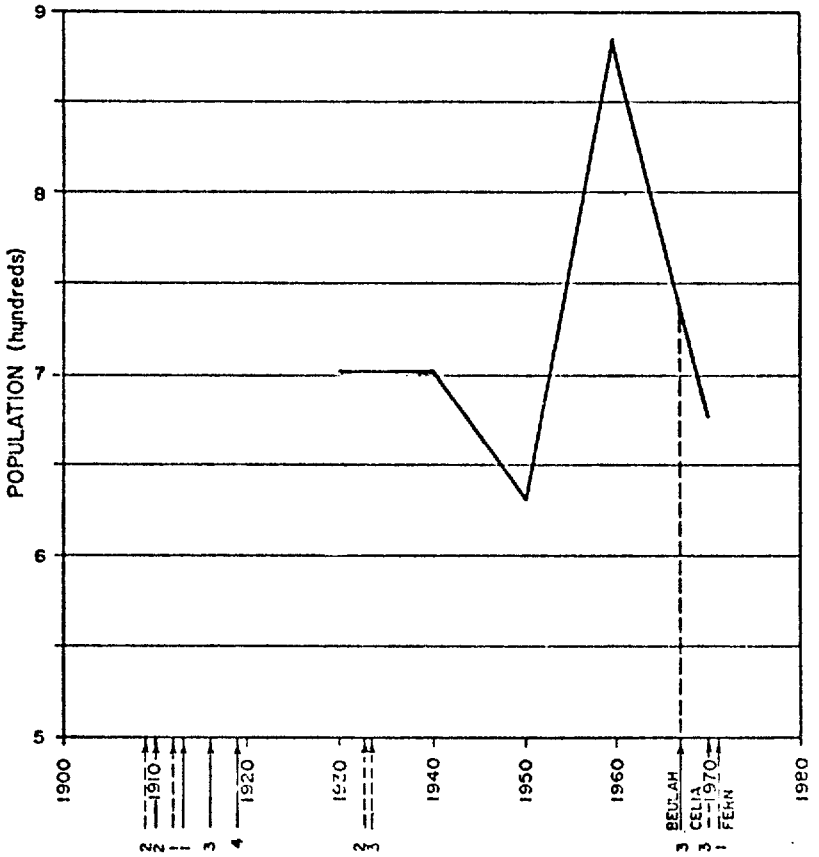
18. MAINE (8)

York, Cumberland (Portland), Sagadahoc, Lincoln, Knox, Waldo, Hancock, Washington (Eastport).

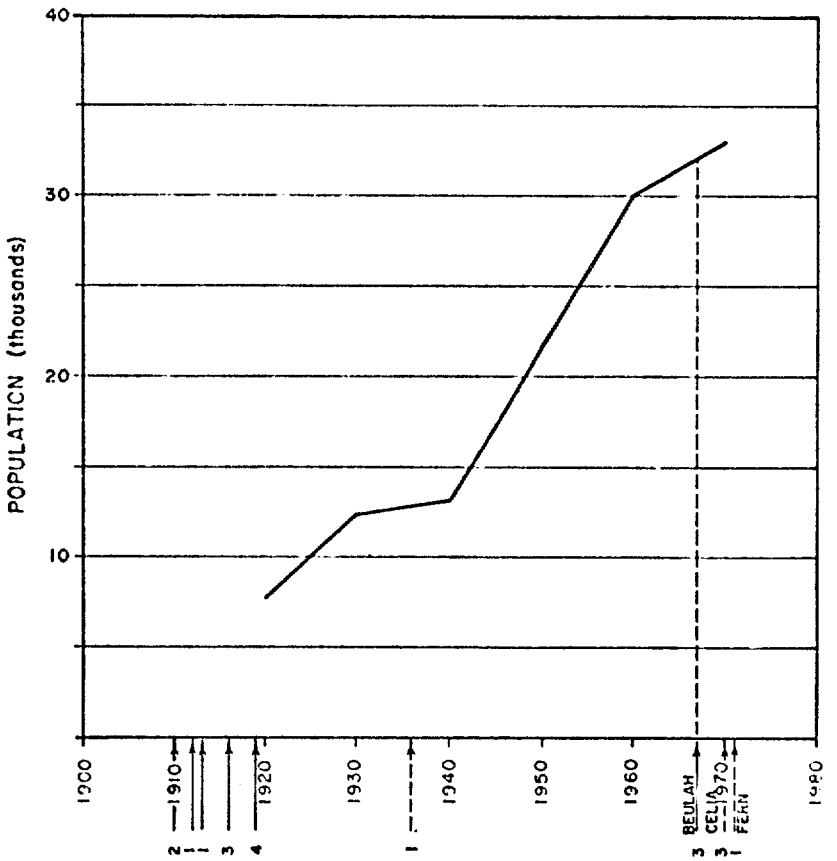

CAMERON COUNTY, TX
POPULATION (thousands)
200
150
100
50
0
1900
1910
1920
1930
1940
1950
1960
1970
BEULAH


WILLACY COUNTY, TX
POPULATION (thousands)
20
15
10
5
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
BEULAH

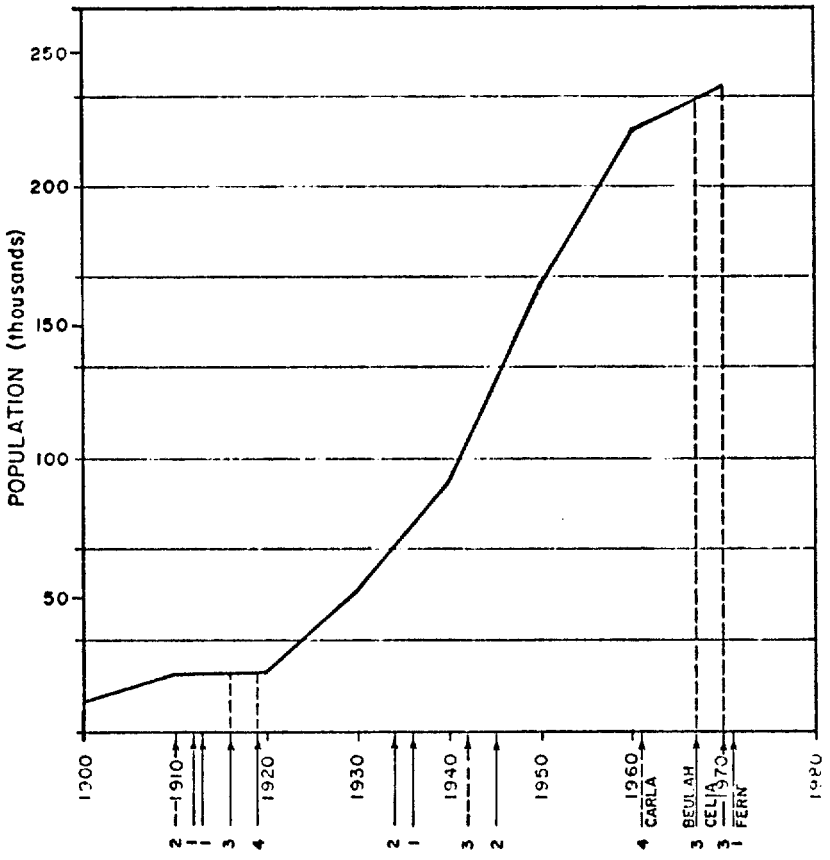
KENEDY COUNTY, TX



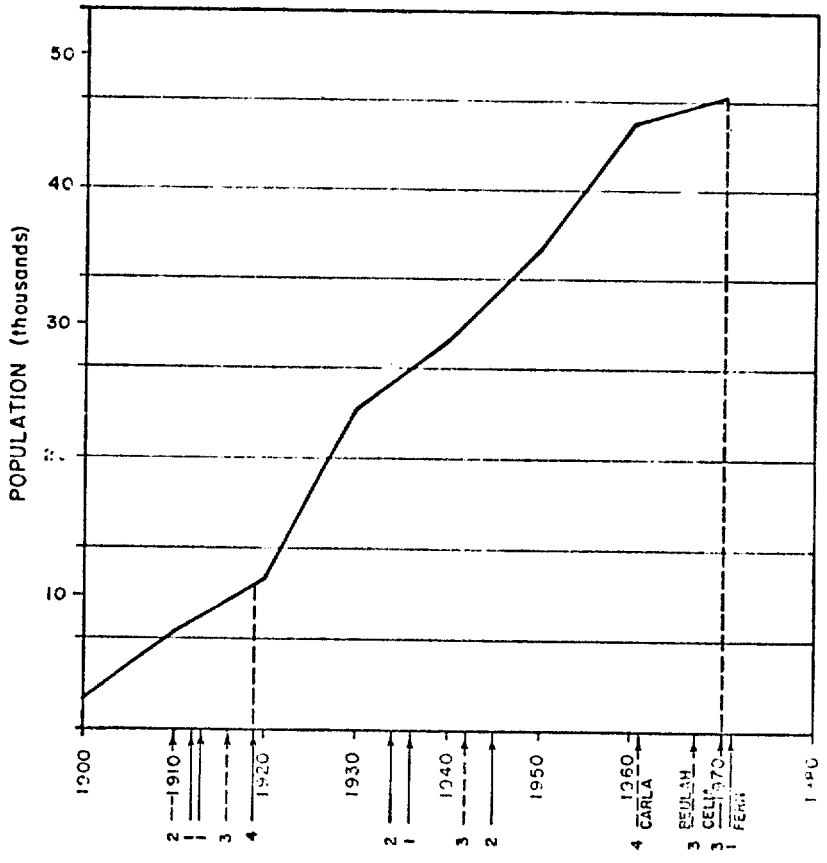
KLEBERG COUNTY, TX

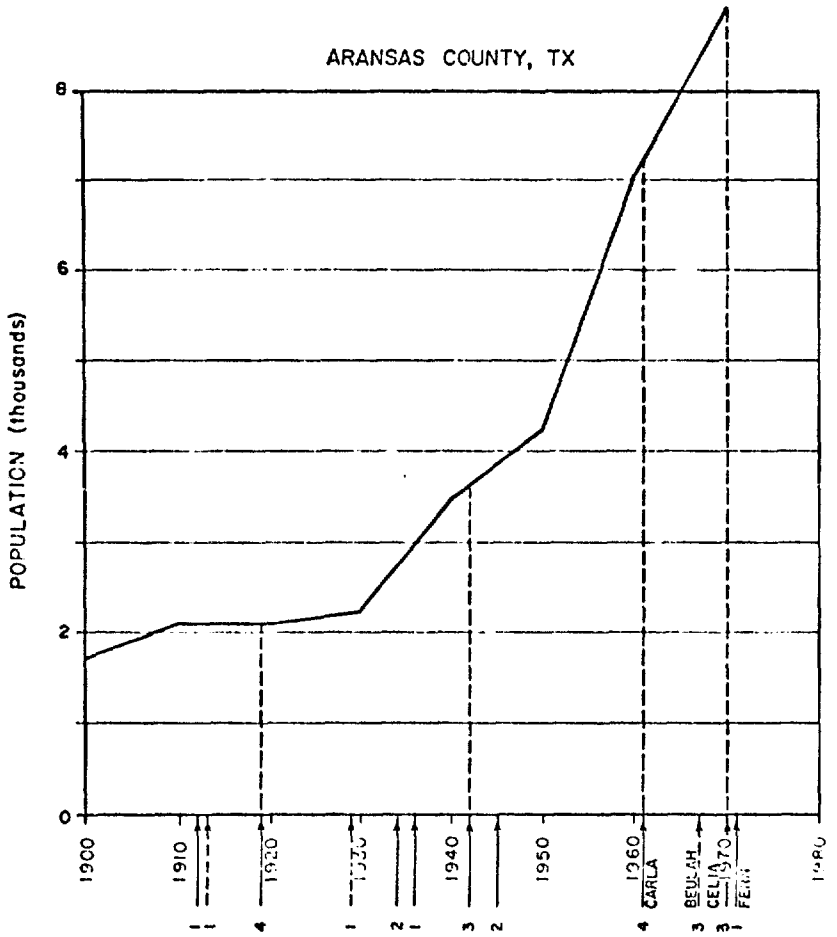


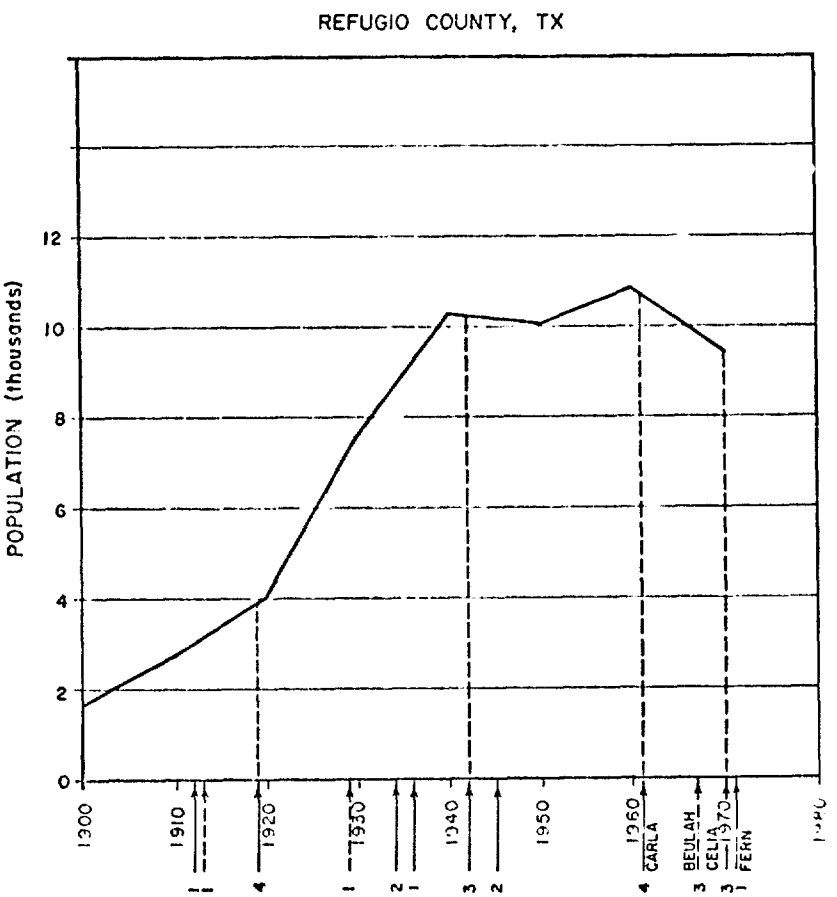
NUECES COUNTY, TX



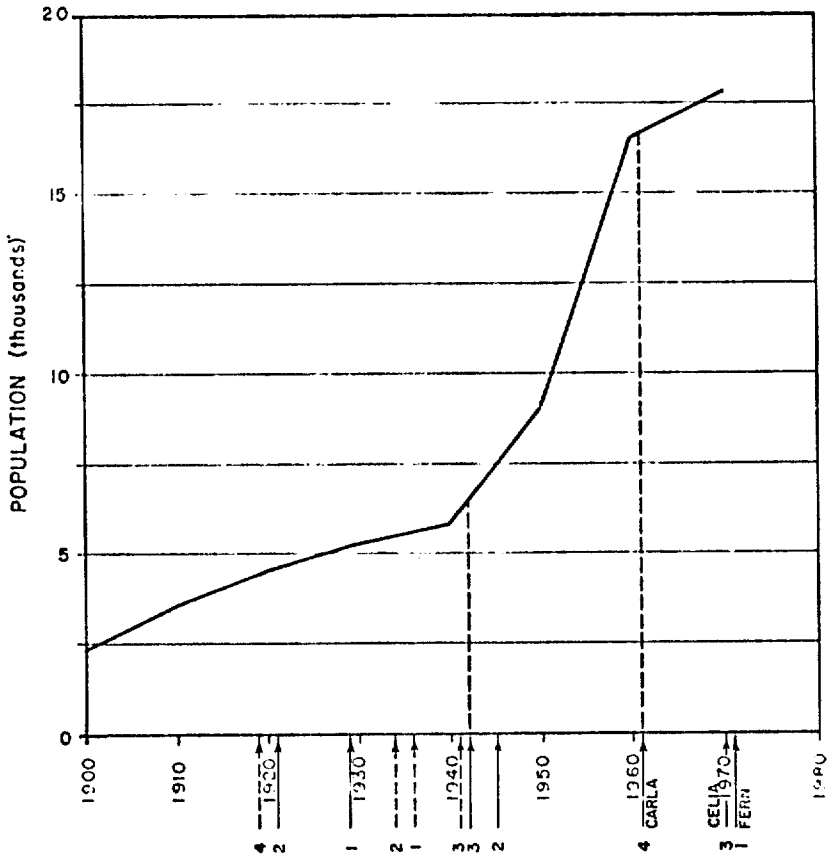
SAN PATRICIO COUNTY, TX



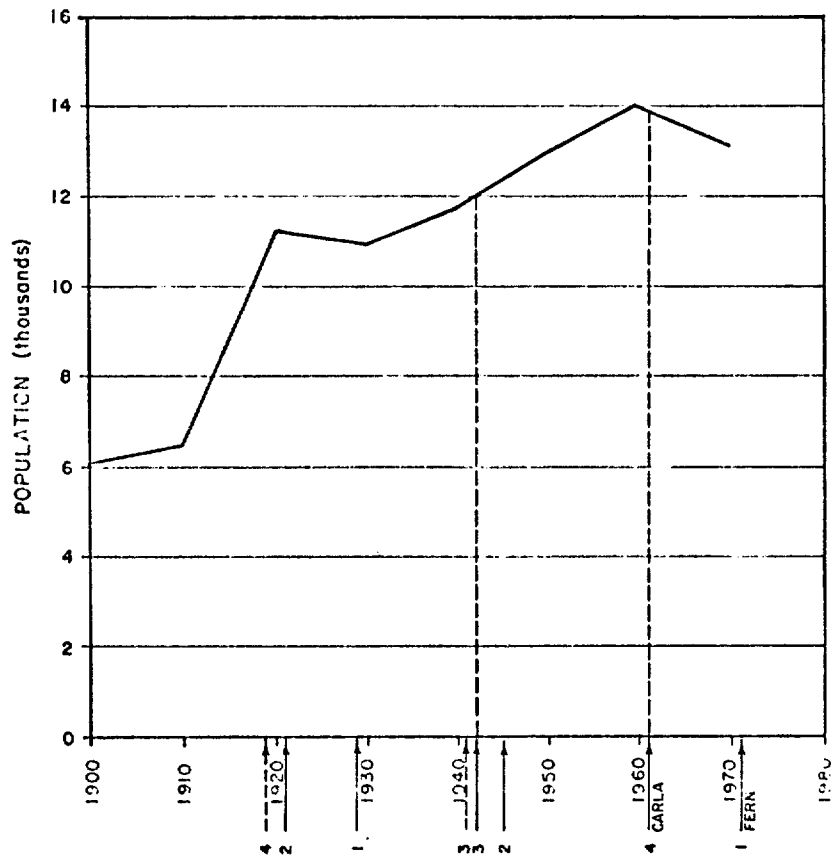

ARANSAS COUNTY, TX
POPULATION (thousands)
0
2
4
6
8
1900
1910
1920
1930
1940
1950
1960
1970
1980
CARLA
BEULAH
CELIA
FERN


REFUGIO COUNTY, TX
POPULATION (thousands)
0
2
4
6
8
10
12
1900
1910
1920
1930
1940
1950
1960
1970
1980
CARLA
BEULAH
CELIA
FERN

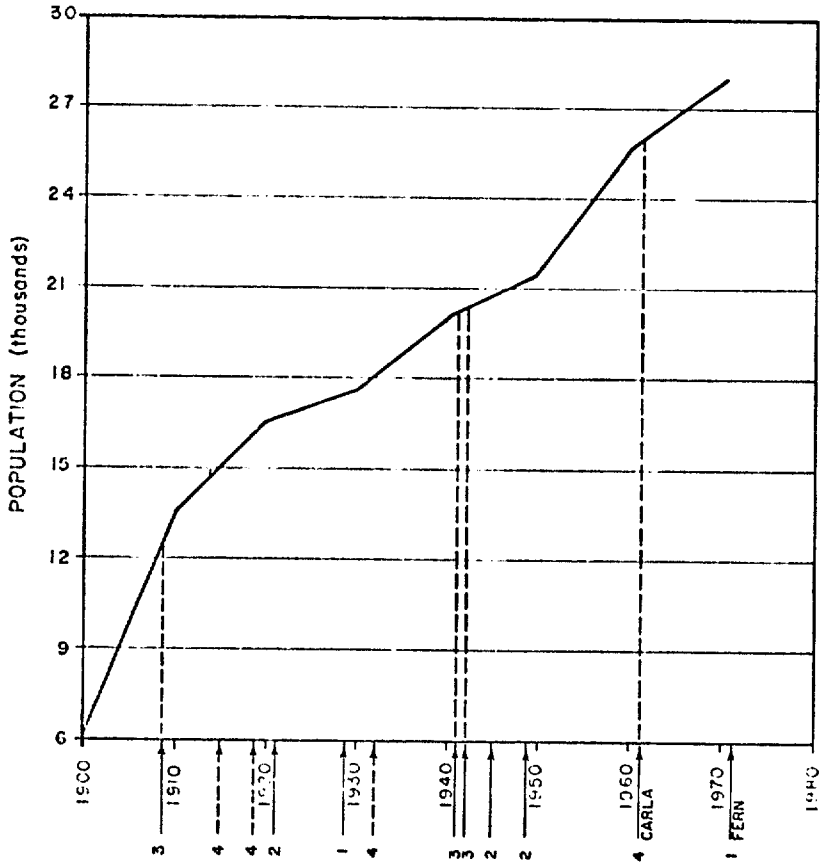
CALHOUN COUNTY, TX



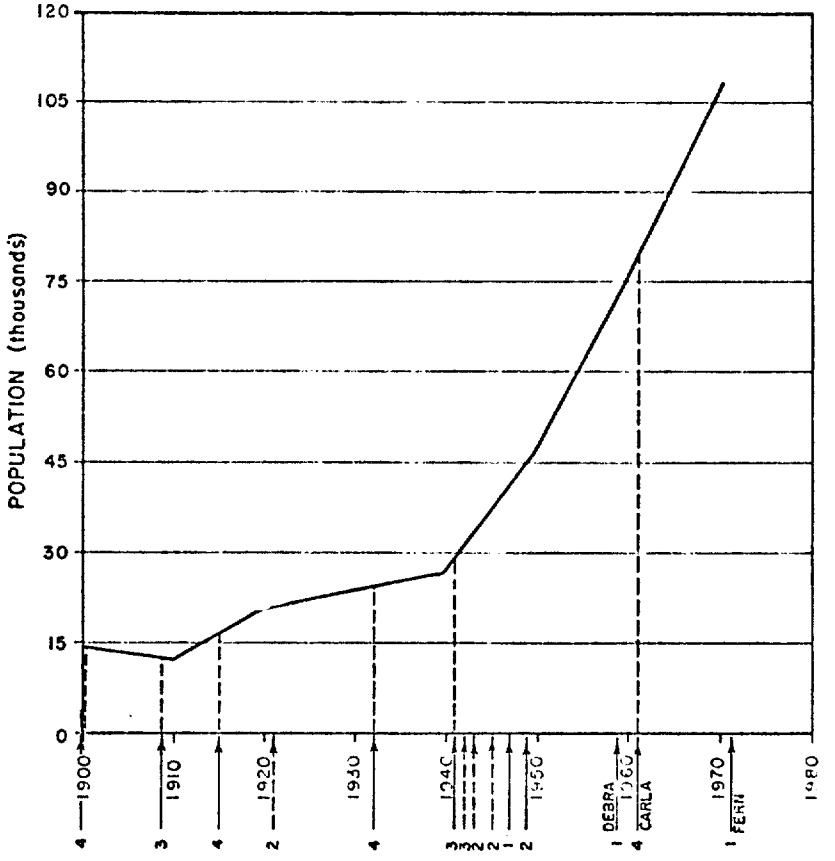
JACKSON COUNTY, TX



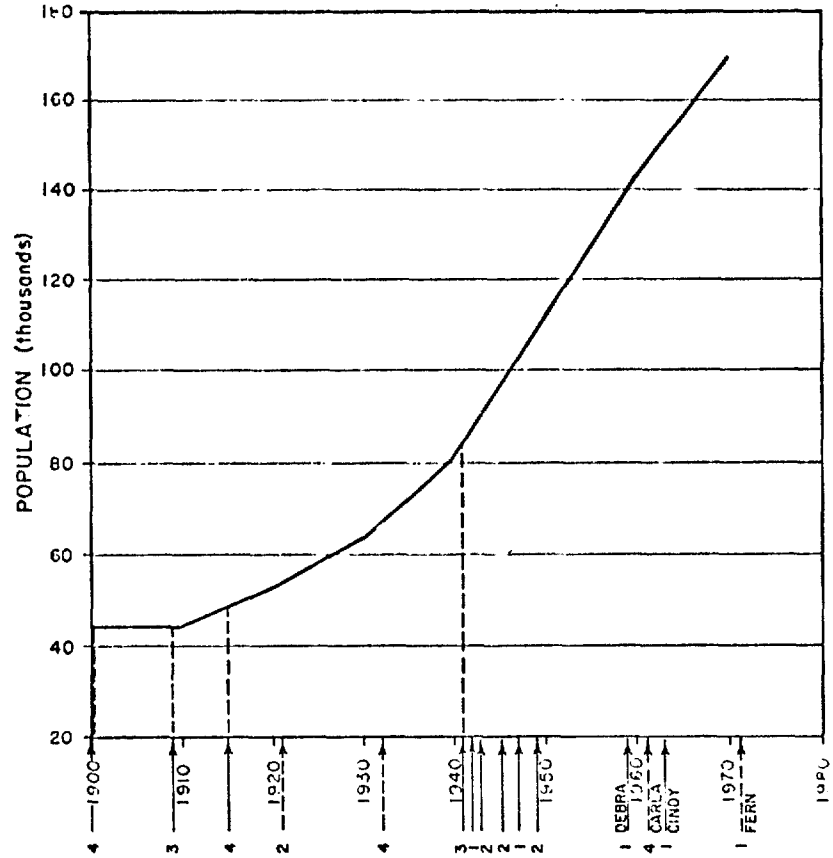
MATAGORDA COUNTY, TX



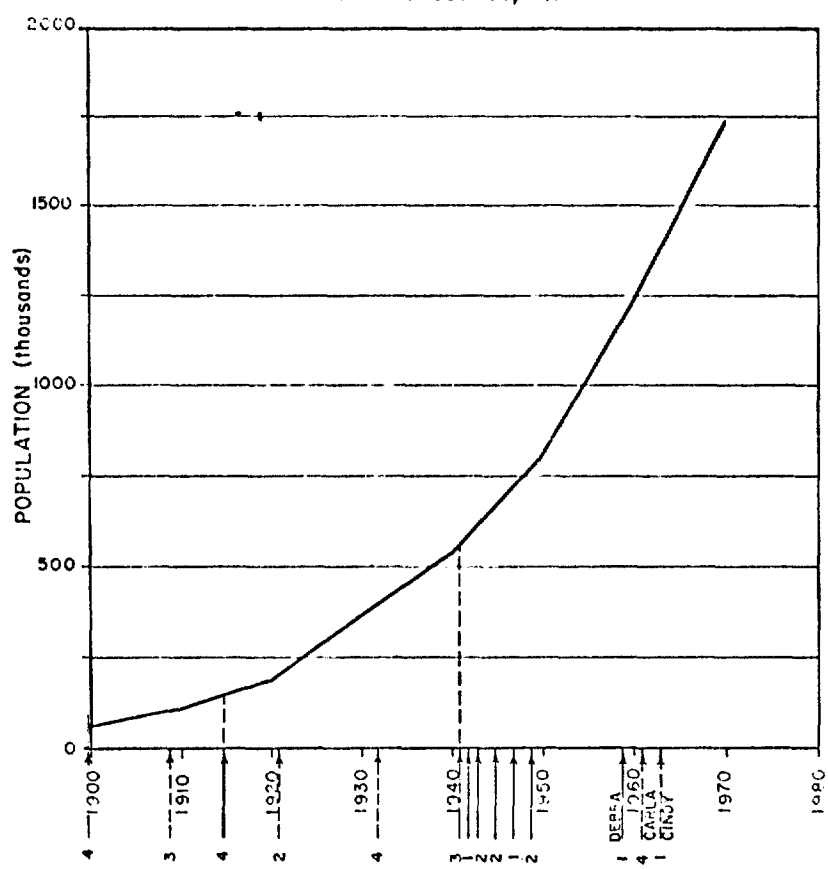
BRAZORIA COUNTY, TX.



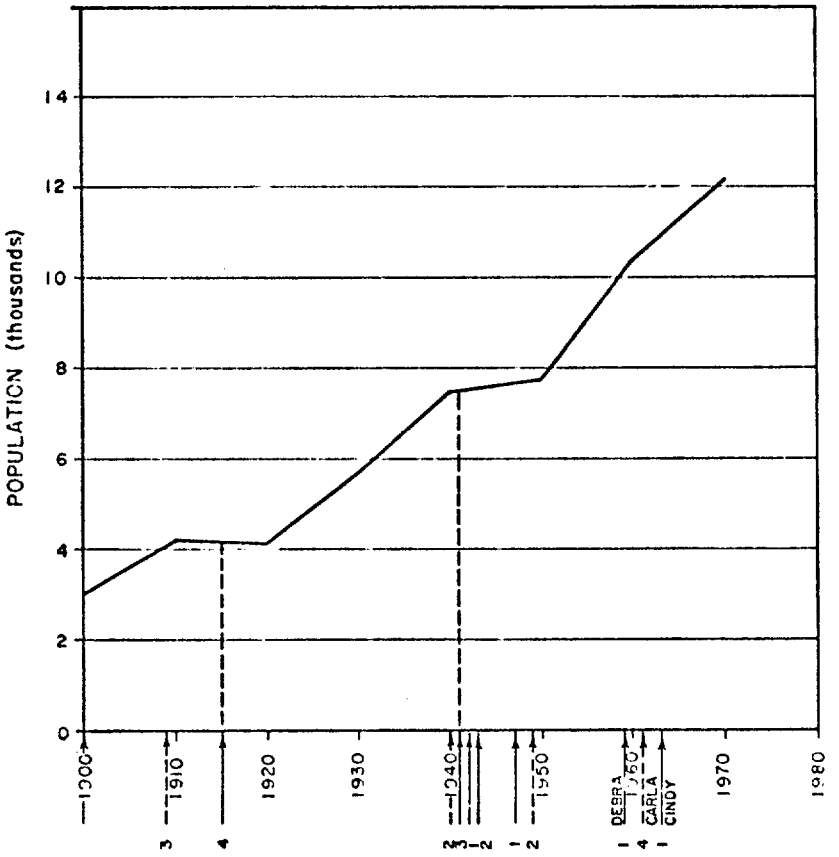
GALVESTON COUNTY, TX.



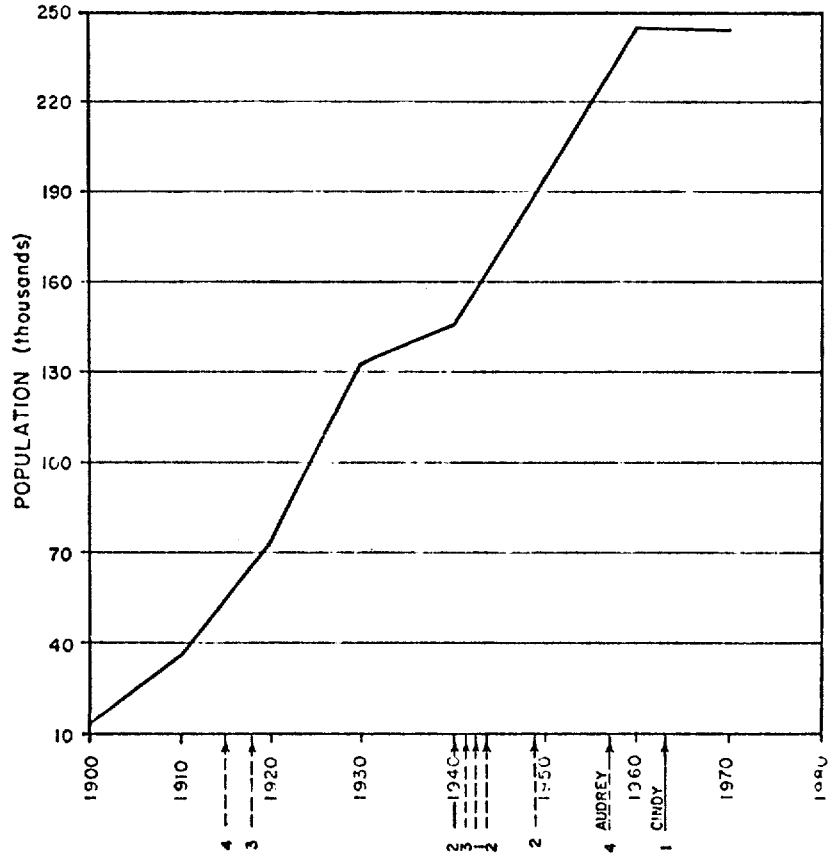
HARRIS COUNTY, TX



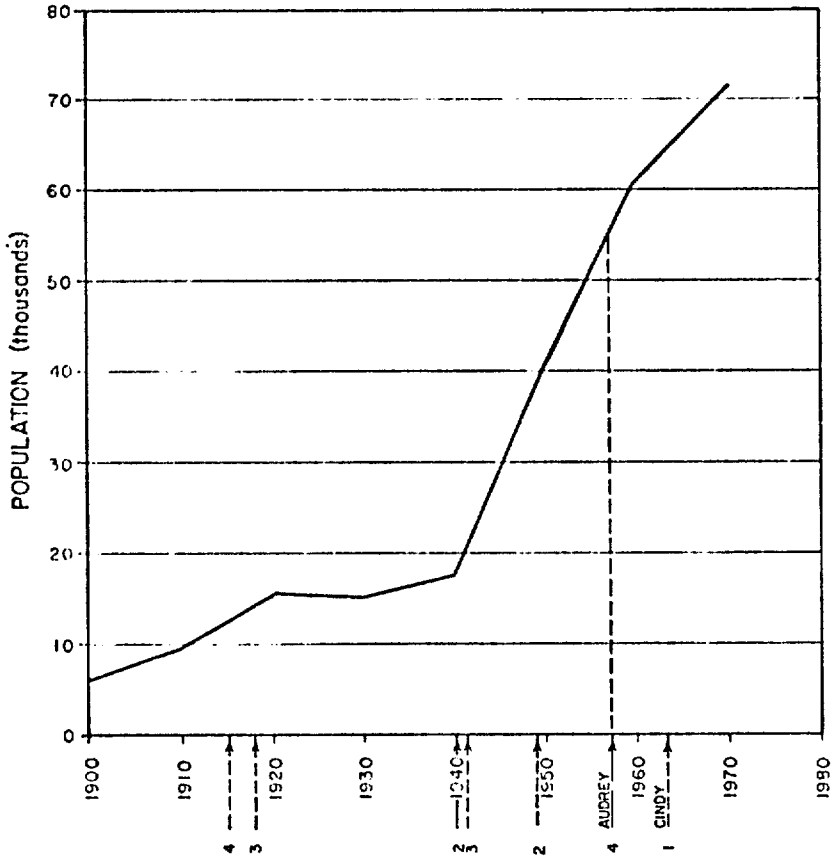
CHAMBERS COUNTY, TX



JEFFERSON COUNTY, TX.

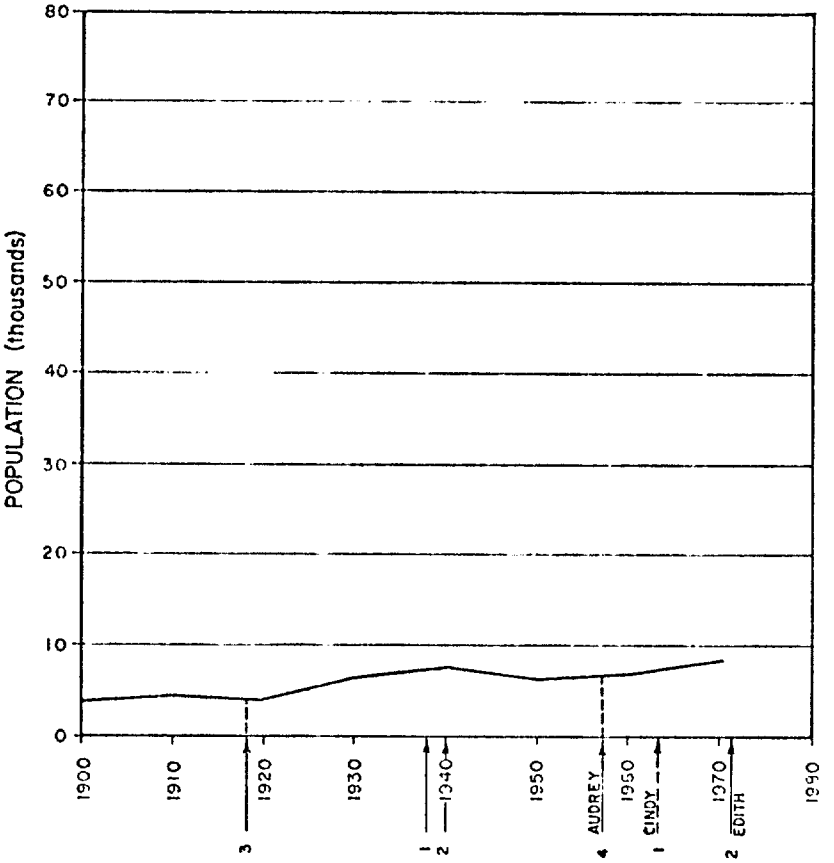


ORANGE COUNTY, TX.

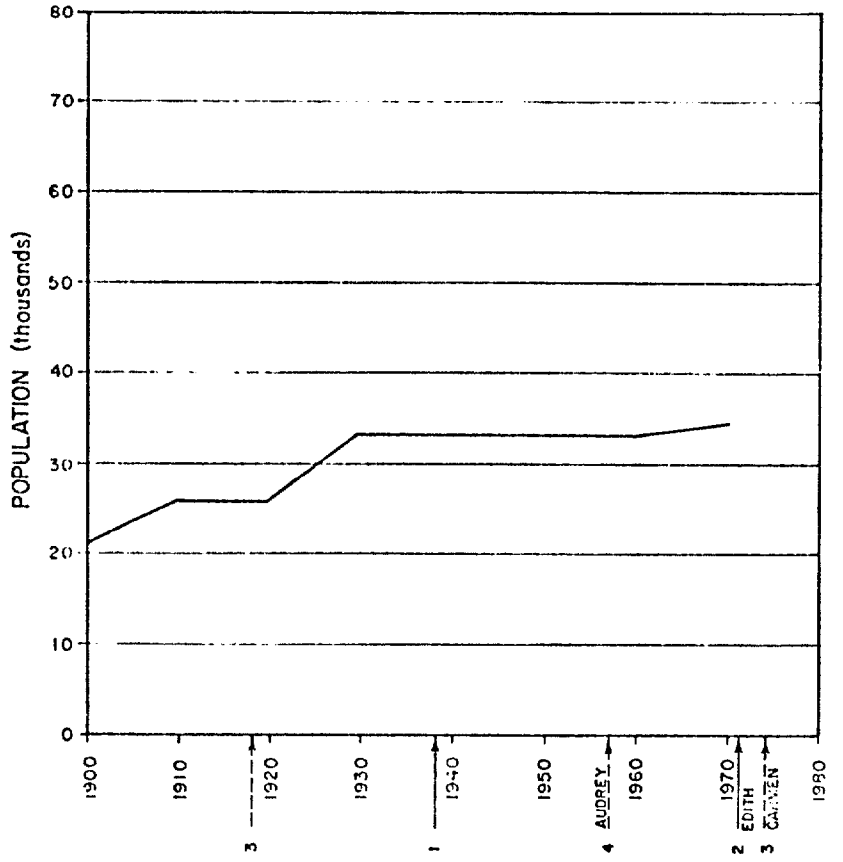


END OF TEXAS COUNTIES

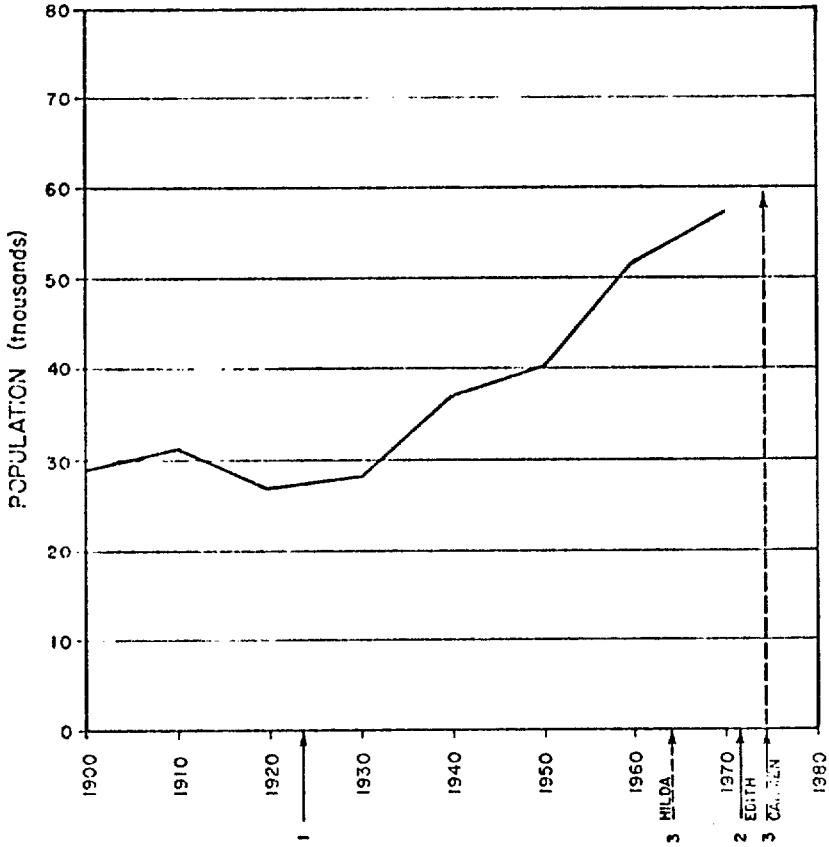
CAMERON PARISH, LA.



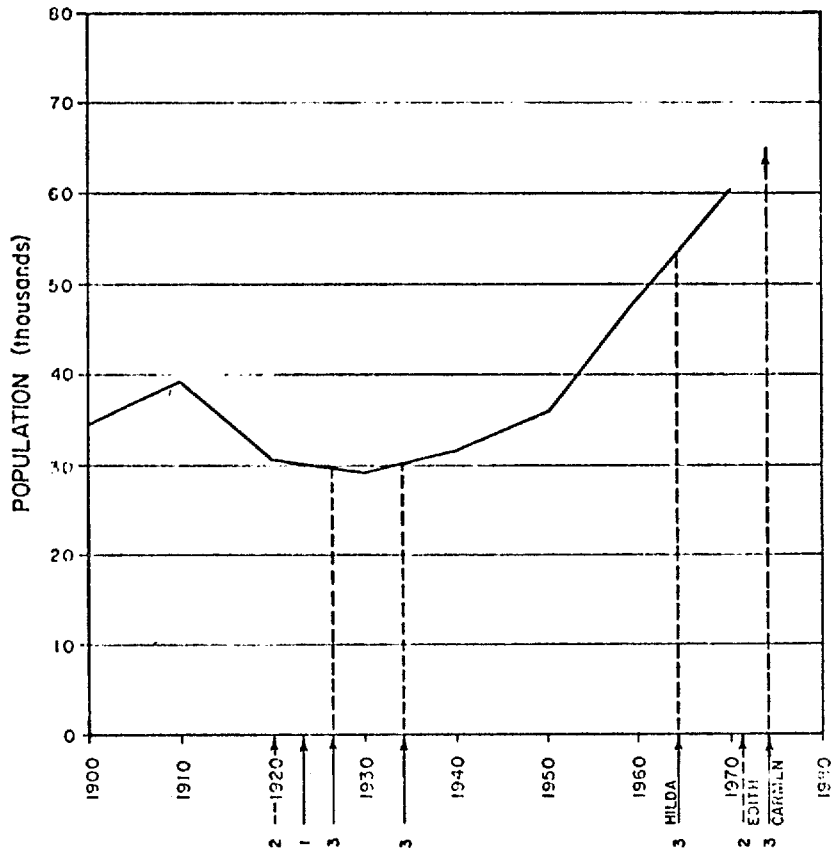
VERMILION PARISH, LA.



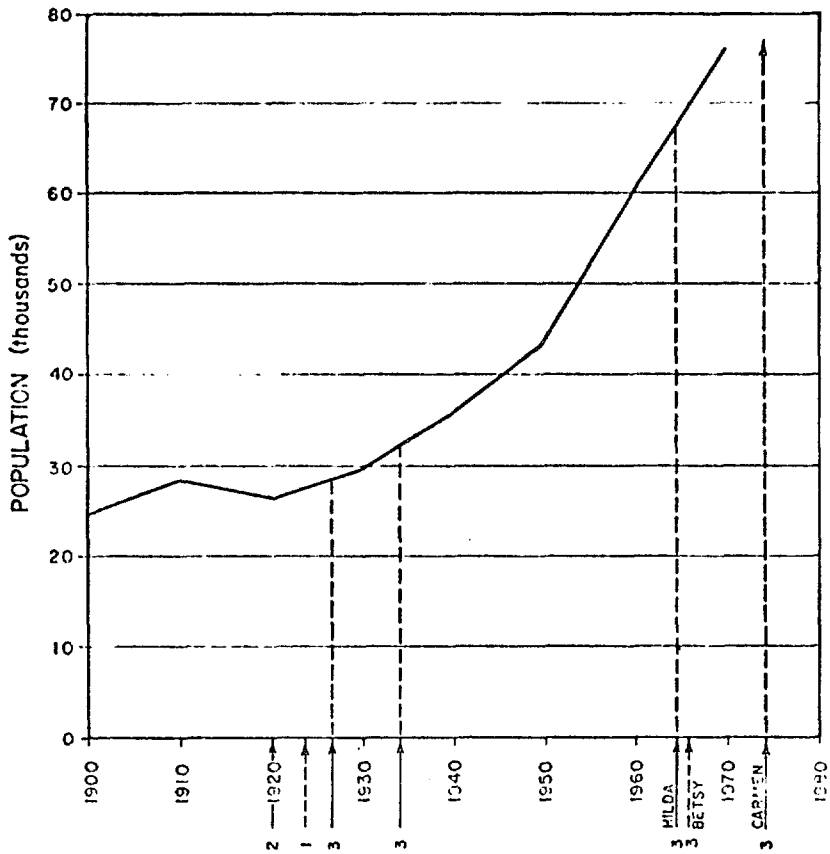
IBERIA PARISH, LA.



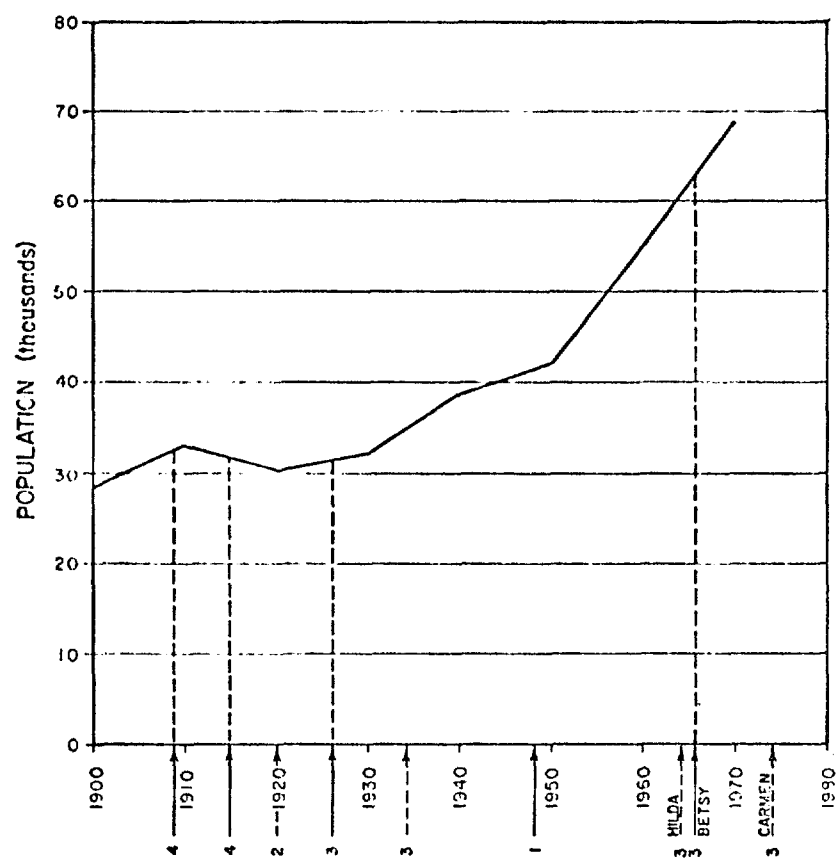
ST. MARY PARISH, LA.



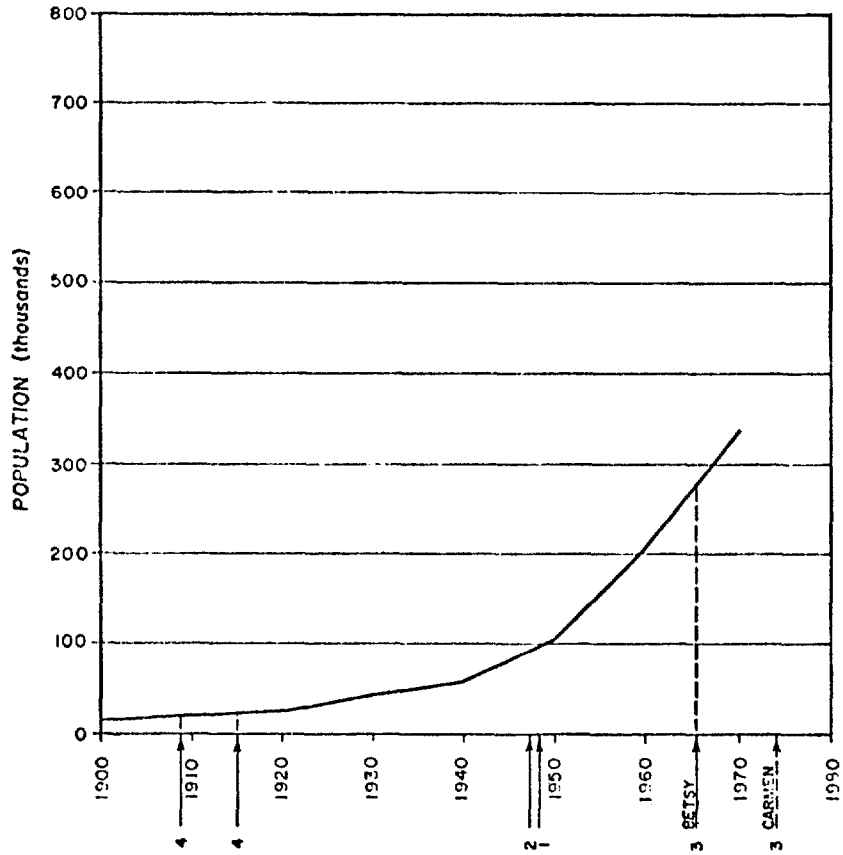
TERREBONNE PARISH, LA.



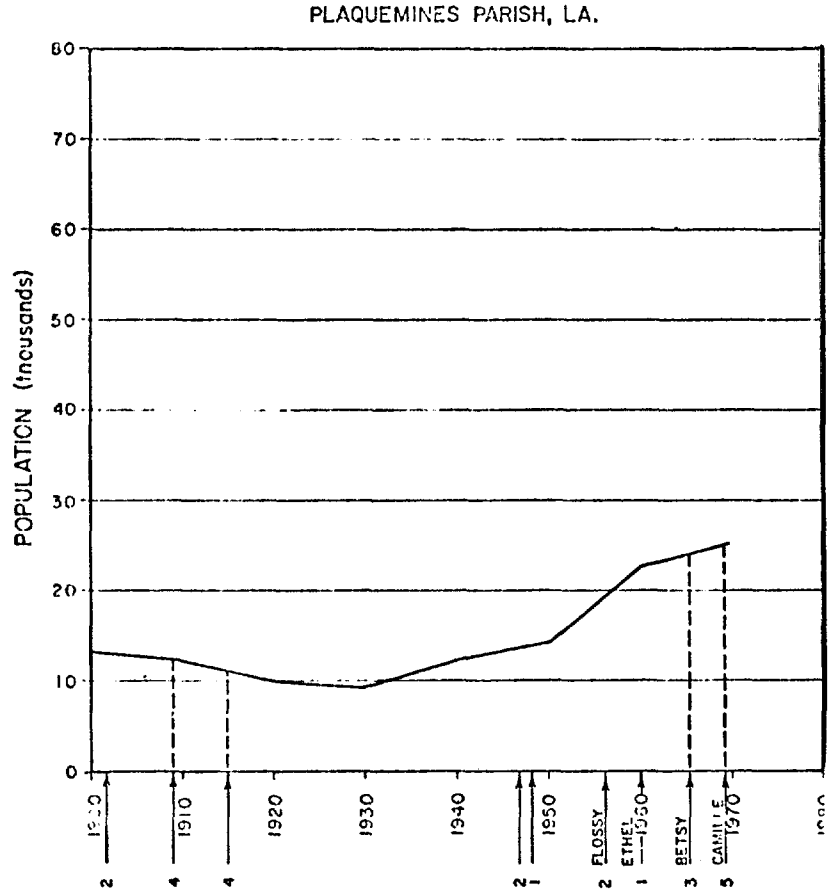
LAFOURCHE PARISH, LA.



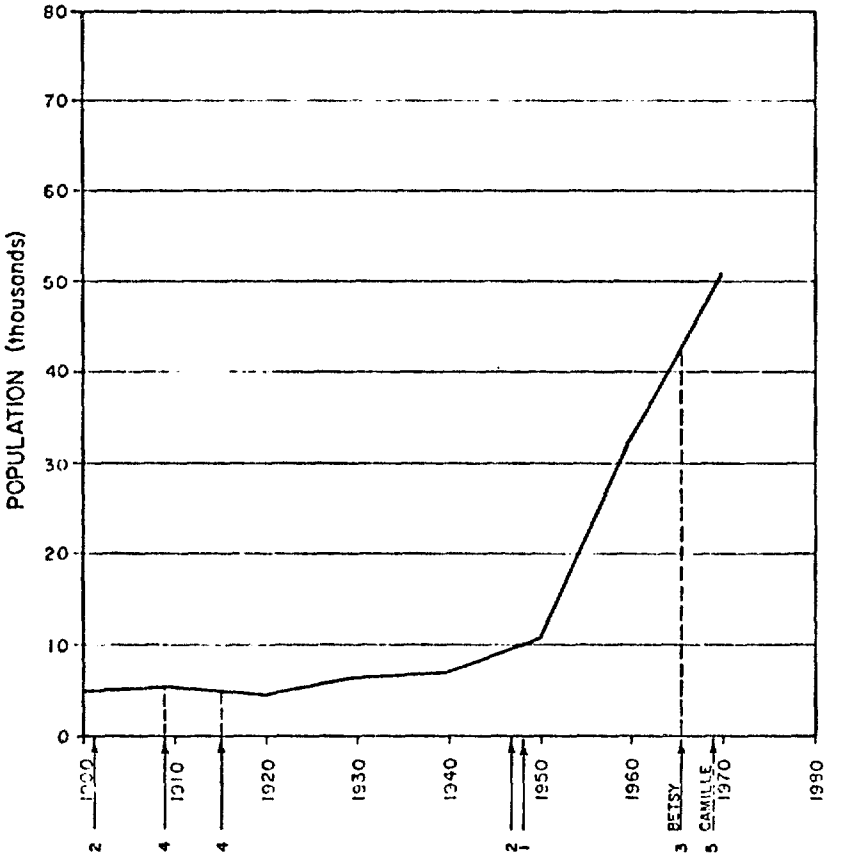
JEFFERSON PARISH, LA.



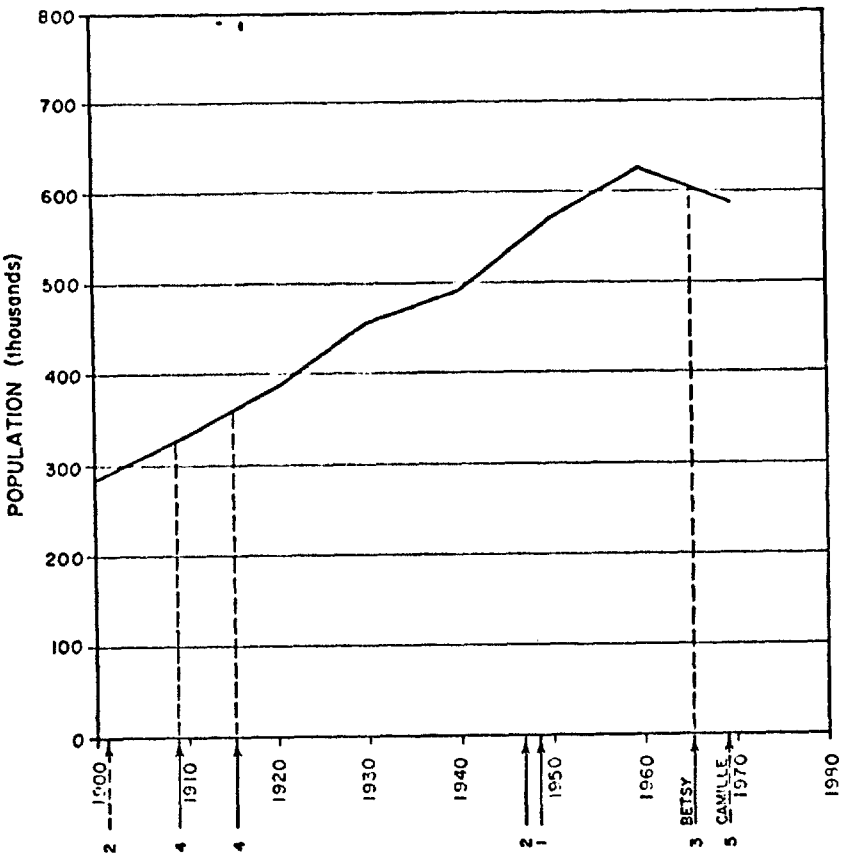
PLAQUEMINES PARISH, LA.

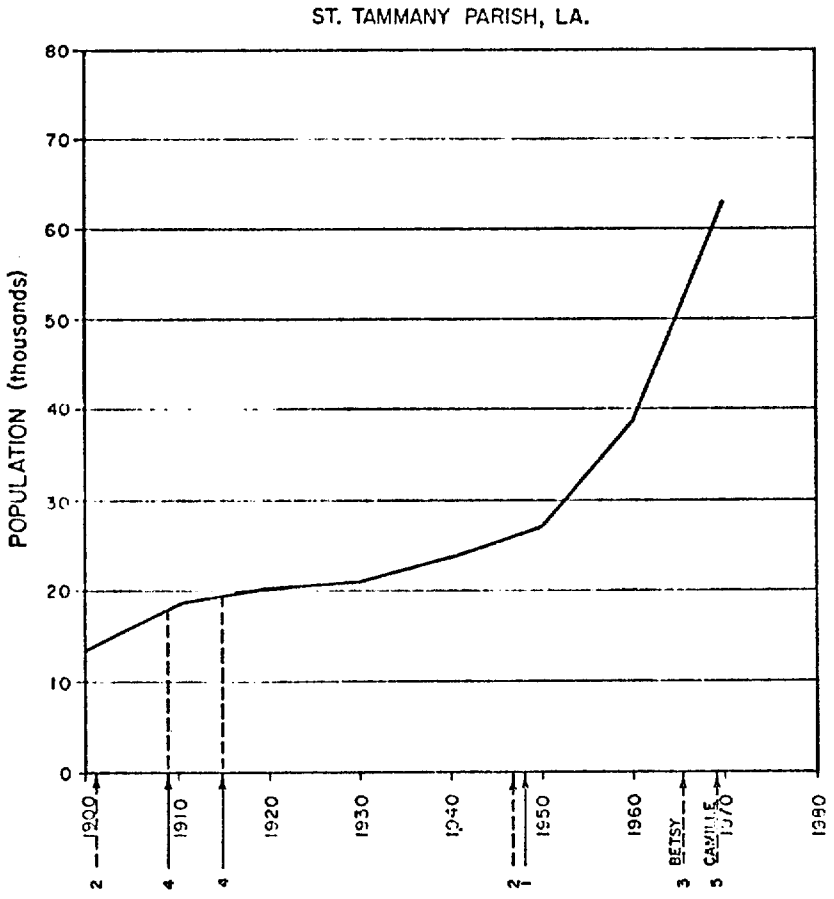


ST. BERNARD PARISH, LA.



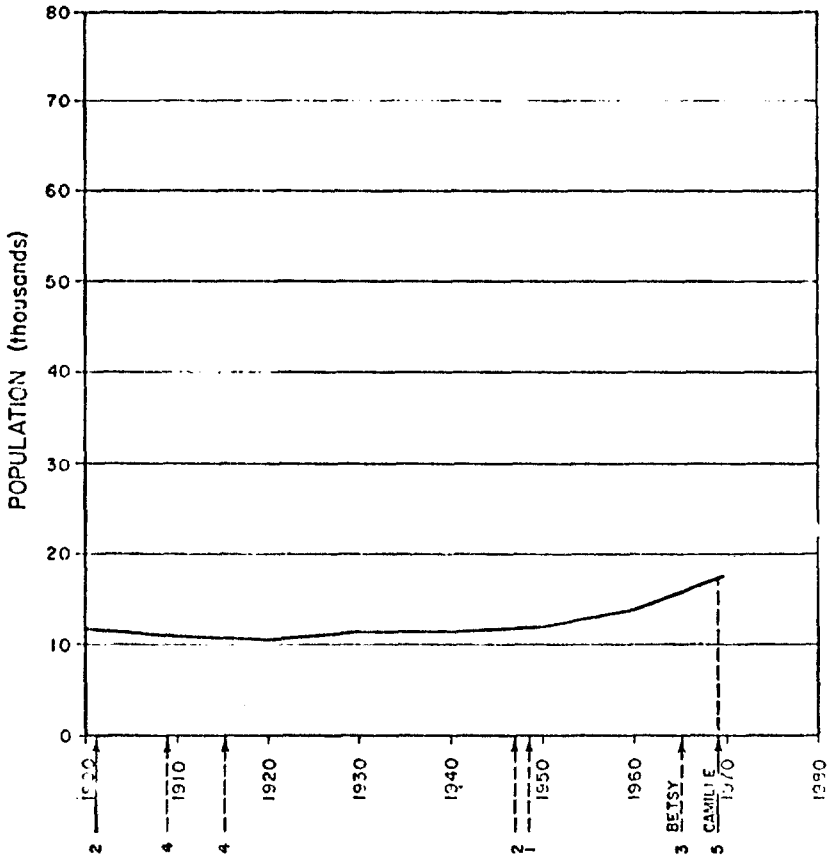
ORLEANS PARISH, LA.



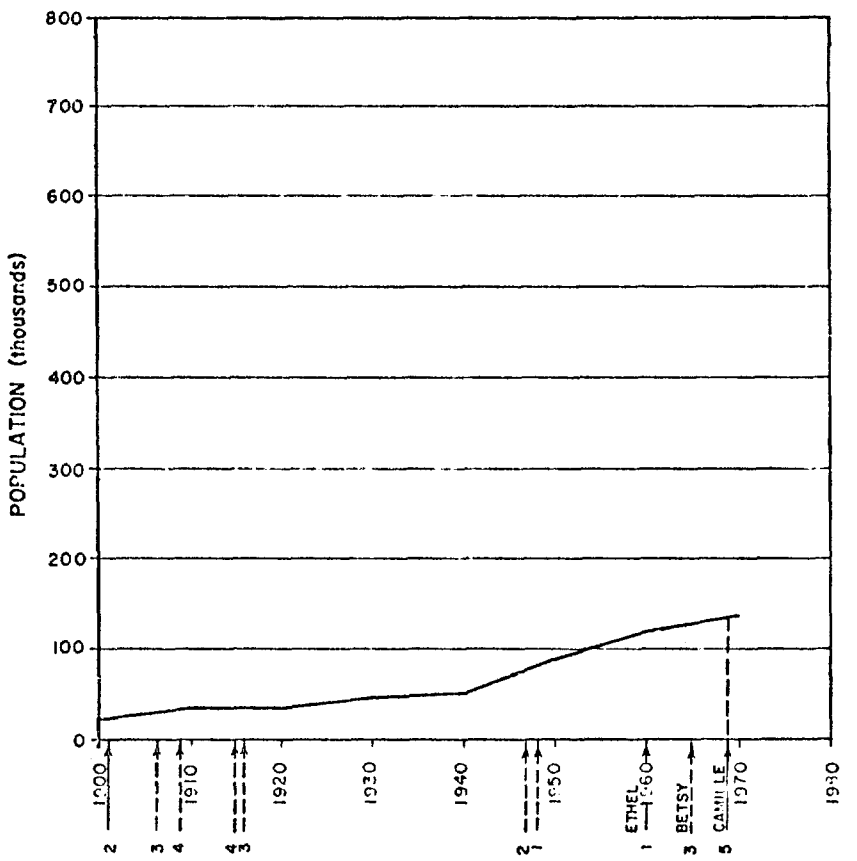


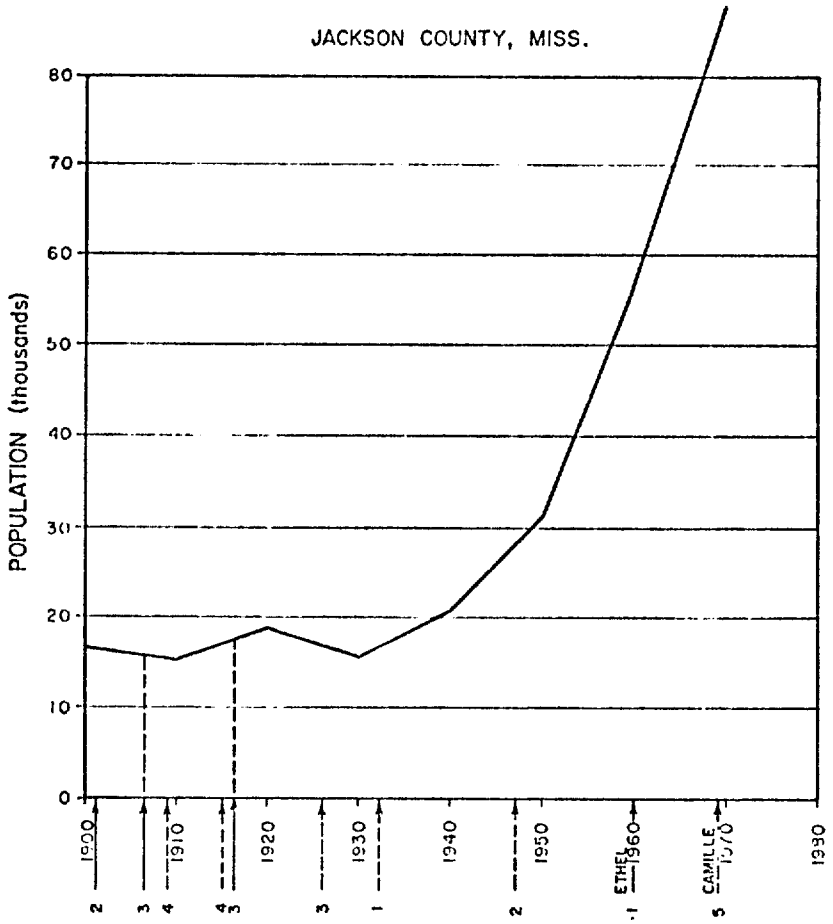
END OF LOUISIANA COUNTIES

HANCOCK COUNTY, MISS.



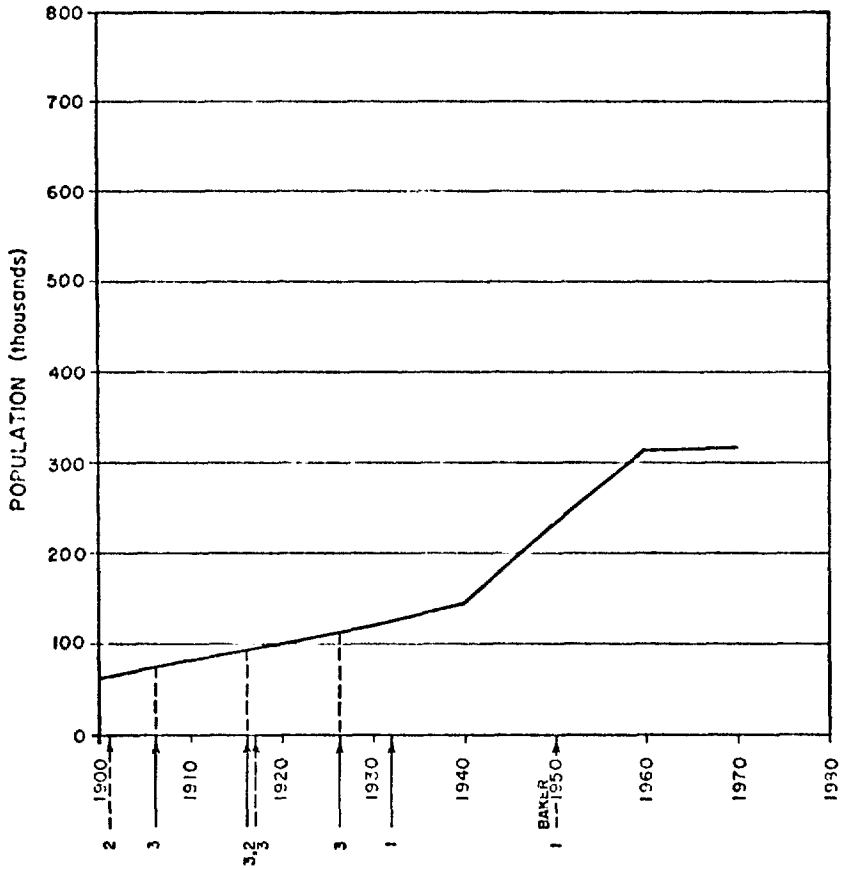
HARRISON COUNTY, MISS.



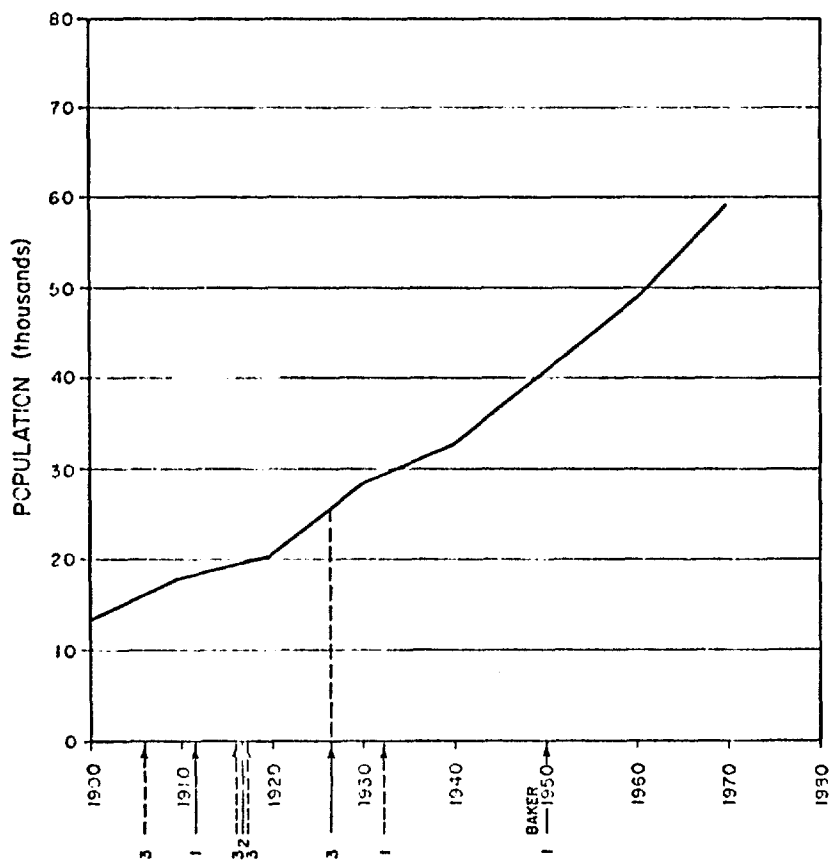


END OF MISSISSIPPI COUNTIES

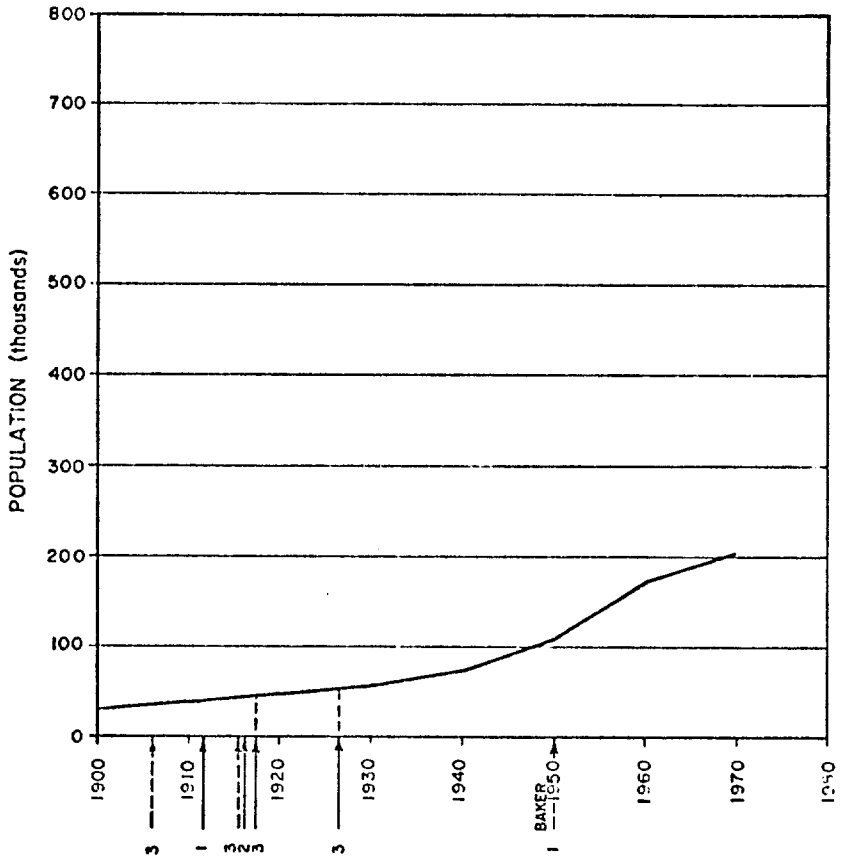
MOBILE COUNTY, ALA.



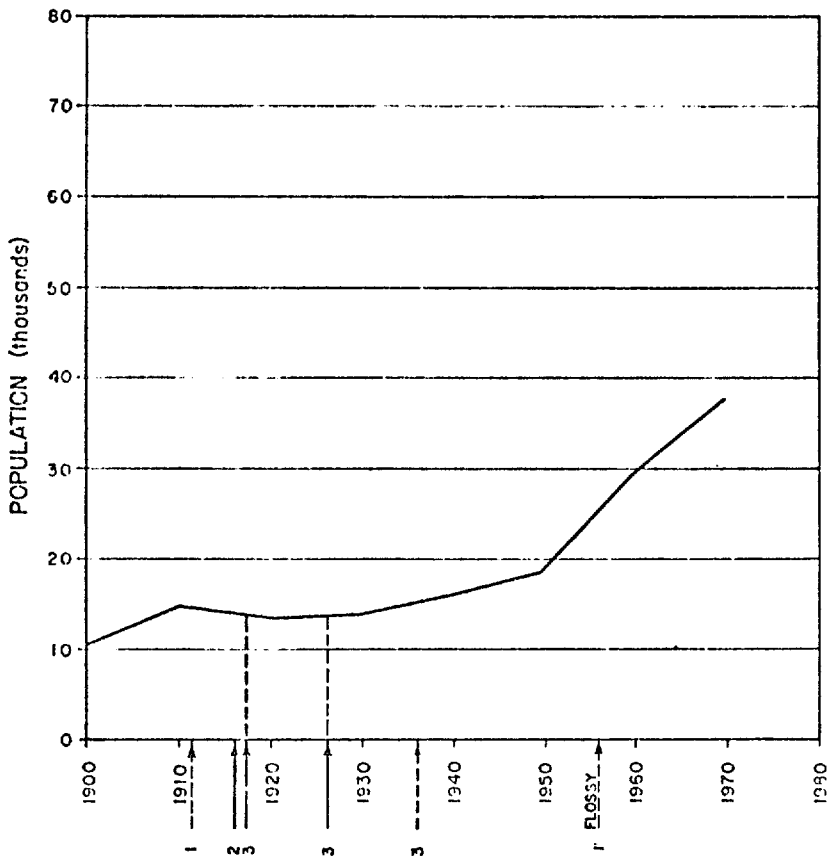
BALDWIN COUNTY, ALA.

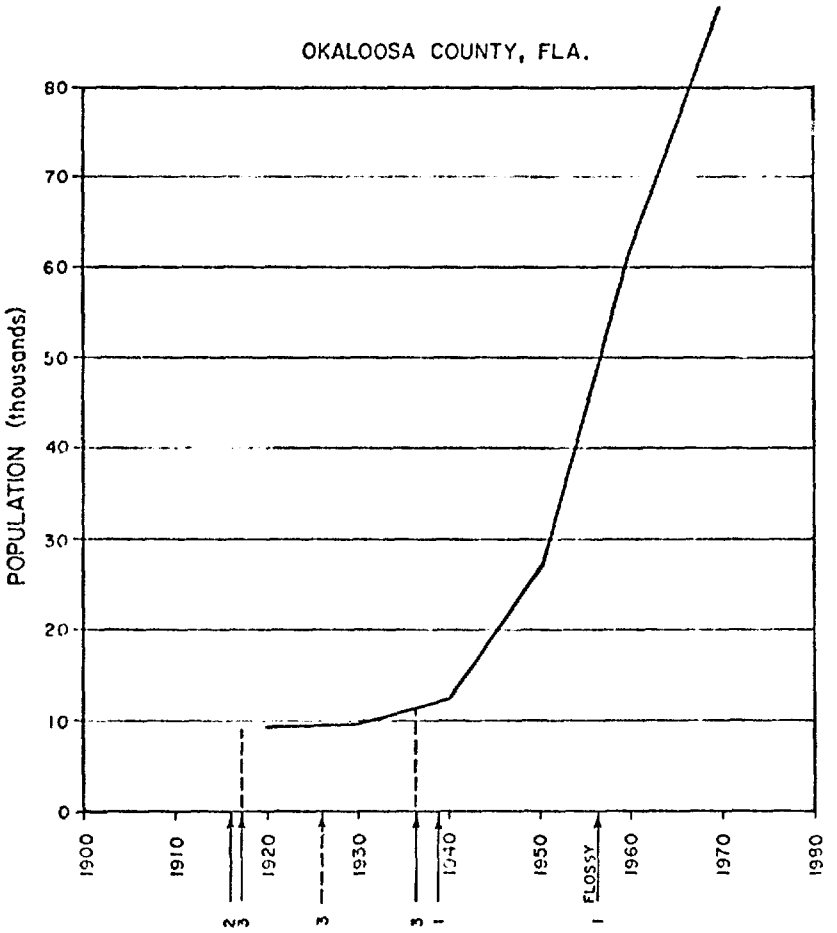


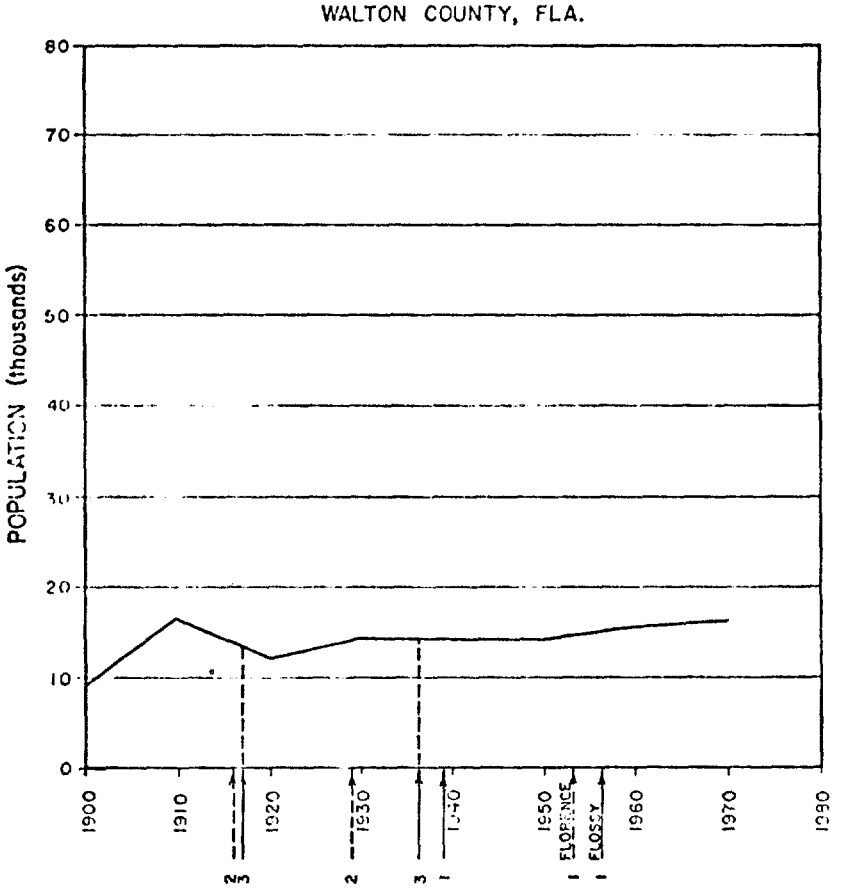
ESCAMBIA COUNTY, FLA.



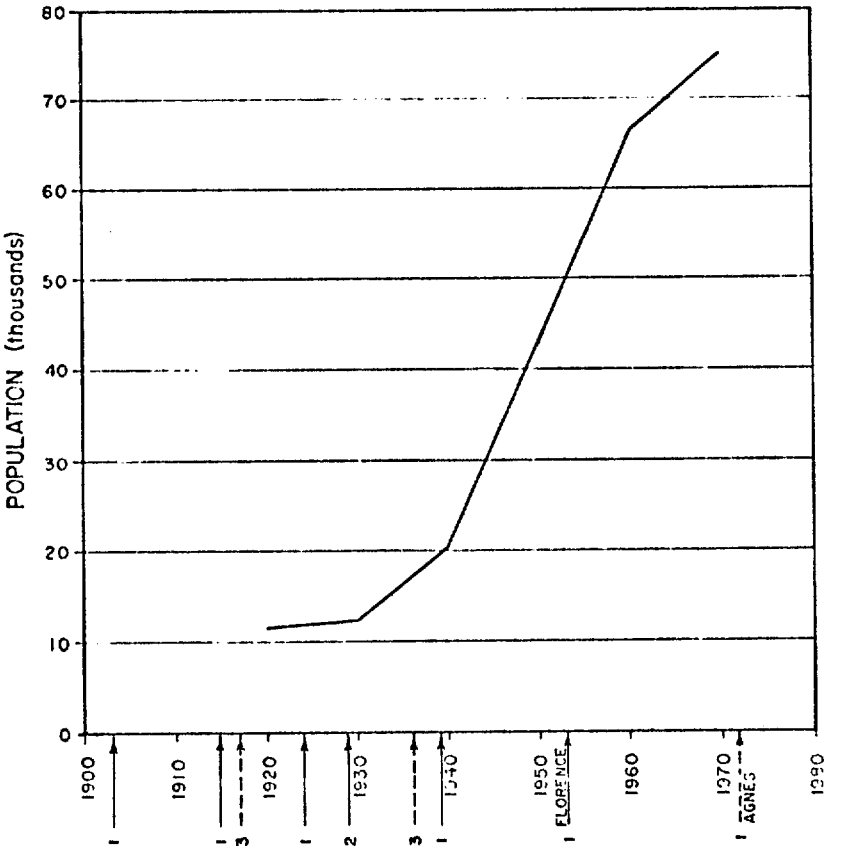
SANTA ROSA COUNTY, FLA.



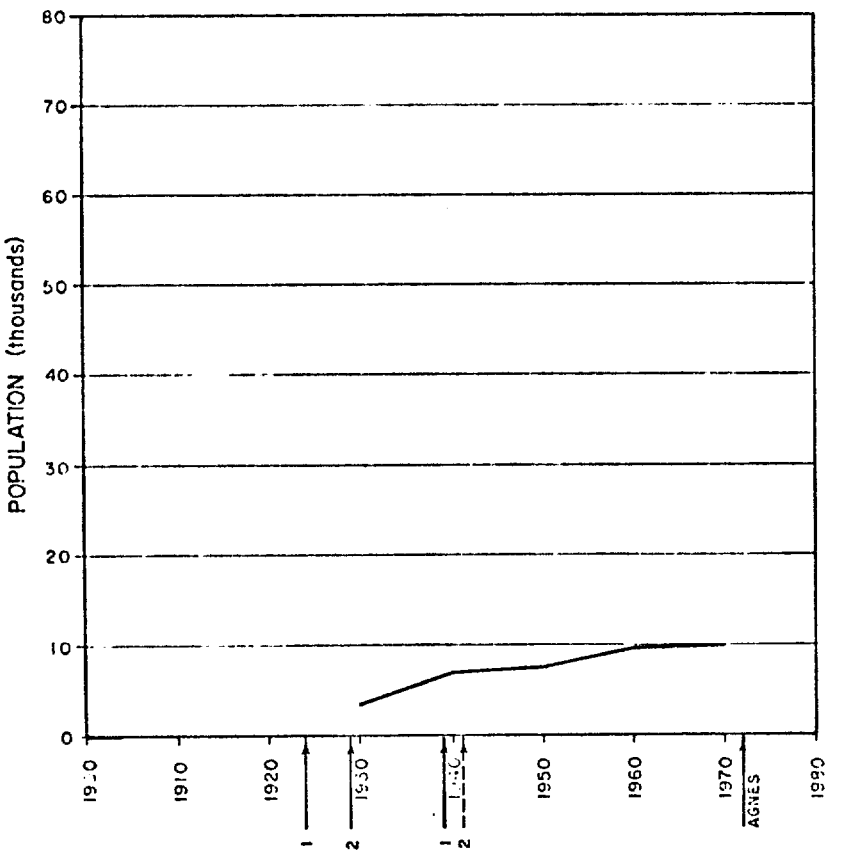

OKALOOSA COUNTY, FLA.
POPULATION (thousands)
80
70
60
50
40
30
20
10
0
1900
1910
1920
1930
1940
1950
1960
1970
1990
FLOSSY
2
3
3
3
1
1


WALTON COUNTY, FLA.
POPULATION (thousands)
80
70
60
50
40
30
20
10
0
1900
1910
1920
1930
1940
1950
1960
1970
1990
FLORENCE
FLOSSY
2
3
2
3
1
1
1

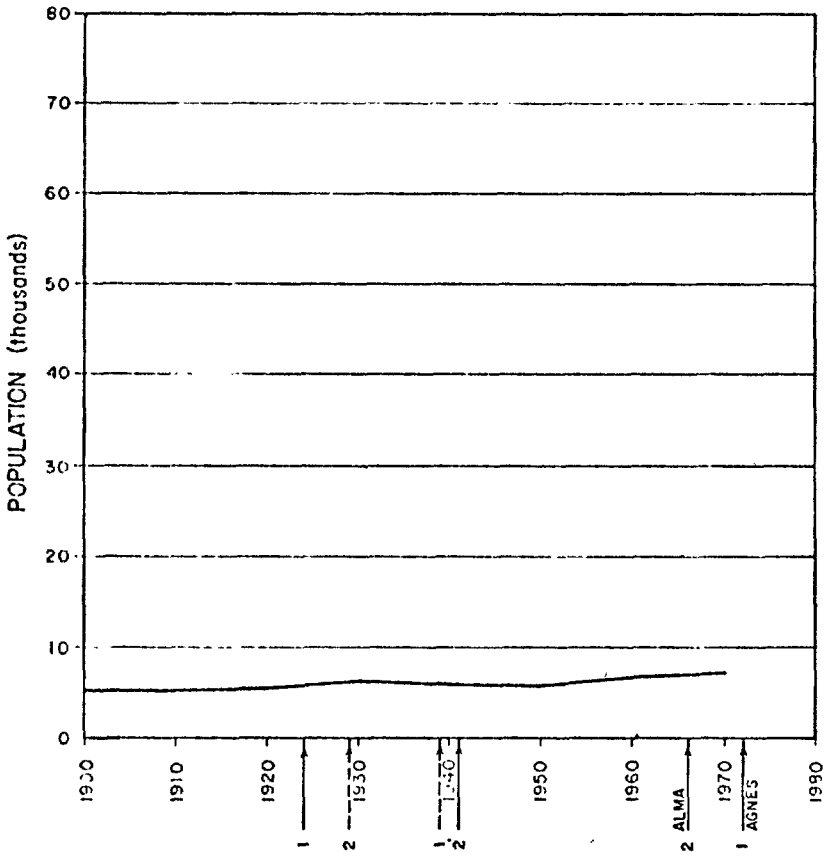
BAY COUNTY, FLA.



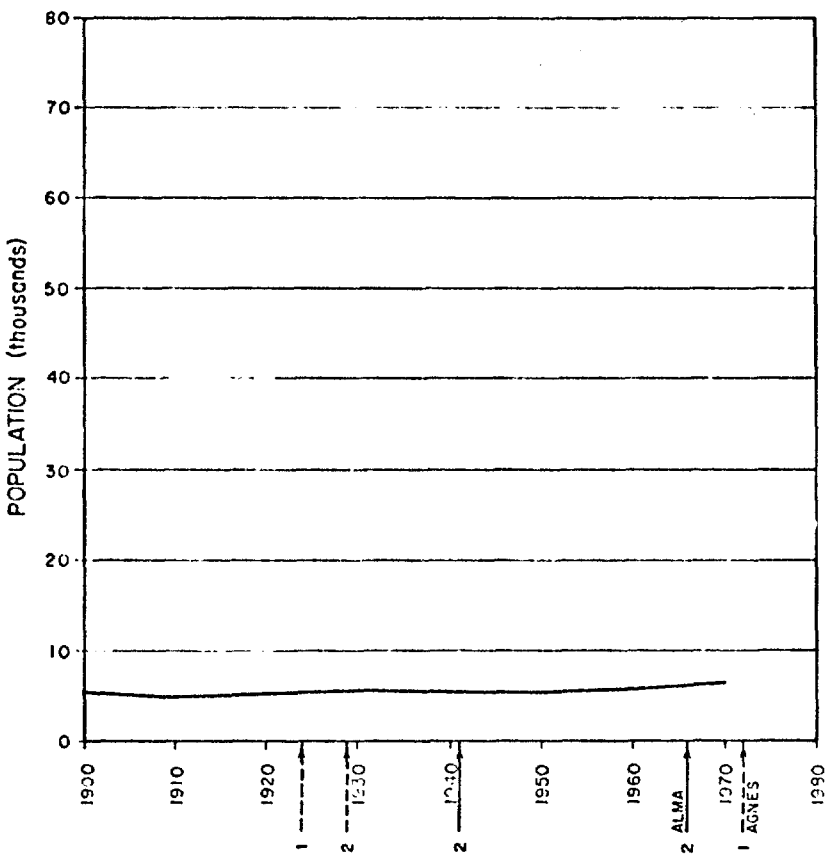
GULF COUNTY, FL



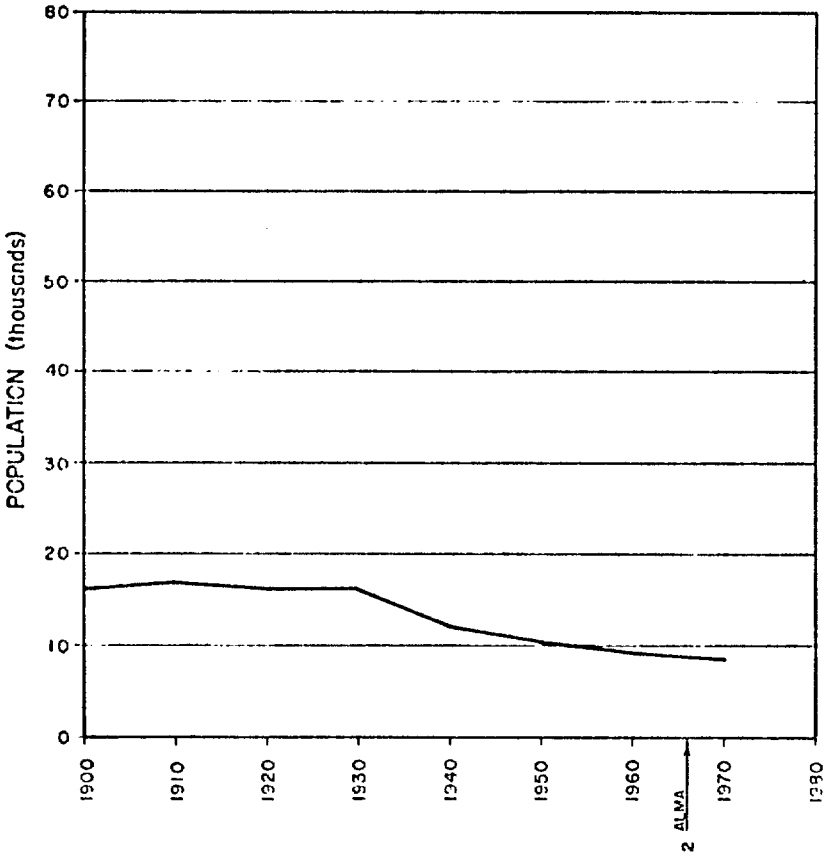
FRANKLIN COUNTY, FL



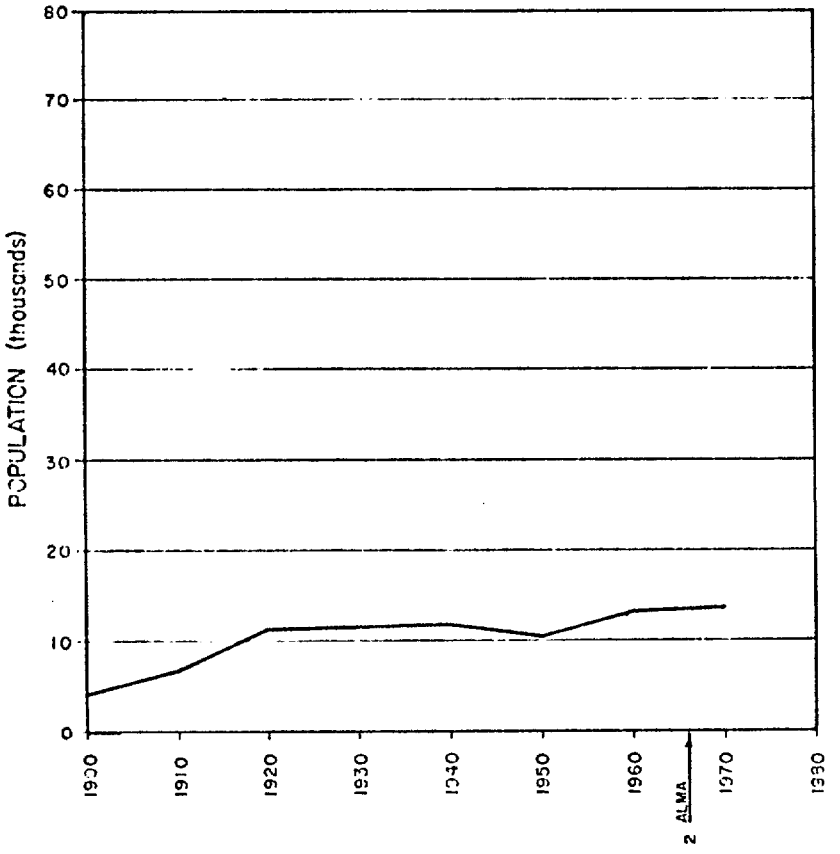
WAKULLA COUNTY, FL



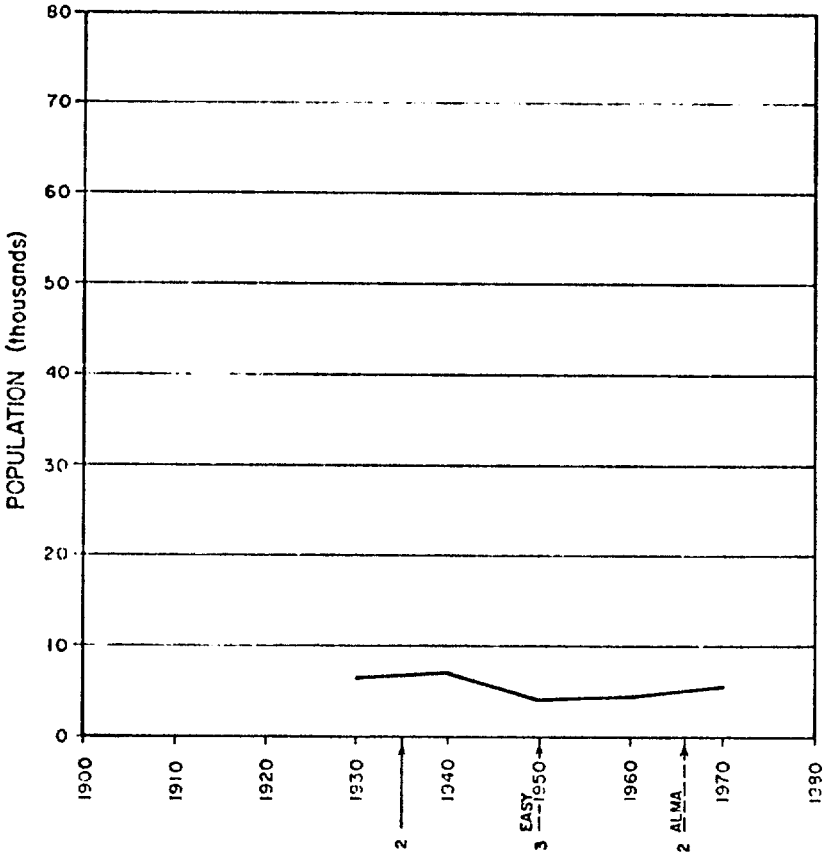
JEFFERSON COUNTY, FL



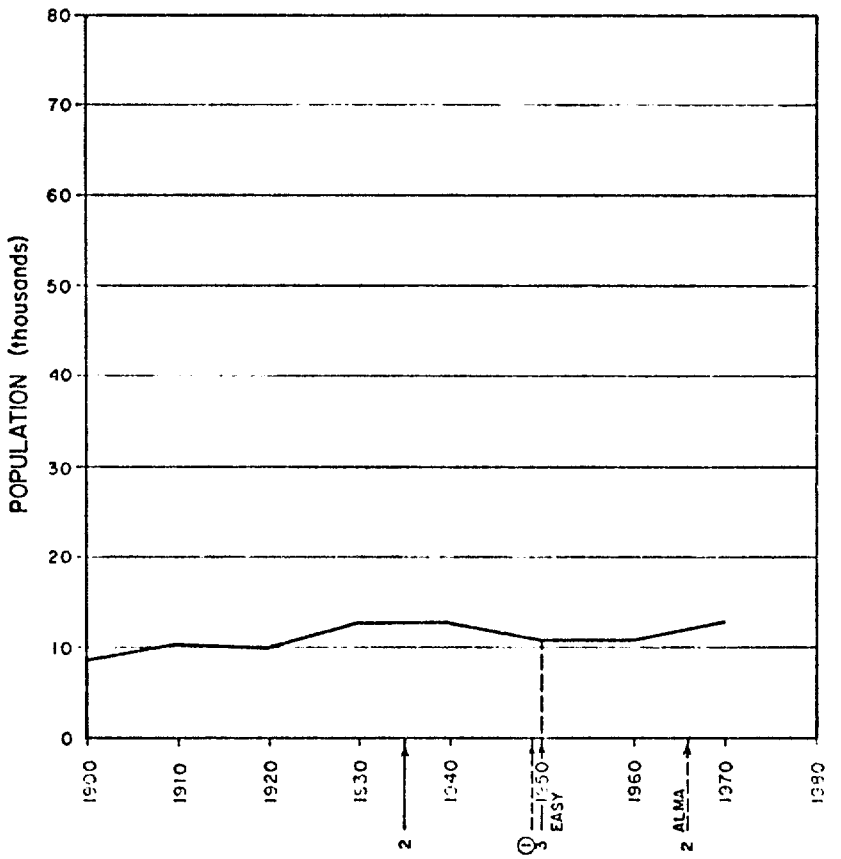
TAYLOR COUNTY, FL



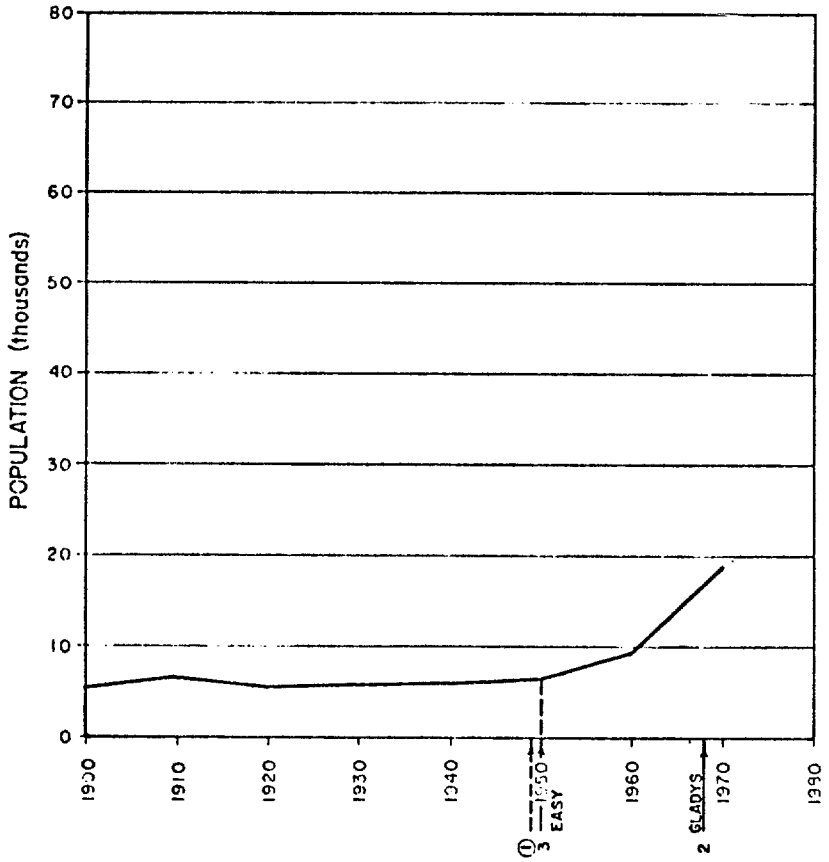
DIXIE COUNTY, FL



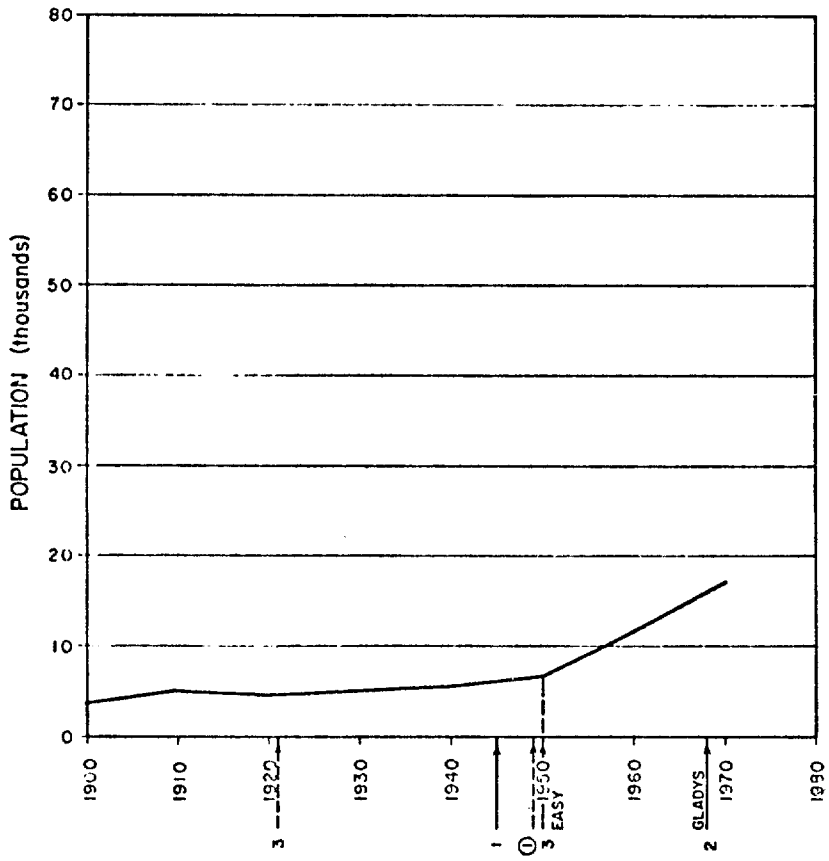
LEVY COUNTY, FL

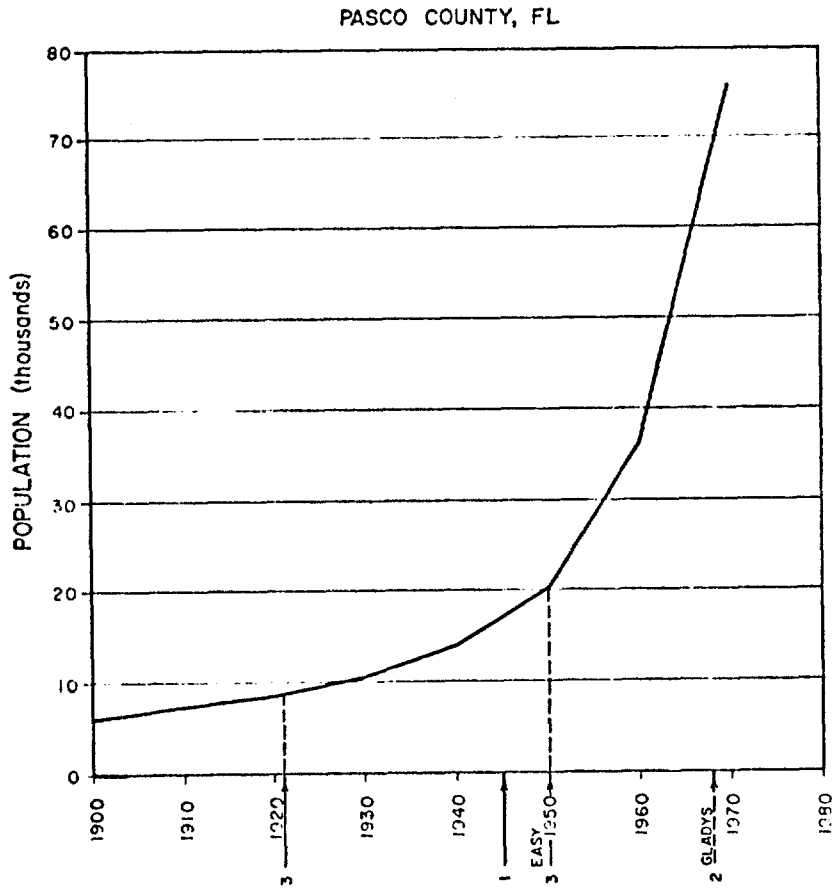


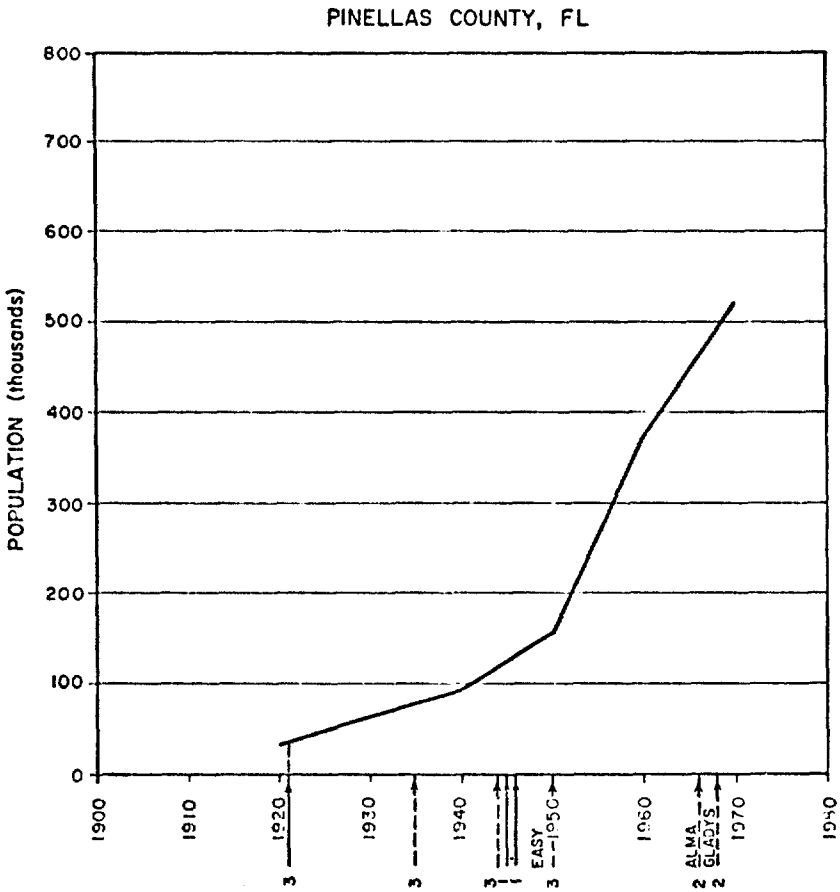
CITRUS COUNTY, FL

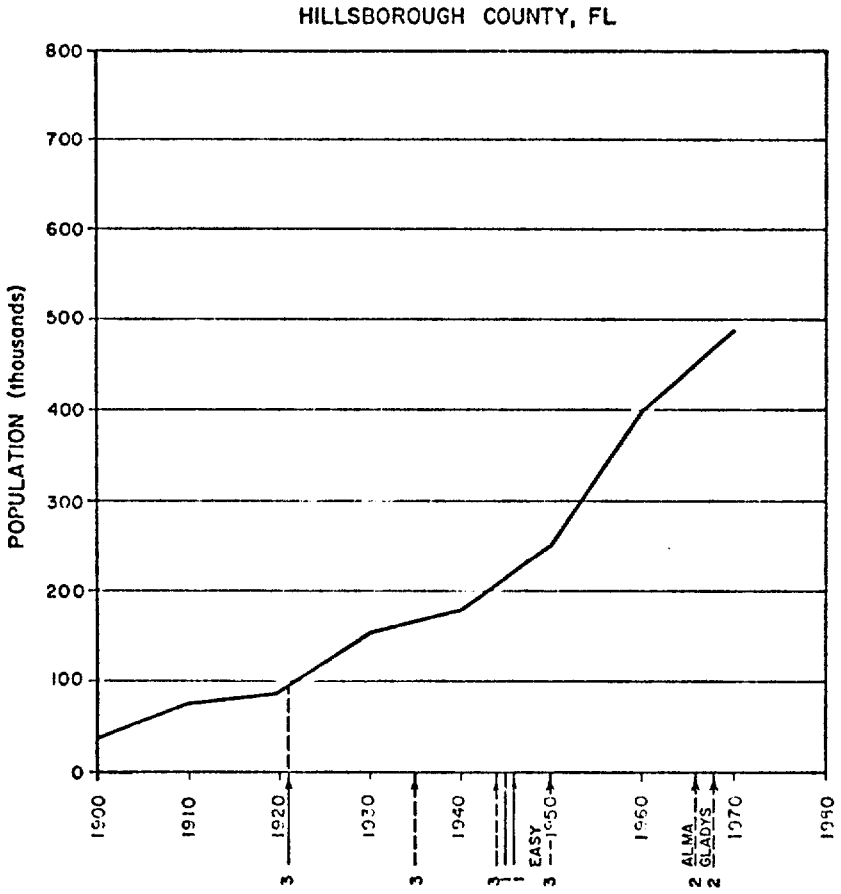


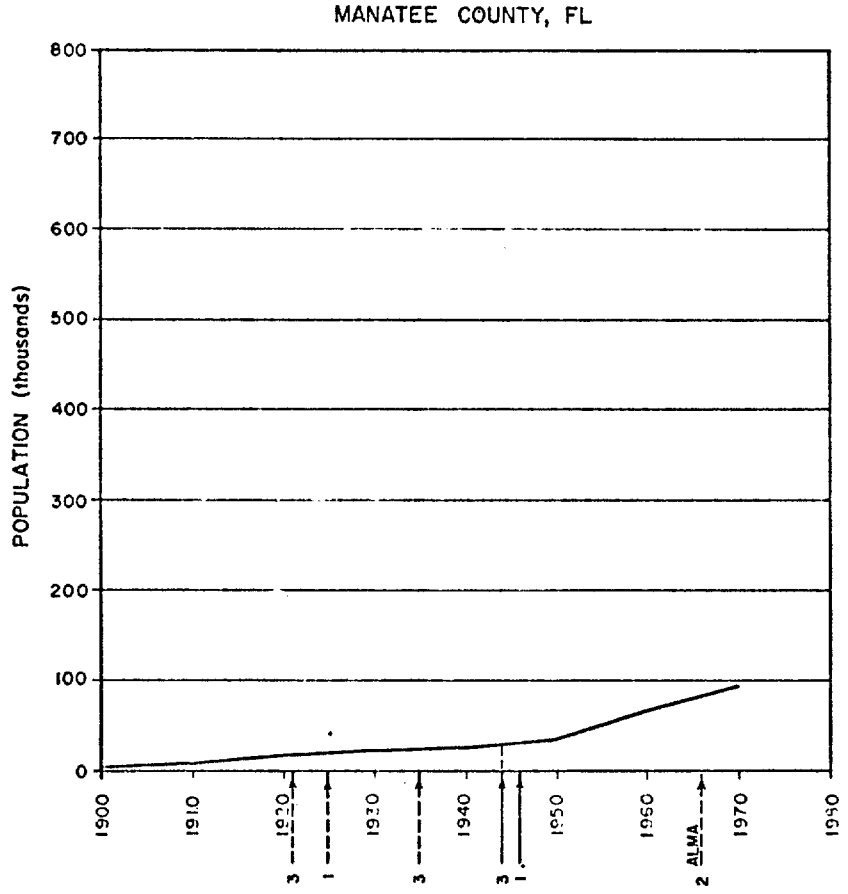
HERNANDO COUNTY, FL



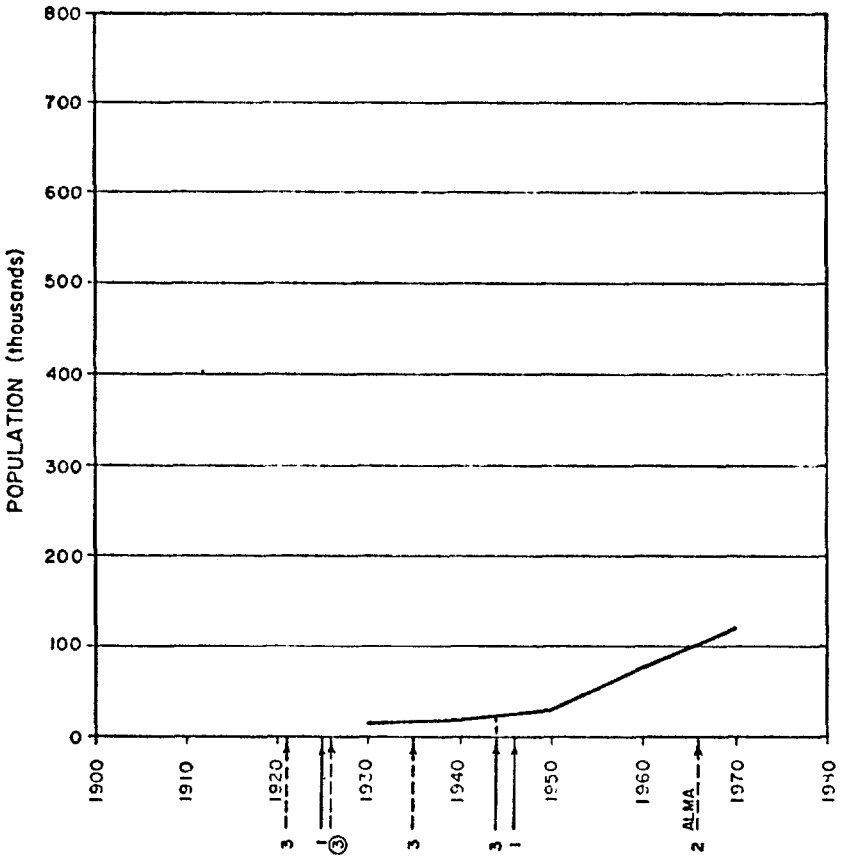

PASCO COUNTY, FL
POPULATION (thousands)
80
70
60
50
40
30
20
10
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
3
1
EASY
3
2
GLADYS


PINELLAS COUNTY, FL
POPULATION (thousands)
800
700
600
500
400
300
200
100
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
3
3
3
1
1
EASY
3
ALMA
GLADYS
2
2

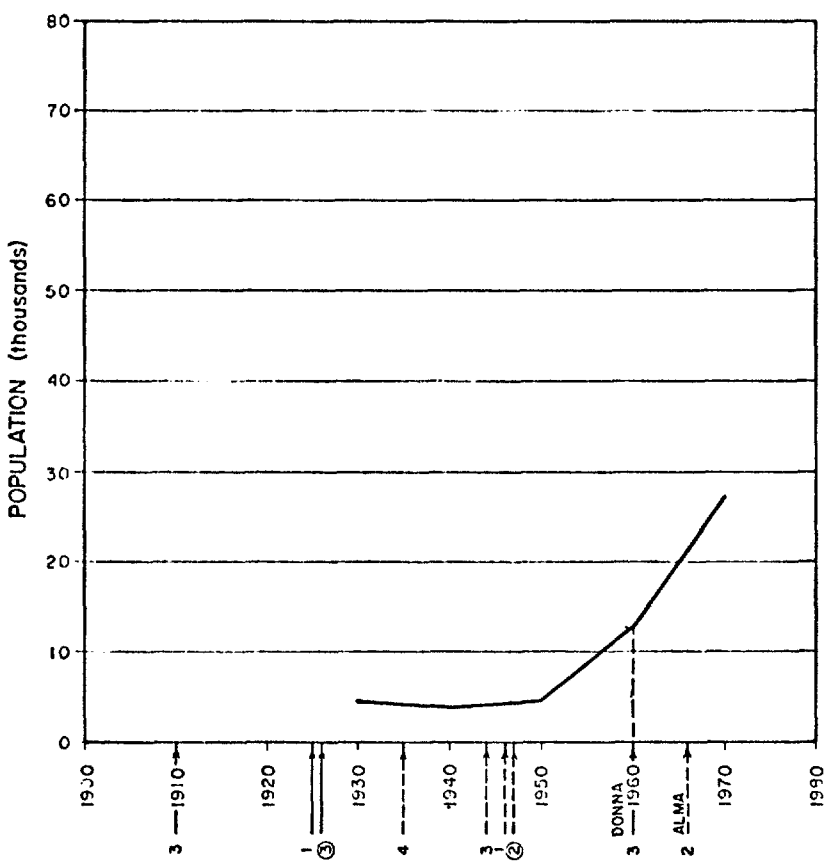

HILLSBOROUGH COUNTY, FL
POPULATION (thousands)
800
700
600
500
400
300
200
100
0
1900
1910
1920
1930
1940
1950
1960
1970
1990
3
3
3
1
EASY
3
2 ALMA
2 GLADYS

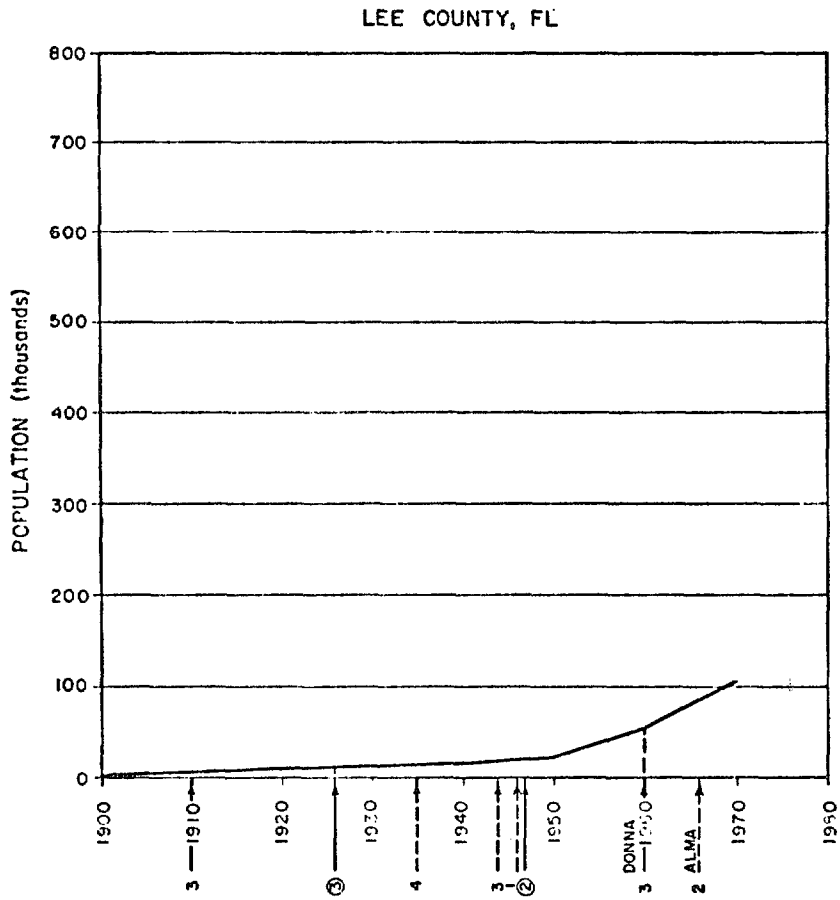

MANATEE COUNTY, FL
POPULATION (thousands)
800
700
600
500
400
300
200
100
0
1900
1910
1920
1930
1940
1950
1960
1970
1990
3
1
3
3
1
2 ALMA

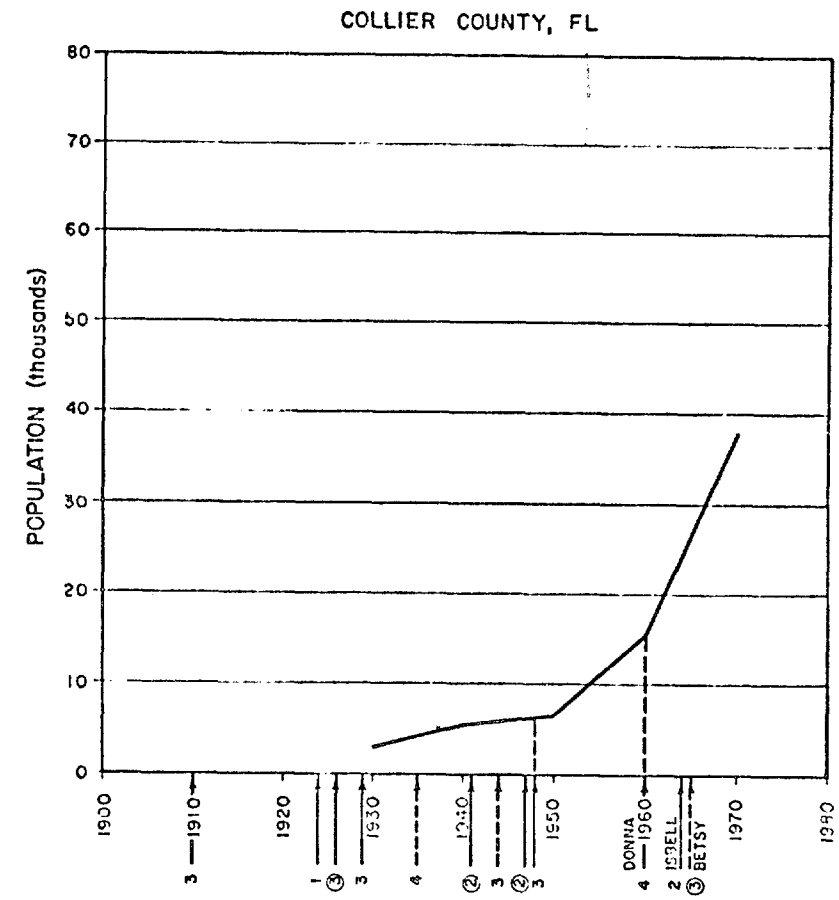
SARASOTA COUNTY, FL



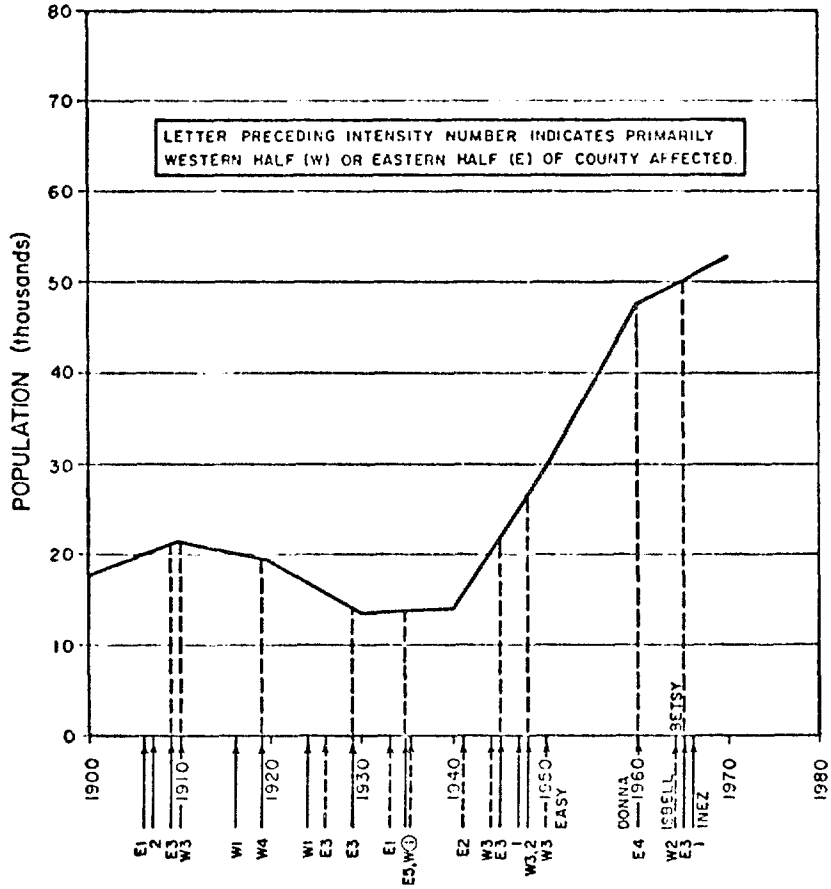
CHARLOTTE COUNTY, FL



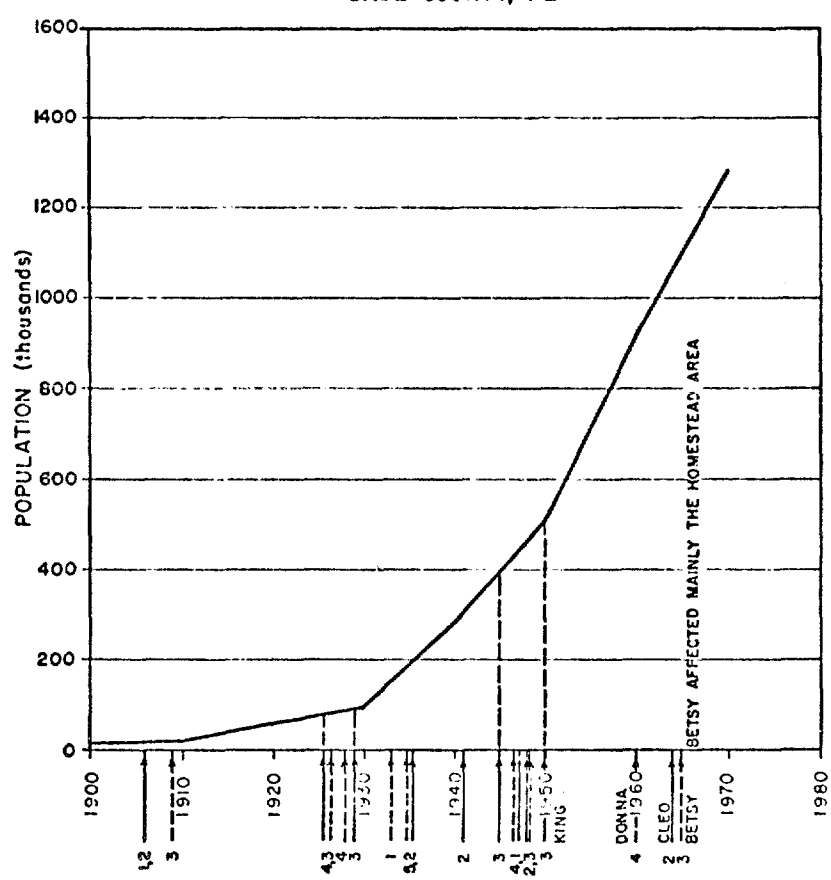

LEE COUNTY, FL
POPULATION (thousands)
800
700
600
500
400
300
200
100
0
1900
1910
1920
1930
1940
1950
1960
1970
1990
DONNA
ALMA

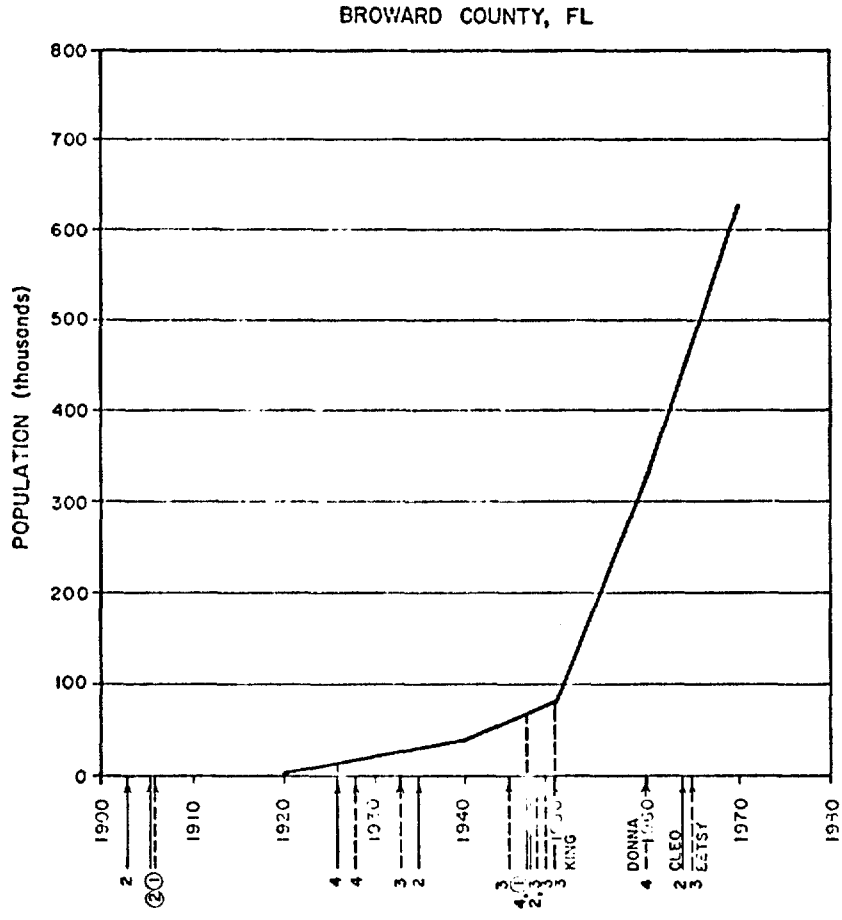

COLLIER COUNTY, FL
POPULATION (thousands)
80
70
60
50
40
30
20
10
0
1900
1910
1920
1930
1940
1950
1960
1970
1990
DONNA
BELL
BETSY

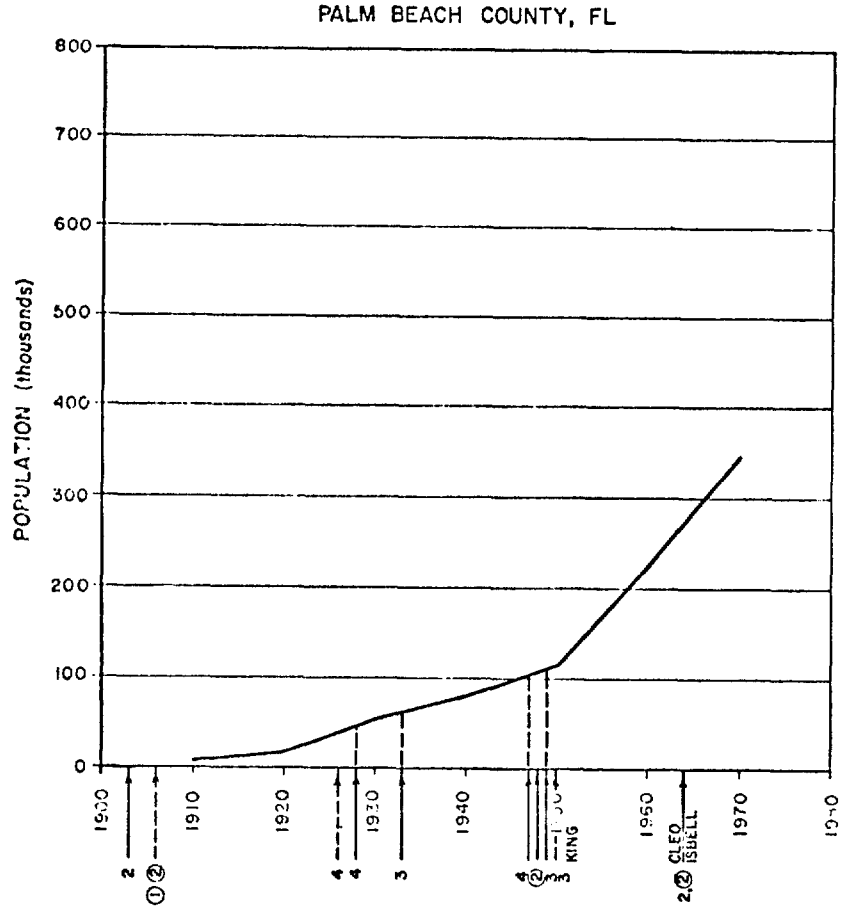
MONROE COUNTY, FL

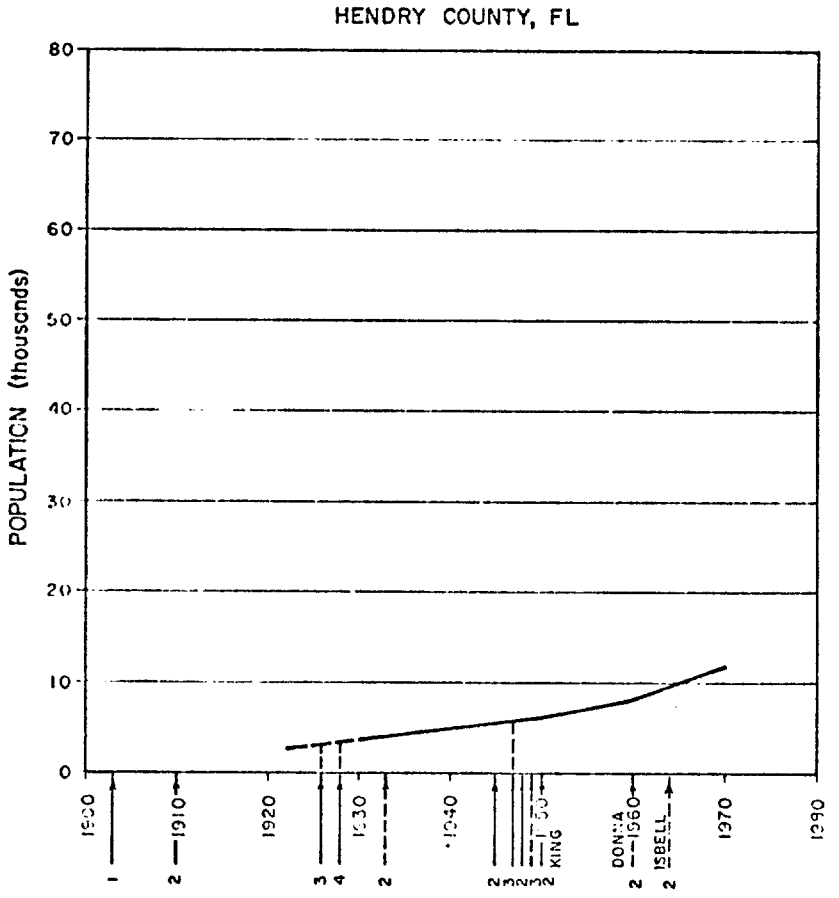


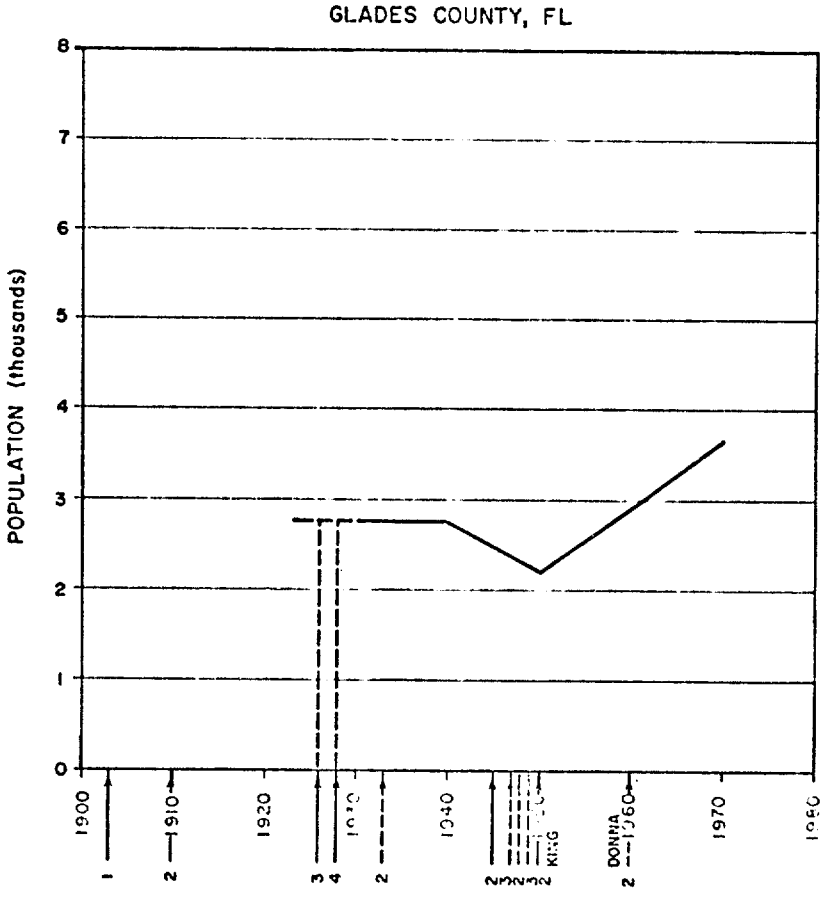
DADE COUNTY, FL



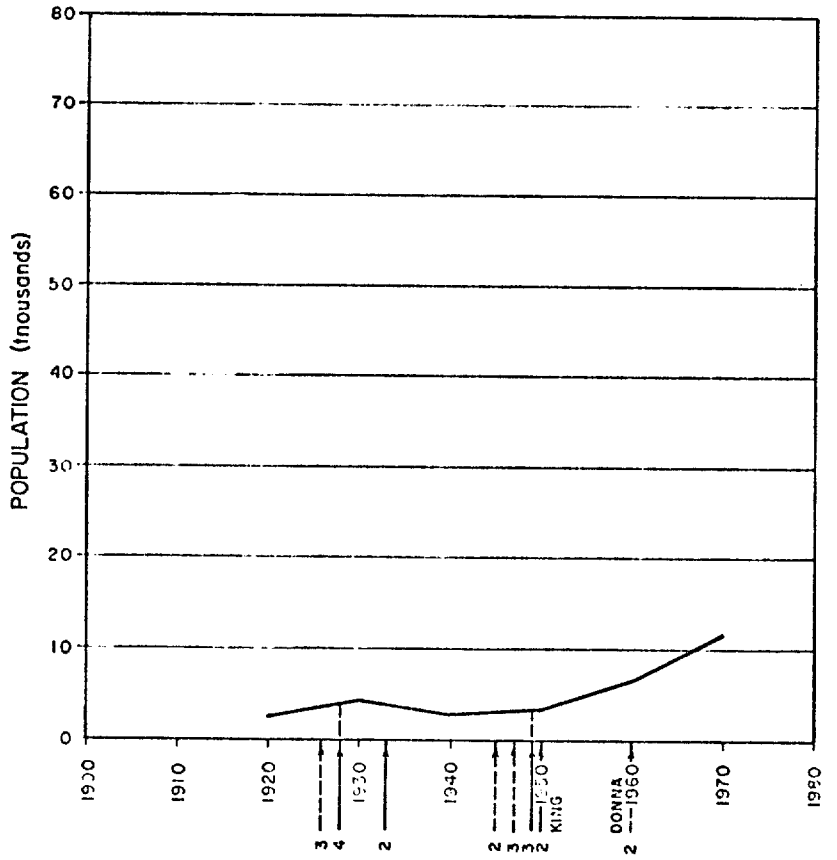

BROWARD COUNTY, FL
POPULATION (thousands)
800
700
600
500
400
300
200
100
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
KING
DONNA
CLEO
BETSY


PALM BEACH COUNTY, FL
POPULATION (thousands)
800
700
600
500
400
300
200
100
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
KING
CLEO
ISBELL

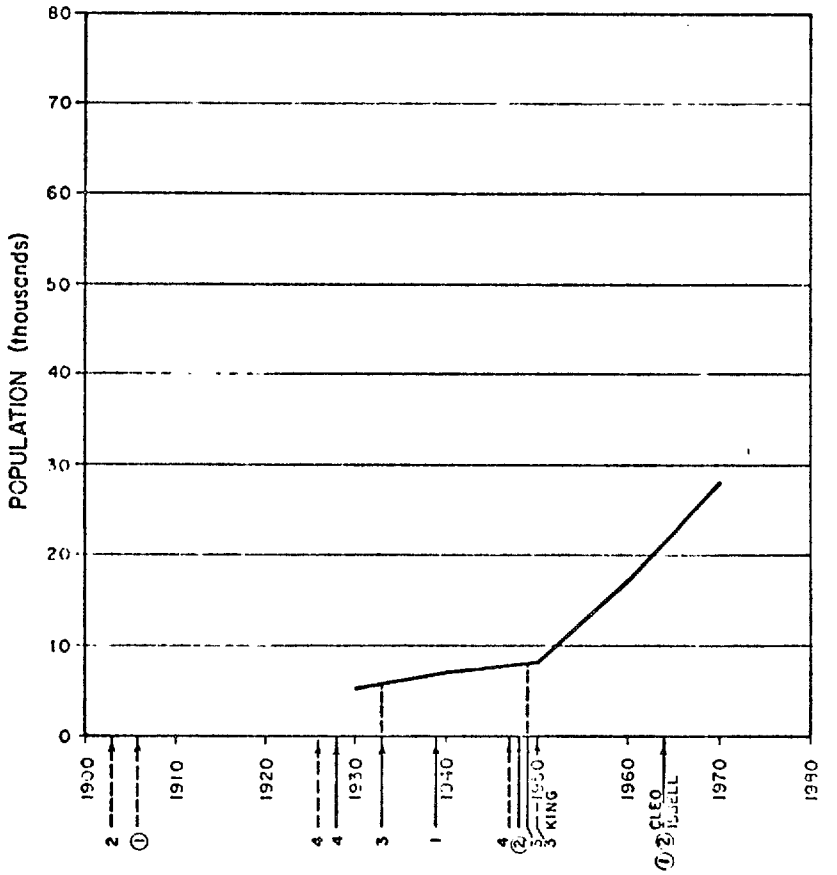

HENDRY COUNTY, FL
POPULATION (thousands)
80
70
60
50
40
30
20
10
0
1900
1910
1920
1930
1940
1950
1960
1970
1990
KING
DONNA
ISBELL


GLADES COUNTY, FL
POPULATION (thousands)
8
7
6
5
4
3
2
1
0
1900
1910
1920
1940
1970
KING
DONNA

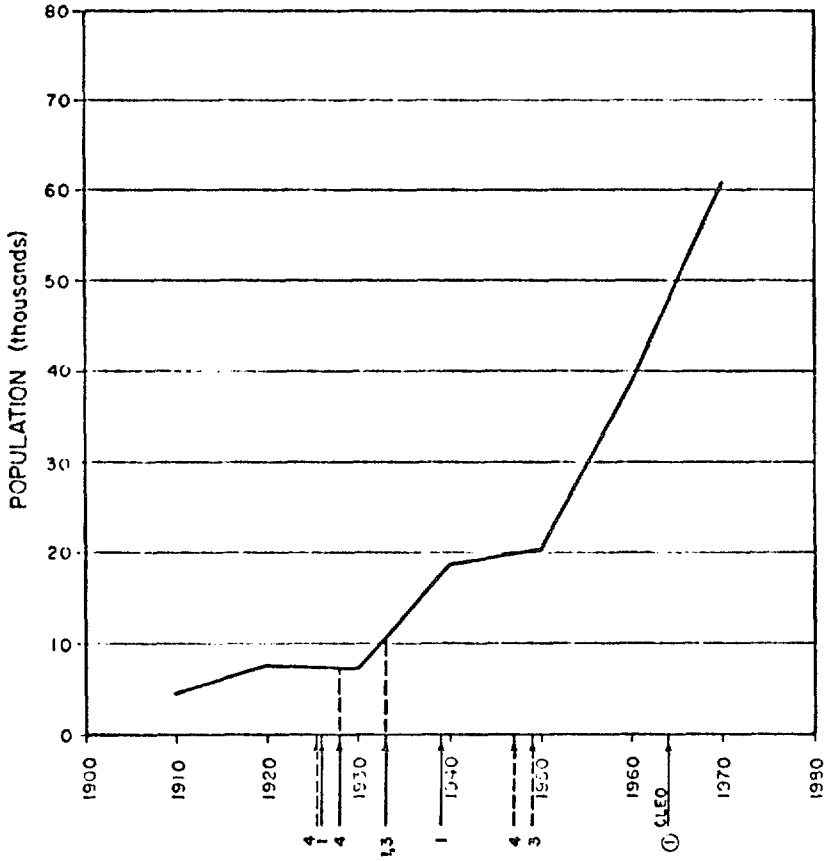
OKEECHOBEE COUNTY, FL



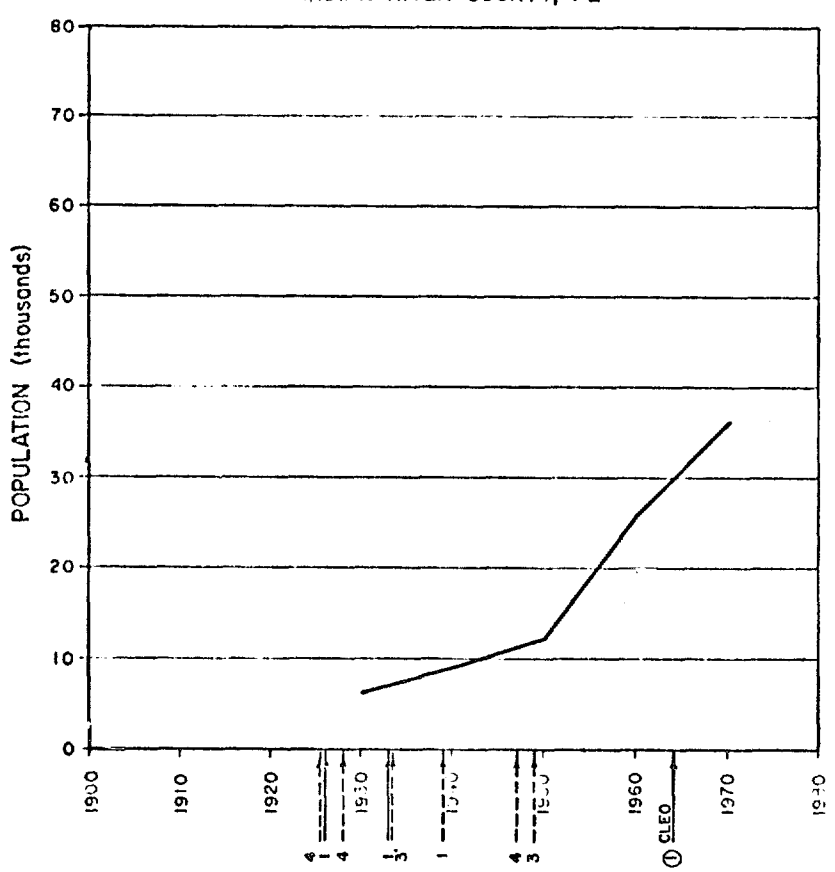
MARTIN COUNTY, FL



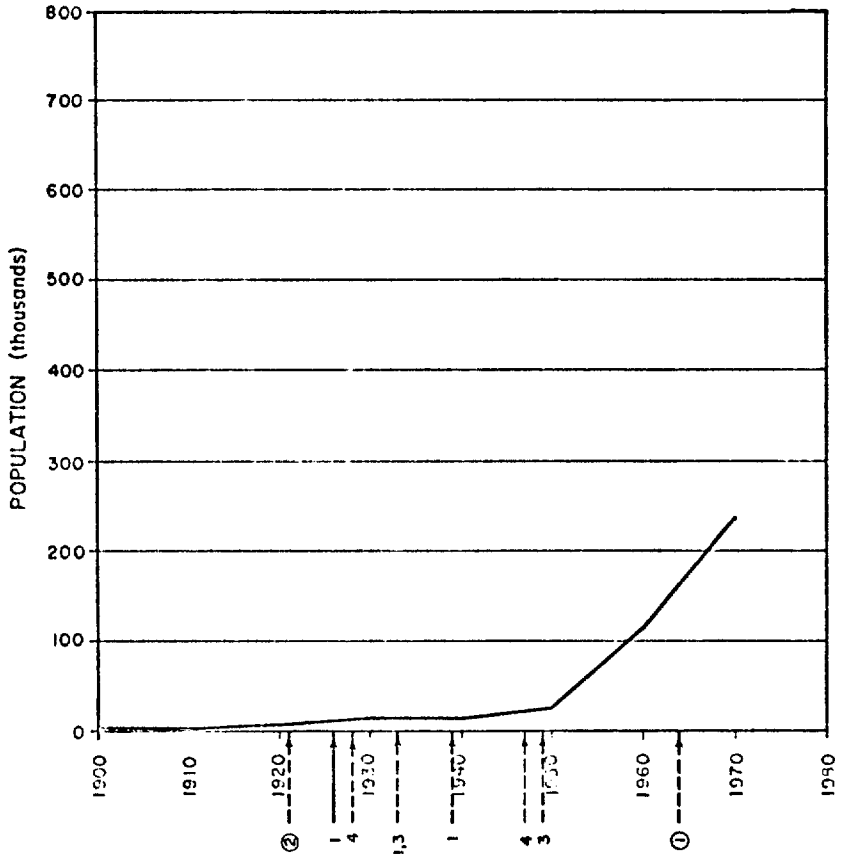
ST. LUCIE COUNTY, FL



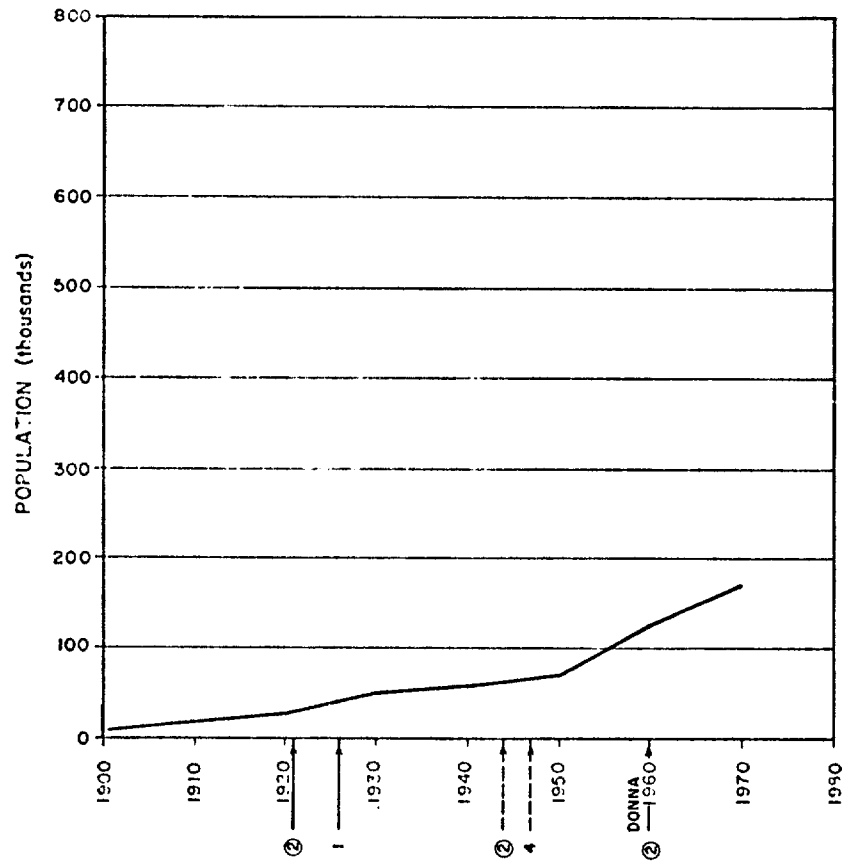
INDIAN RIVER COUNTY, FL



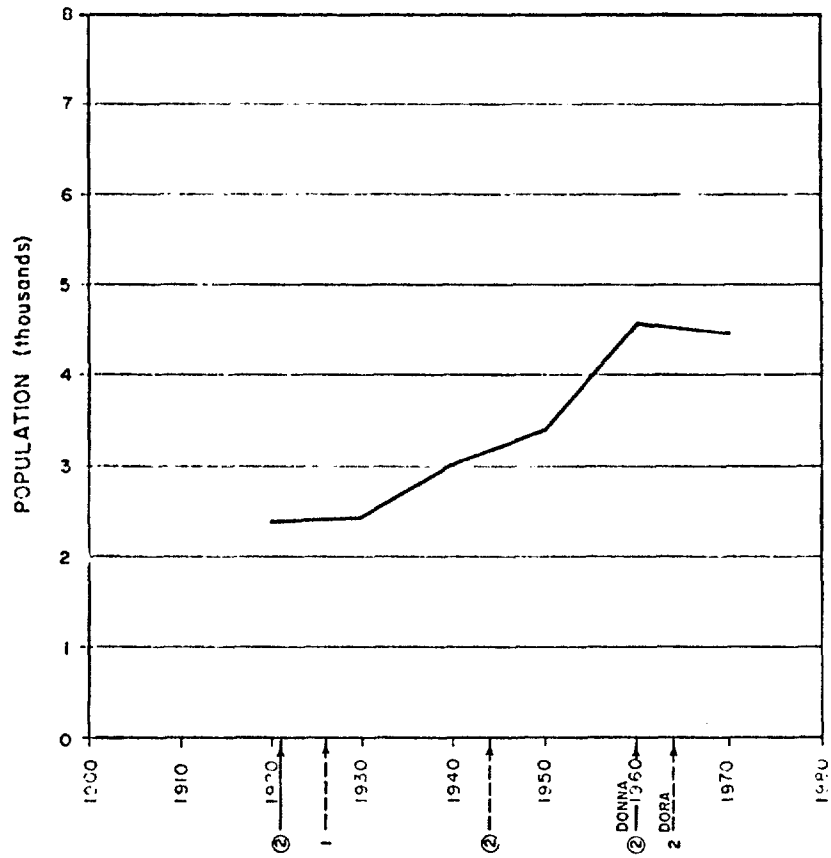
BREVARD COUNTY, FL



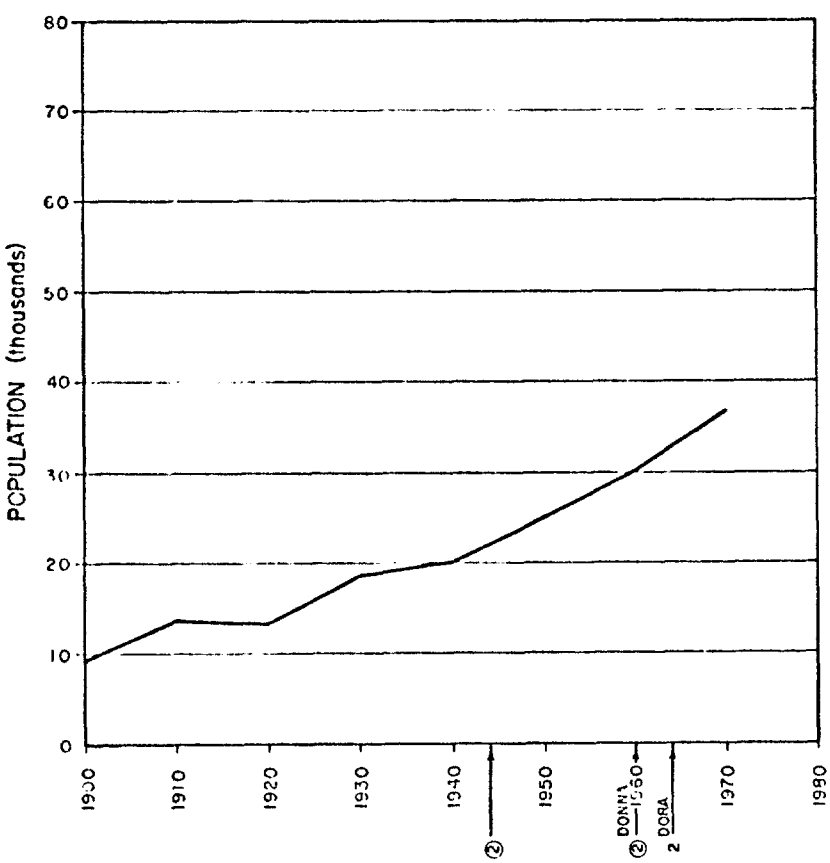
VOLUSIA COUNTY, FL

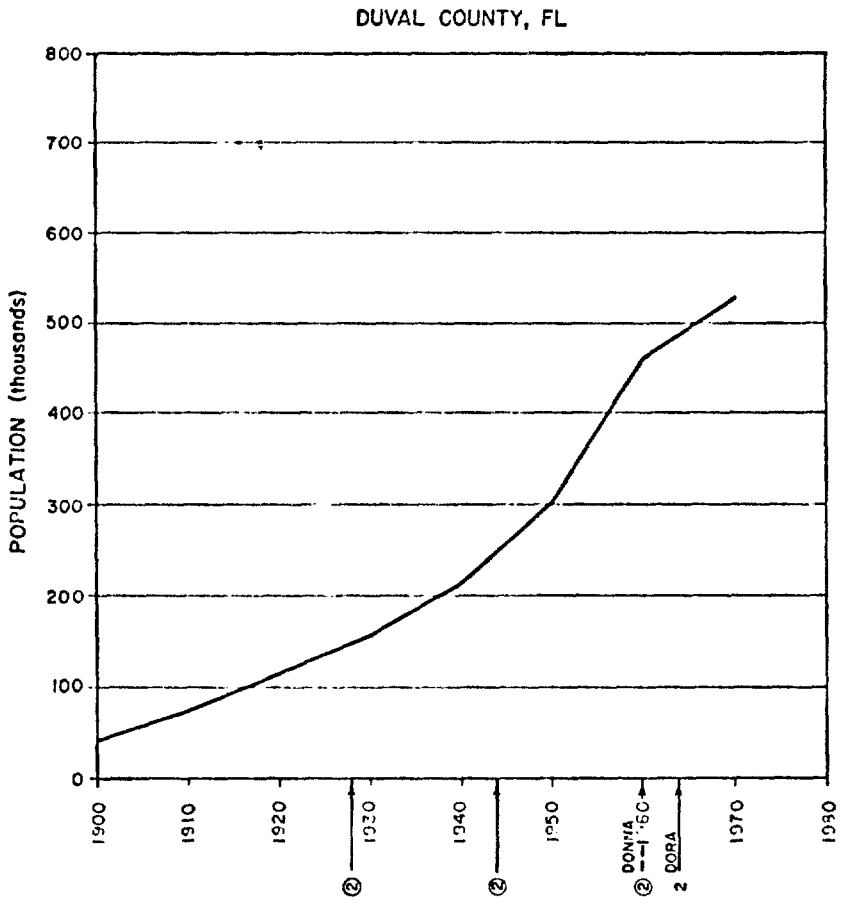


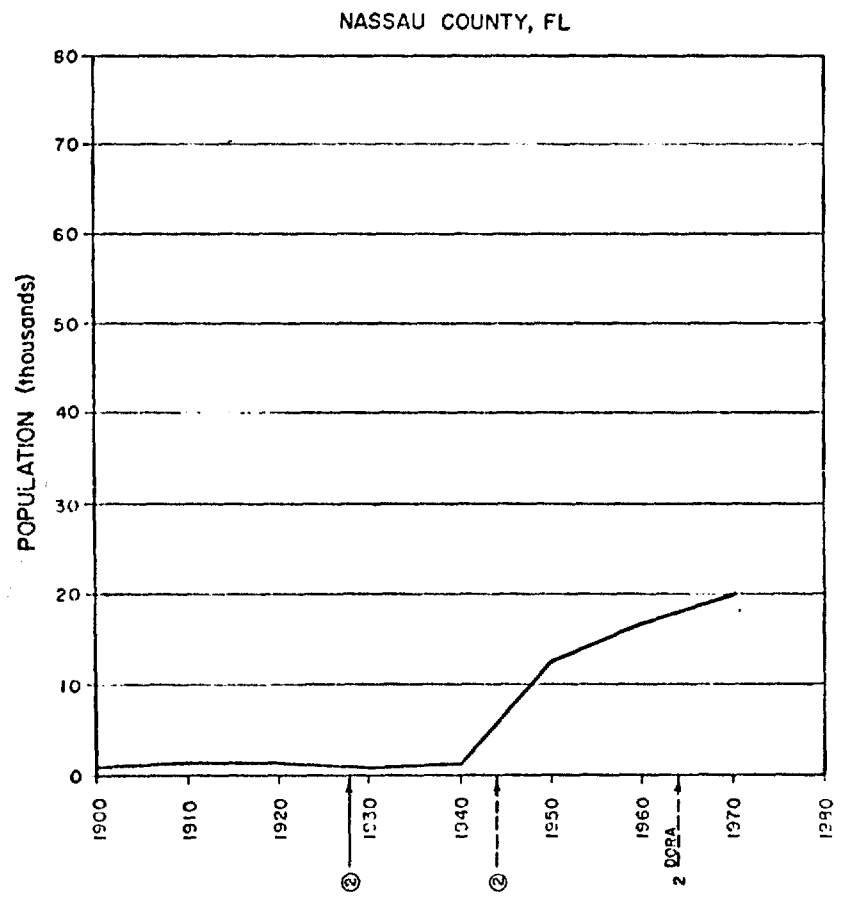
FLAGLER COUNTY, FL

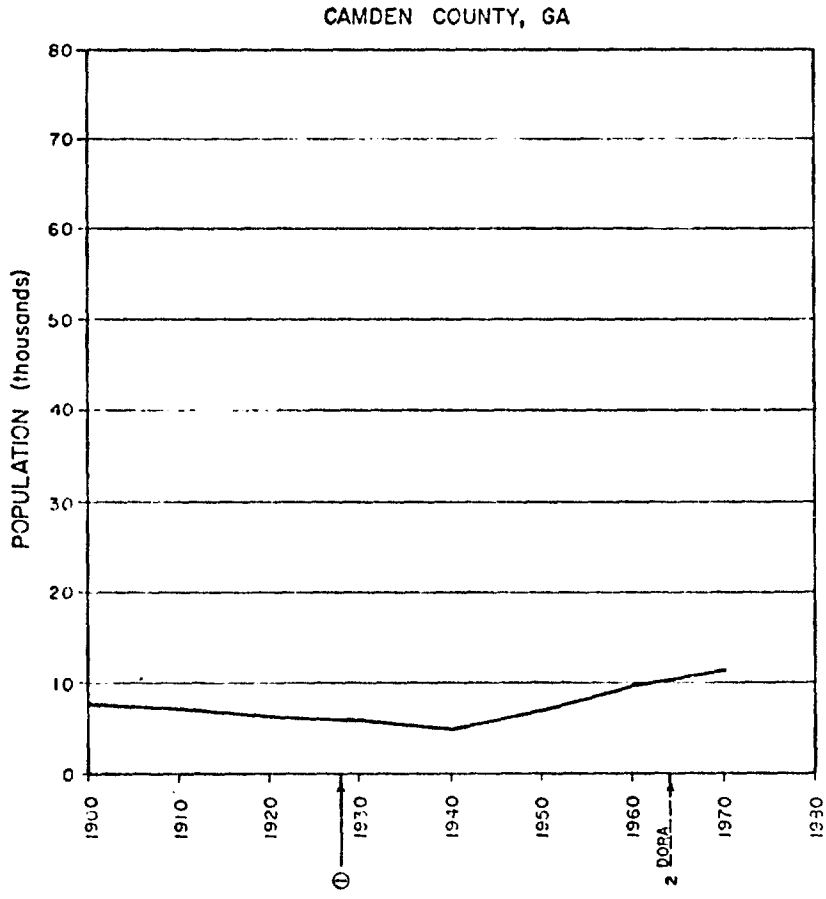


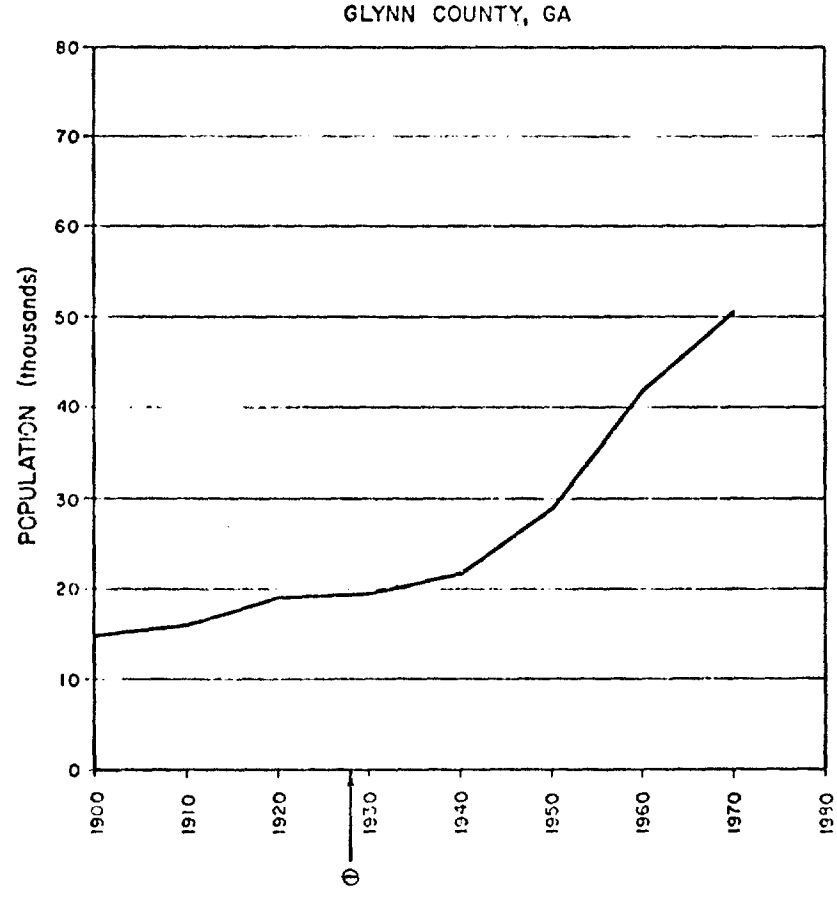
ST. JOHNS COUNTY, FL

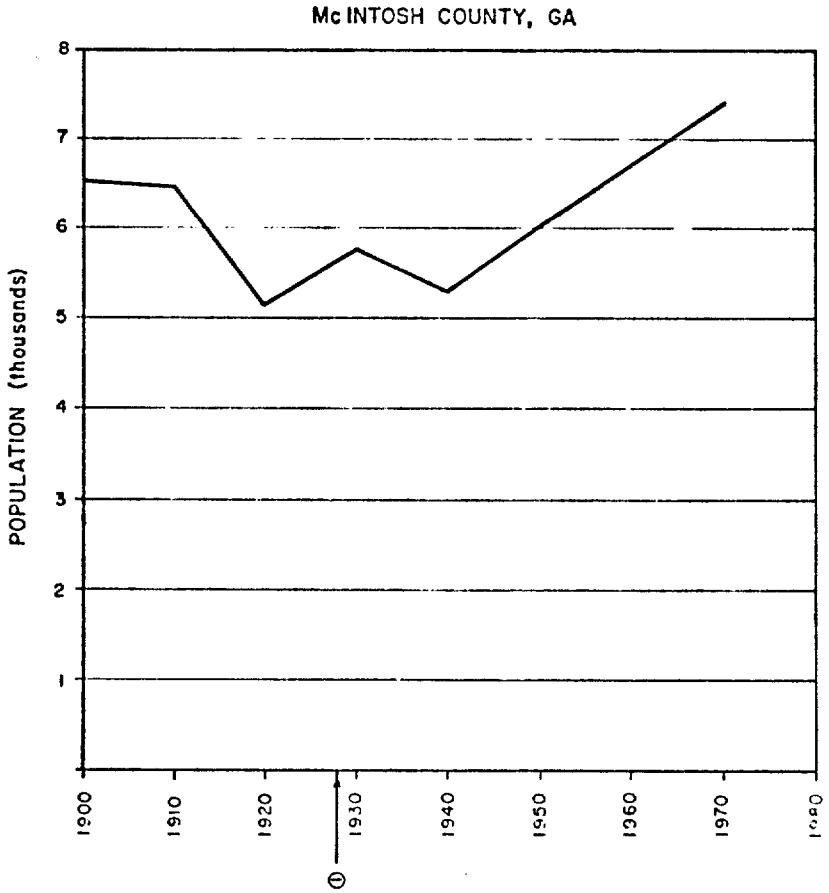


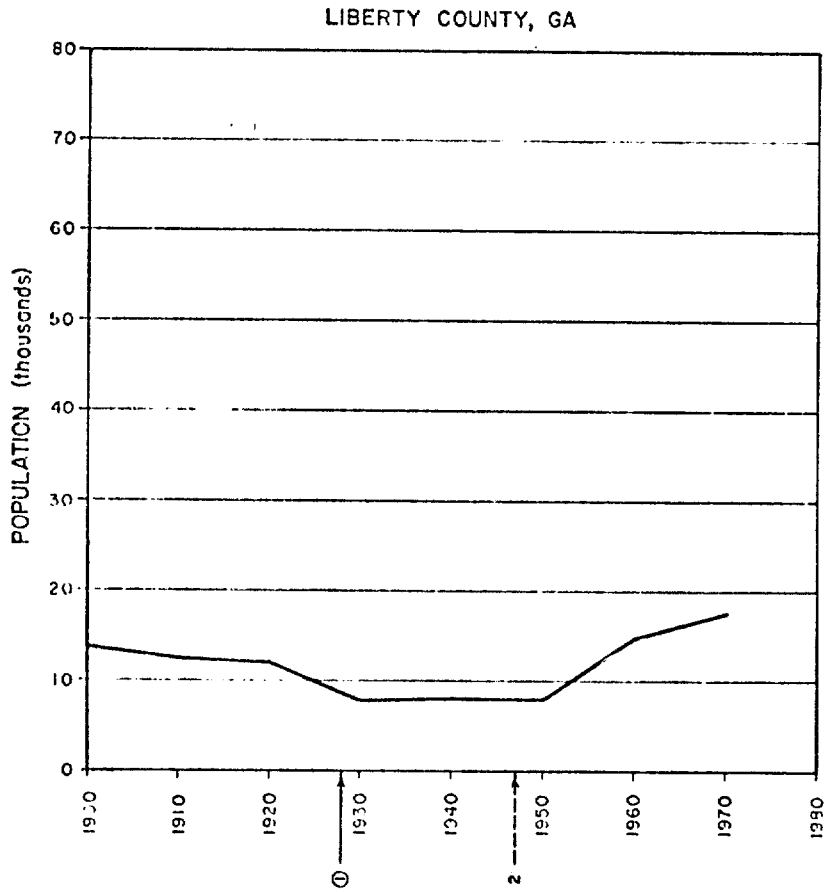

DUVAL COUNTY, FL
POPULATION (thousands)
800
700
600
500
400
300
200
100
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
DONNA
DORA
2
2
2
2

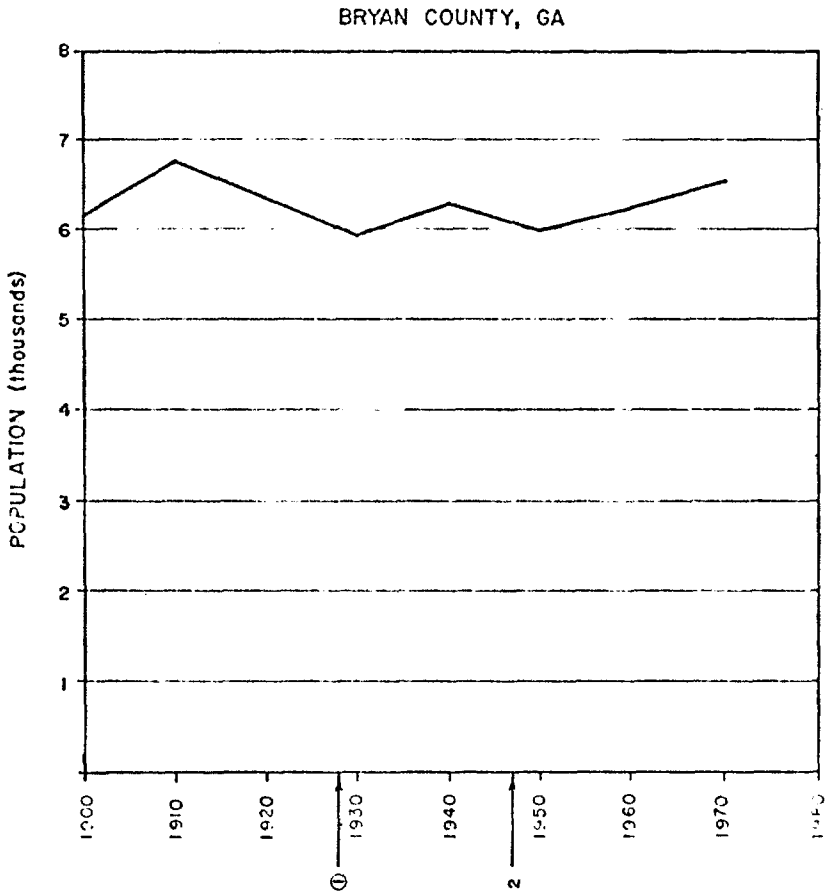

NASSAU COUNTY, FL
POPULATION (thousands)
80
70
60
50
40
30
20
10
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
DORA
2
2
2

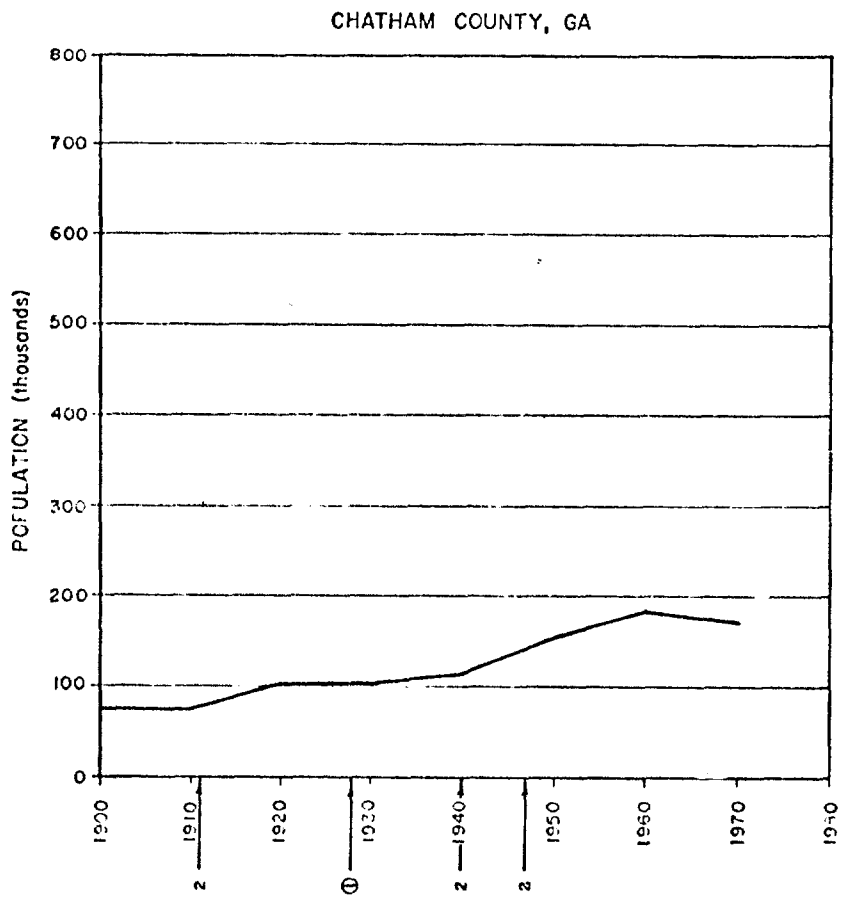

CAMDEN COUNTY, GA
POPULATION (thousands)
80
70
60
50
40
30
20
10
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
2 DOBA

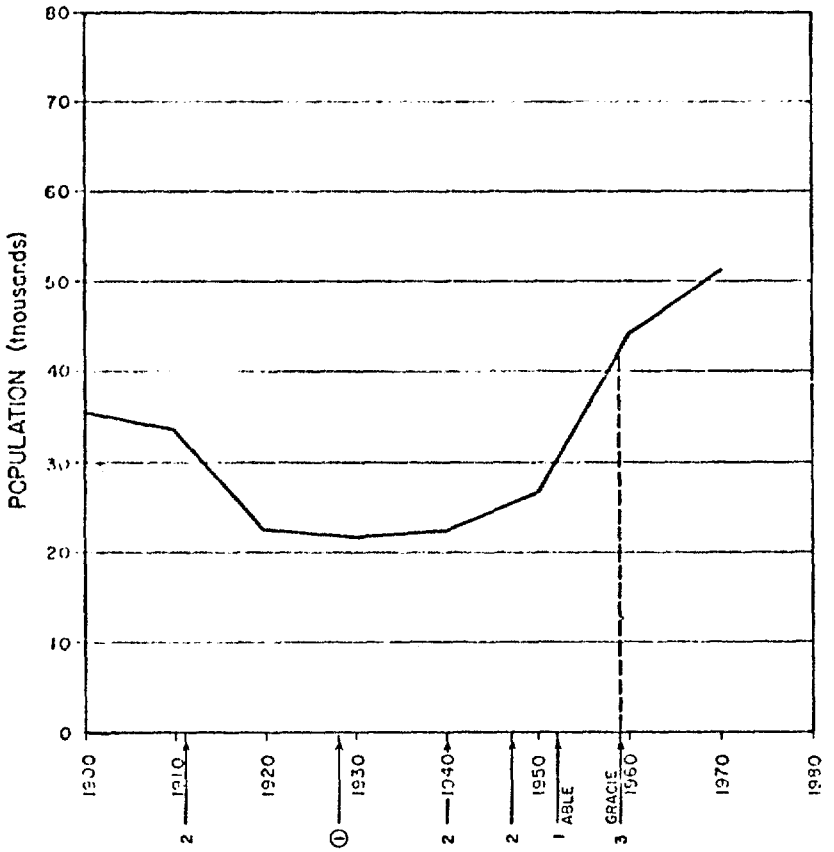

GLYNN COUNTY, GA
POPULATION (thousands)
80
70
60
50
40
30
20
10
0
1900
1910
1920
1930
1940
1950
1960
1970
1980


McINTOSH COUNTY, GA
POPULATION (thousands)
8
7
6
5
4
3
2
1
1900
1910
1920
1930
1940
1950
1960
1970
1980
1

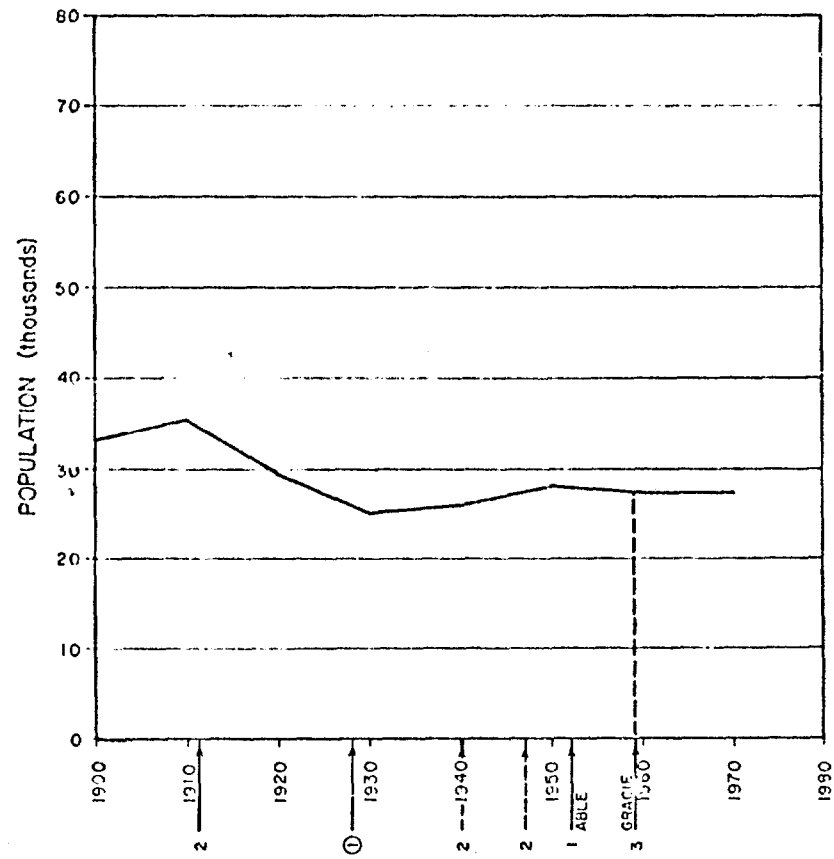

LIBERTY COUNTY, GA
POPULATION (thousands)
80
70
60
50
40
30
20
10
0
1900
1910
1920
1930
1940
1950
1960
1970
1990
1
2


BRYAN COUNTY, GA
POPULATION (thousands)
8
7
6
5
4
3
2
1
1900
1910
1920
1930
1940
1950
1960
1970
1980
1
2

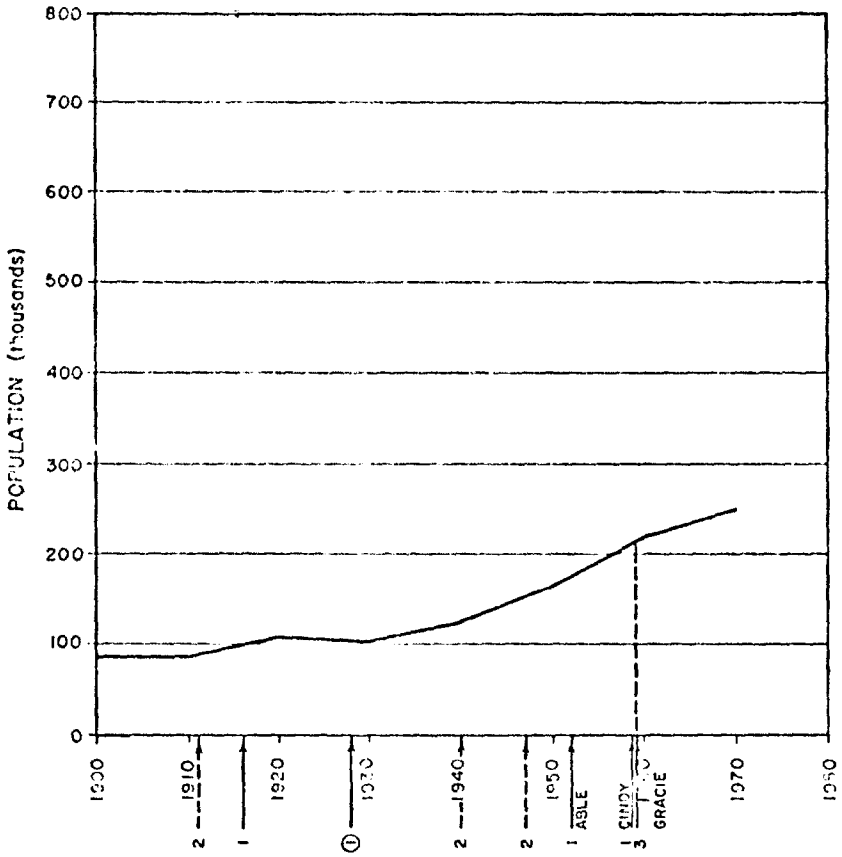

CHATHAM COUNTY, GA
POPULATION (thousands)
800
700
600
500
400
300
200
100
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
2
1
2
2



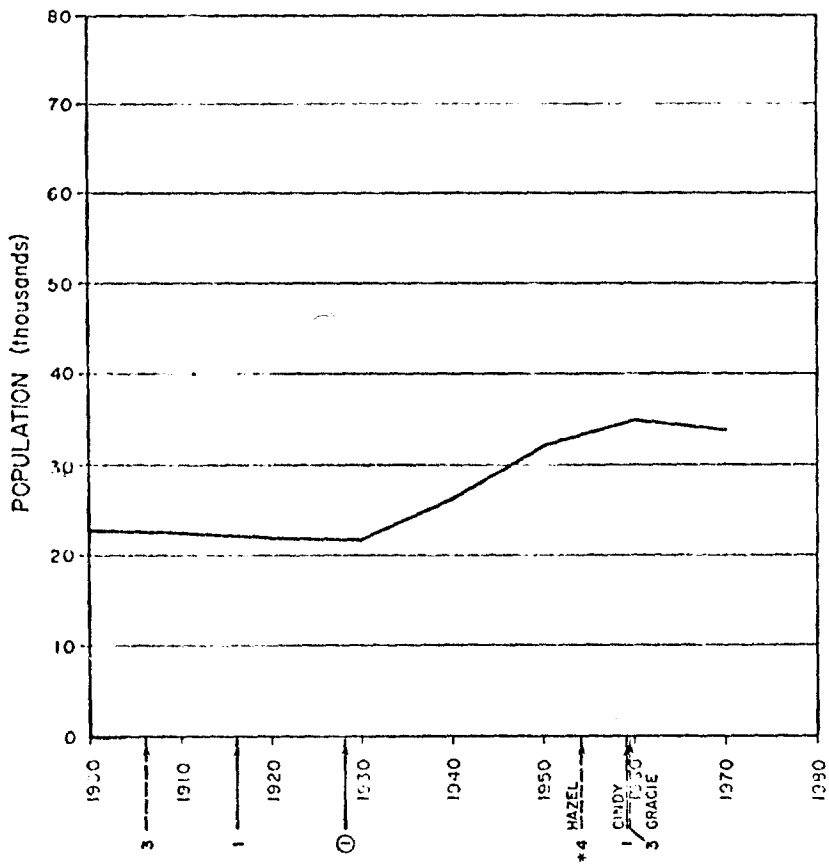
COLLETON COUNTY, SC

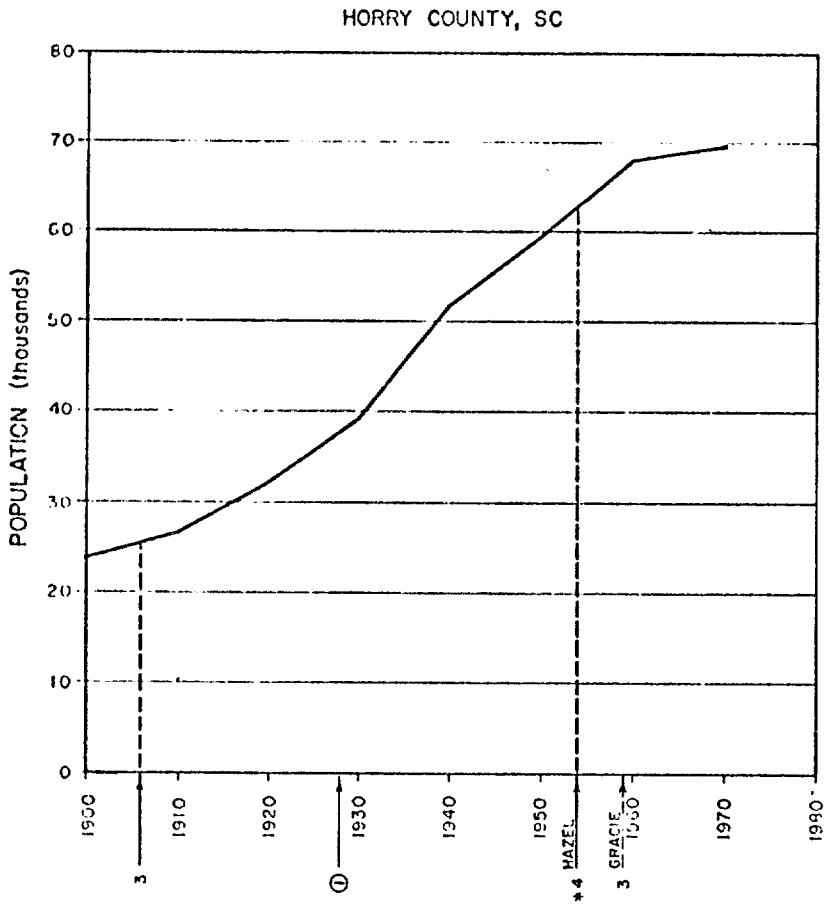


CHARLESTON COUNTY, SC



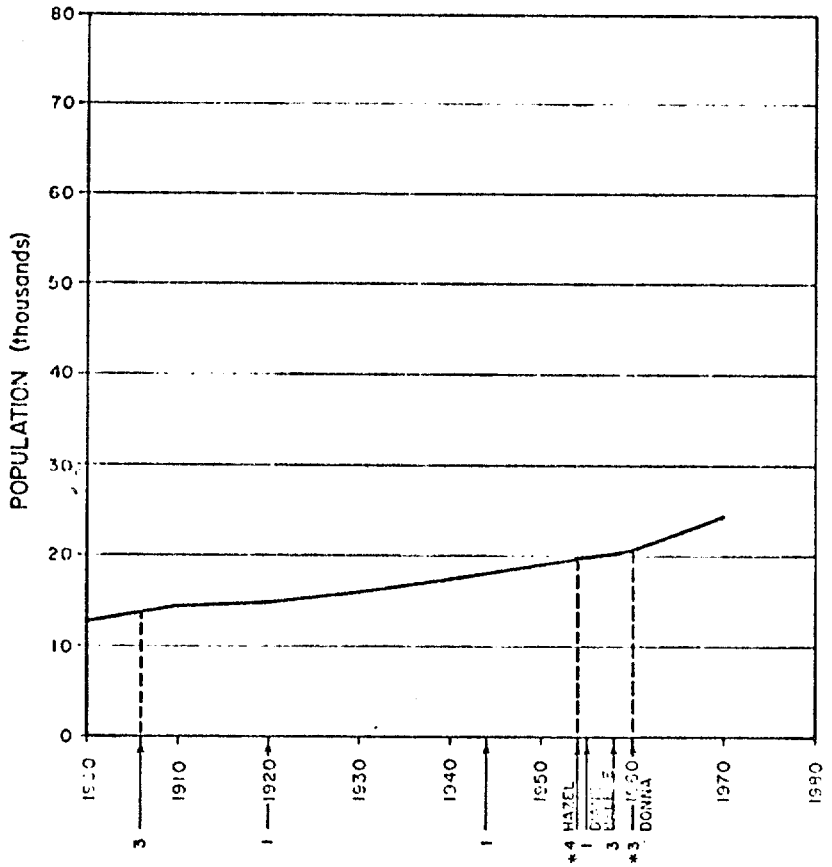
GEORGETOWN COUNTY, SC



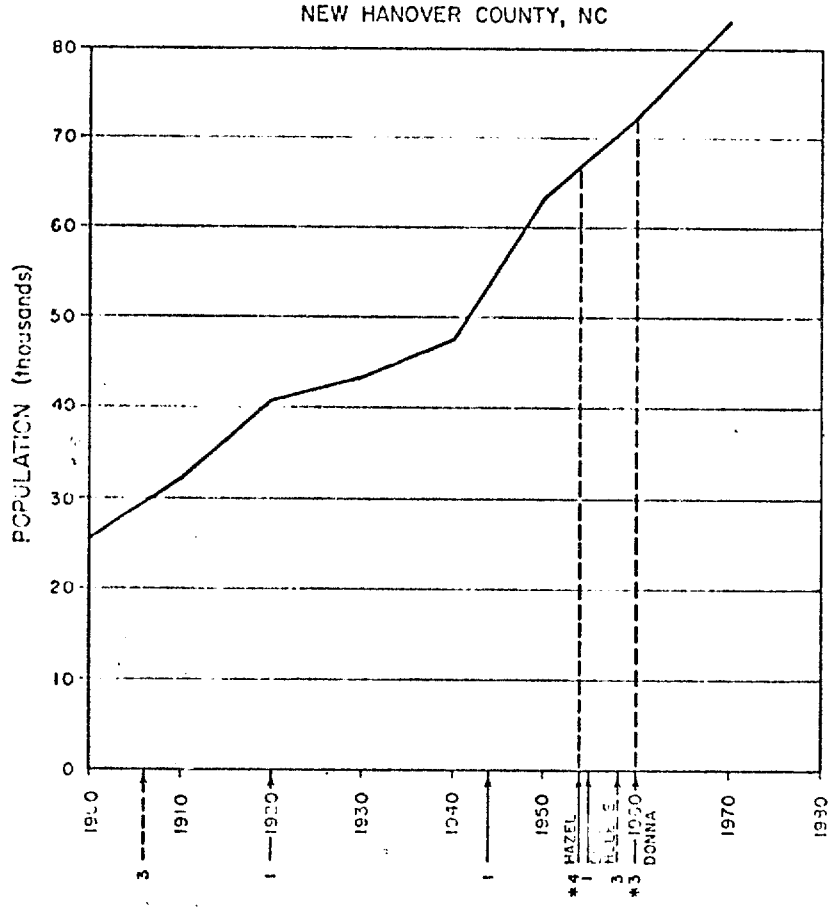


END OF SOUTH CAROLINA COUNTIES

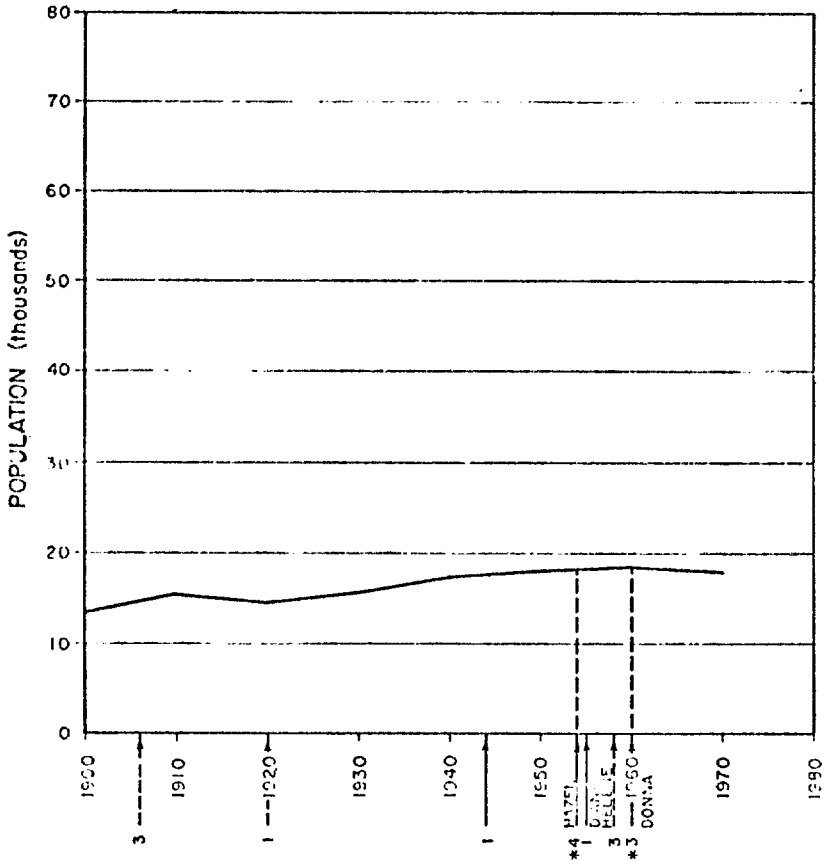
BRUNSWICK COUNTY, NC



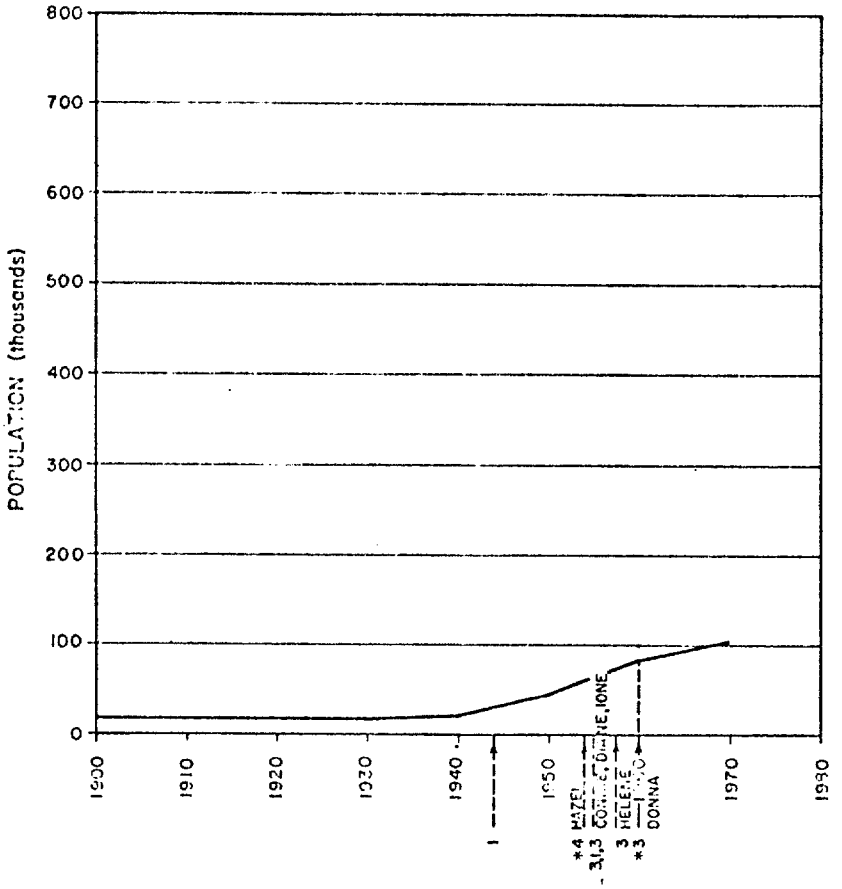
NEW HANOVER COUNTY, NC



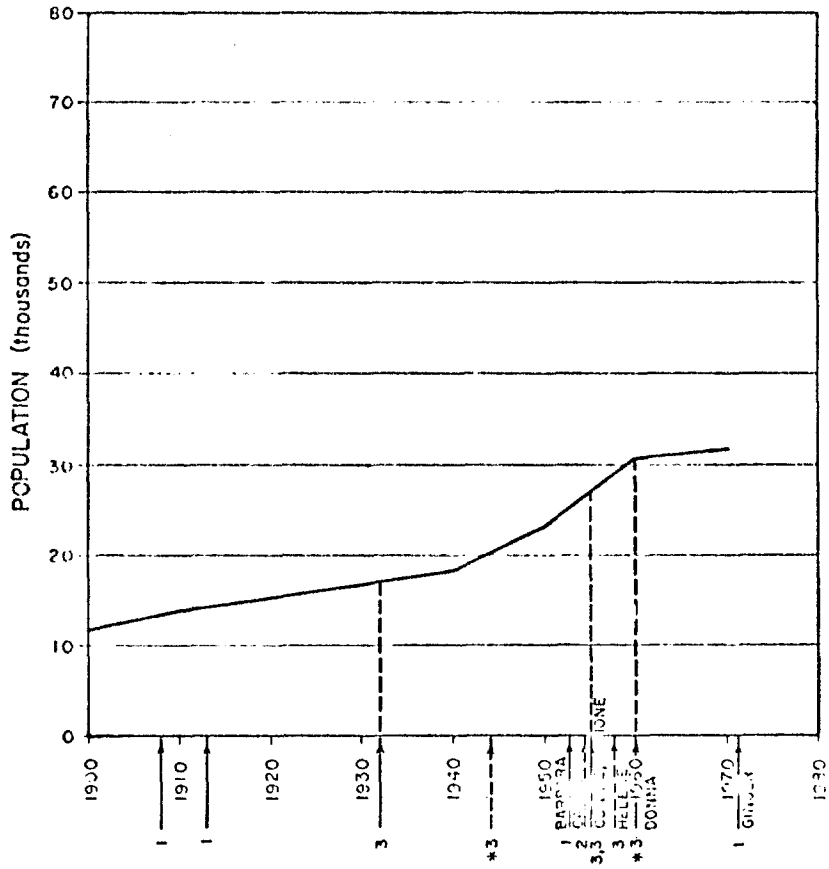
PENDER COUNTY, NC



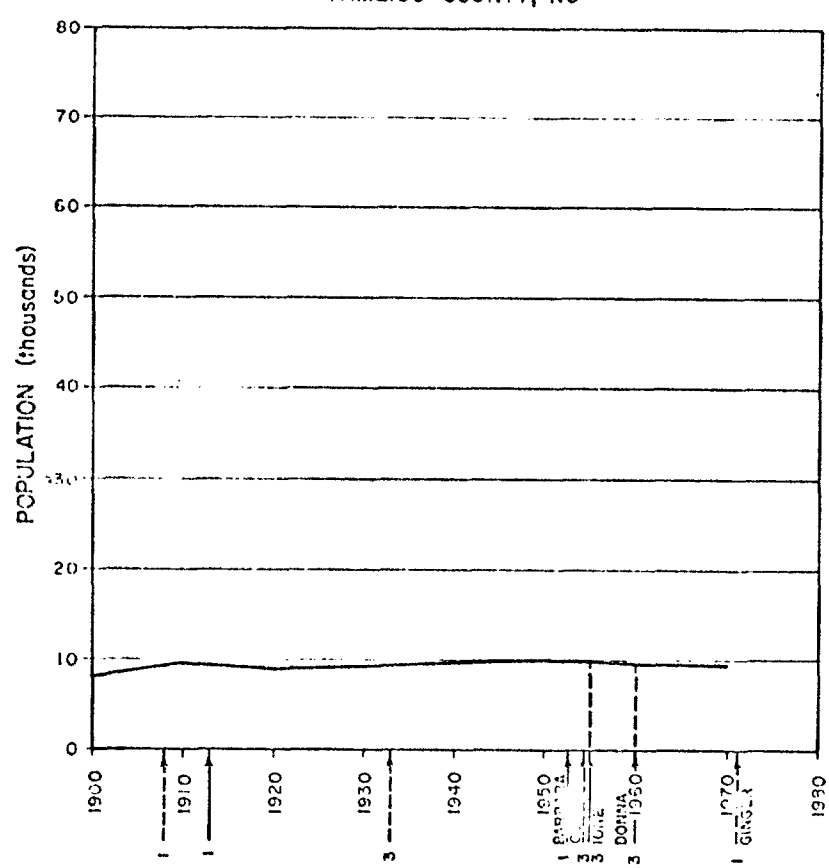
ONSLOW COUNTY, NC



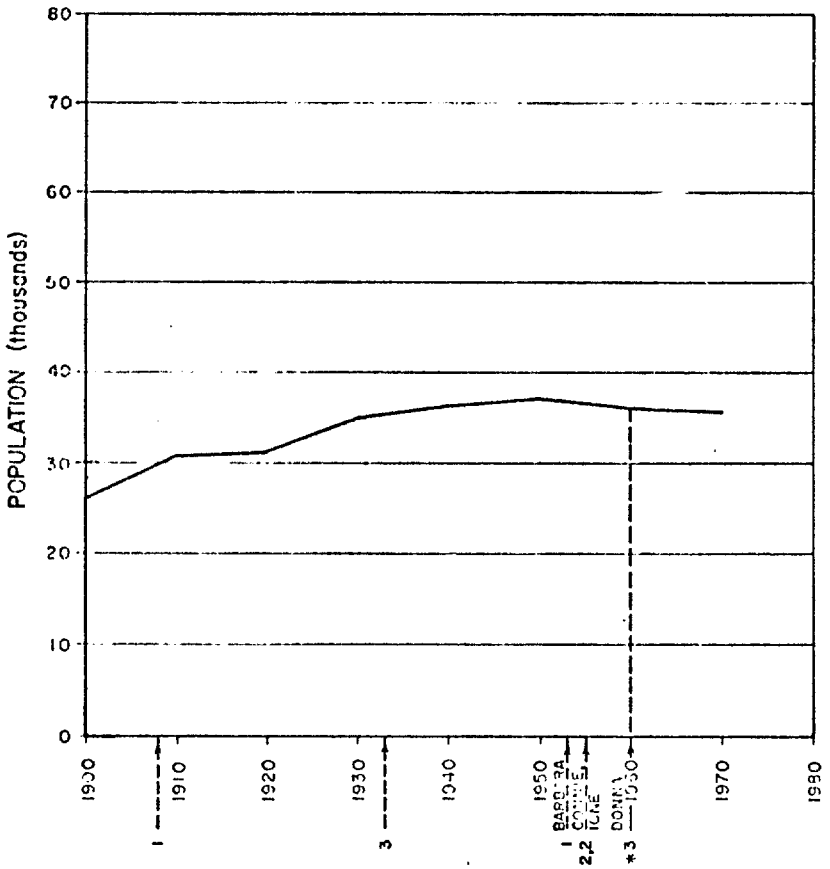
CARTERET COUNTY, NC



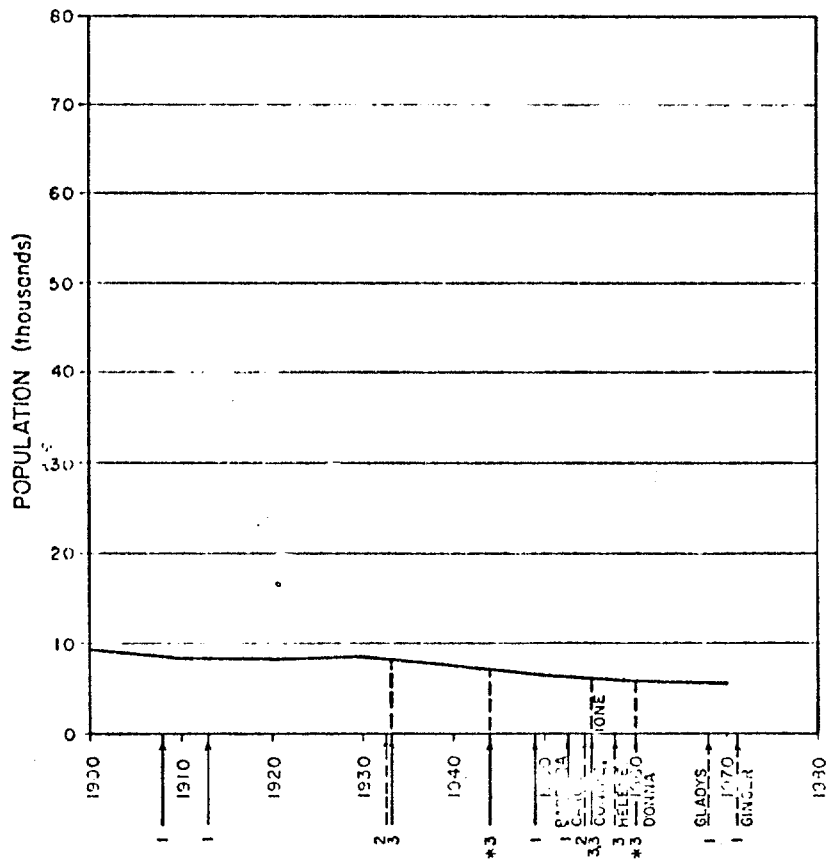
PAMLICO COUNTY, NC



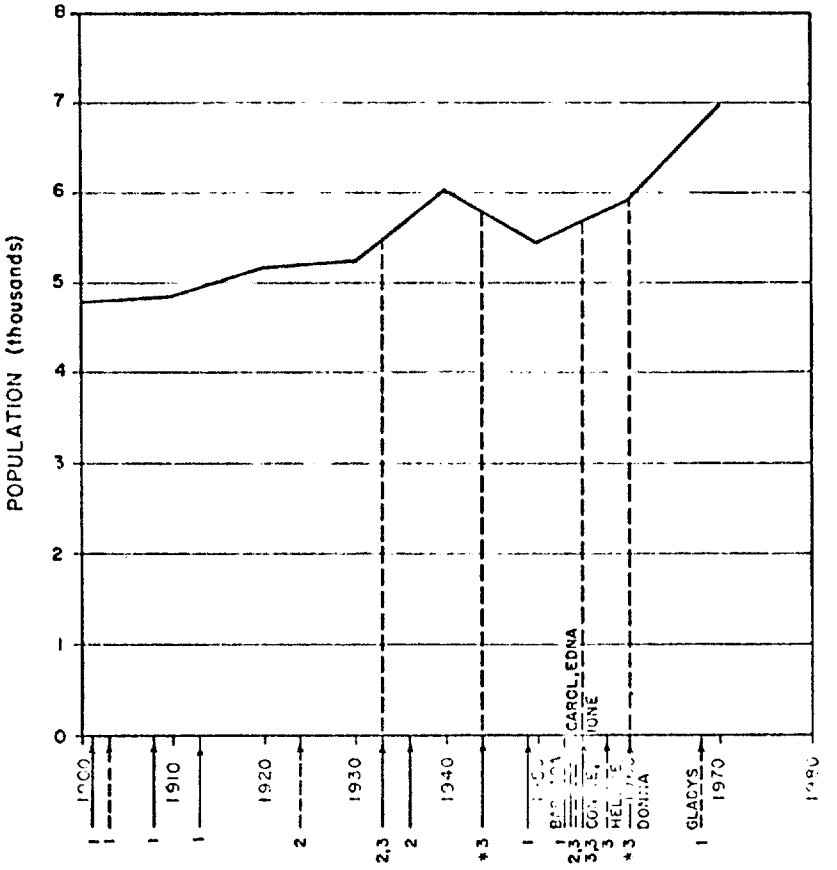
BEAUFORT COUNTY, NC



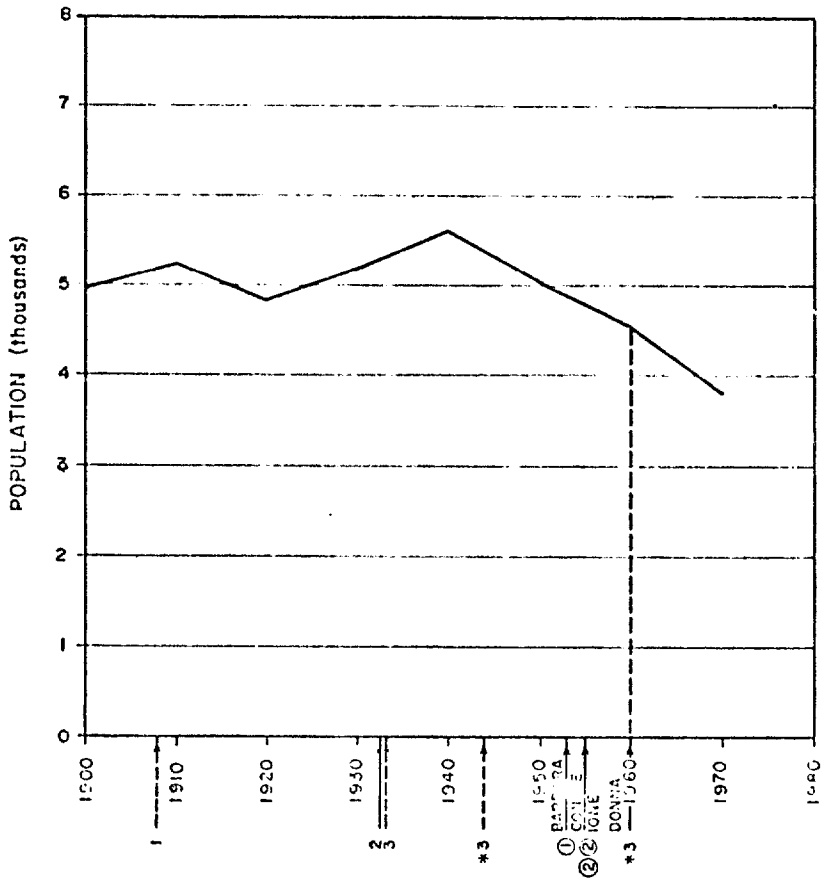
HYDE COUNTY, NC



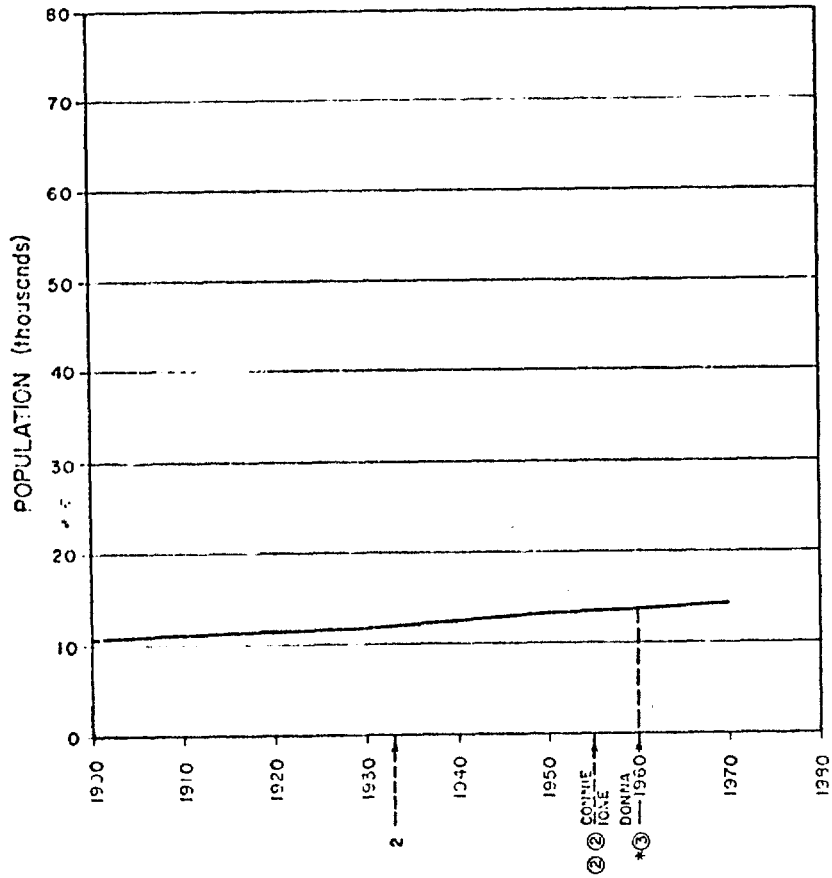
DARE COUNTY, NC



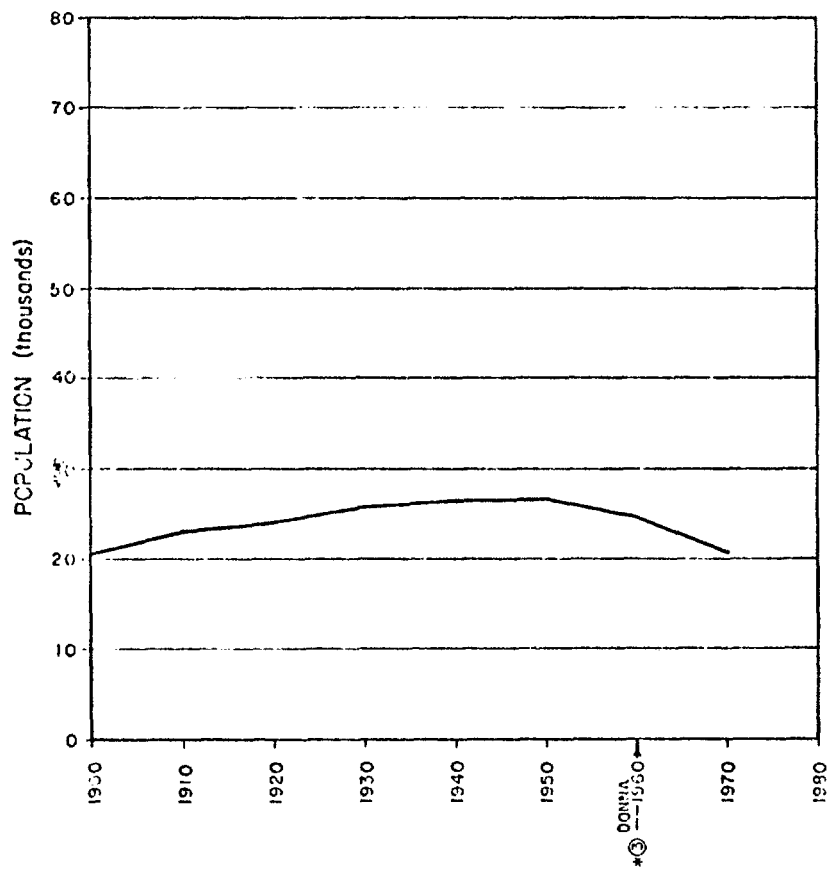
TYRRELL COUNTY, NC



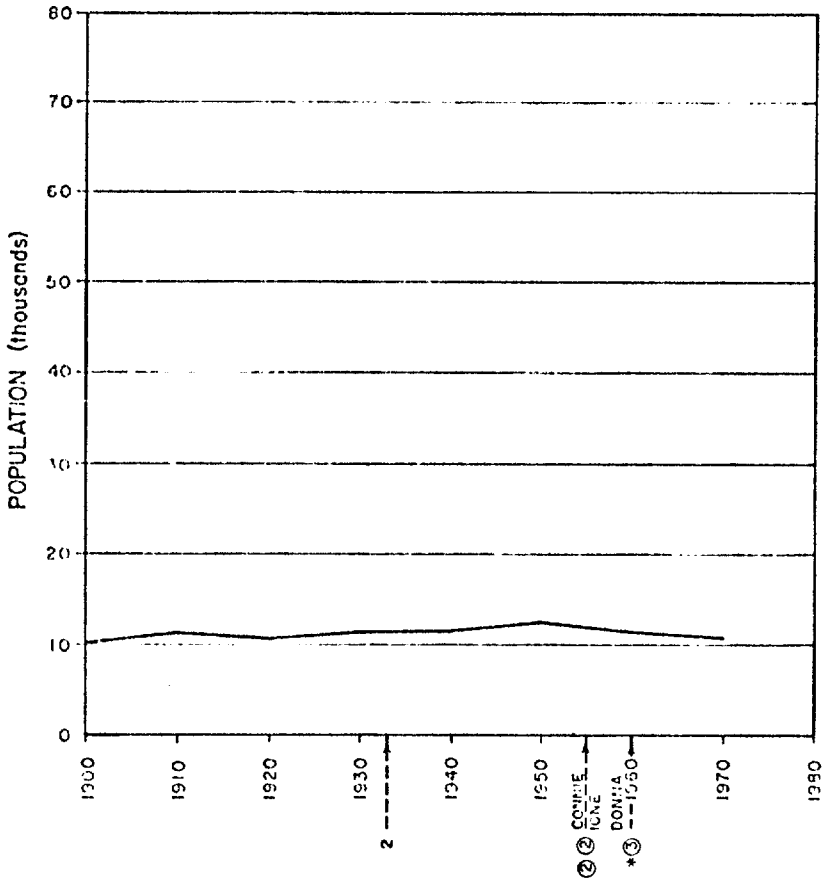
WASHINGTON COUNTY, NC



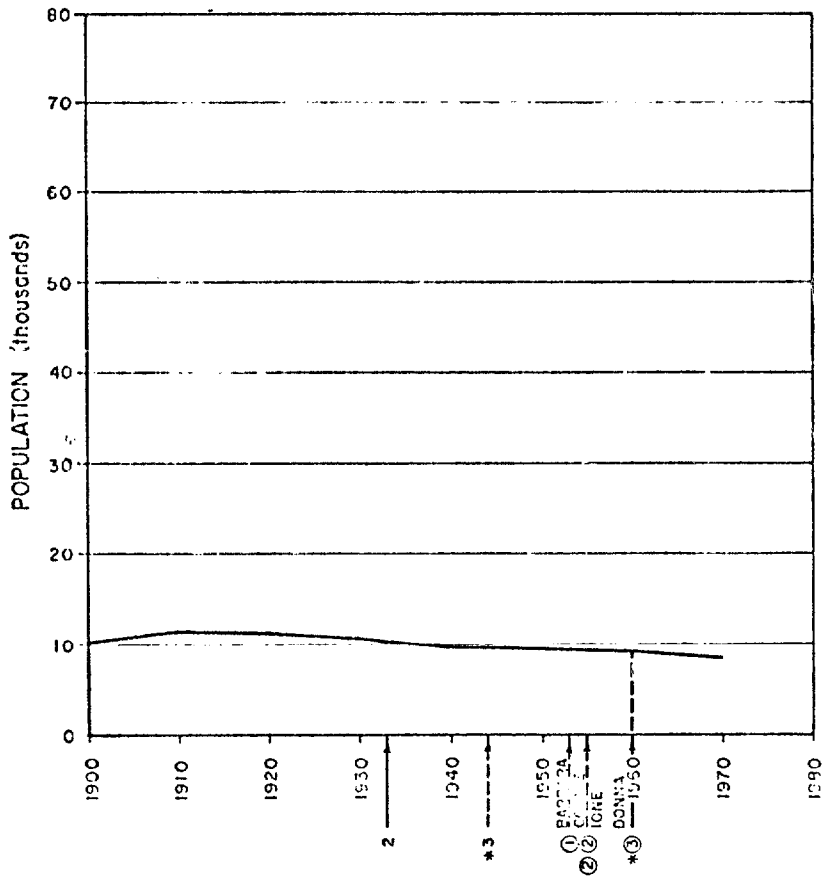
BERTIE COUNTY, NC



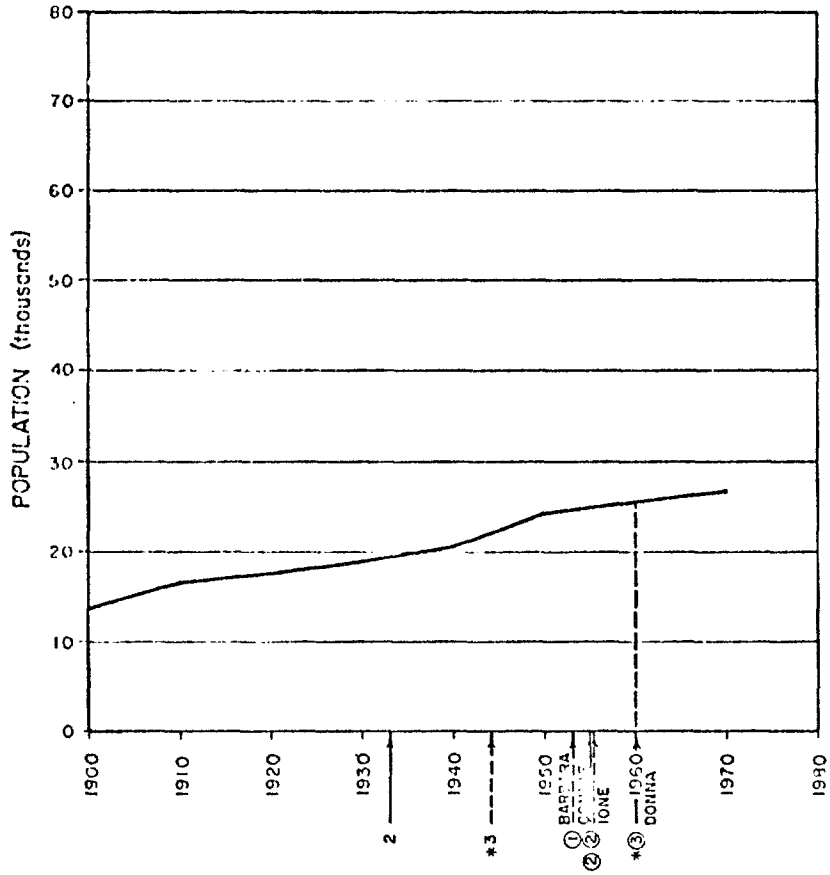
CHOWAN COUNTY, NC



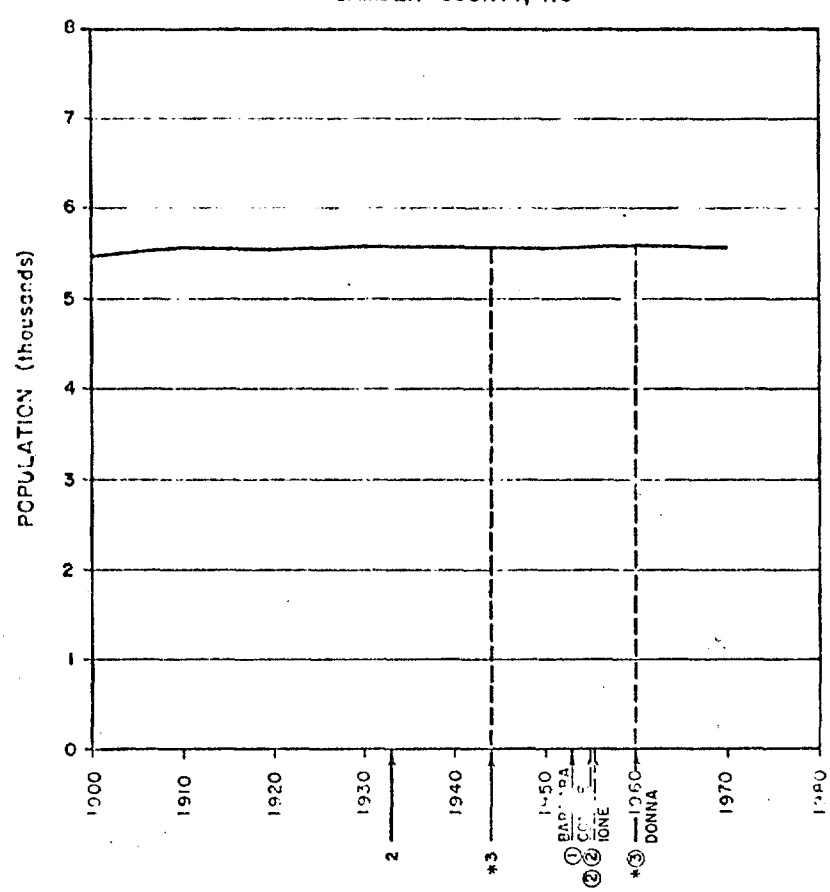
PERQUIMANS COUNTY, NC

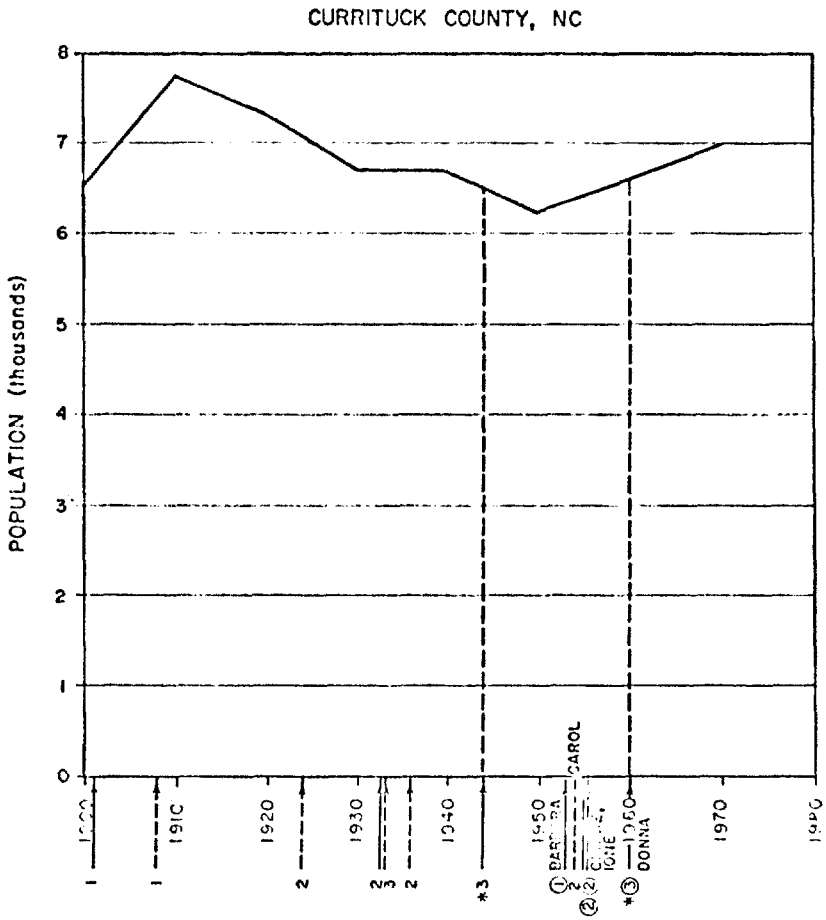


PASQUOTANK COUNTY, NC



CAMDEN COUNTY, NC

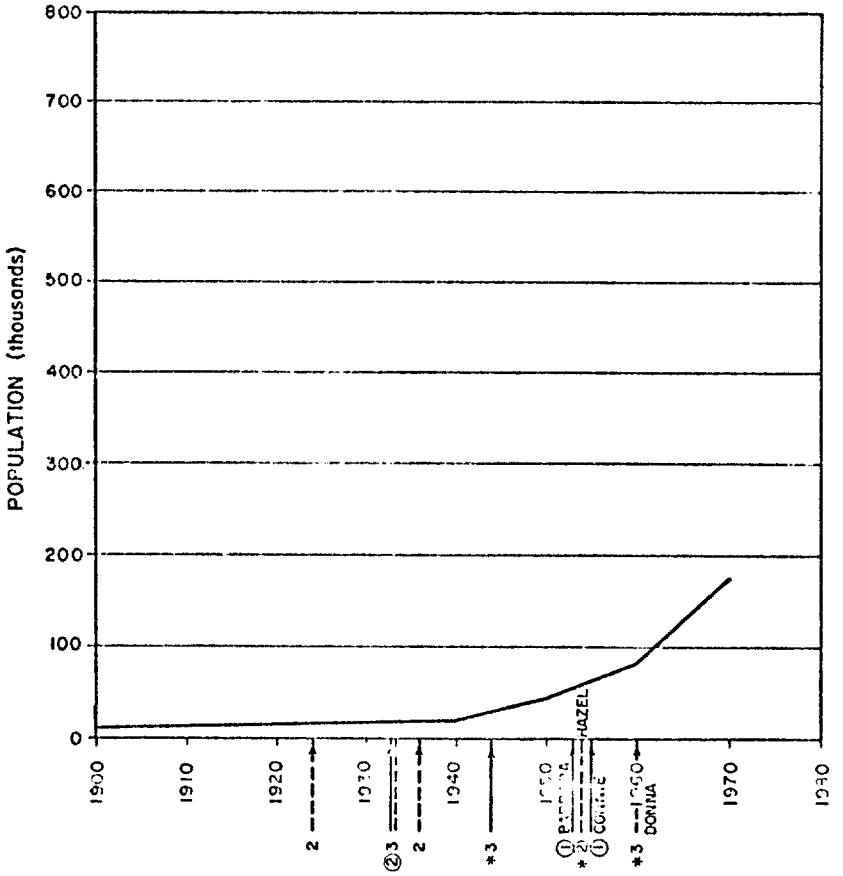




END OF NORTH CAROLINA COUNTIES

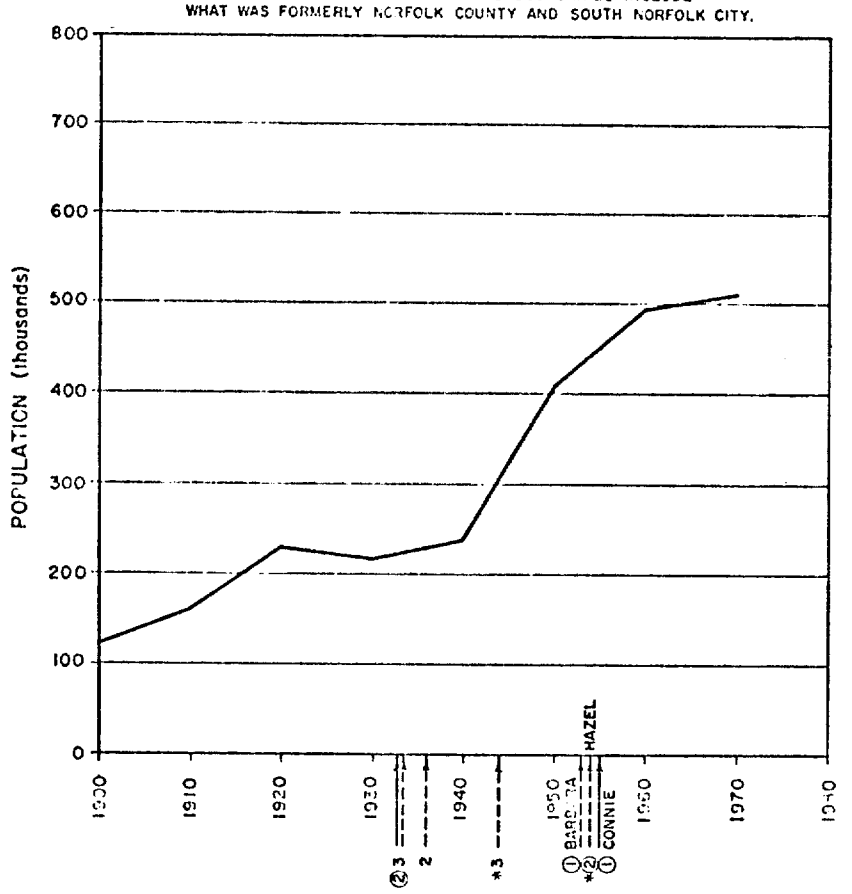
VIRGINIA BEACH, VA

INDEPENDENT CITY, CONSOLIDATED WITH PRINCESS ANNE COUNTY IN 1963.



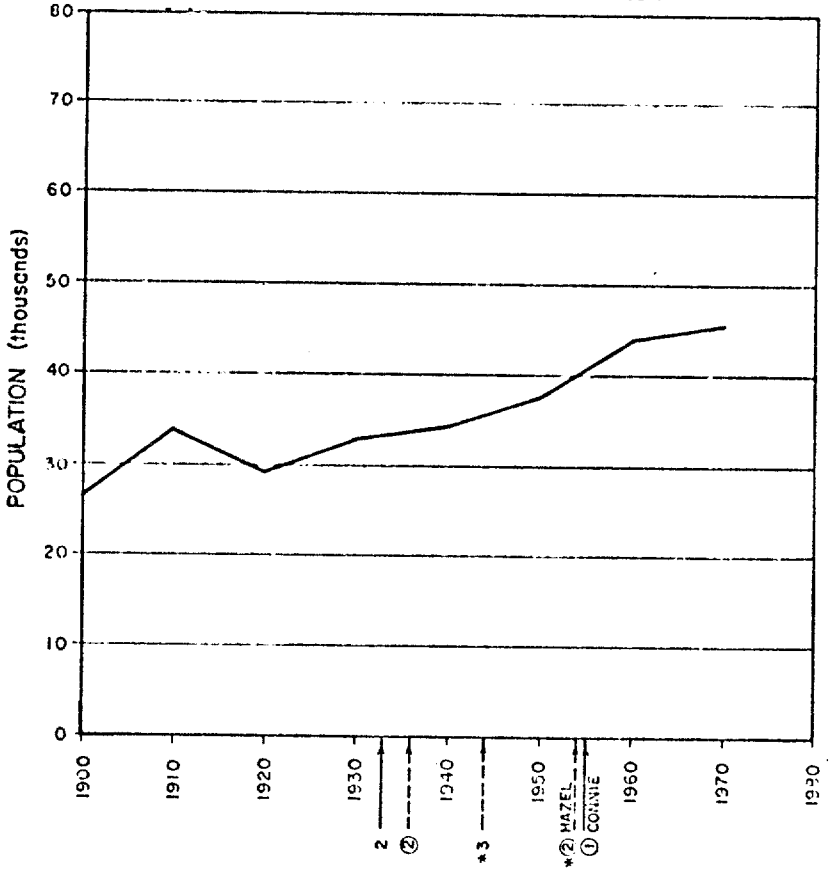
CHESAPEAKE, NORFOLK and PORTSMOUTH, VA

INDEPENDENT CITIES' COMBINED BOUNDARIES INCLUDE WHAT WAS FORMERLY NORFOLK COUNTY AND SOUTH NORFOLK CITY.

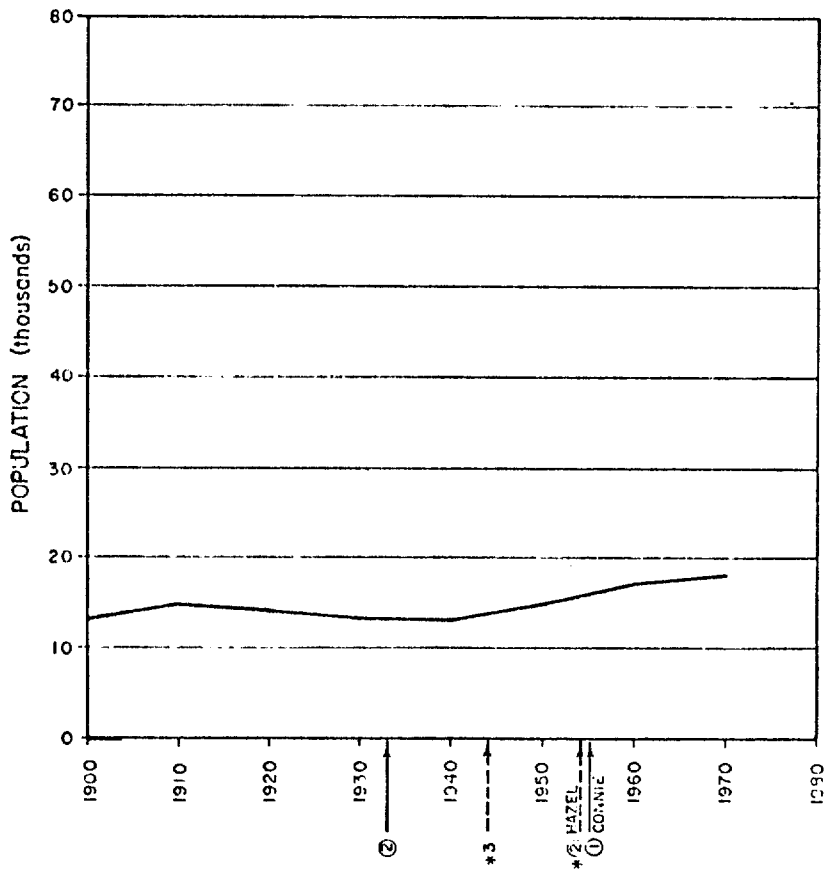


NANSEMOND COUNTY, VA

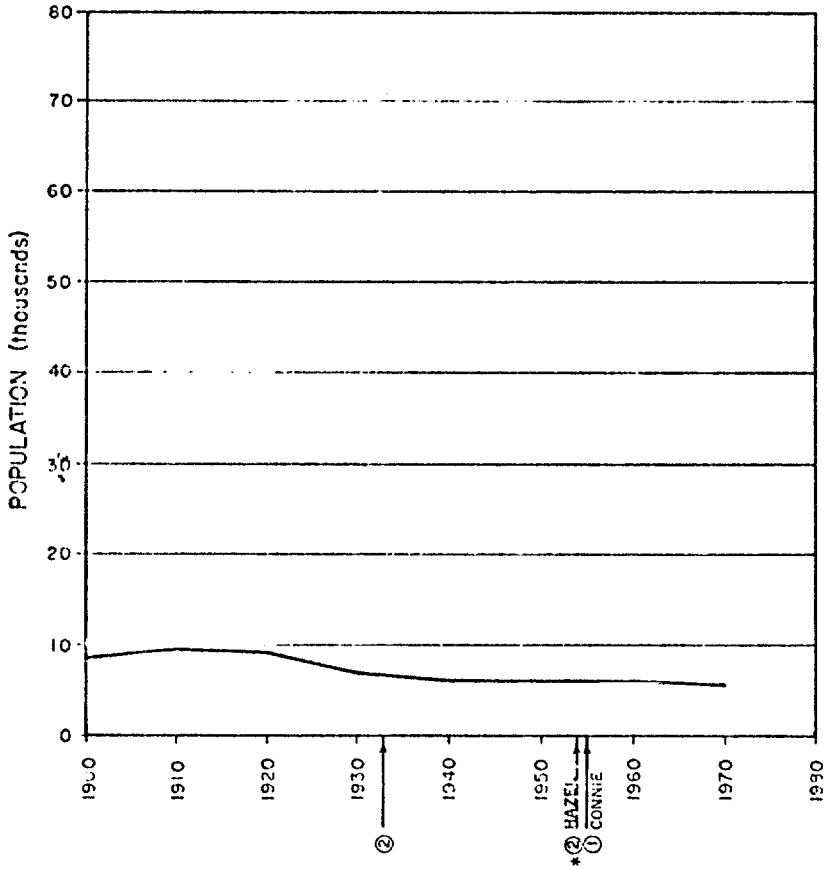
INCLUDES THE INDEPENDENT CITY OF SUFFOLK.



ISLE OF WIGHT COUNTY, VA

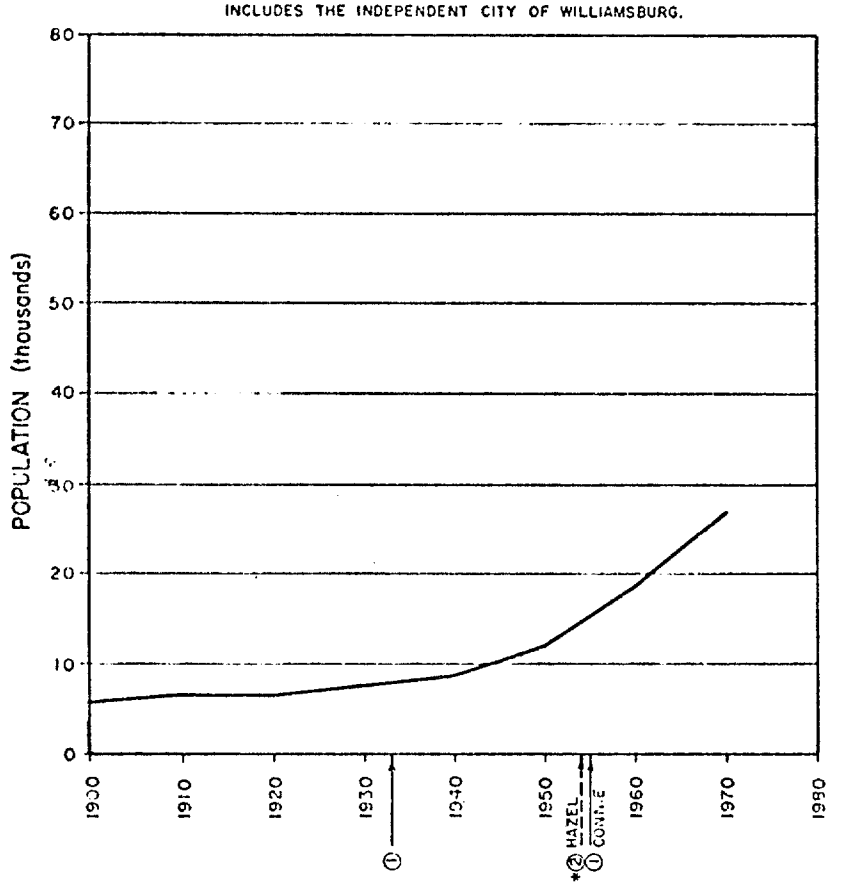


SURRY COUNTY, VA



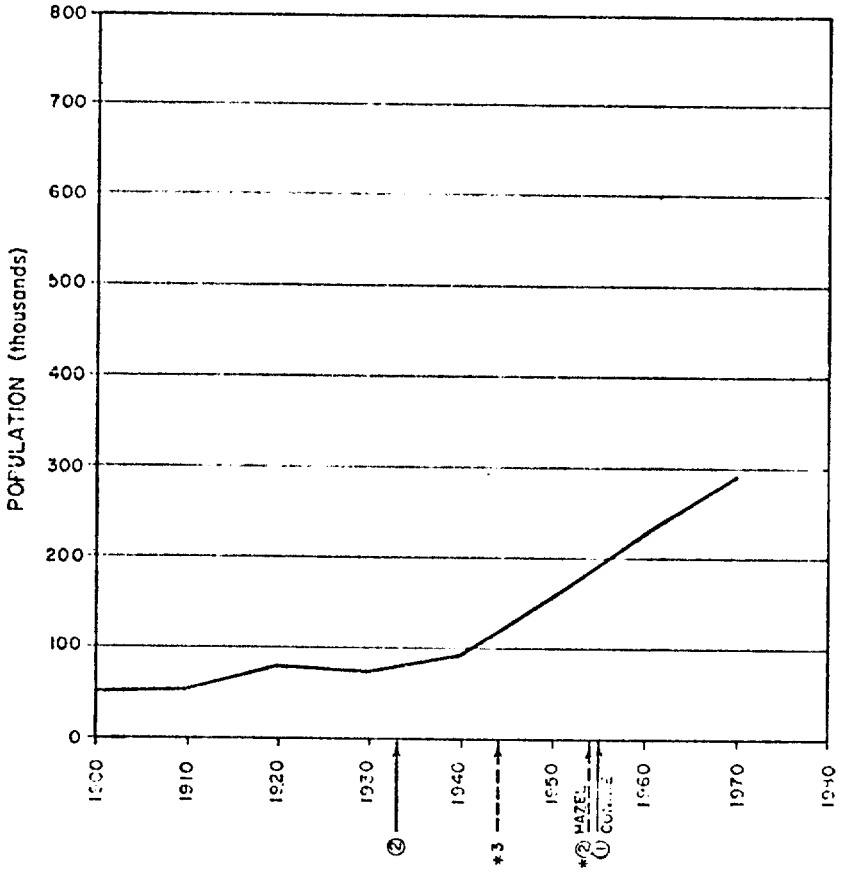
JAMES CITY COUNTY, VA

INCLUDES THE INDEPENDENT CITY OF WILLIAMSBURG.

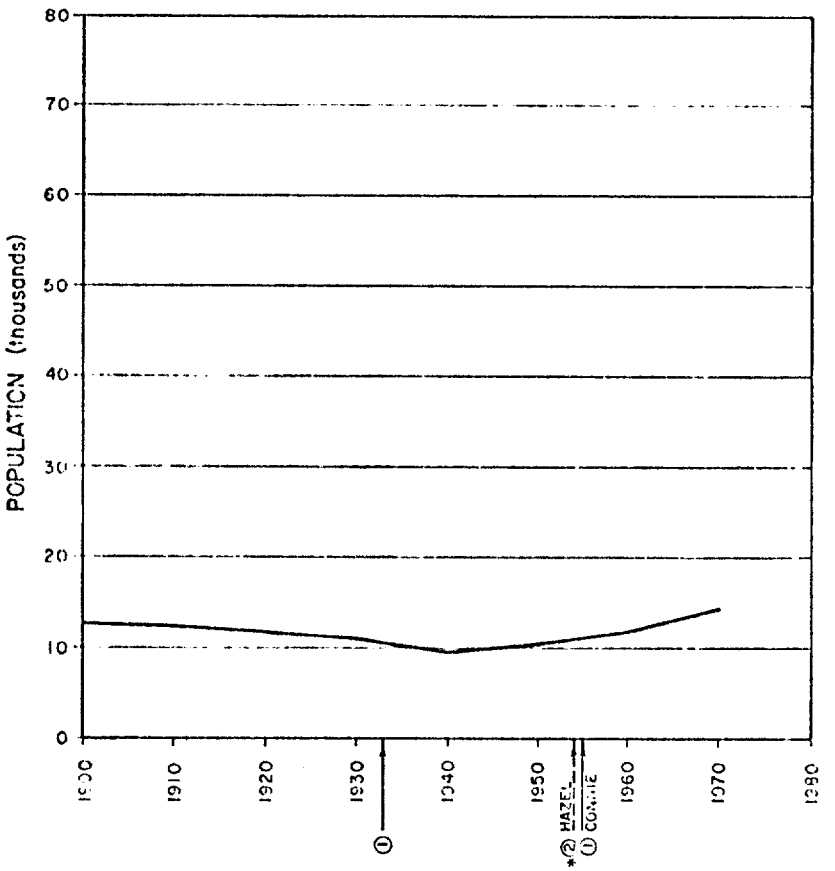


YORK COUNTY, VA

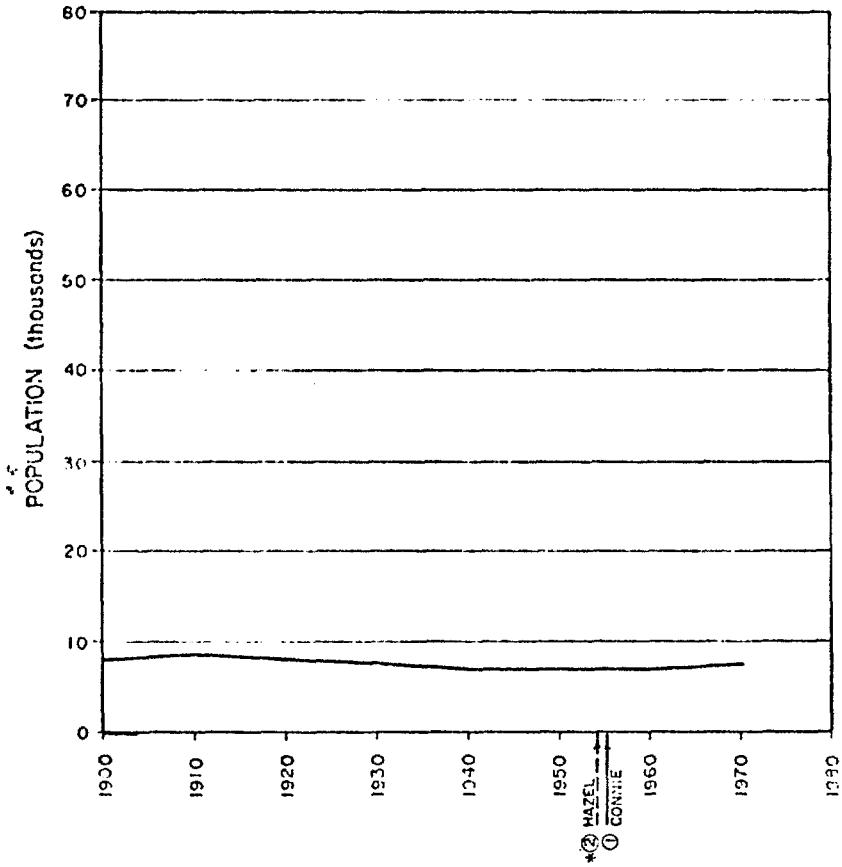
INCLUDES THE INDEPENDENT CITIES OF HAMPTON AND NEWPORT NEWS AND THE FORMER COUNTIES OF ELIZABETH CITY AND WARWICK CITY.



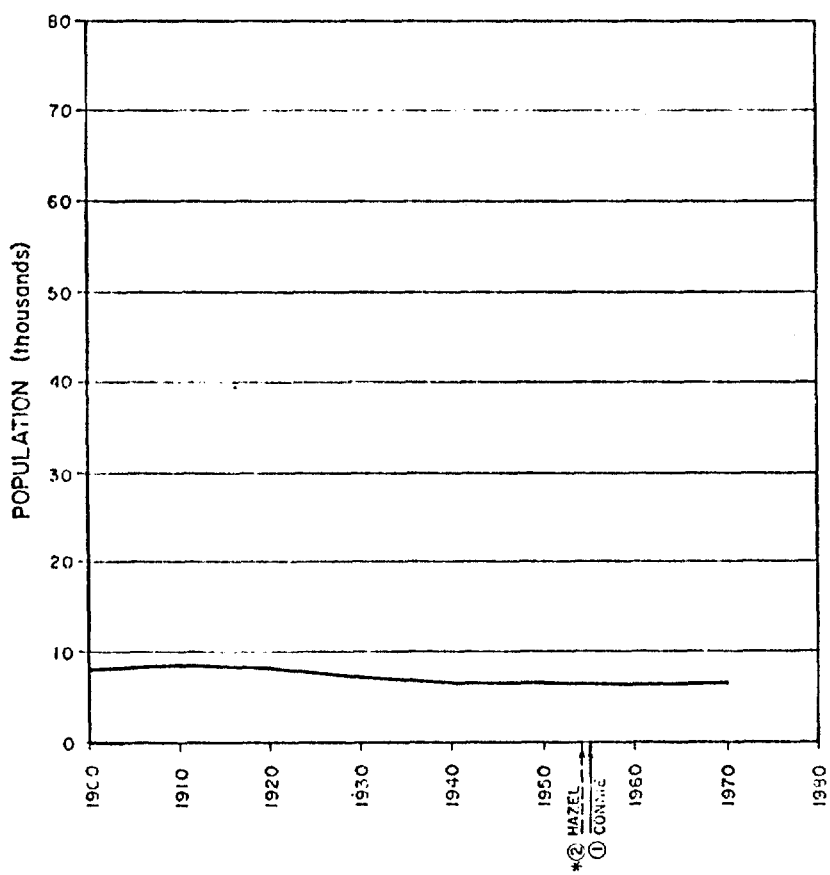
GLOUCESTER COUNTY, VA



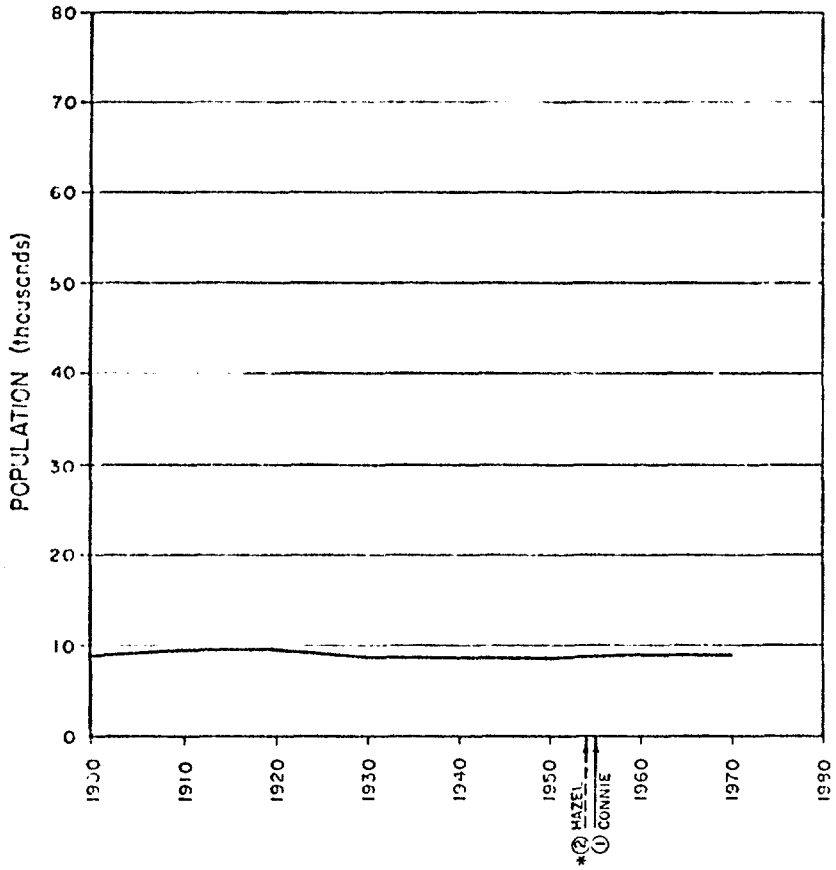
MATHEWS COUNTY, VA



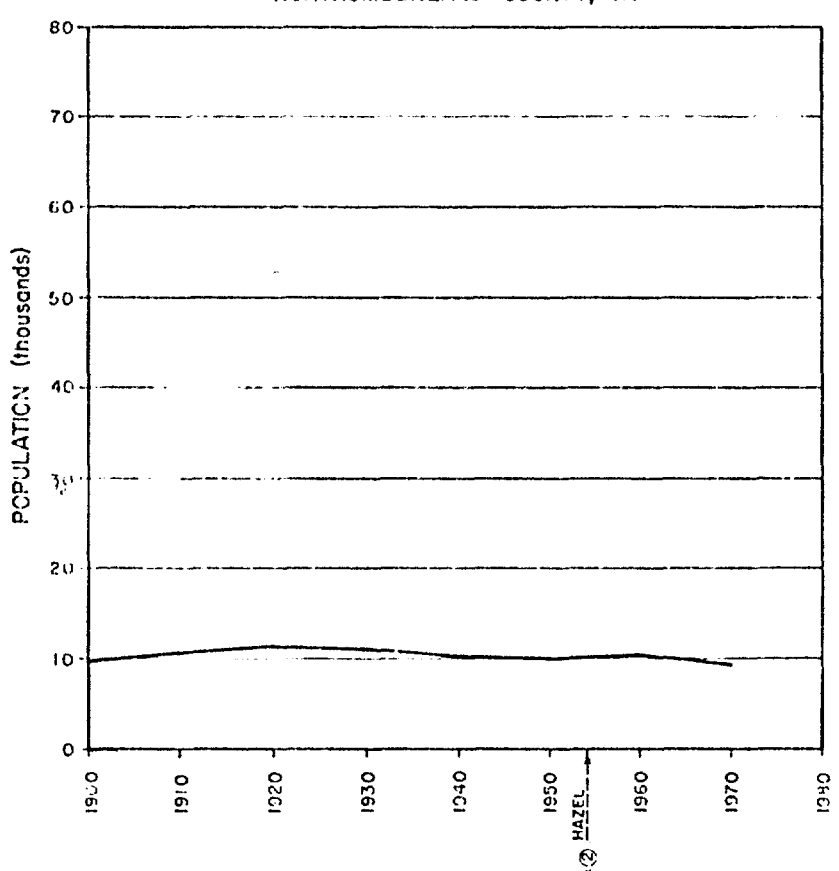
MIDDLESEX COUNTY, VA

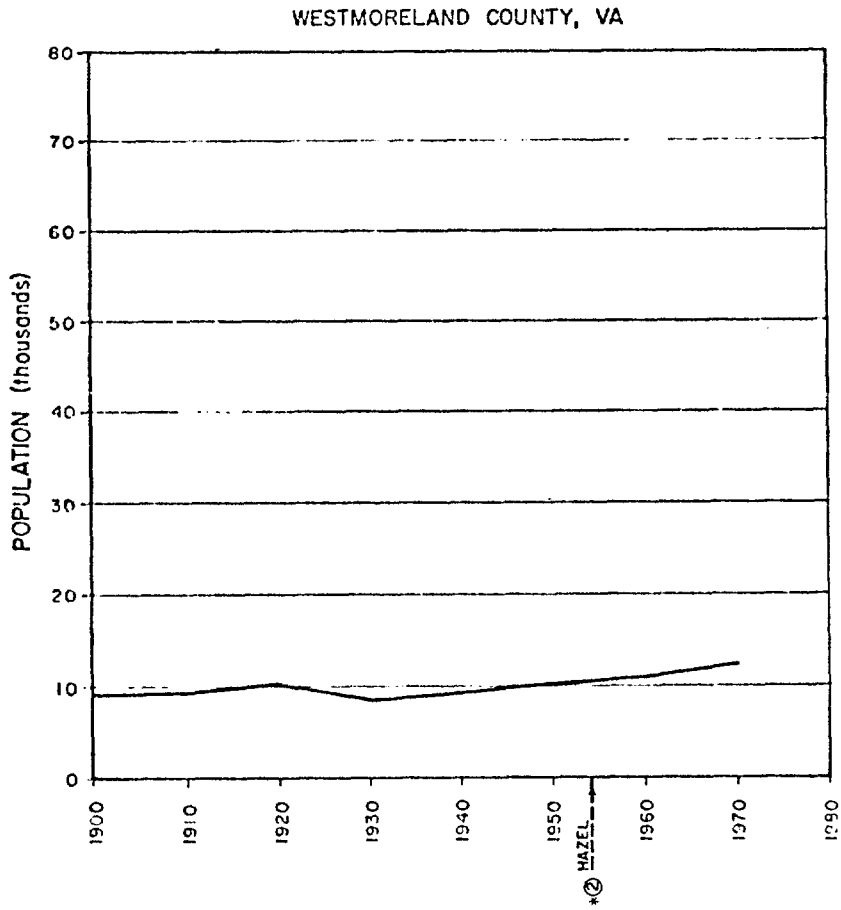


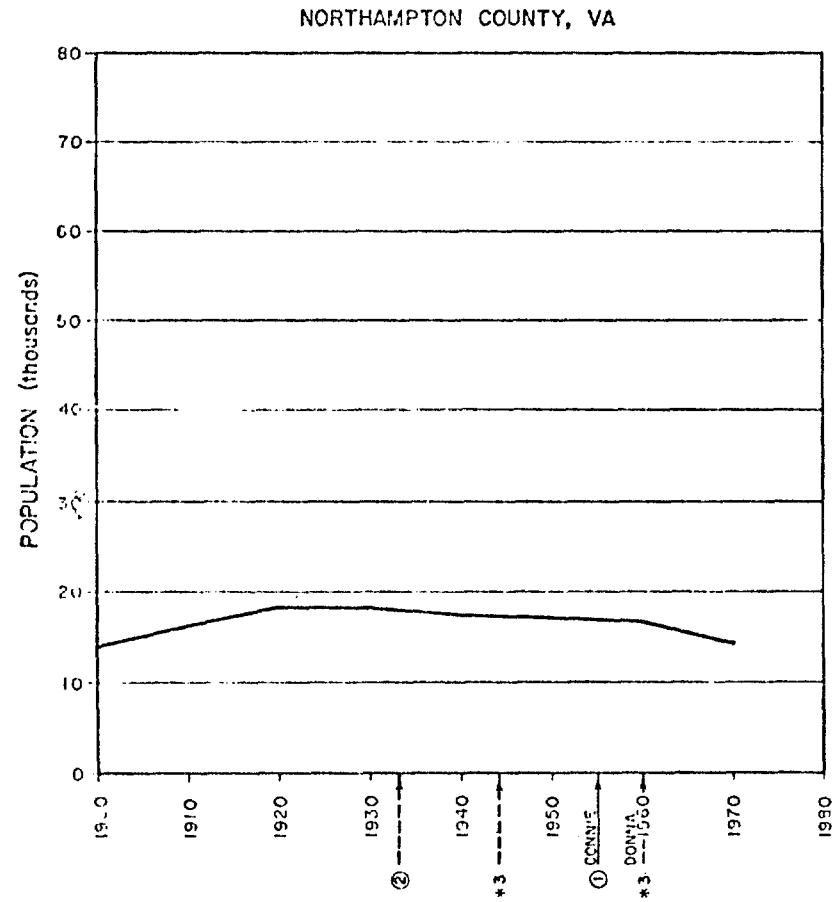
LANCASTER COUNTY, VA



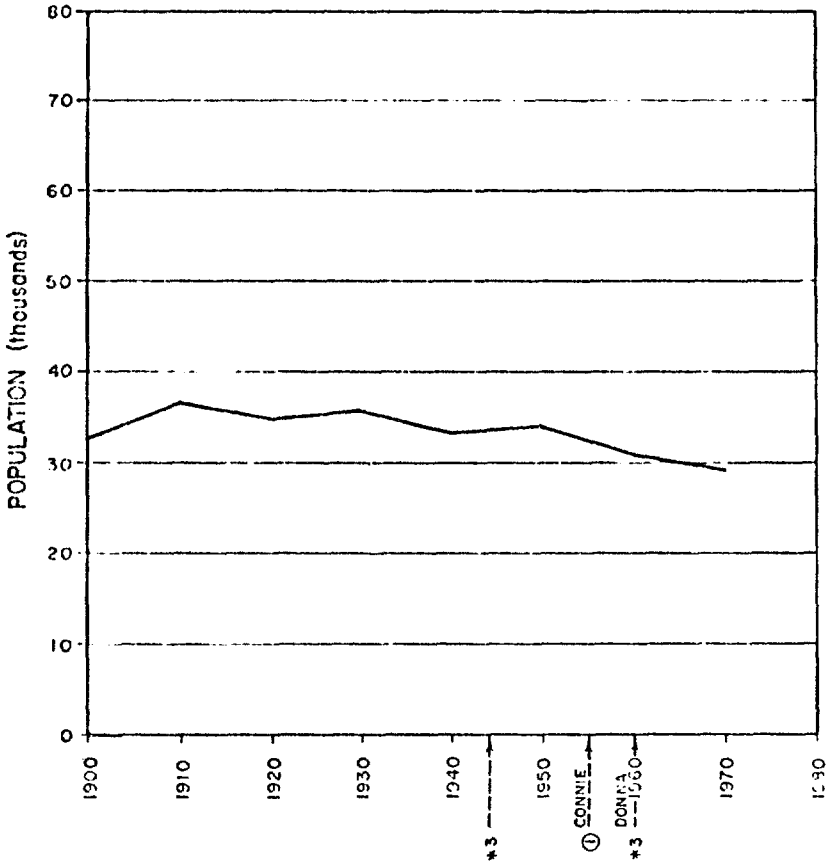
NORTHUMBERLAND COUNTY, VA



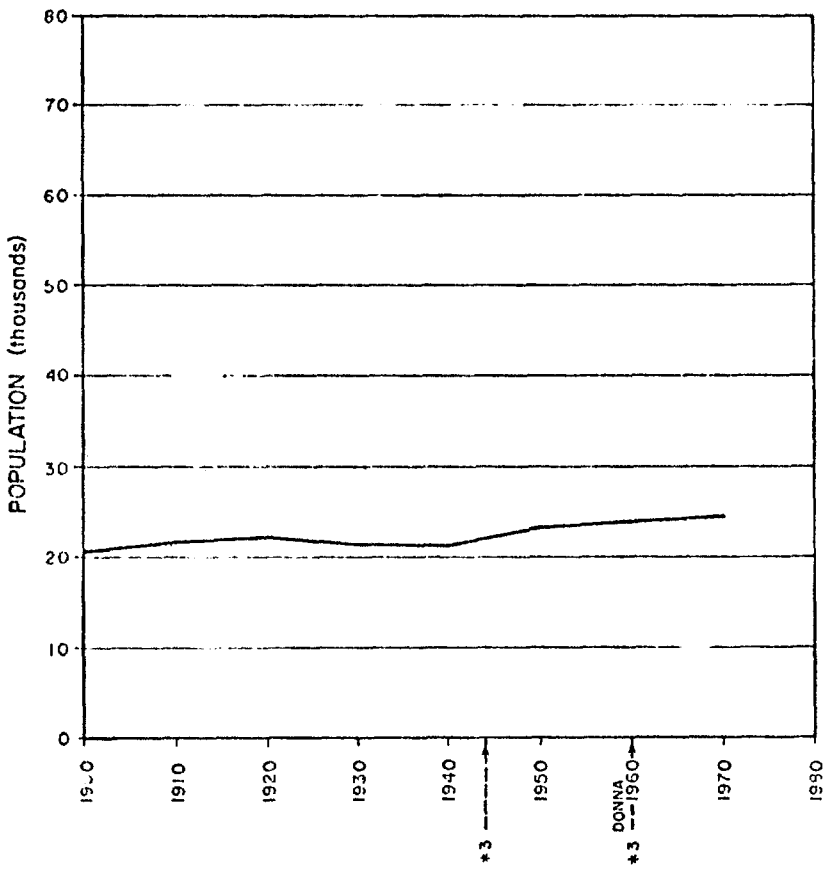

WESTMORELAND COUNTY, VA
POPULATION (thousands)
80
70
60
50
40
30
20
10
0
1900
1910
1920
1930
1940
1950
1960
1970
1990
*② HAZEL


NORTHAMPTON COUNTY, VA
POPULATION (thousands)
80
70
60
50
40
30
20
10
0
1910
1920
1930
1940
1950
1970
1990
②
*3
① CONNIE
DONNA
*3

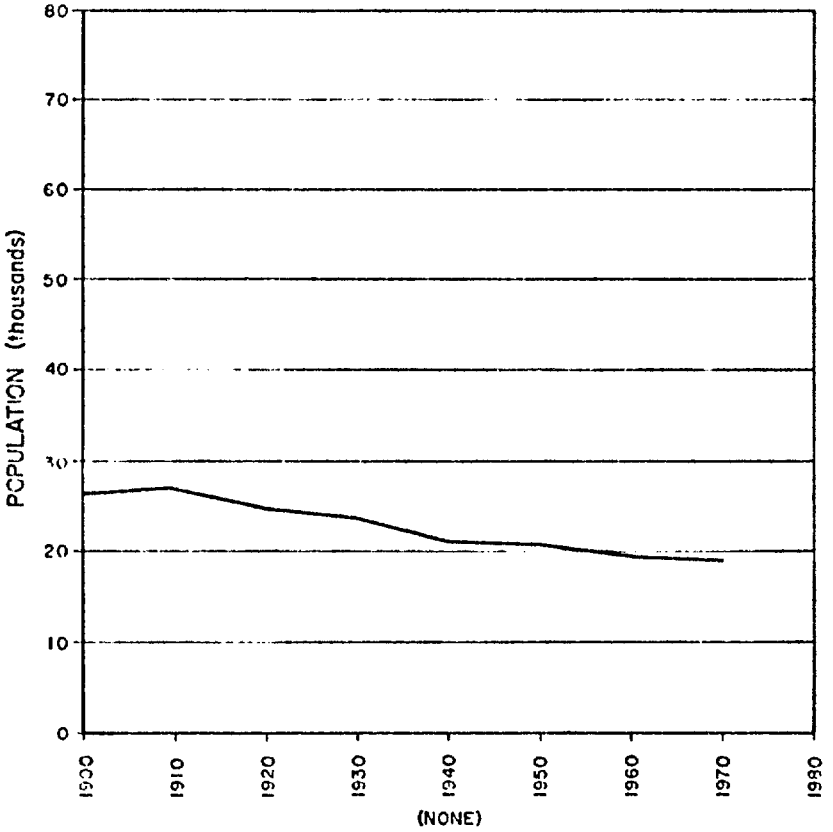
ACCOMACK COUNTY, VA



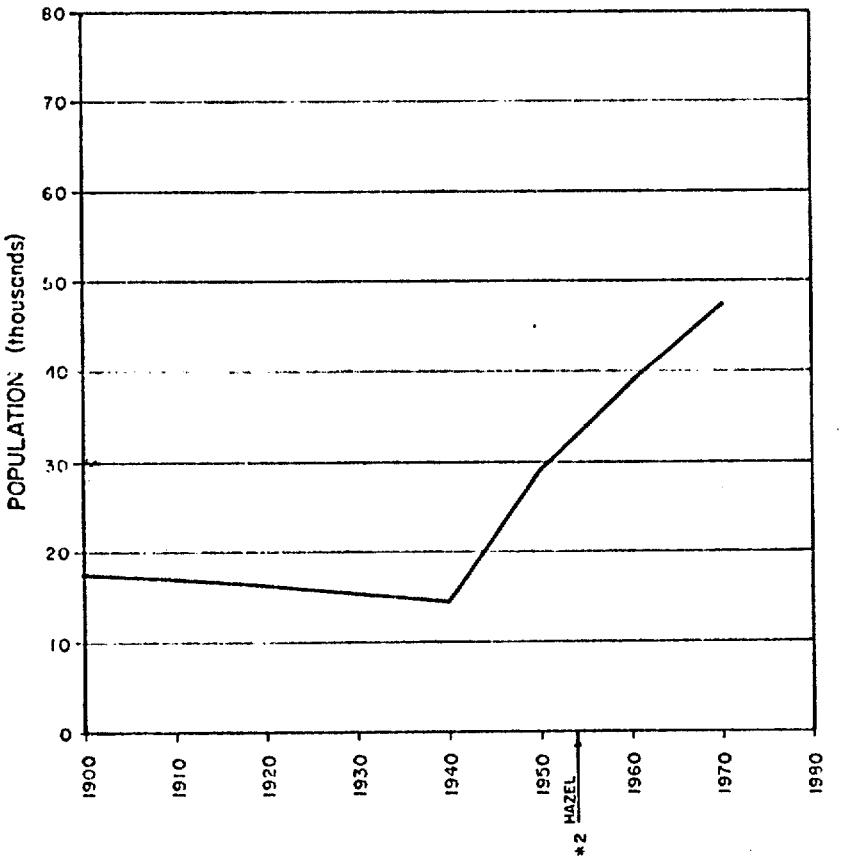
WORCESTER COUNTY, MD



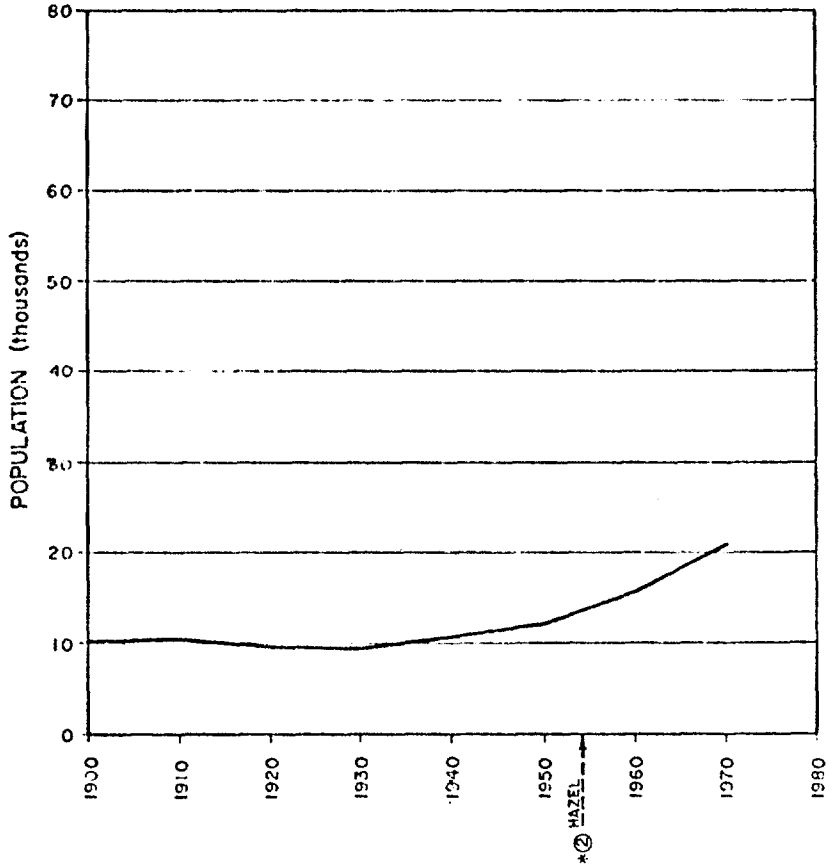
SOMERSET COUNTY, MD



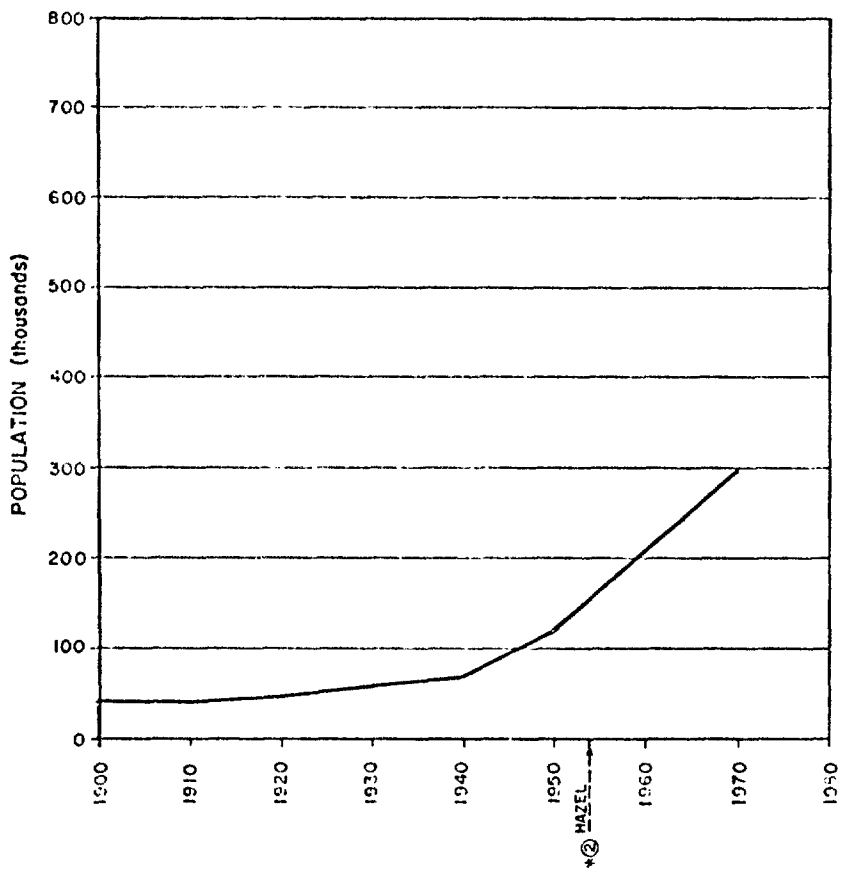
ST. MARYS COUNTY, MD



CALVERT COUNTY, MD

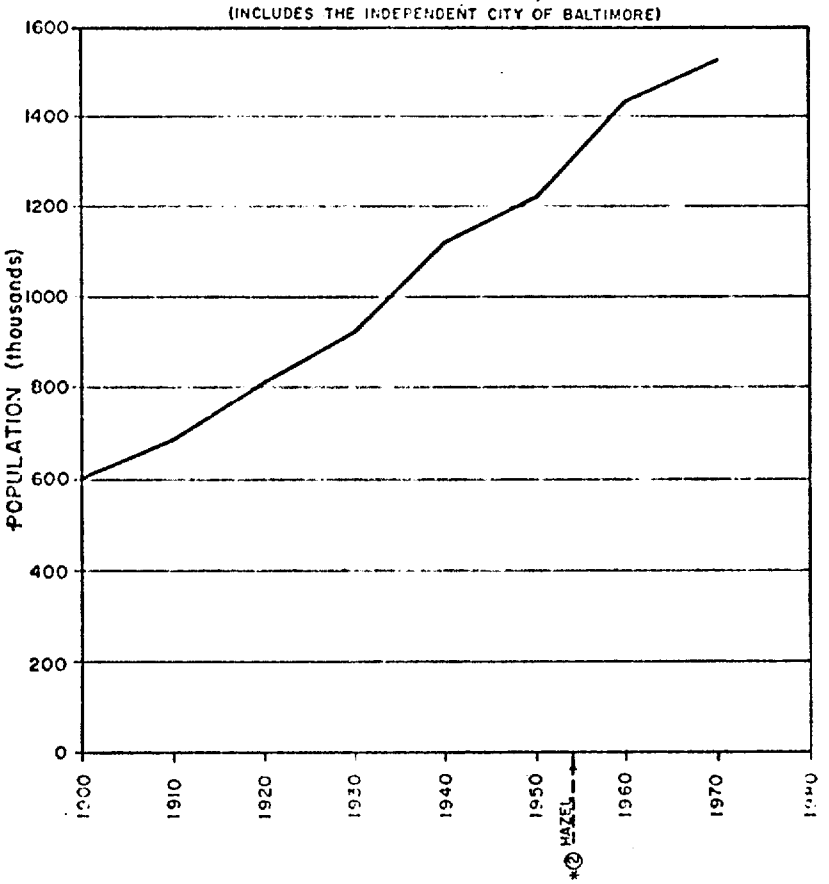


ANNE ARUNDEL COUNTY, MD

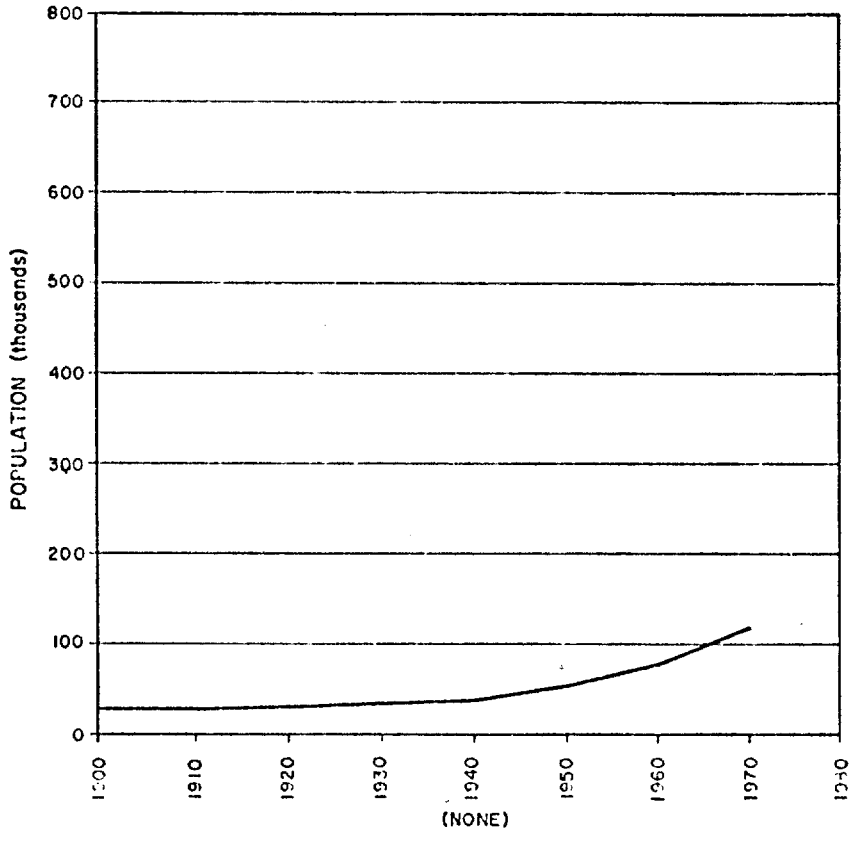


BALTIMORE COUNTY, MD

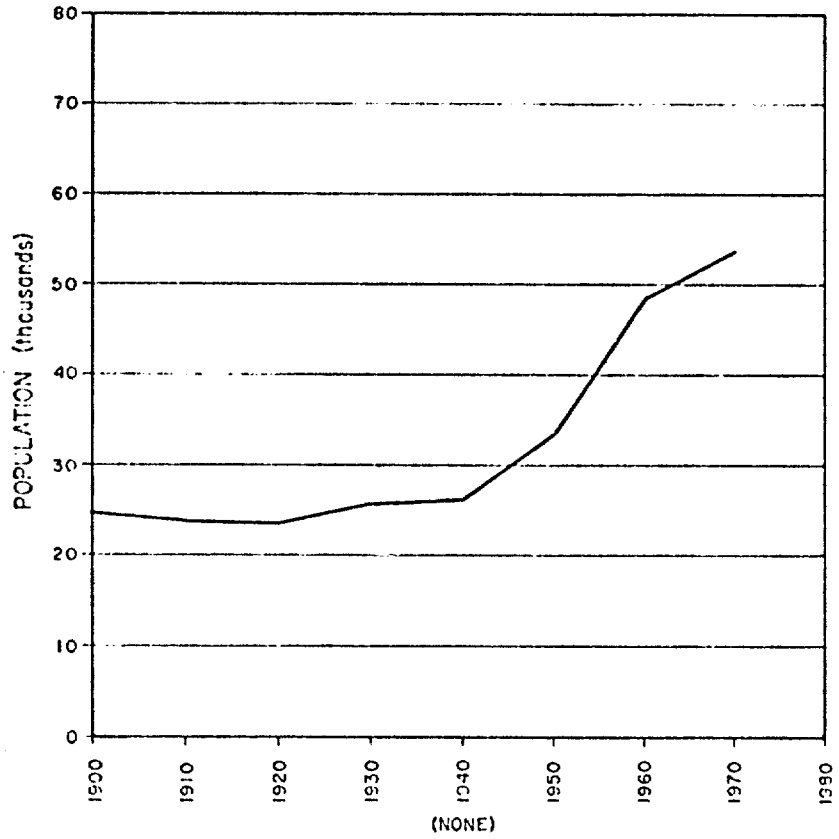
(INCLUDES THE INDEPENDENT CITY OF BALTIMORE)



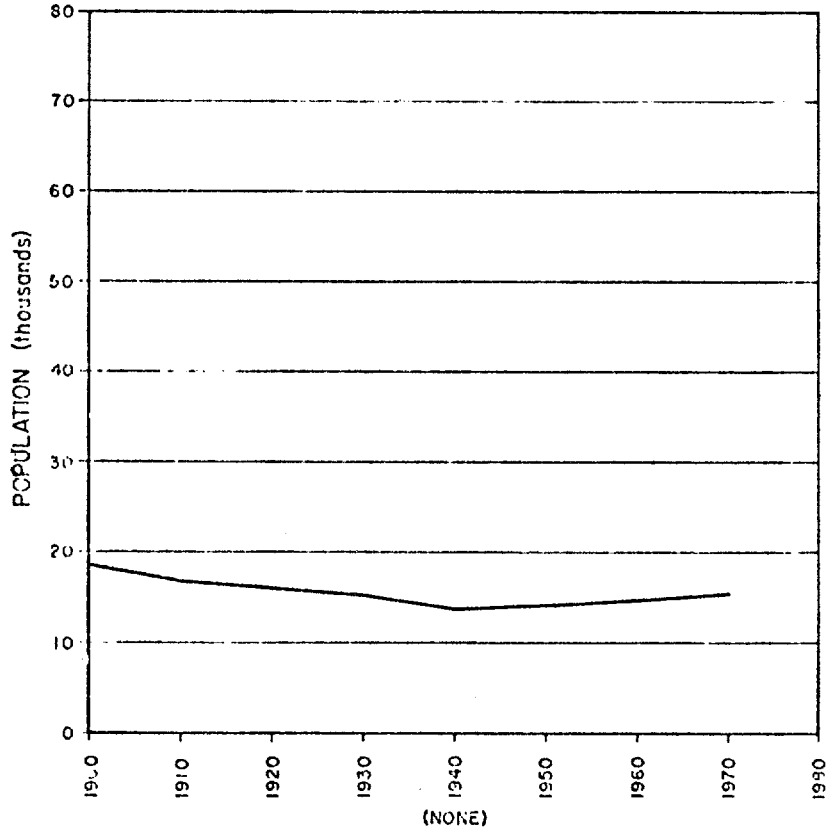
HARFORD COUNTY, MD



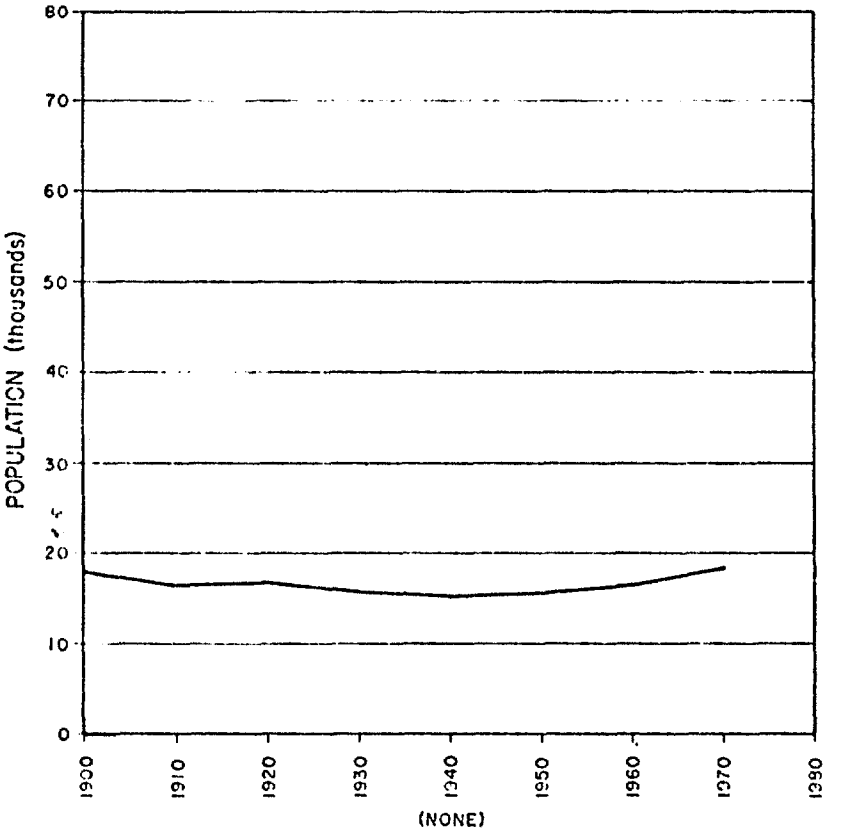
CECIL COUNTY, MD



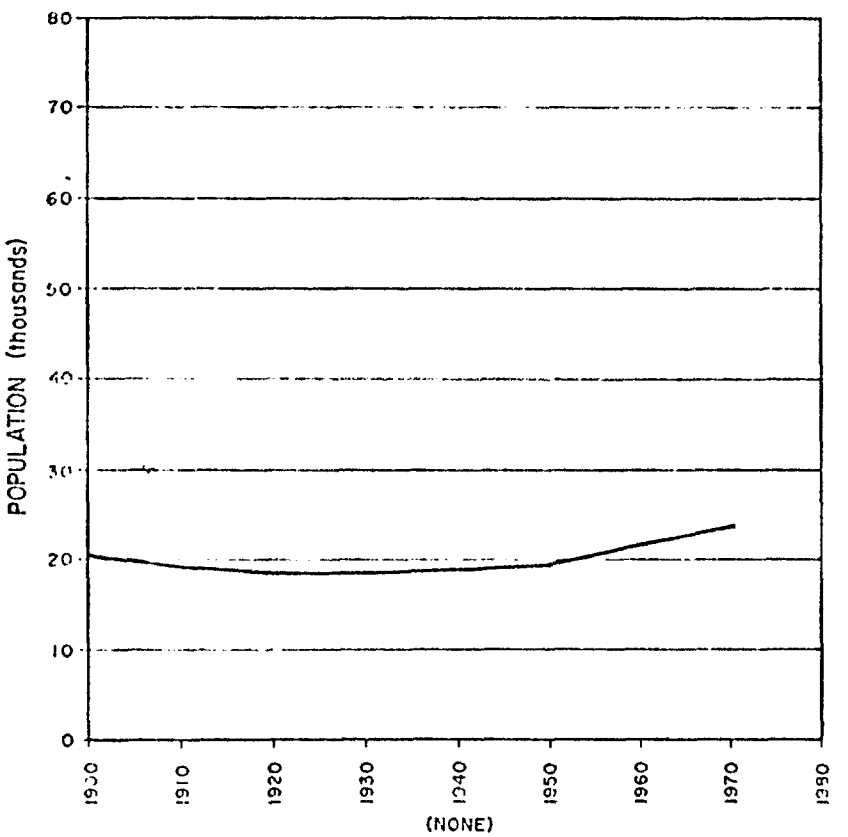
KENT COUNTY, MD

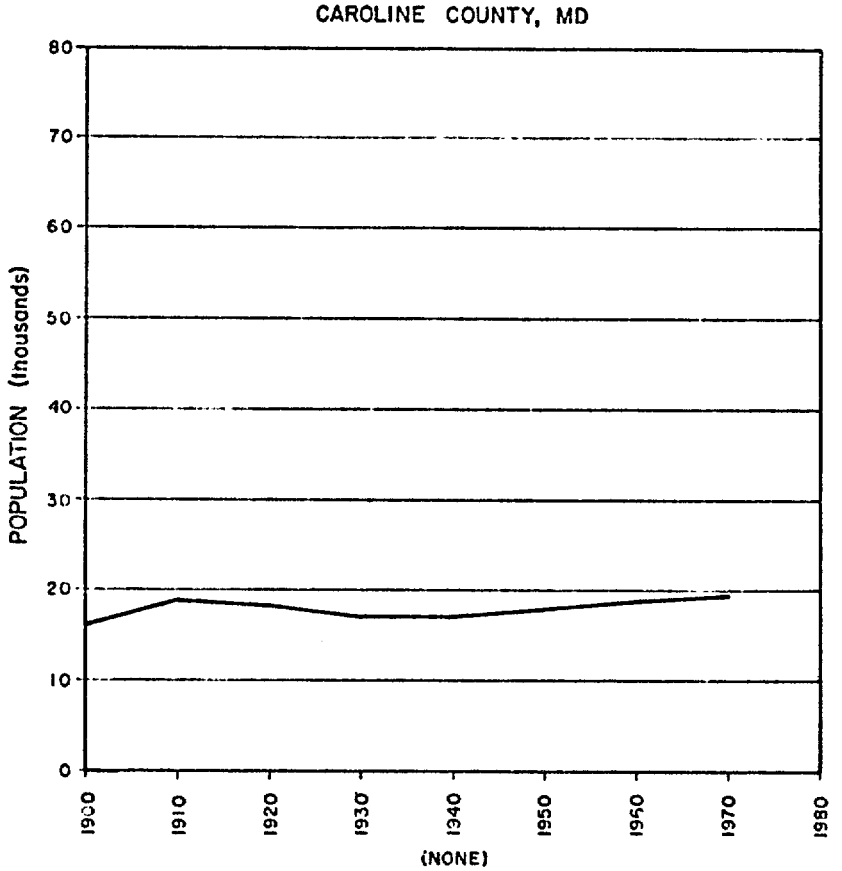


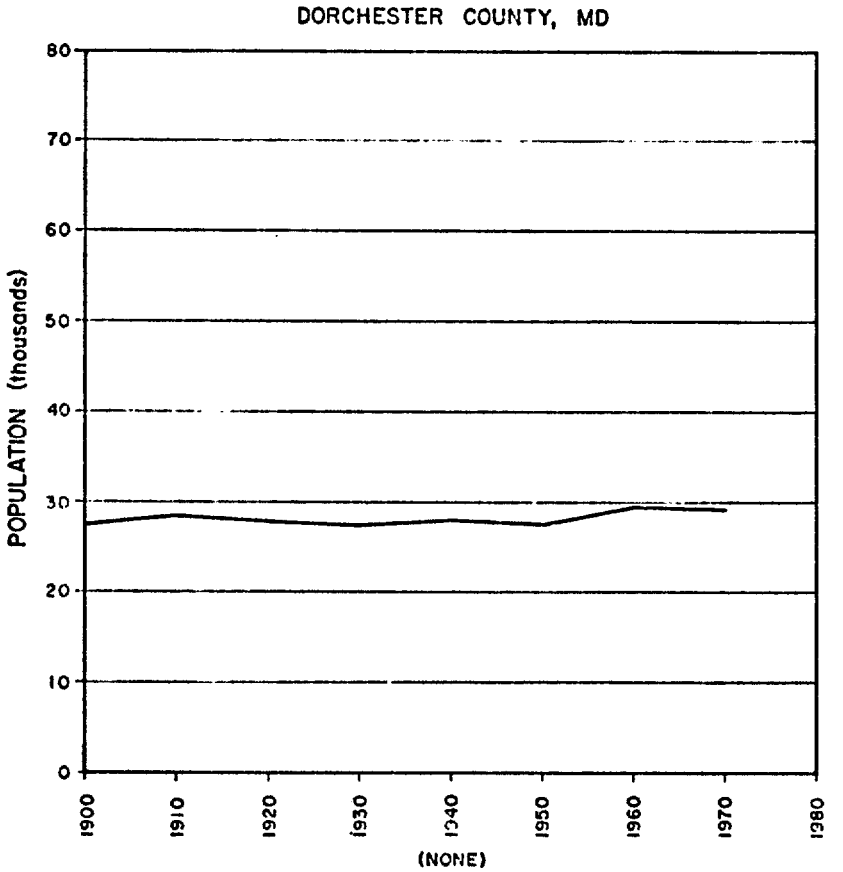
QUEEN ANNES COUNTY, MD

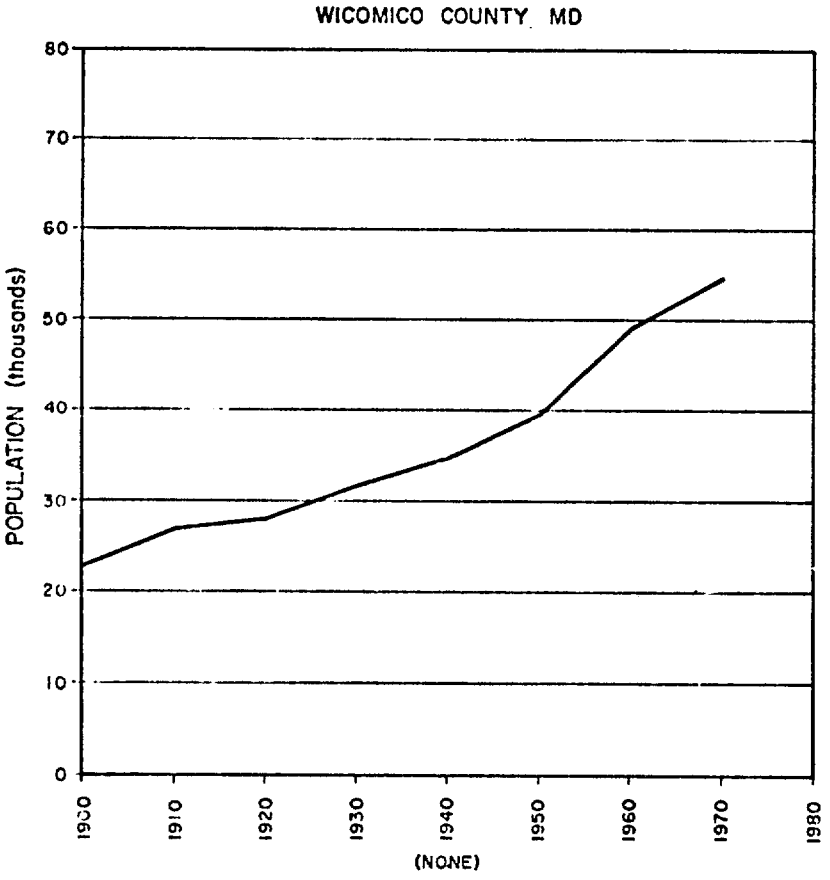


TALBOT COUNTY, MD

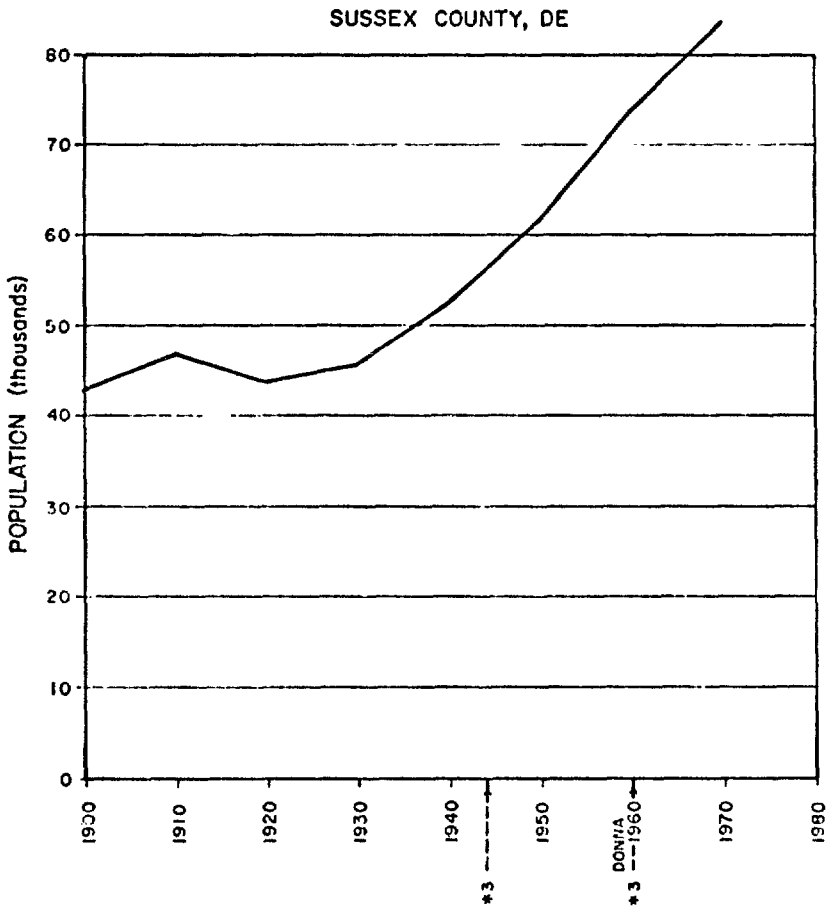


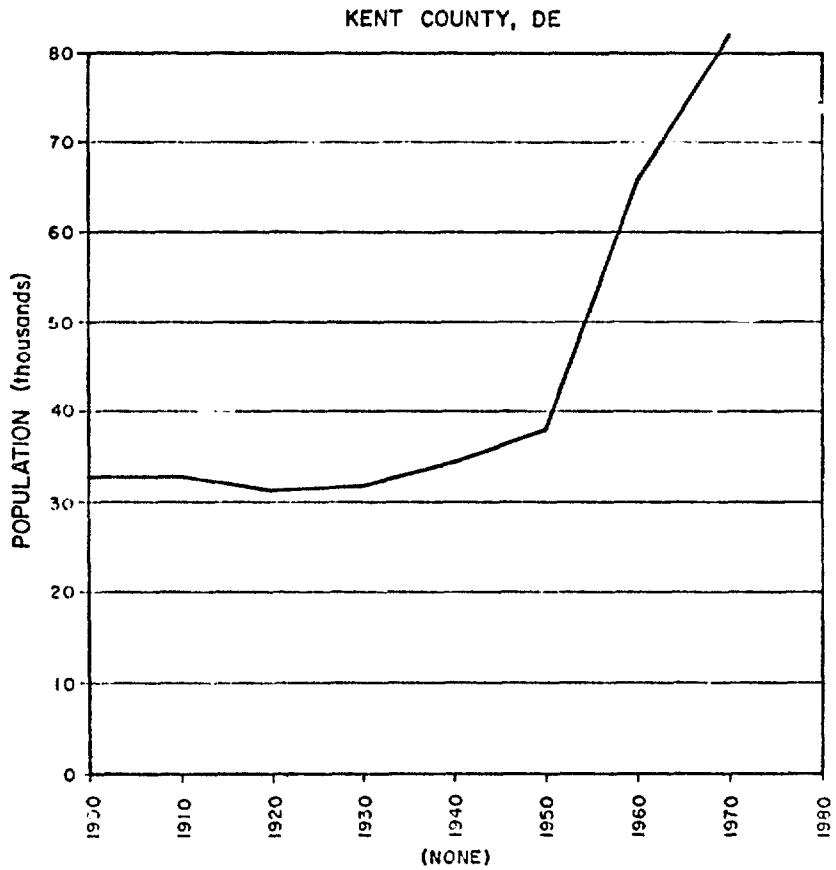

CAROLINE COUNTY, MD
POPULATION (thousands)
80
70
60
50
40
30
20
10
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
(NONE)

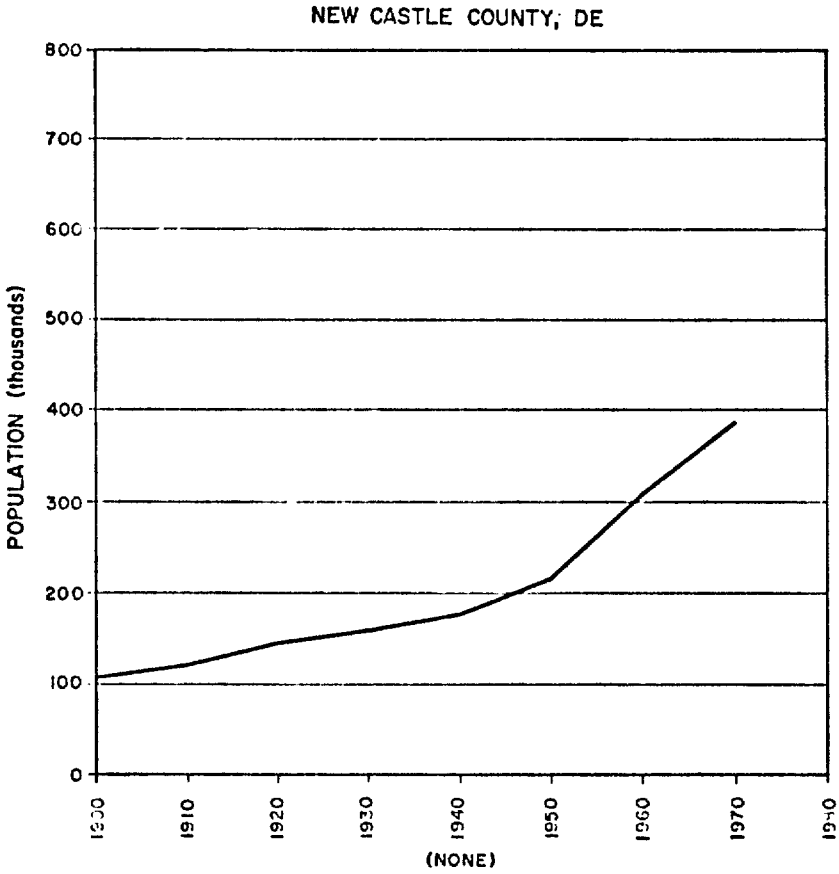

DORCHESTER COUNTY, MD
POPULATION (thousands)
80
70
60
50
40
30
20
10
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
(NONE)



END OF MARYLAND COUNTIES

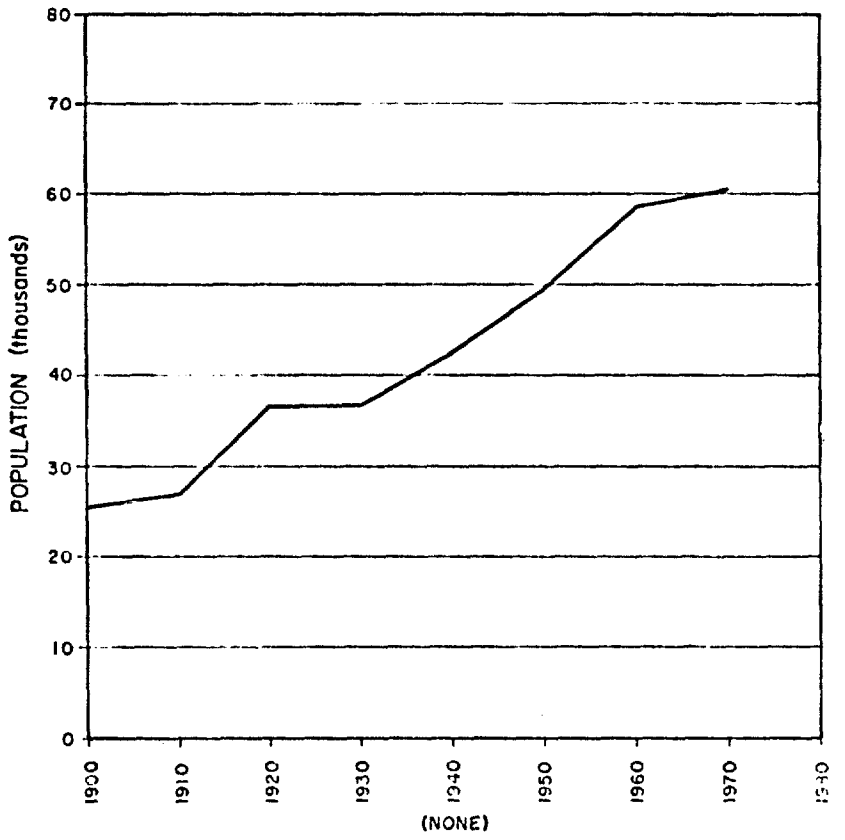

SUSSEX COUNTY, DE
POPULATION (thousands)
80
70
60
50
40
30
20
10
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
*3
DONNA
*3


KENT COUNTY, DE
POPULATION (thousands)
80
70
60
50
40
30
20
10
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
(NONE)

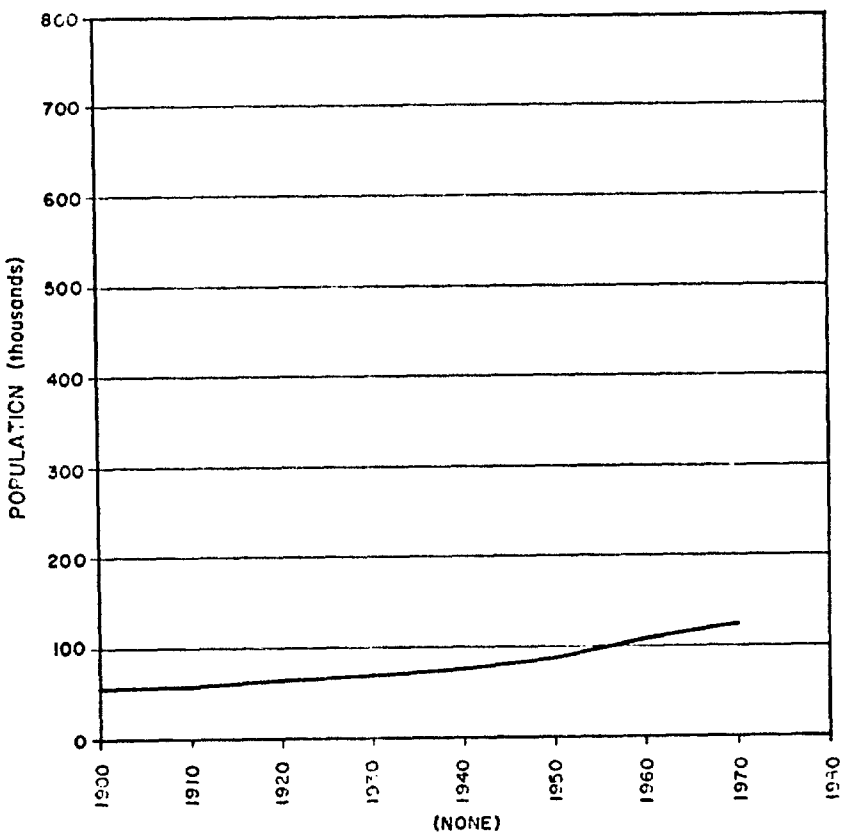


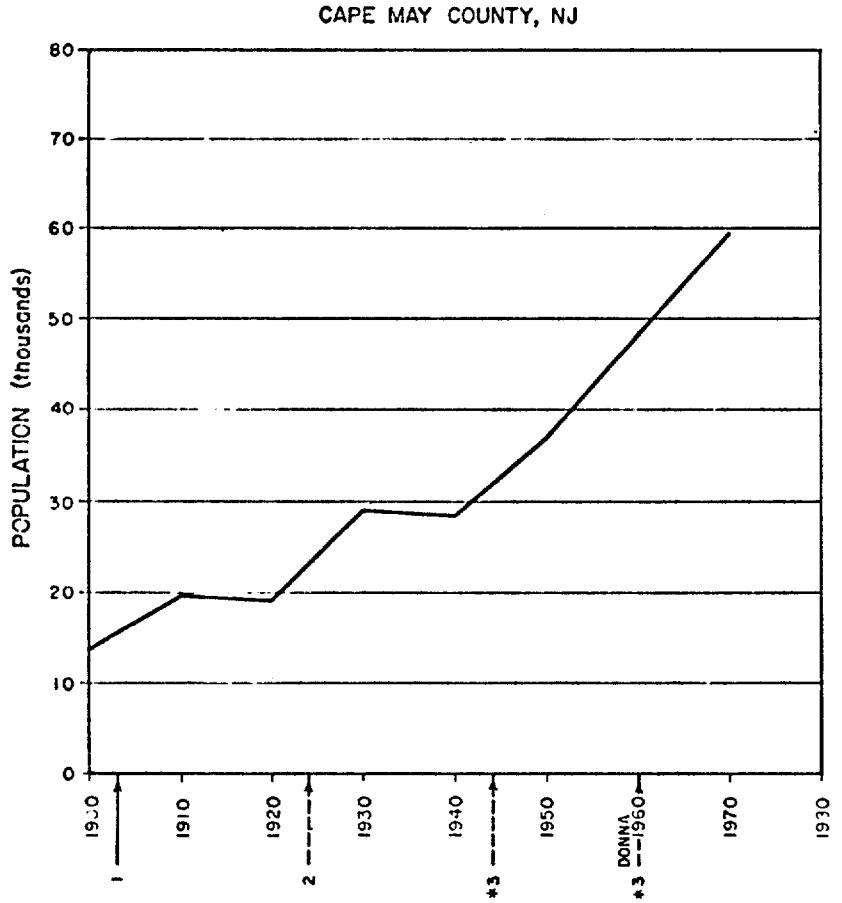
END OF DELAWARE COUNTIES

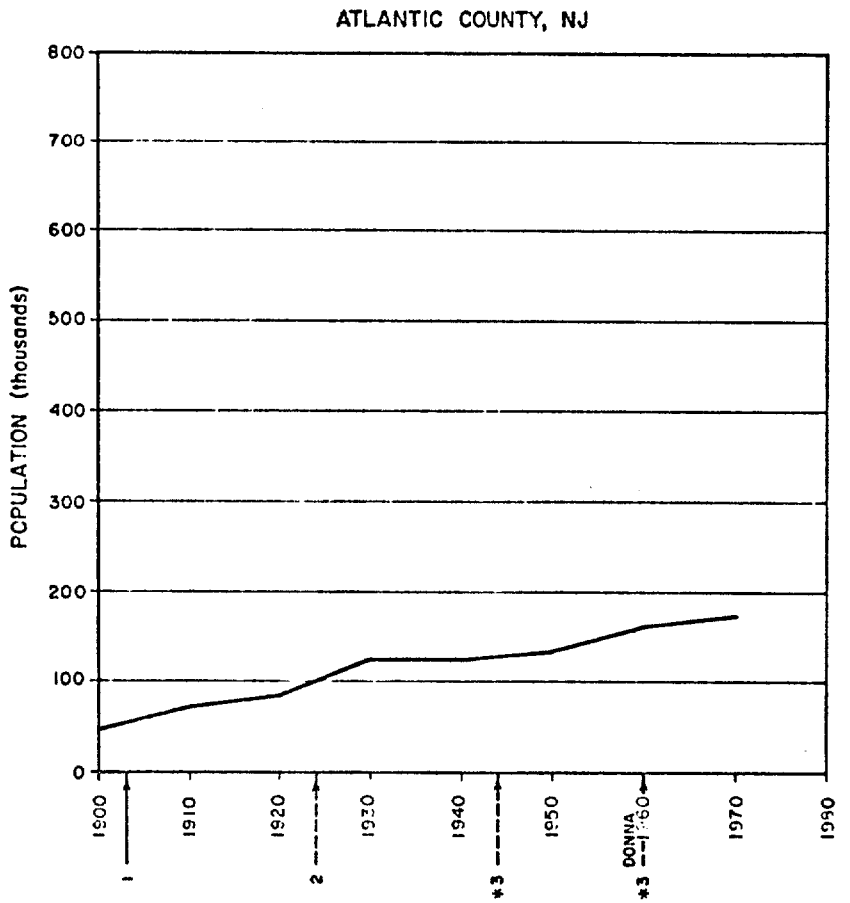
SALEM COUNTY, NJ

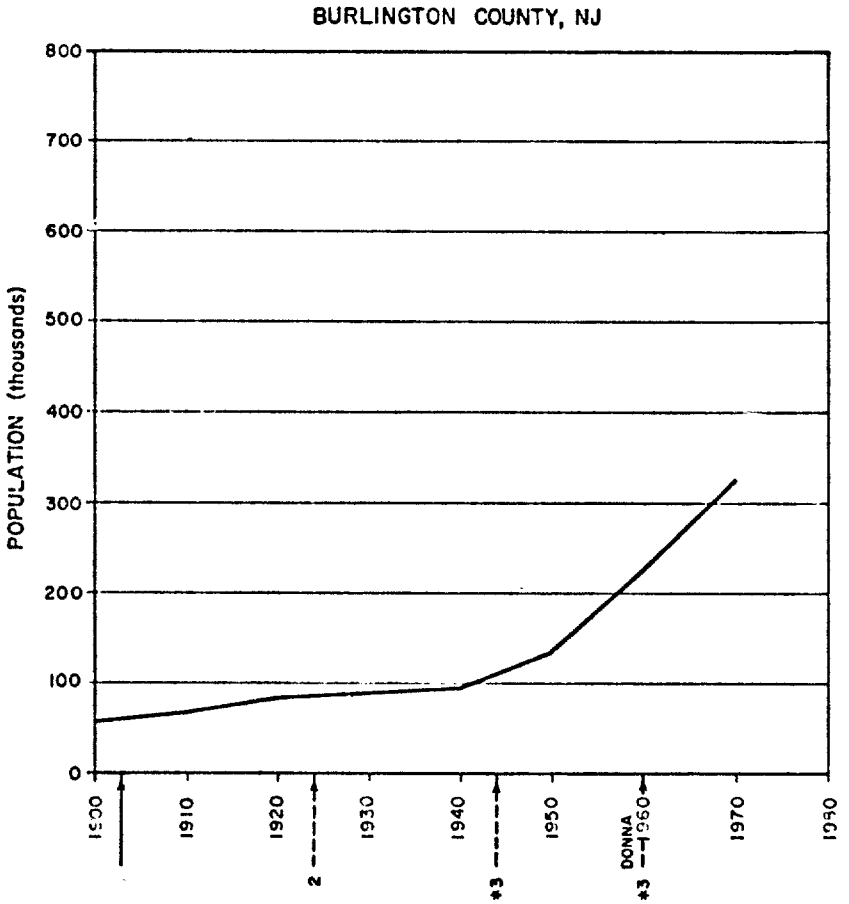


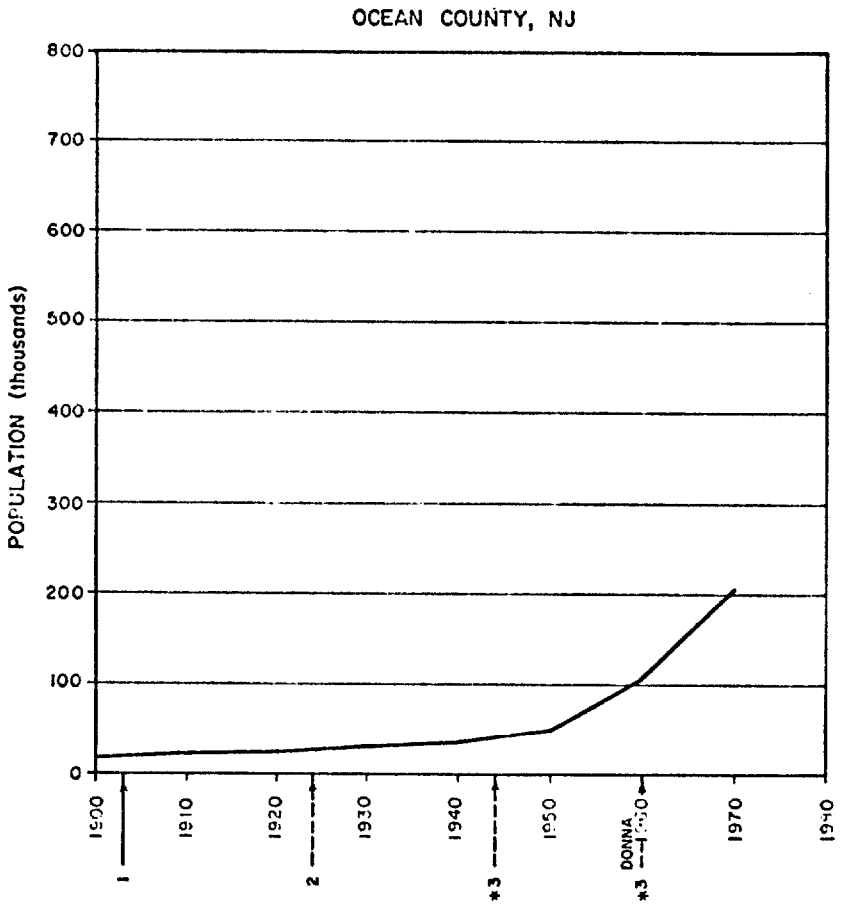
CUMBERLAND COUNTY, NJ



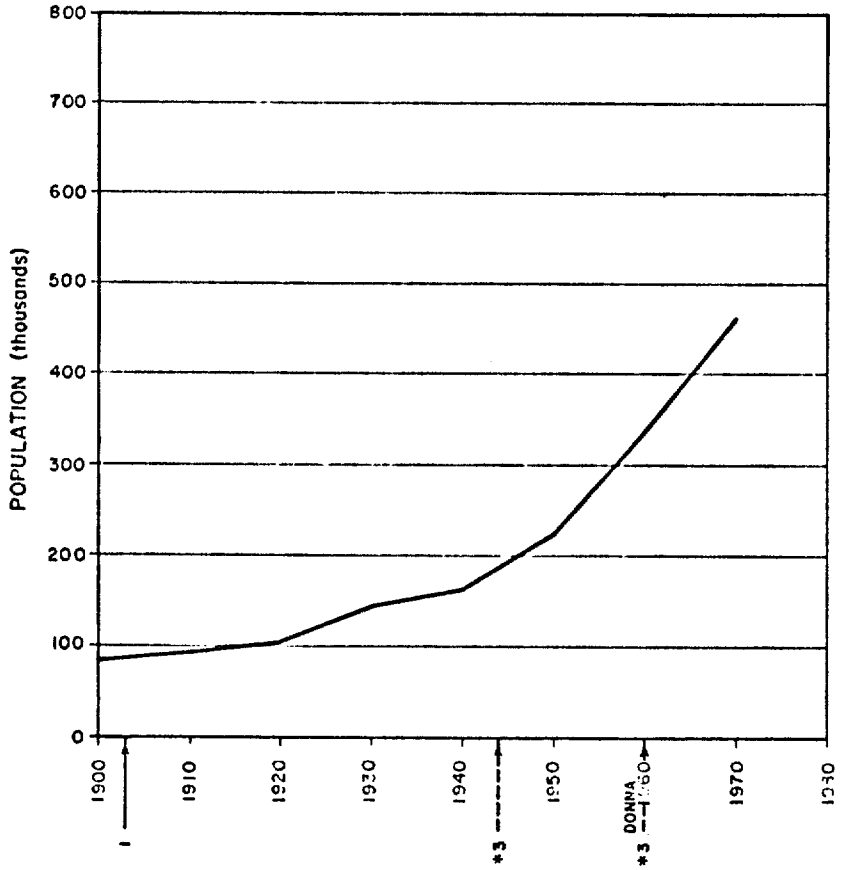

CAPE MAY COUNTY, NJ
POPULATION (thousands)
80
70
60
50
40
30
20
10
0
1900
1910
1920
1930
1940
1950
DONNA
1960
1970
1930
1
2
*3
*3


ATLANTIC COUNTY, NJ
POPULATION (thousands)
800
700
600
500
400
300
200
100
0
1900
1910
1920
1930
1940
1950
DONNA
1960
1970
1990
1
2
*3
*3

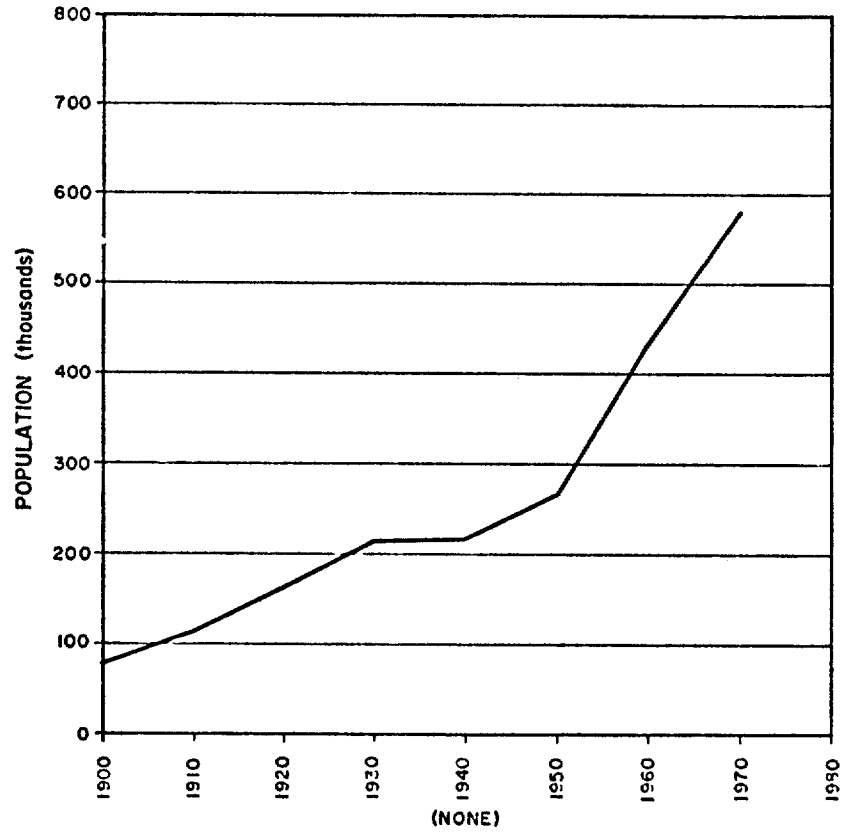

BURLINGTON COUNTY, NJ
POPULATION (thousands)
800
700
600
500
400
300
200
100
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
DONNA
2
*3
*3

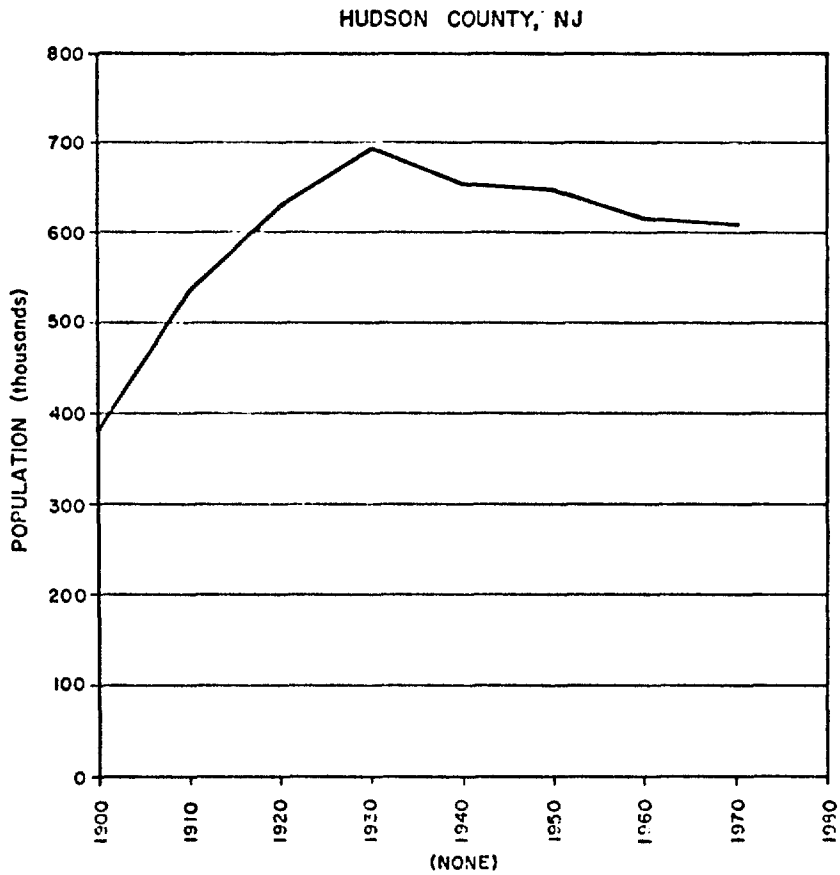

OCEAN COUNTY, NJ
POPULATION (thousands)
800
700
600
500
400
300
200
100
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
1
2
*3
*3

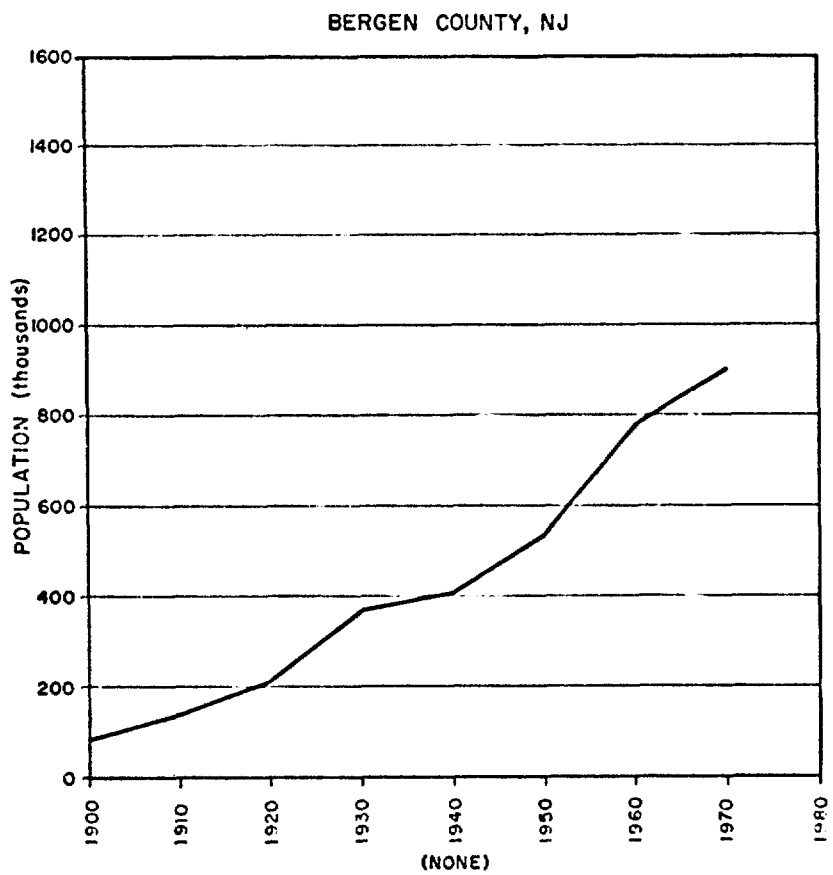
MONMOUTH COUNTY, NJ

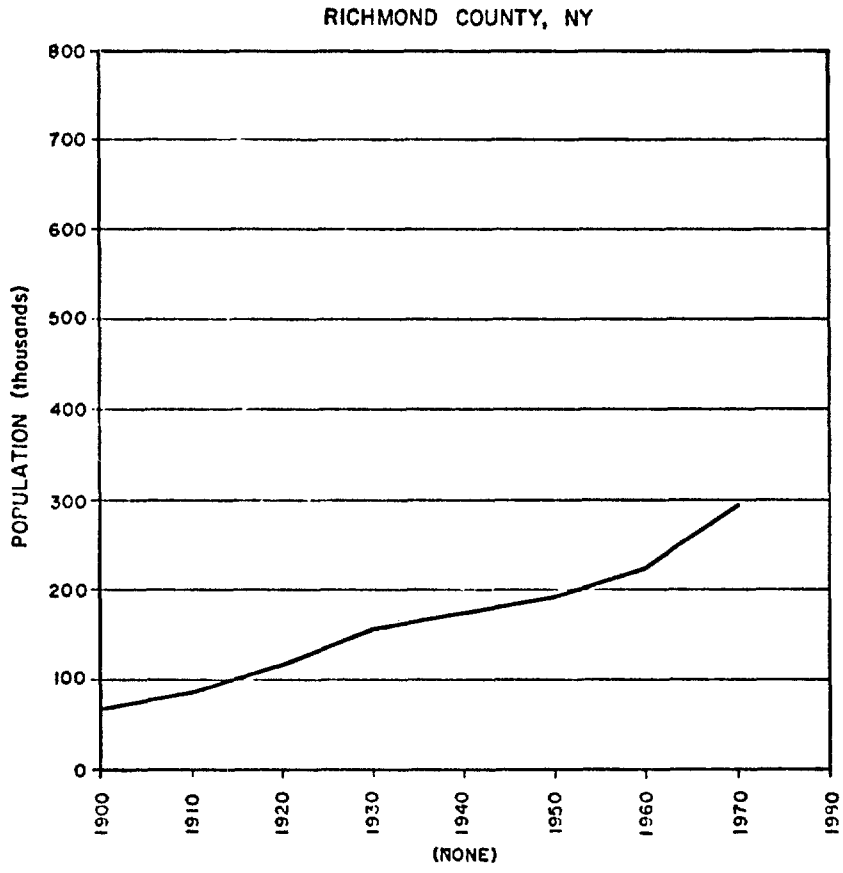


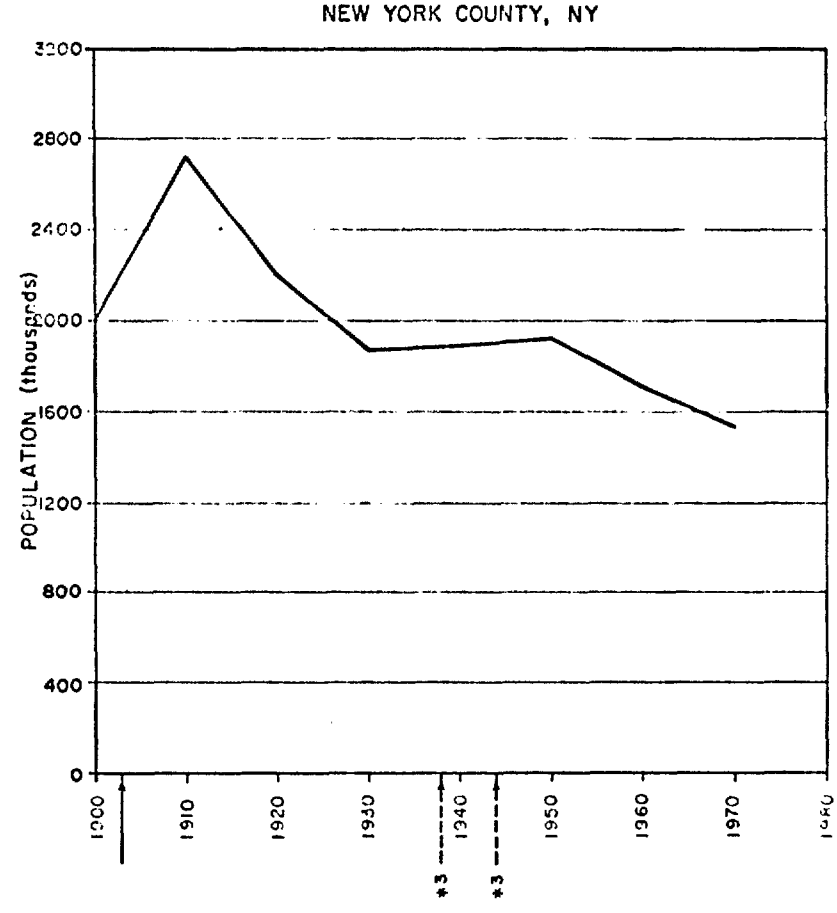
MIDDLESEX COUNTY, NJ



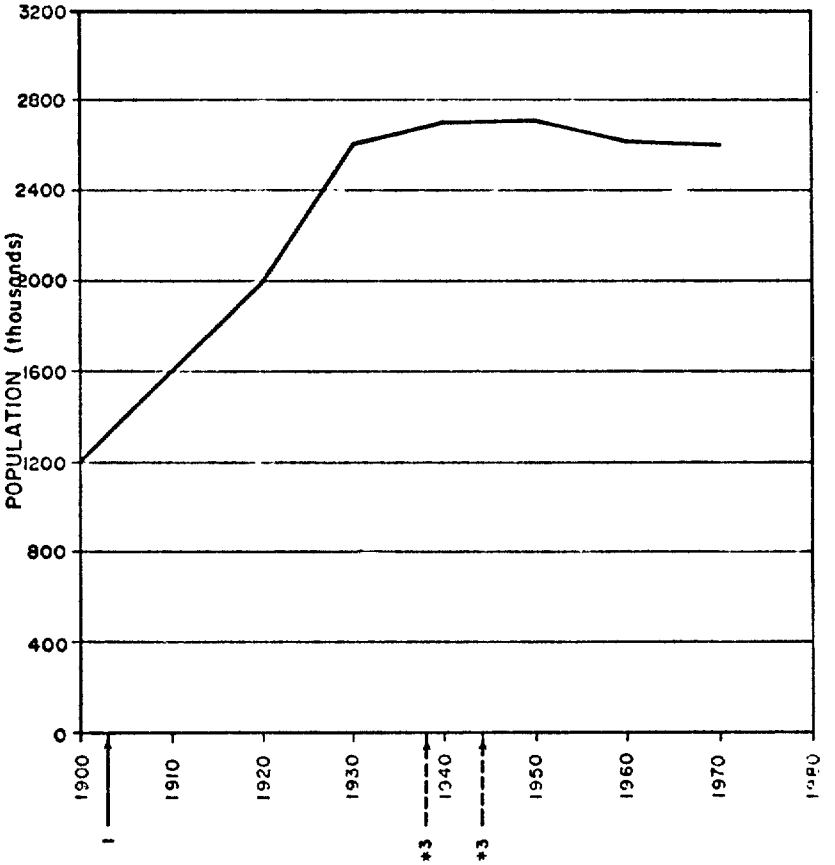

HUDSON COUNTY, NJ
POPULATION (thousands)
800
700
600
500
400
300
200
100
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
(NONE)


BERGEN COUNTY, NJ
POPULATION (thousands)
1600
1400
1200
1000
800
600
400
200
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
(NONE)

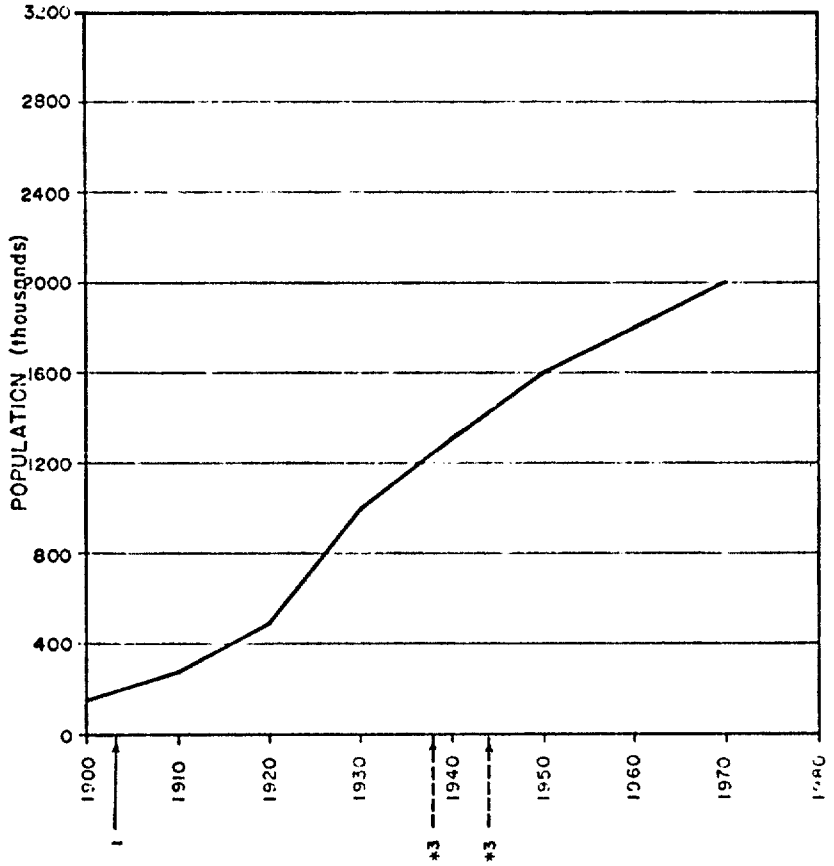

RICHMOND COUNTY, NY
POPULATION (thousands)
800
700
600
500
400
300
200
100
0
1900
1910
1920
1930
1940
1950
1960
1970
1990
(NONE)


NEW YORK COUNTY, NY
POPULATION (thousands)
2800
2400
1600
1200
800
400
0
1900
1910
1920
1930
1940
1950
1960
1970
#3
#3

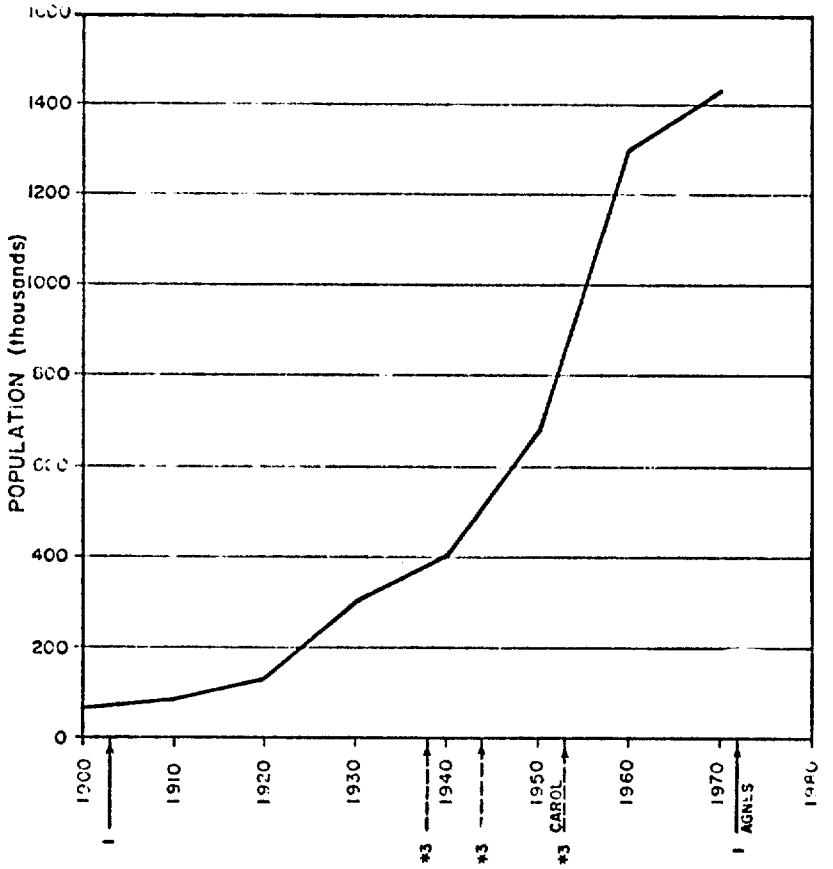
KINGS COUNTY, NY



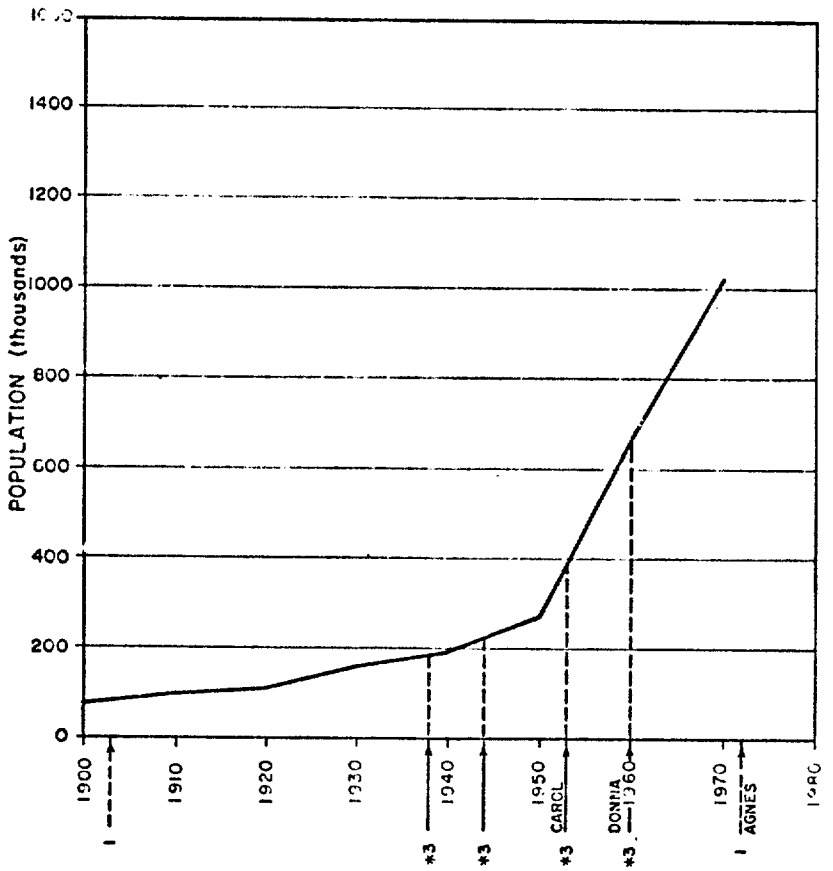
QUEENS COUNTY, NY

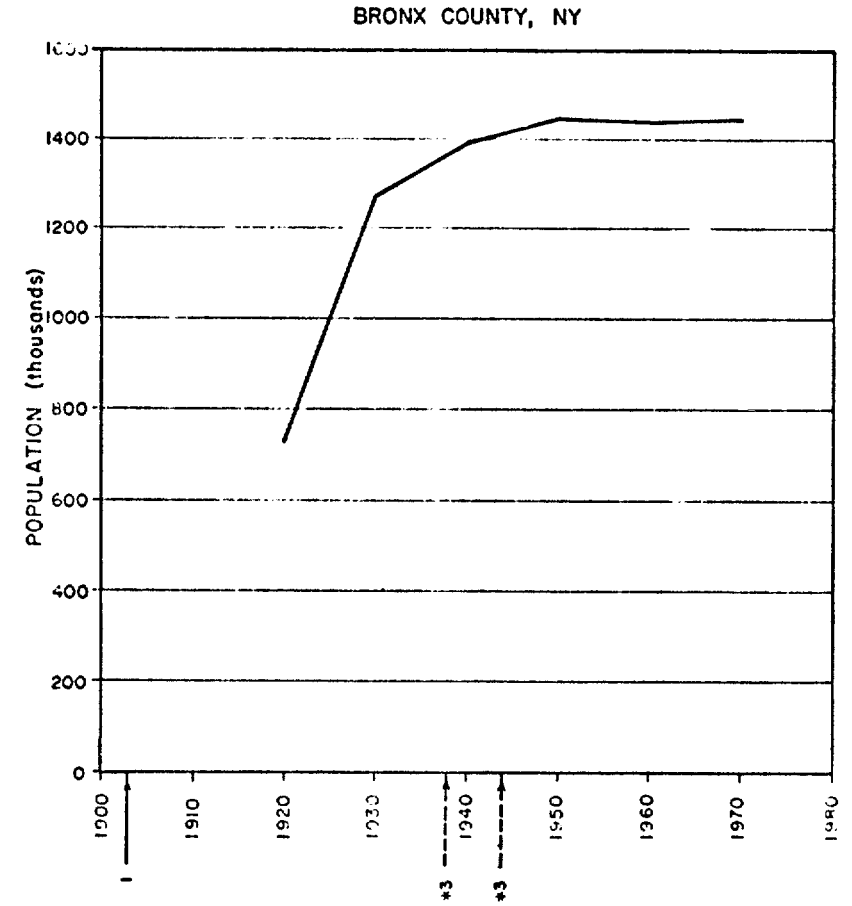


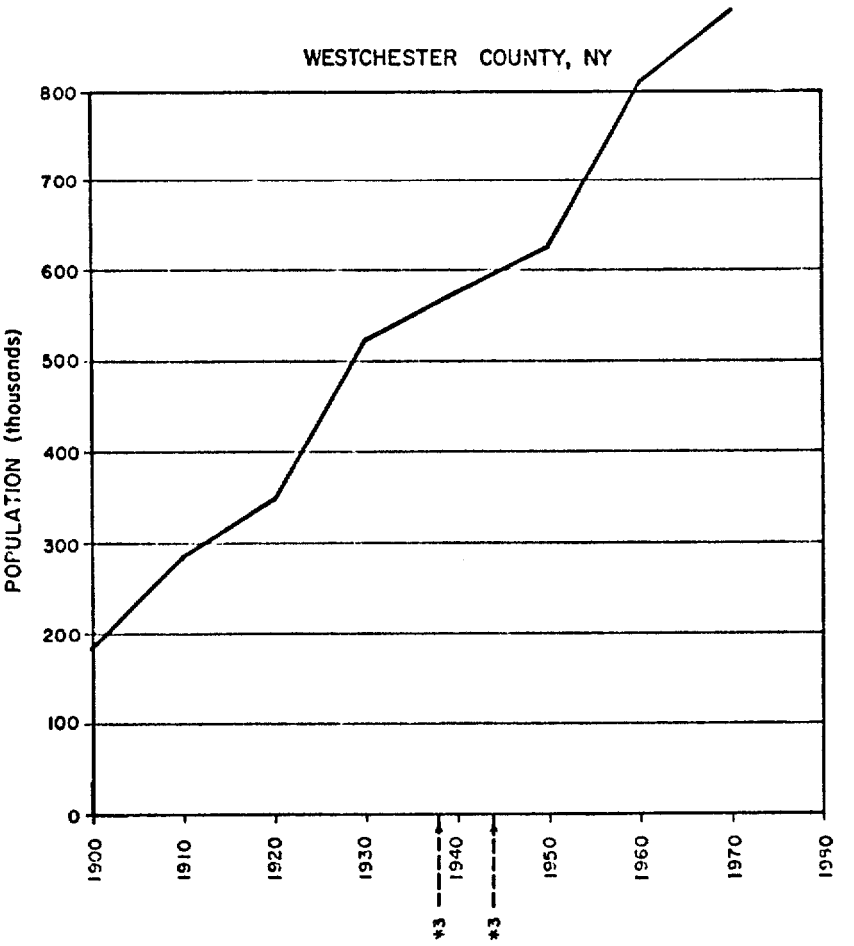
NASSAU COUNTY, NY



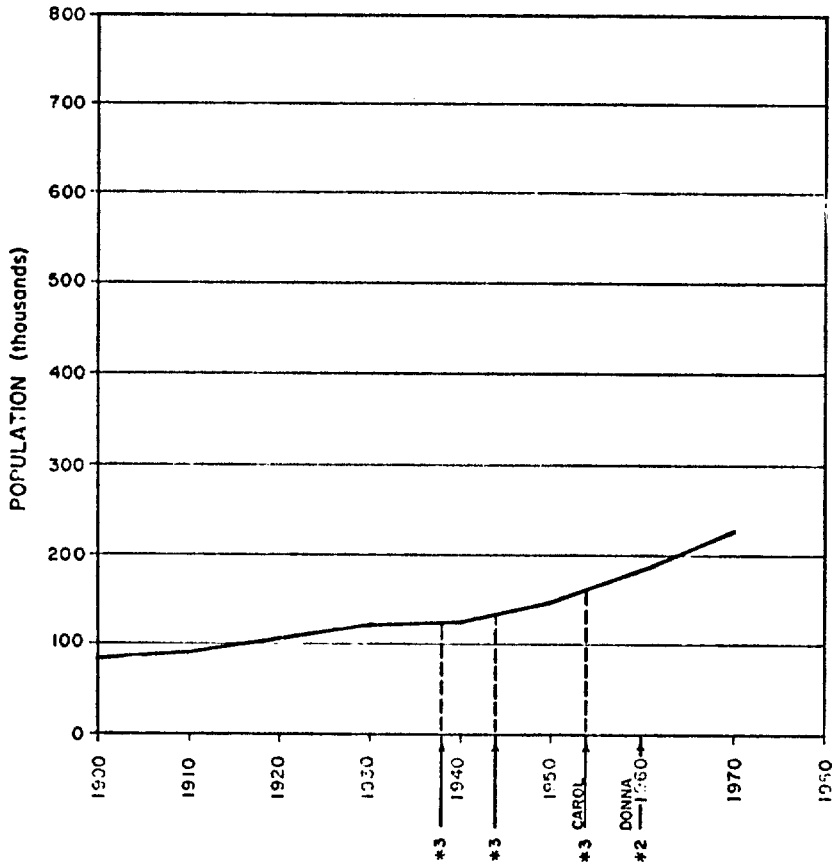
SUFFOLK COUNTY, NY



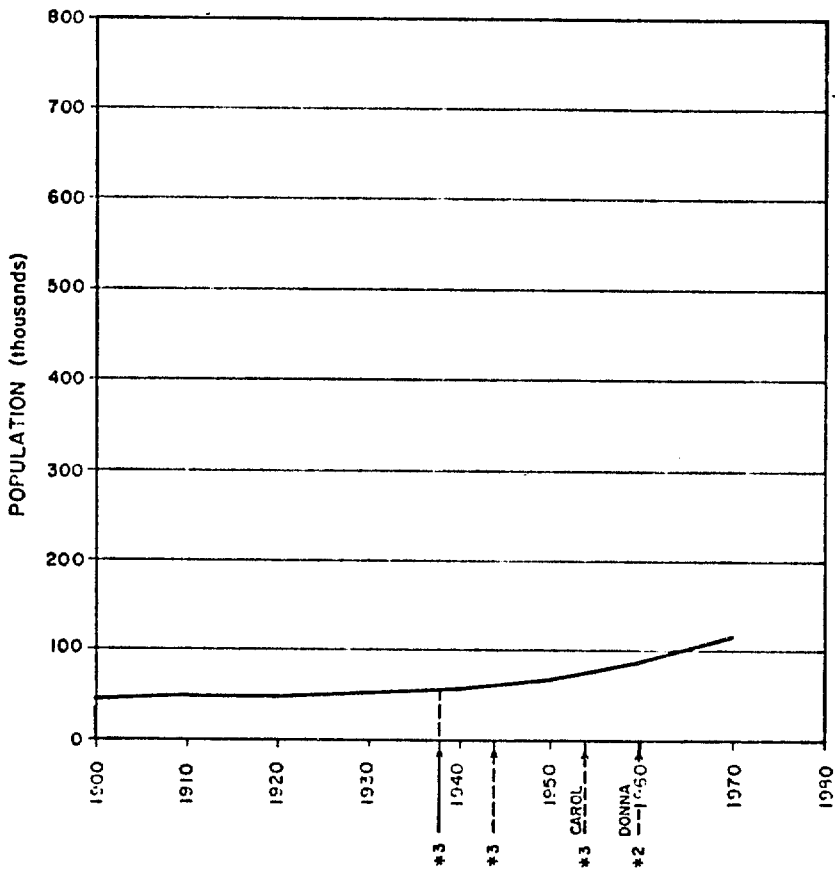

BRONX COUNTY, NY
POPULATION (thousands)
1600
1400
1200
1000
800
600
400
200
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
1
*3
*3

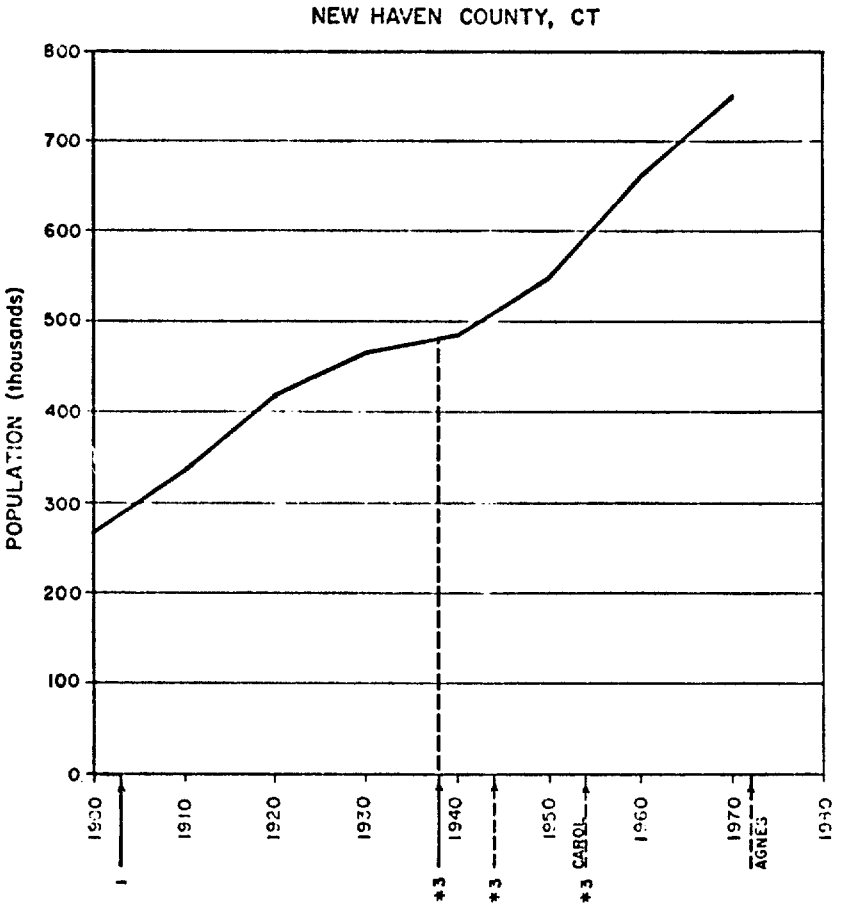

WESTCHESTER COUNTY, NY
POPULATION (thousands)
800
700
600
500
400
300
200
100
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
*3
*3

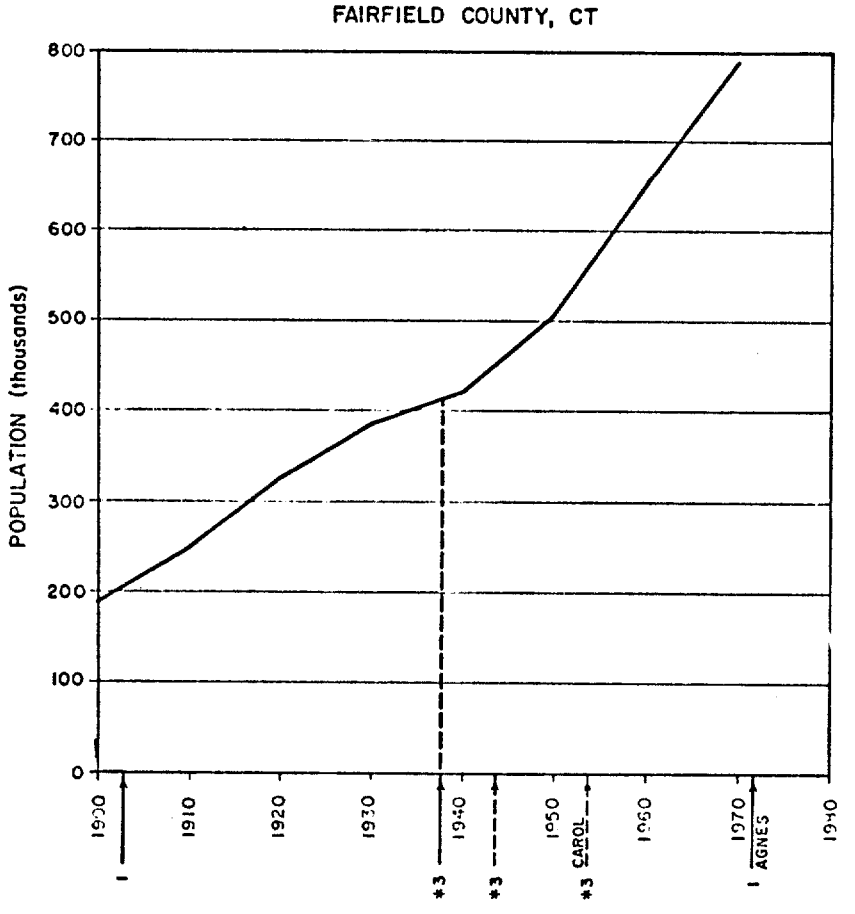
NEW LONDON COUNTY, CT



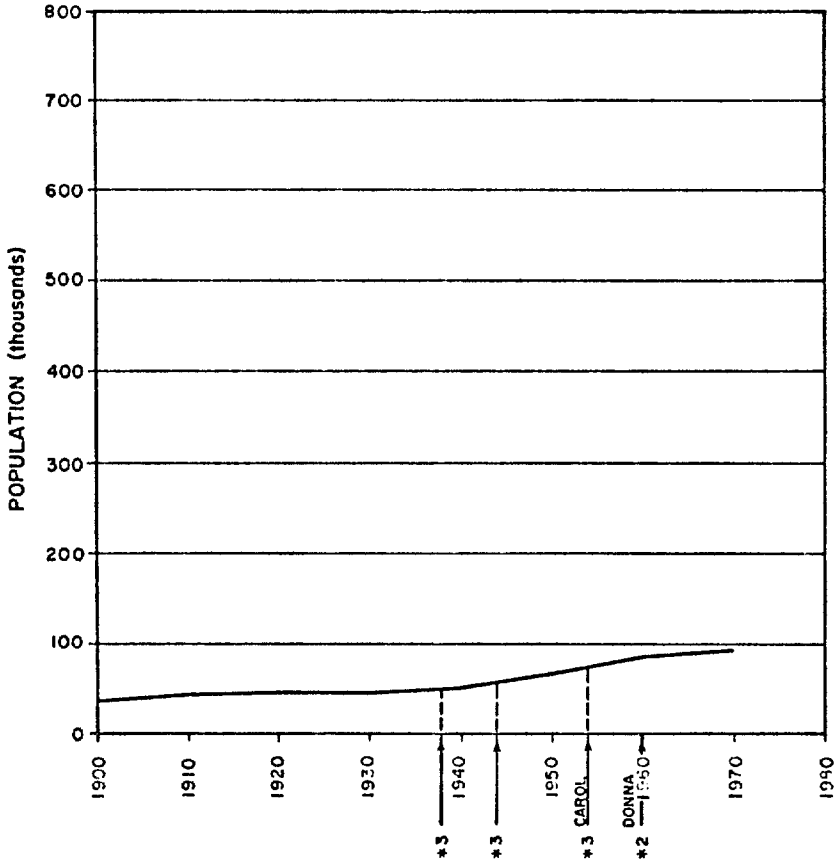
MIDDLESEX COUNTY, CT



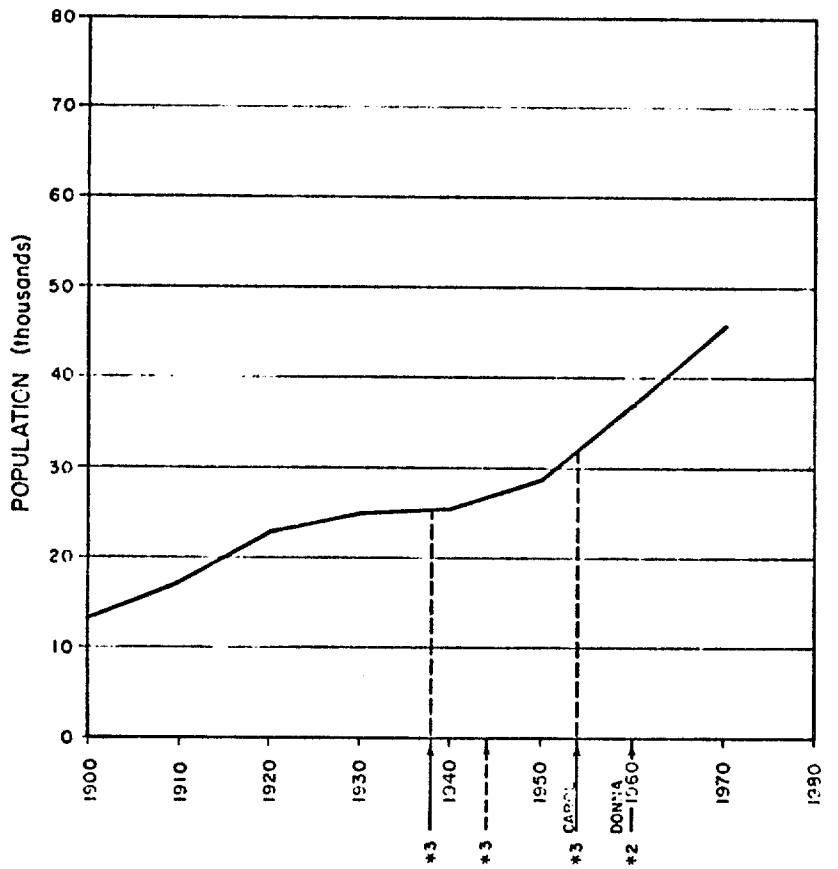

NEW HAVEN COUNTY, CT
POPULATION (thousands)
800
700
600
500
400
300
200
100
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
1
*3
*3
*3 CAROL
AGNES

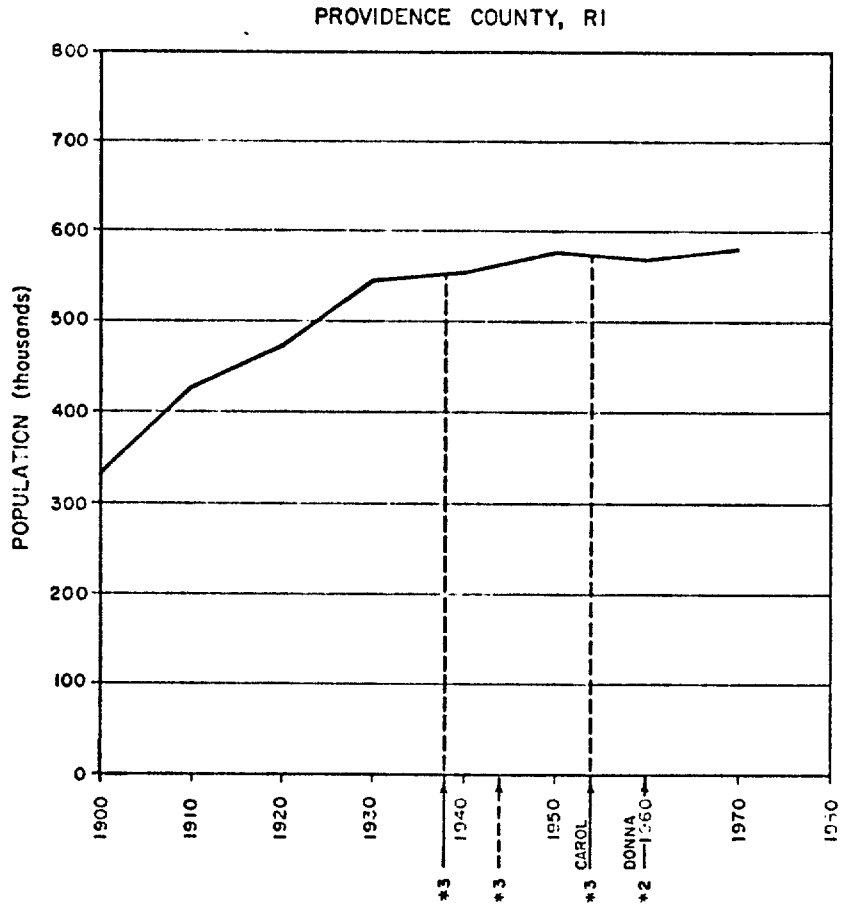

FAIRFIELD COUNTY, CT
POPULATION (thousands)
800
700
600
500
400
300
200
100
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
1
*3
*3
*3 CAROL
1 AGNES

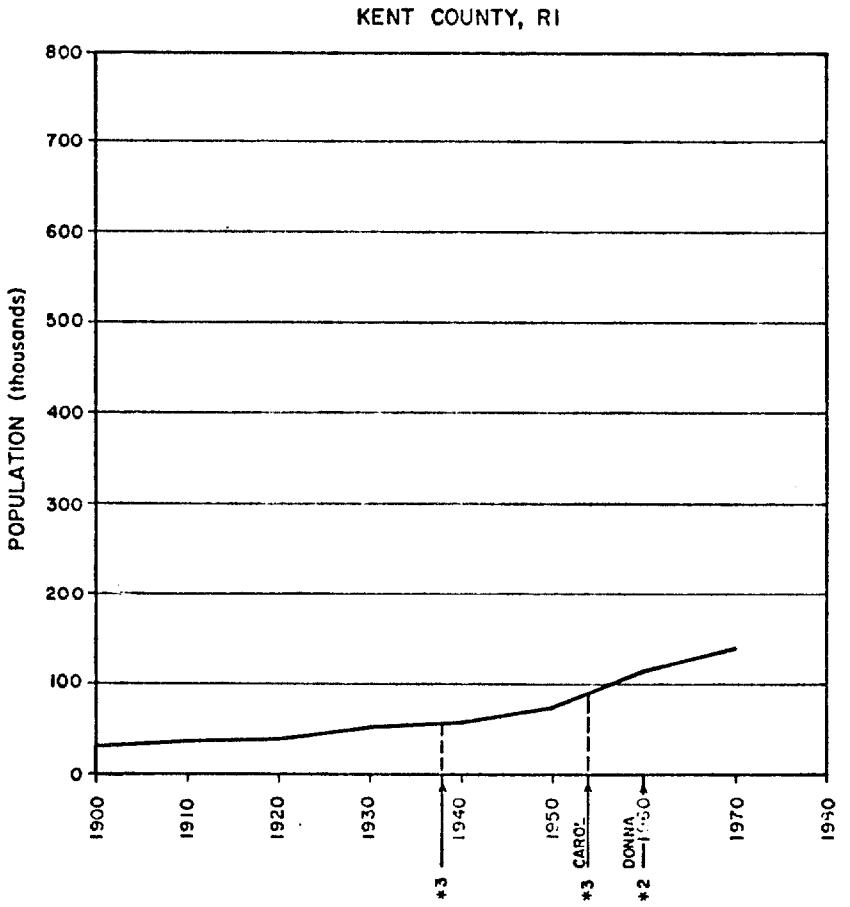
NEWPORT COUNTY, RI

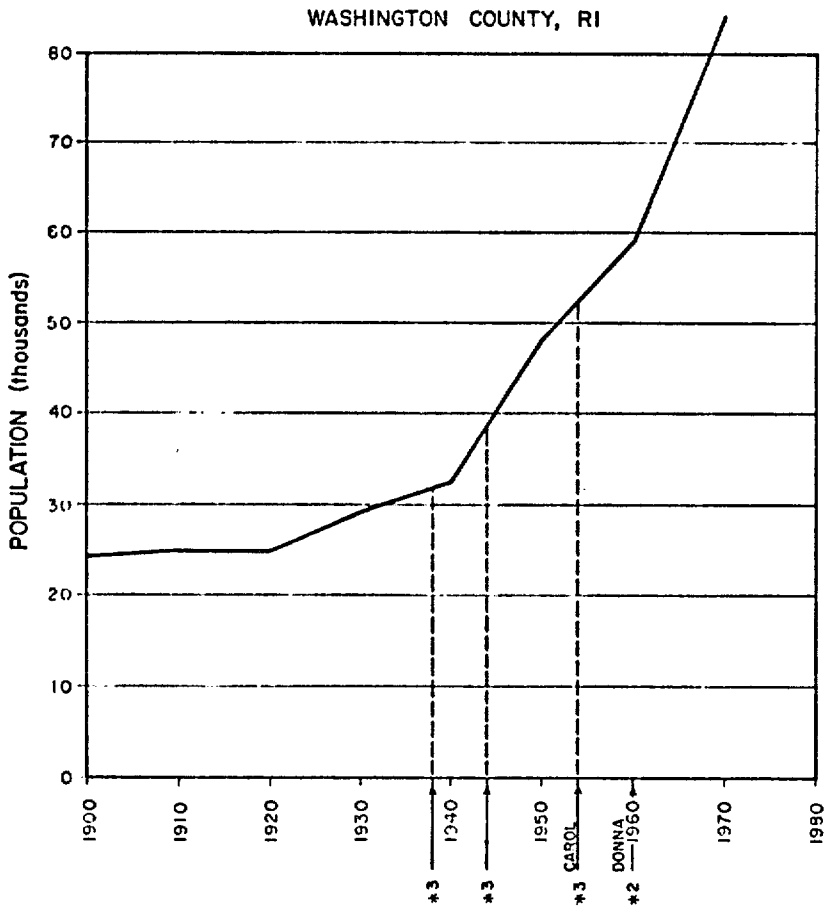


BRISTOL COUNTY, RI

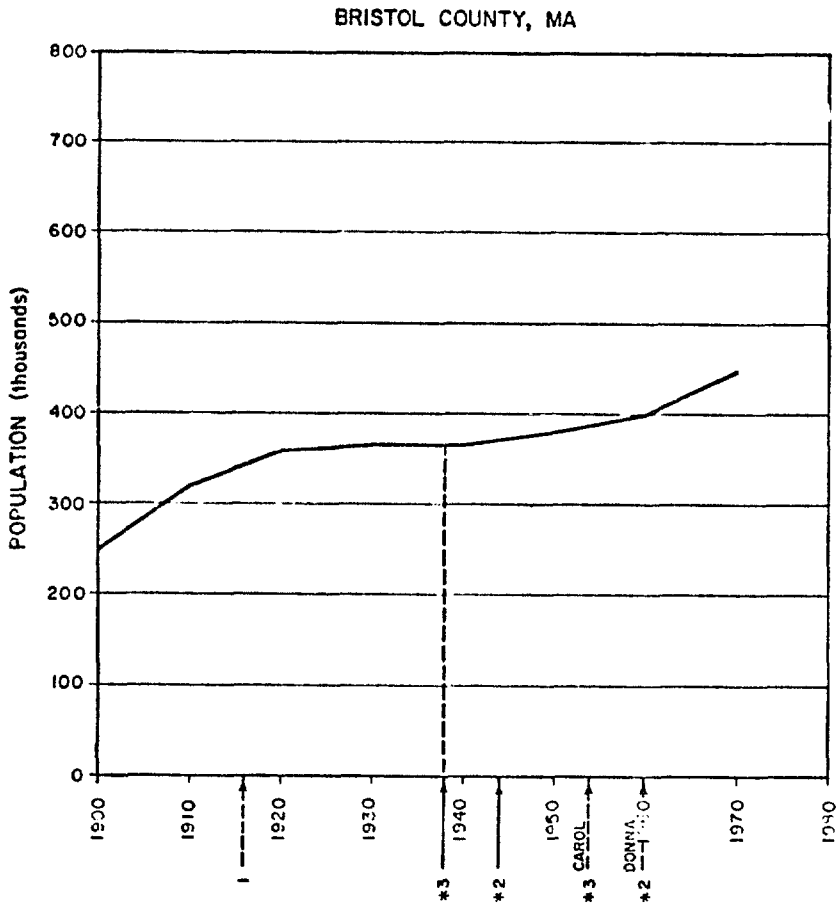


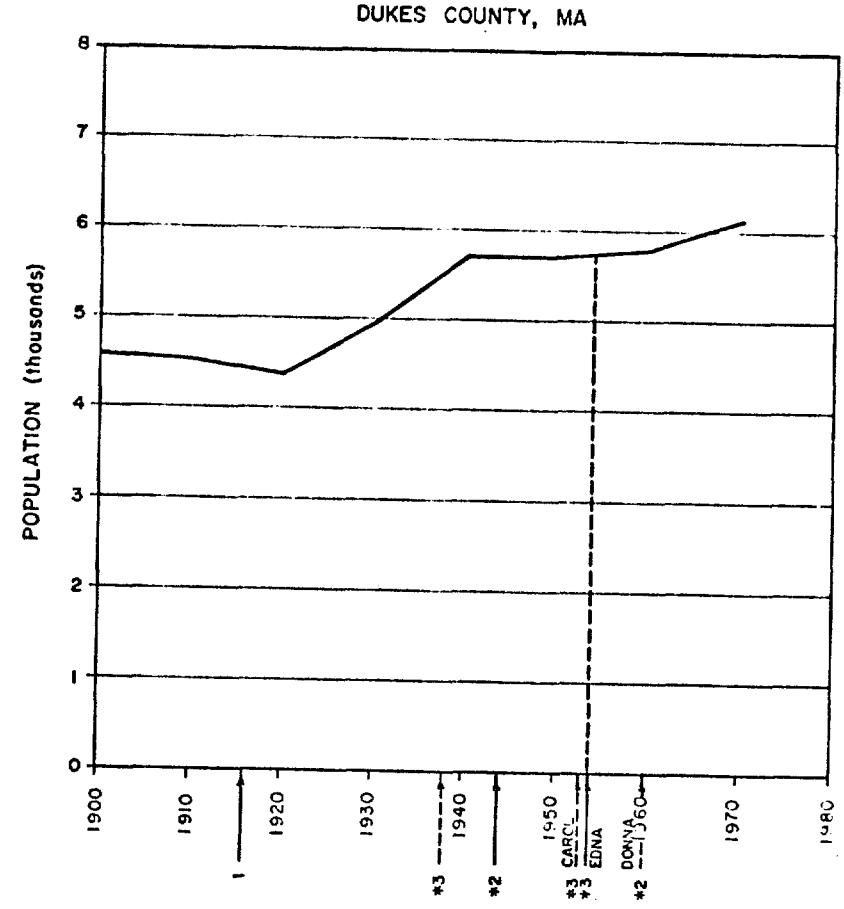

PROVIDENCE COUNTY, RI
POPULATION (thousands)
800
700
600
500
400
300
200
100
0
1900
1910
1920
1930
1940
1950
1970
*3
*3
*3
CAROL
DONNA
*2

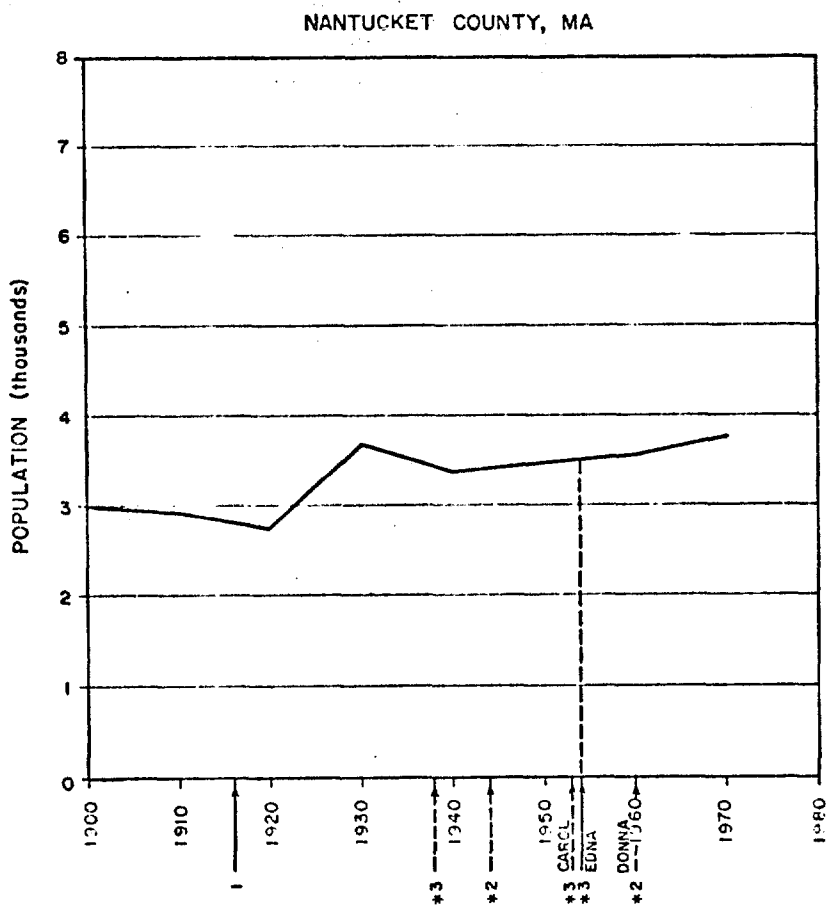

KENT COUNTY, RI
POPULATION (thousands)
800
700
600
500
400
300
200
100
0
1900
1910
1920
1930
1940
1950
1970
*3
*3
CAROL
*2

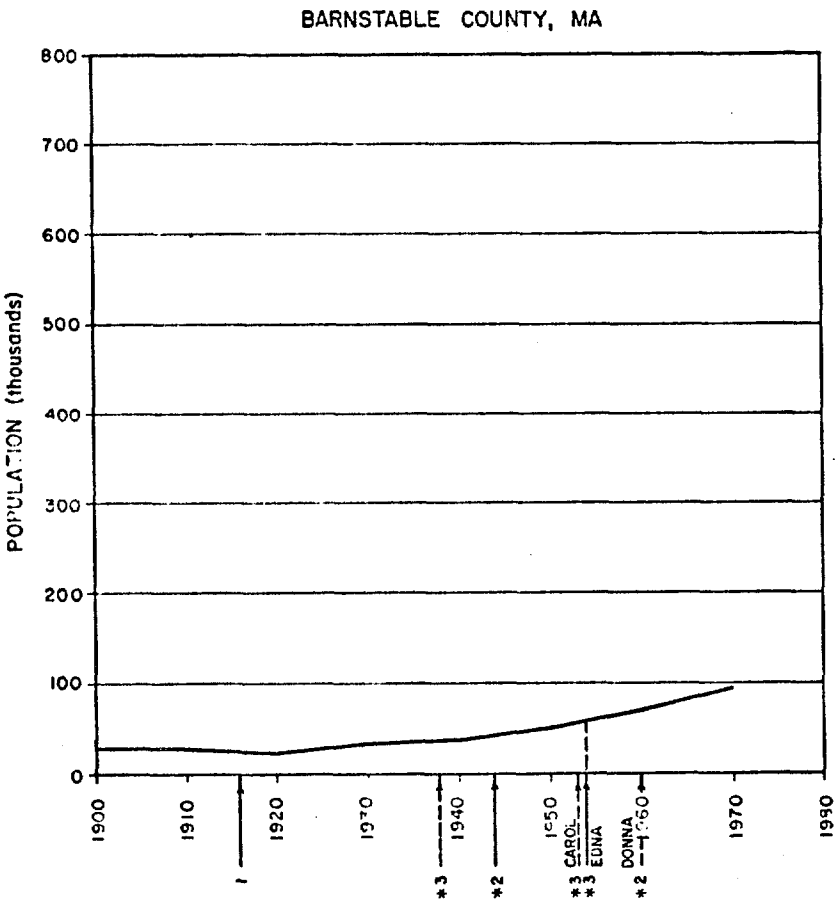


END OF RHODE ISLAND COUNTIES

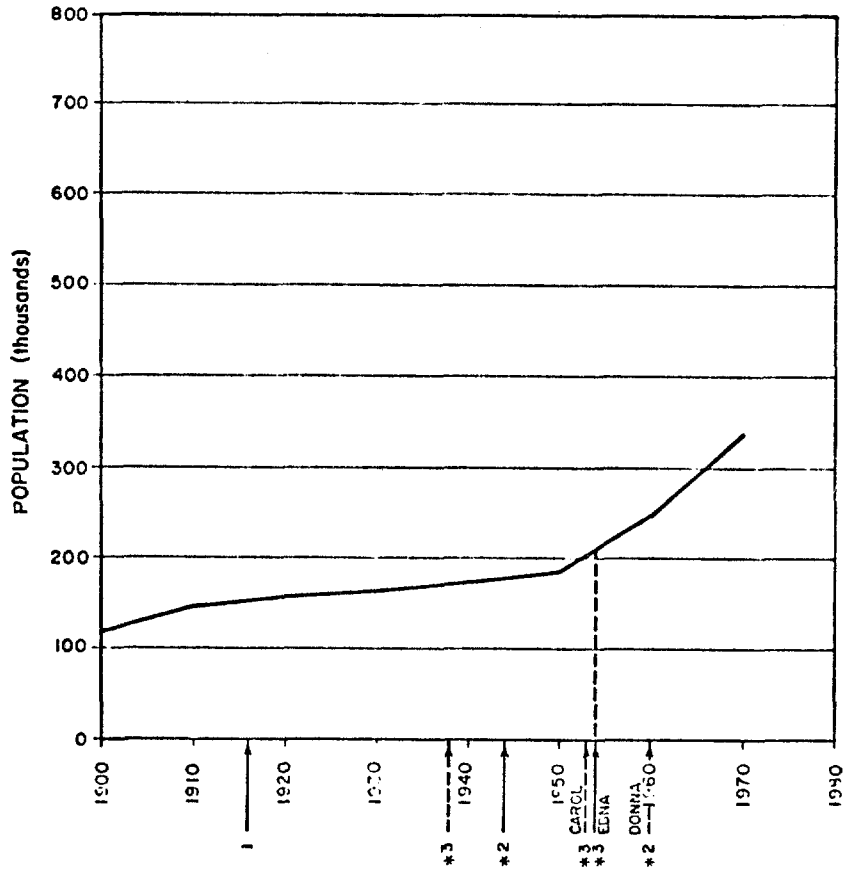

BRISTOL COUNTY, MA
POPULATION (thousands)
800
700
600
500
400
300
200
100
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
1
*3
*2
*3
CAROL
*2
DONNA


DUKES COUNTY, MA
POPULATION (thousands)
8
7
6
5
4
3
2
1
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
1
*3
*2
*3
CAROL
EDNA
*2
DONNA

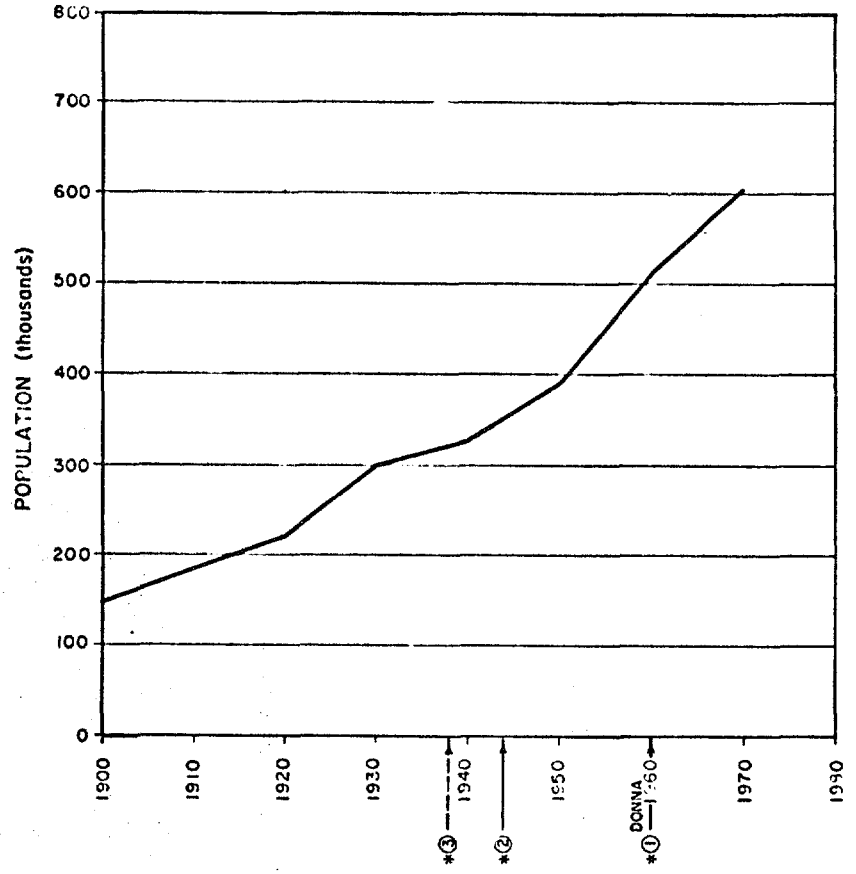

NANTUCKET COUNTY, MA
POPULATION (thousands)
8
7
6
5
4
3
2
1
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
1
*3
*2
CAROL
*3
EDNA
DONNA
*2

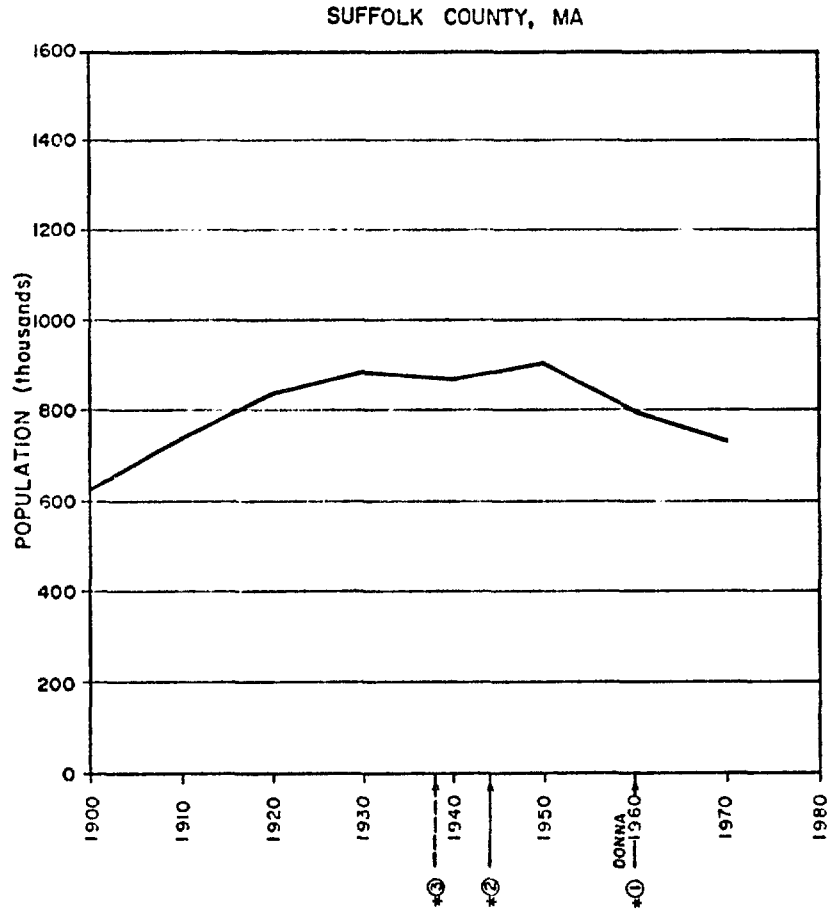

BARNSTABLE COUNTY, MA
POPULATION (thousands)
800
700
600
500
400
300
200
100
0
1900
1910
1920
1930
1940
1950
1960
1970
1990
1
*3
*2
CAROL
*3
EDNA
DONNA
*2

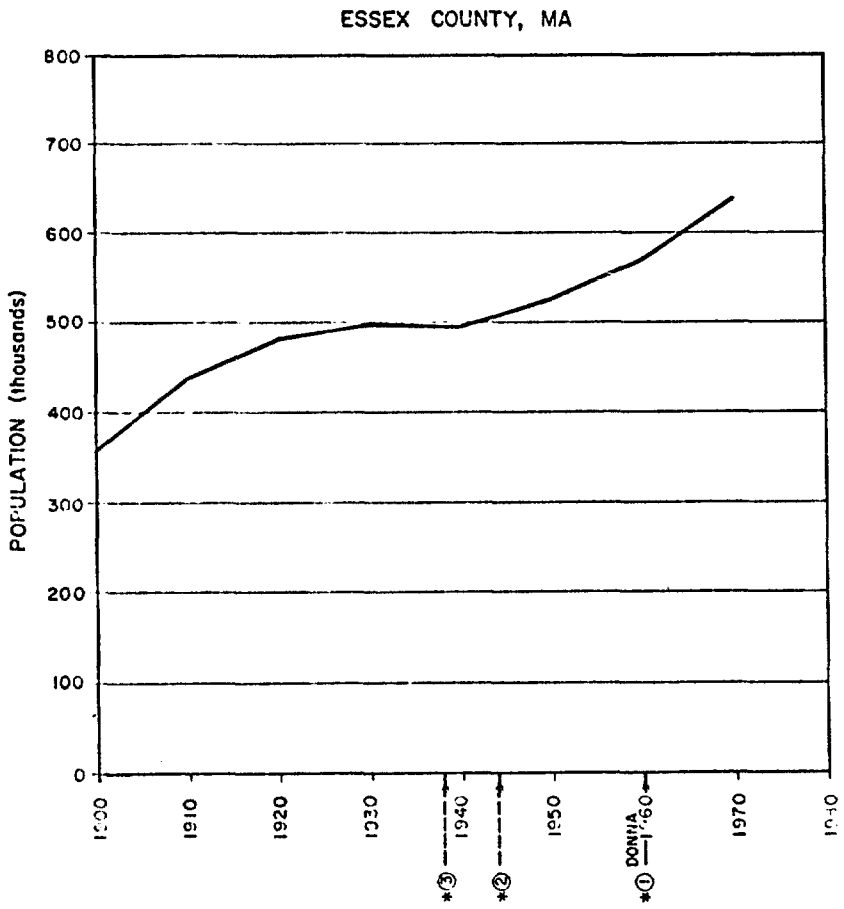
PLYMOUTH COUNTY, MA

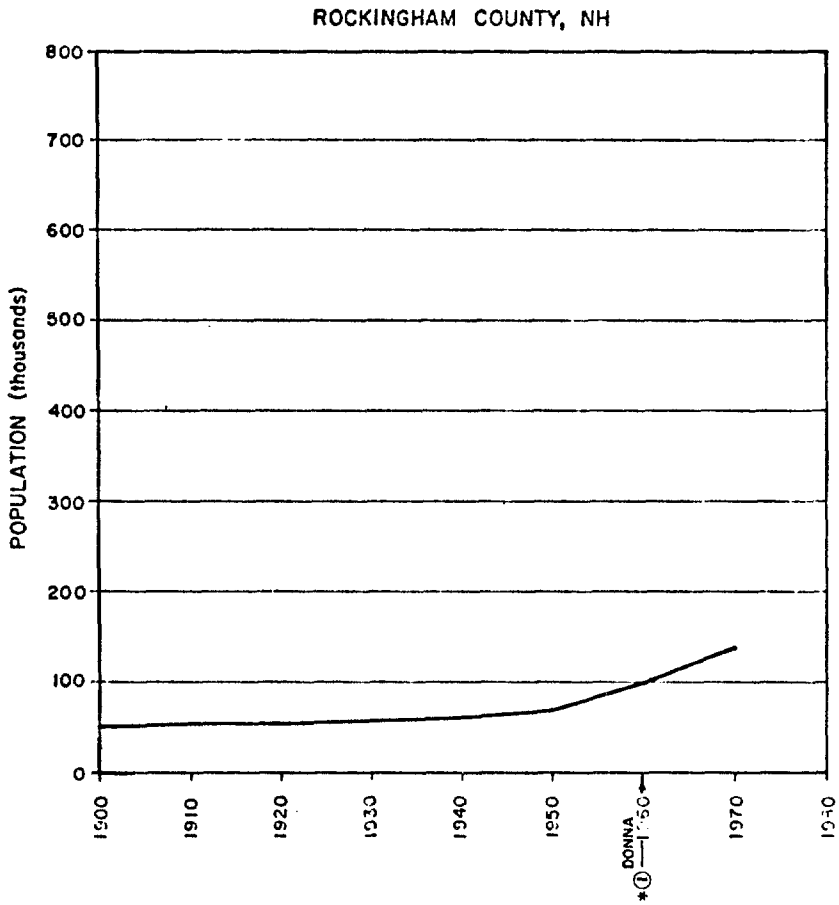


NORFOLK COUNTY, MA



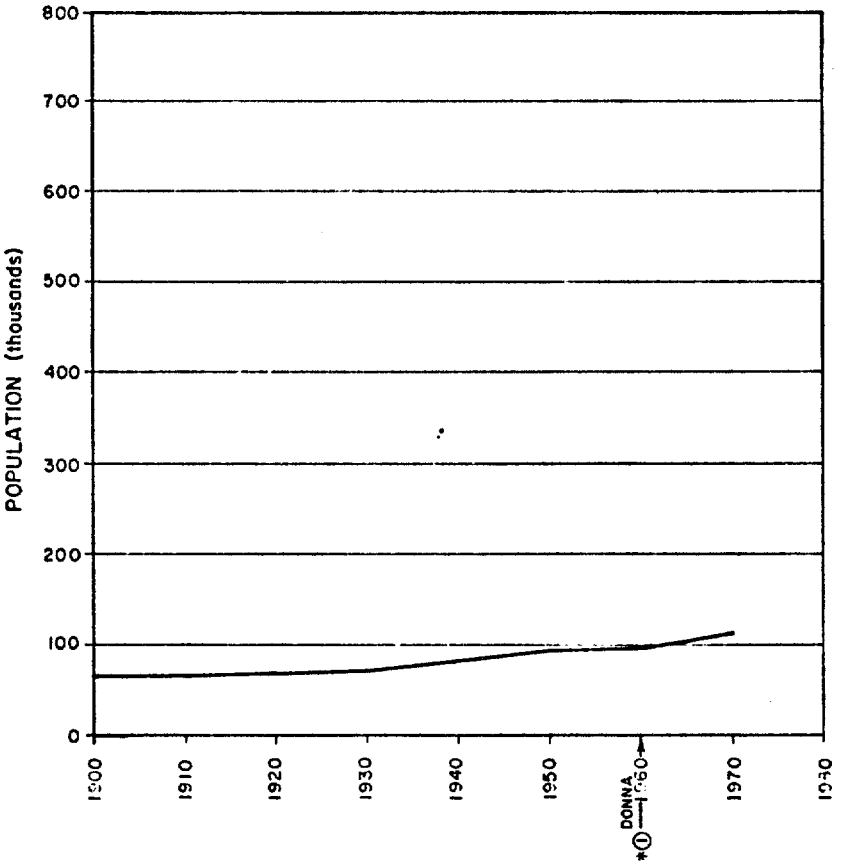

SUFFOLK COUNTY, MA
POPULATION (thousands)
1600
1400
1200
1000
800
600
400
200
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
DONNA
③
②
①


ESSEX COUNTY, MA
POPULATION (thousands)
800
700
600
500
400
300
200
100
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
DONNA
③
②
①

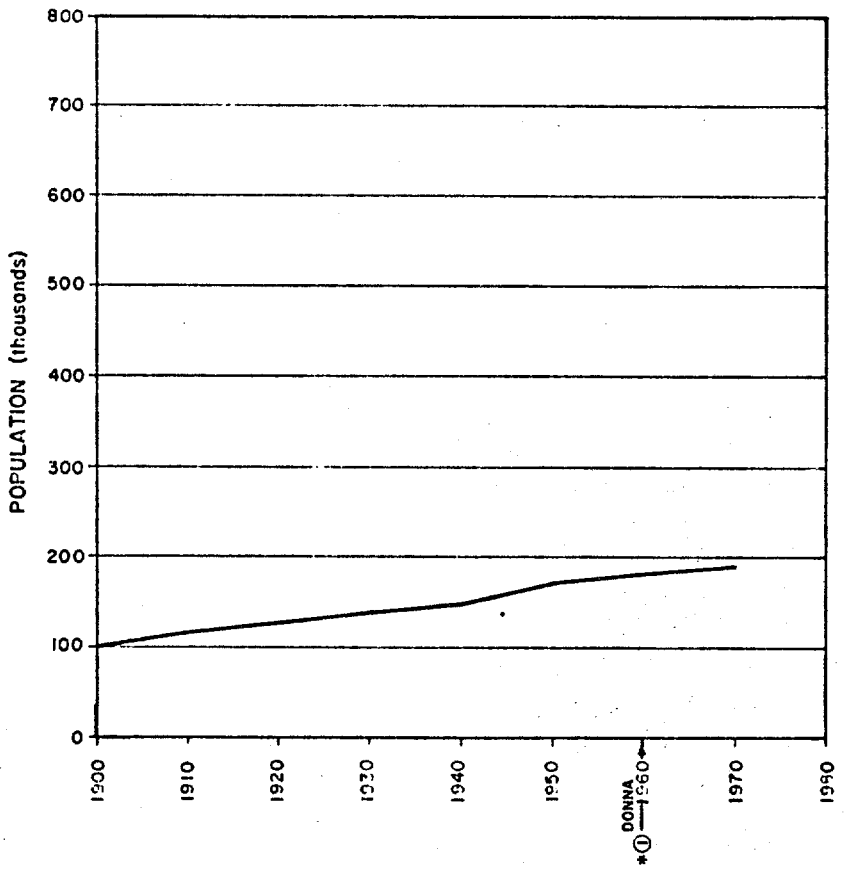


END OF NEW HAMPSHIRE COUNTIES

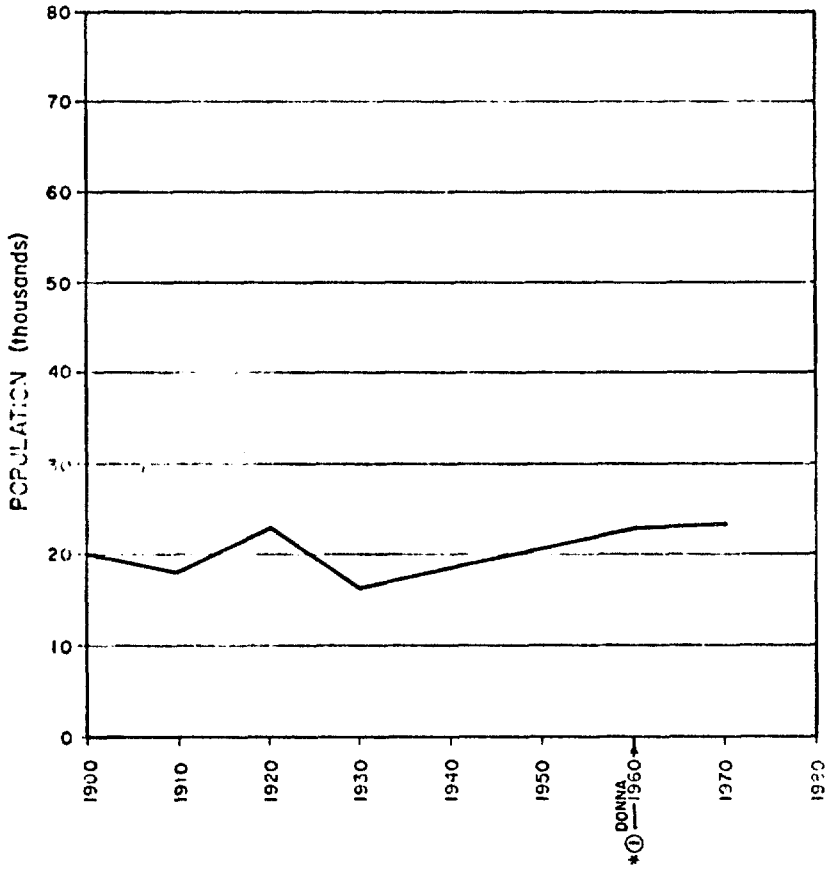
YORK COUNTY, ME



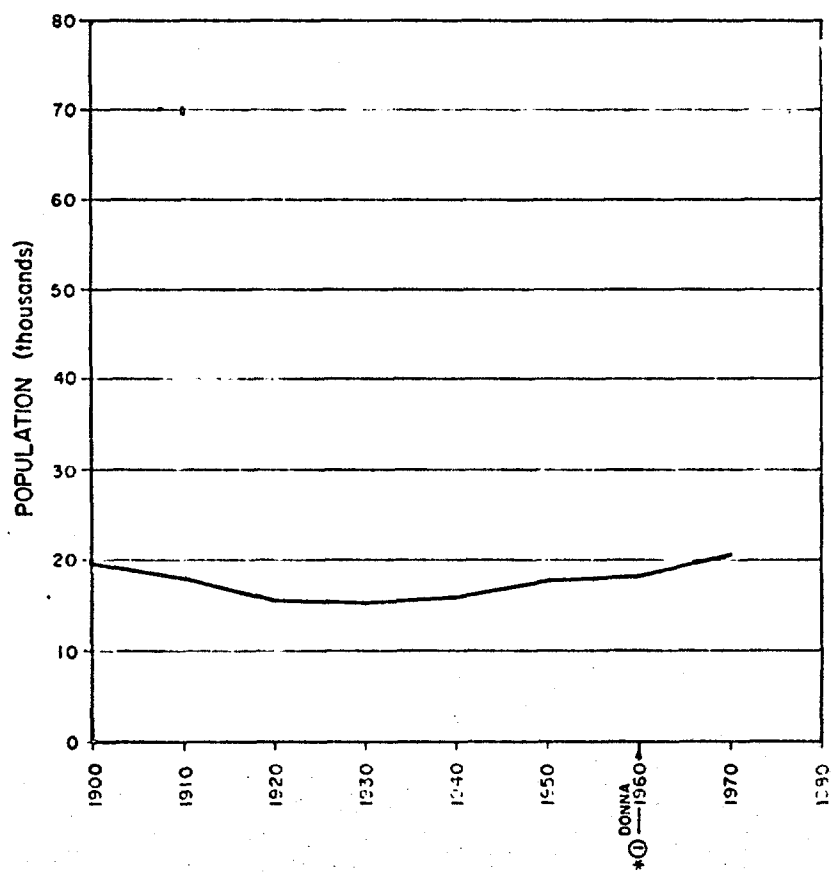
CUMBERLAND COUNTY, ME



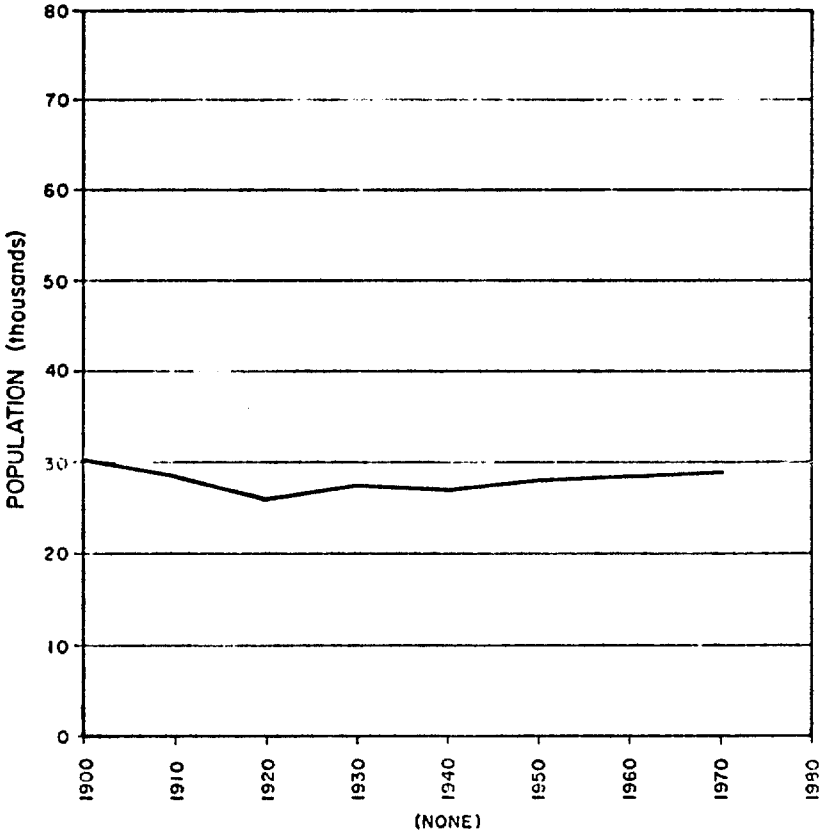
SAGADAHOC COUNTY, ME



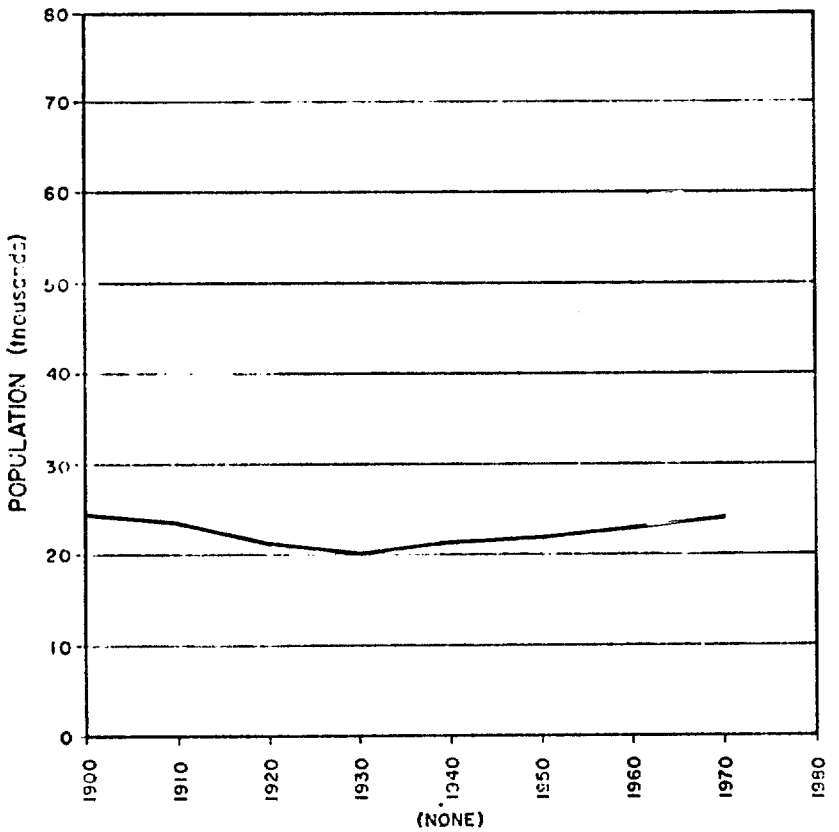
LINCOLN COUNTY, ME



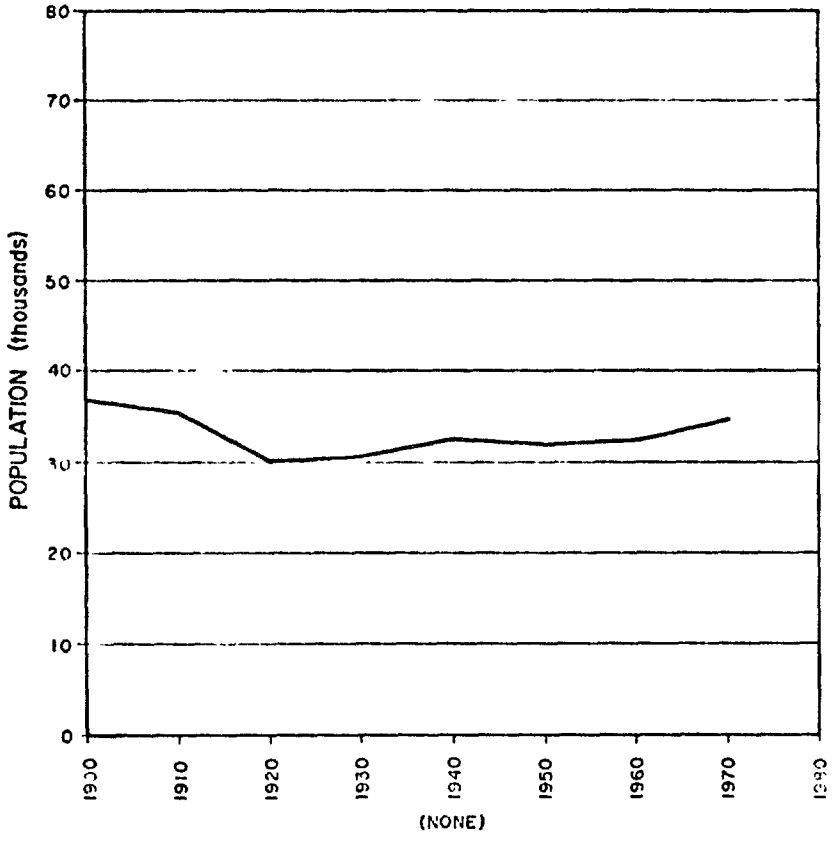
KNOX COUNTY, ME



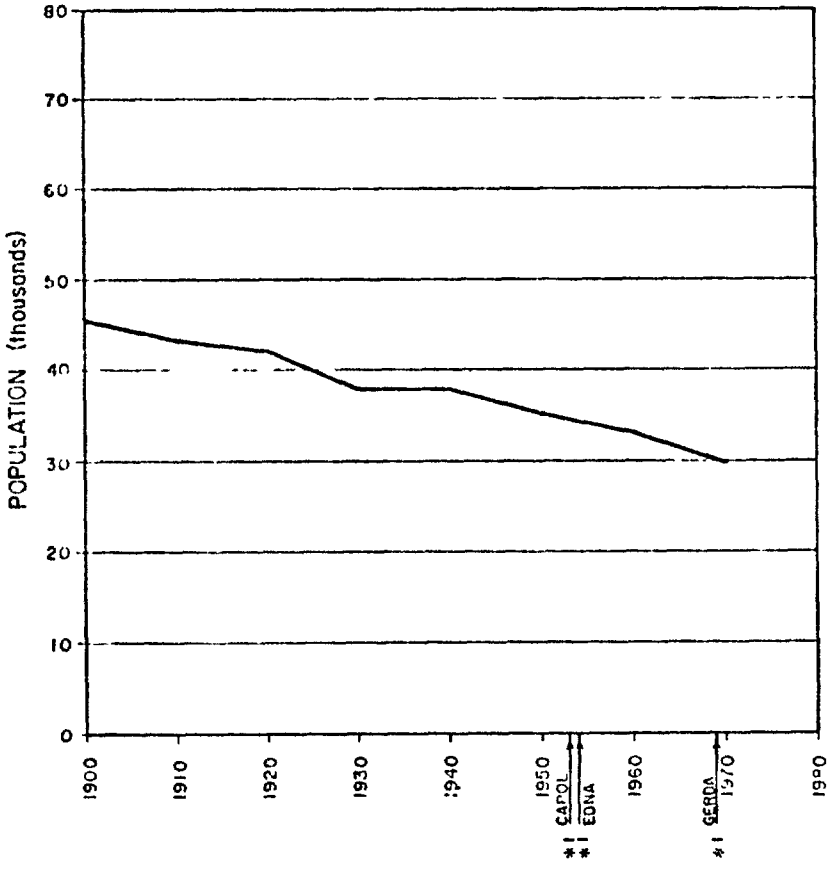
WALDO COUNTY, ME



HANCOCK COUNTY, ME



WASHINGTON COUNTY, ME



APPENDIX C

A TABULAR HURRICANE CLIMATOLOGY BY COUNTIES, TEXAS TO MAINE, 1900-1974

This climatology is a convenient reference for the hurricane history of individual coastal counties as well as for states. It is apparent at a glance when any particular county was last affected by a hurricane. Also, it can be determined whether a hurricane was large or small by the number of counties affected. The severity of a hurricane, of course, is indicated by its Saffir/Simpson Scale Number classification. Another useful feature of these tables is that the time between hurricane occurrences is readily apparent both for counties and states.

One point to keep in mind is that while some areas have not experienced a major hurricane during this century, severe hurricanes have been recorded prior to 1900. Examples of this include Savannah, New York City and Panama City, as indicated below:

Savannah: It is obvious at a glance that the Georgia coast has had very few direct hits in this century. However, Savannah was devastated by a severe hurricane (possibly a category 4) in 1893.

Panama City: Climatology indicates that Bay County, Florida (which includes Panama City), as well as six adjacent counties, has not received a direct hit by a major hurricane in this century. Here again, records indicate that severe hurricanes have affected that area prior to 1900. Excluding earlier hurricanes, such as in 1856, which probably moved inland very close to Panama City, four hurricanes moved to within 50 miles of Panama City during the 12-year period 1887-1898. One, in 1894, had winds of 120 mph - a Category 3. A total of nine hurricanes moved to within 100 miles of Panama City during the 13-year period 1886-1898.

New York City: Early records indicate that a major hurricane affected the New York City area in 1821. This hurricane possibly was as severe as the New England hurricane of 1938. However, New York City has not received a direct hit by a major hurricane during the 20th century. In fact, records indicate that the 1821 hurricane is the only major hurricane whose center passed over a part of New York City in the last 200 years.

The main point to be illustrated by the above examples of hurricanes prior to 1900 is that no particular area along the Gulf or Atlantic coast of the United States is immune to direct hits by major hurricanes, regardless of how the climatology appears to have been in recent years.

As indicated in Appendix B, dual symbols were necessary in illustrating the hurricane climatology. Arrows were used with the graphs in Appendix B, while arrows were not appropriate in a tabular presentation such as in this appendix. The key for symbols (non-arrows) is repeated below along with examples of Saffir/Simpson Scale Numbers as used in this appendix.

Key for Symbols

Plain Number - Direct Hit

( ) - Indirect Hit

__ - Exiting or Inland

* - Forward Speed 30 mph or Greater

Examples

1 - Direct Hit by a Category 1 Hurricane

(1) - Indirect Hit (or fringe hit) by a Category 1 Hurricane

2 - Direct Hit by an Inland or Exiting (moving from land to water) Category 2 Hurricane

3* - Direct Hit by a Category 3 Hurricane moving 30 mph or more

(3*) - Indirect Hit by an exiting Category 3 Hurricane moving 30 mph or more

3,2 - Direct Hits by a Category 3 and a Category 2 Hurricane in the same year, with the Category 3 Hurricane occurring first

(3,1,3) - Indirect Hits by Categories 3, 1 and 3 Hurricanes in the same year. Occurrences were in the order listed.

E4 - Direct Hit by a Category 4 Hurricane in the eastern part of Monroe County, Florida. (See example in Appendix B)

This page intentionally left
blank and unnumbered.

YEAR	TEXAS																	LA.									MISS.			ALA.			FLA. (N.W.)	
	CAMERON	WILLACY	KENEDY	KLEBERG	NUECES	SAN PATRICIO	ARANSAS	REFUGIO	CALHOUN	JACKSON	MATAGORDA	BRAZORIA	GALVESTON	HARRIS	CHAMBERS	JEFFERSON	ORANGE	CAMERON	VERMILION	IBERIA	ST. MARY	TERREBONNE	LAFOURCHE	JEFFERSON	PLAQUEMINES	ST. BERNARD	ORLEANS	ST. TAMMANY	HANCOCK	HARRISON	JACKSON	MOBILE	BALDWIN	ESCAMBIA	SANTA ROSA	OKALOOSA	WALTON	BAY
1900											4	4	4	4																							
1901																							2	2	(2)	(2)			2	2	2	(2)					
1902																																					
1903																																					1
1904																																					
1905																																					
1906																													(3)	3		3	(3)		(3)			
1907																																					
1908																																					
1909	2	(2)	(2)								3	3	3	(3)	(3)							4	4	4	4	4	4		(4)	(4)	(4)							
1910	(2)	(2)	2	2	(2)	(2)																															
1911																																					
1912			(1)	1	1	1	1	1																								1		1	(1)		
1913			1	1	1	1	(1)	(1)																													
1914																																					
1915											(4)	4	4	4	4	(4)	(4)					4	4	4	4	4	4		(4)	(4)	(4)							1
1916		(3)	3	3	3	(3)																								(3)	3	3,2	(3),2	(3),2	2	2	(2)	
1917																																(3)	(3)	3	3	3	3	(3)
1918																(3)	(3)	3	(3)																			
1919	(4)	(4)	4	4	4	4	4	4	(4)	(4)	(4)																										
1920																				(2)	2	(2)															
1921									2	2	2	(2)	(2)	(2)																							
1922																																					
1923																			1	1	(1)																
1924																																					1
1925																																					
1926																				3	3	3								(3)		3	3	3	(3)		
1927																																					
1928																																					
1929							(1)	(1)	1	1	1																										(1)	
1930																																					
1931																																					
1932											(4)	4	(4)	(4)																(1)		1	(1)					
1933	2,3	2,3	2,3																																		
1934					2	2	2	2	(2)											3	3	(3)															
1935																																					
1936				(1)	1	1	1	1	(1)																											3	3	
1937																																					
1938																		1	1																		
1939																																					
1940														(2)	2	2		2																	1	1	
1941								(3)	(3)	3	3	3	3	3	(3)	(3)																					
1942					(3)	(3)	3	3	3	3	(3)	1	1	1	(1)																						
1943											(2)	2	2	2	(2)																						
1944																																					
1945					2	2	2	2	2	2	2	(2)	(2)	(2)																							
1946																																					
1947												1	1	1	1								2	2	2	2	(2)		(2)	(2)	(2)						
1948																					1	1	1	1	1	1			(1)	(1)							
1949											2	2	2	2	2	(2)	(2)																				
1950																																(1)	1		(1)		
1951																																					
1952																																					
1953																																				(1)	1
1954																																					
1955																																					
1956																																					
1957															(4)	4		4	(4)					2											(1)	1	1	
1958																																					
1959											1	1	1	1																							
1960																																					
1961					(4)	(4)	4	4	4	4	4	4	(4)	(4)	(4)										(1)					1	1						
1962																																					
1963													1	(1)	1	1	(1)	(1)																			
1964																			(1)																		
1965																				(3)	3	3	3	3													
1966																						(3)	3	3	3	3	3	(3)		(3)	(3)						
1967	3	3	3	3	3	(3)	(3)	(3)																													
1968																																					
1969																																					
1970			(3)	(3)	3	3	3	3	(3)																				5	(5)	(5)	(5)	5	5	(5)			
1971			(1)	(1)	1	1	1	1	1	1	1	1	(1)						2	2	2	(2)															
1972																																					
1973																																					1
1974																																					
1975																			(3)	3	3	3	(3)	(3)													

YEAR	GA. CAMDEN	GLYNN	MCINTOSH	LIBERTY	BRYAN	CHATHAM	S.C. BEAUFORT	COLLETON	CHARLESTON	GEORGETOWN	HORRY
1900											
1901											
1902											
1903											
1904											
1905											
1906										(3)	3
1907											
1908											
1909											
1910											
1911						2	2	2	(2)		
1912											
1913											
1914											
1915											
1916									1	1	
1917											
1918											
1919											
1920											
1921											
1922											
1923											
1924											
1925											
1926											
1927											
1928	1	1	1	1	1	1	1	1	1	1	1
1929											
1930											
1931											
1932											
1933											
1934											
1935											
1936											
1937											
1938											
1939											
1940						2	2	(2)	(2)		
1941											
1942											
1943											
1944											
1945											
1946											
1947				(2)	2	2	2	(2)	(2)		
1948											
1949											
1950											
1951											
1952							1	1	1		
1953											
1954										(4*)	4*
1955											
1956											
1957											
1958											
1959							3	3	1,3	1,(3)	
1960											
1961											
1962											
1963											
1964	(2)										
1965											
1966											
1967											
1968											
1969											
1970											
1971											
1972											
1973											
1974											
1975											

YEAR	N.C. BRUNSWICK	NEW HANOVER	PENDER	ONSLOW	CARTERET	PAMLICO	BEAUFORT	HYDE	DARE	TYRRELL	WASHINGTON	BERTIE	CHOWAN	PERQUIMANS	PASQUOTANK	CAMDEN	CURRITUCK
1900																	
1901									1								1
1902																	
1903									(1)								
1904																	
1905																	
1906	3	(3)	(3)														
1907																	
1908					1	(1)	(1)	1	1	(1)							(1)
1909																	
1910																	
1911																	
1912																	
1913					1	1		1	1								
1914																	
1915																	
1916																	
1917																	
1918																	
1919																	
1920	1	1	(1)														
1921																	
1922																	
1923																	
1924									(2)								(2)
1925																	
1926																	
1927																	
1928																	
1929																	
1930																	
1931																	
1932																	
1933					3	(3)	(3)	(2),3	2,3	2,(3)	(2)		(2)	2	2	2	2,(3)
1934																	
1935																	
1936									2								(2)
1937																	
1938																	
1939																	
1940																	
1941																	
1942																	
1943																	
1944	1	1	1	(1)	(3*)			3*	3*	(3*)				(3*)	(3*)	3*	3*
1945																	
1946																	
1947																	
1948																	
1949								1	1								
1950																	
1951																	
1952																	
1953					1	1	(1)	1	1	1				(1)	(1)	1	1
1954	4*	4*	4*	(4*)	(2)			(2)	2,(3)								(2)
1955	1	1	1	(3,1,3)	(3,3)	3,(3)	(2,2)	3,3	3,3	2,2	(2,2)		(2,2)	(2,2)	2,(2)	2,(2)	2,(2)
1956																	
1957																	
1958	(3)	(3)	(3)	(3)	(3)			(3)	(3)								
1959																	
1960	3*	3*	3*	3*	3*	3*	3*	3*	3*	3*	3*	(3*)	(3*)	3*	3*	3*	3*
1961																	
1962																	
1963																	
1964																	
1965																	
1966																	
1967																	
1968								(1)	(1)								
1969																	
1970																	
1971					1	(1)		(1)									
1972																	
1973																	
1974																	
1975																	

YEAR	VA. VIRGINIA BEACH @	CHESAPEAKE #	NANSEMOND $	ISLE OF WIGHT	SURRY	JAMES CITY %	YORK ¢	GLOUCESTER	MATHEWS	MIDDLESEX	LANCASTER	NORTHUMBERLAND	WESTMORELAND	NORTHAMPTON	ACCOMACK
1900															
1901															
1902															
1903															
1904															
1905															
1906															
1907															
1908															
1909															
1910															
1911															
1912															
1913															
1914															
1915															
1916															
1917															
1918															
1919															
1920															
1921															
1922															
1923															
1924	(2)														
1925															
1926															
1927															
1928															
1929															
1930															
1931															
1932															
1933	2,(3)	2,(3)	2	2	2	1	2	1						(2)	
1934															
1935															
1936	(2)	(2)	(2)												
1937															
1938															
1939															
1940															
1941															
1942															
1943															
1944	3*	(3*)	(3*)	(3*)			(3*)							(3*)	(3*)
1945															
1946															
1947															
1948															
1949															
1950															
1951															
1952															
1953	(1)	(1)													
1954	(2*)	(2*)	(2*)	(2*)	(2*)	(2*)	(2*)	(2*)	(2*)	(2*)	(2*)	(2*)	(2*)		
1955	1	1	1	1	1	1	1	1	1	1	1			1	(1)
1956															
1957															
1958															
1959															
1960	(3*)													(3*)	(3*)
1961															
1962															
1963															
1964															
1965															
1966															
1967															
1968															
1969															
1970															
1971															
1972															
1973															
1974															
1975															

@ INDEPENDENT CITY. CONSOLIDATED WITH PRINCESS ANNE COUNTY IN 1963.

CHESAPEAKE, NORFOLK AND PORTSMOUTH — INDEPENDENT CITIES. COMBINED BOUNDARIES INCLUDE WHAT WAS FORMERLY NORFOLK COUNTY AND SOUTH NORFOLK CITY.

$ INCLUDES THE INDEPENDENT CITY OF SUFFOLK.

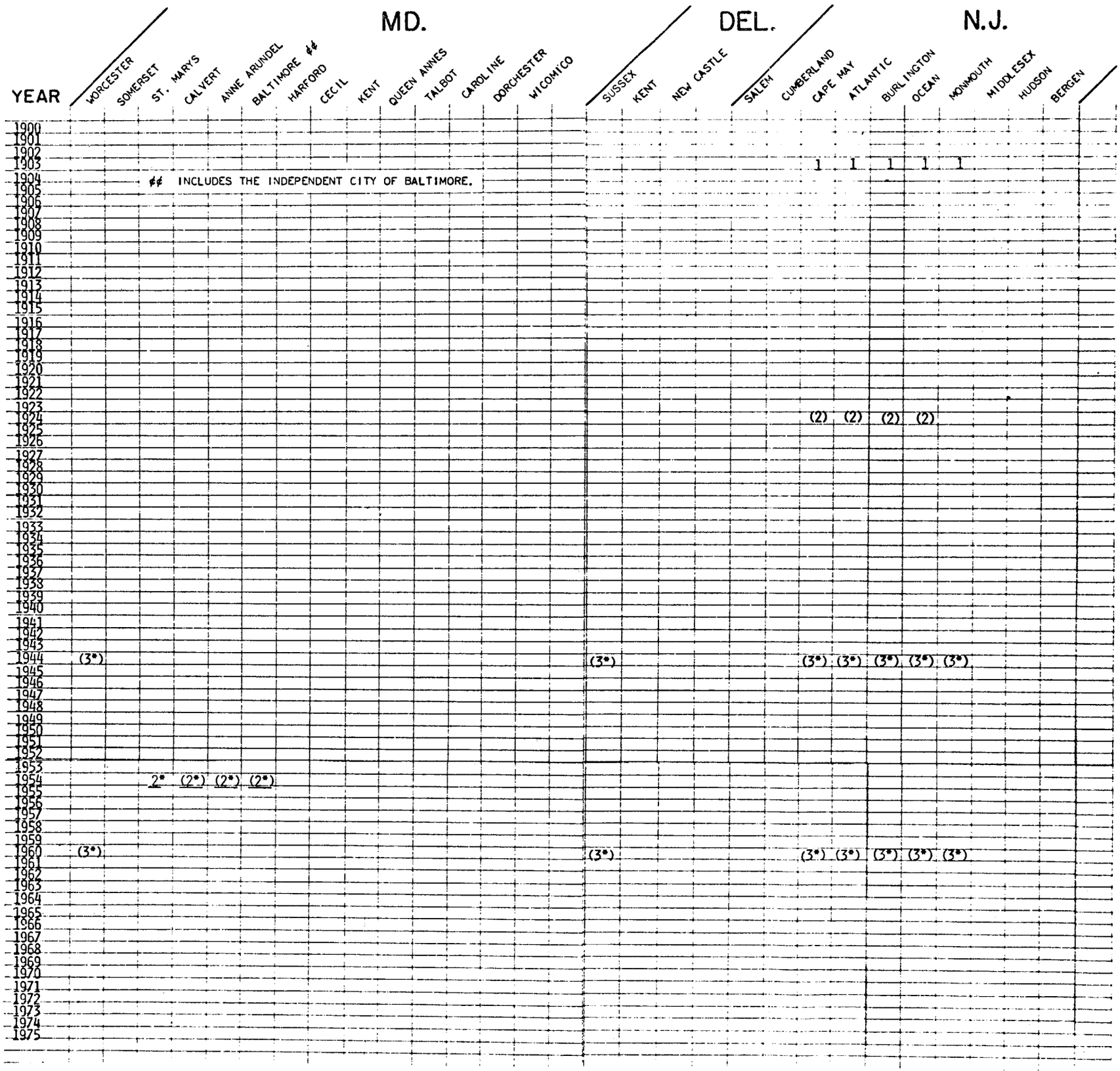
% INCLUDES THE INDEPENDENT CITY OF WILLIAMSBURG.

¢ INCLUDES THE INDEPENDENT CITIES OF HAMPTON AND NEWPORT NEWS AND THE FORMER COUNTIES OF ELIZABETH CITY AND WARWICK CITY.

NOTE: NO HURRICANES ARE LISTED 1900 - 1923.

FLORIDA

YEAR	ESCAMBIA	SANTA ROSA	OKALOOSA	WALTON	BAY	GULF	FRANKLIN	WAKULLA	JEFFERSON	TAYLOR	DIXIE	LEVY	CITRUS	HERNANDO	PASCO	PINELLAS	HILLSBOROUGH	MANATEE	SARASOTA	CHARLOTTE	LEE	COLLIER	MONROE	DADE	BROWARD	PALM BEACH	HENDRY	GLADES	OKEECHOBEE	MARTIN	ST. LUCIE	INDIAN RIVER	BREVARD	VOLUSIA	FLAGLER	ST. JOHNS	DUVAL	NASSAU
1900																																						
1901																																						
1902																																						
1903					1																				2	2	1	1		(2)								
1904																																						
1905																																						
1906	(3)																						EL,2	1,2	(1),2	(1,2)				(1)								
1907																																						
1908																																						
1909																							E3	(3)														
1910																				3	3	3	W3				2	2										
1911	1	(1)																																				
1912																																						
1913																																						
1914																																						
1915					1																																	
1916	(3)	2	2	2	(2)																		W1															
1917	3	3	3	3	(3)																																	
1918																																						
1919																							W4															
1920																																						
1921														(3)	3	3	3	3	(3)	(3)	(3)													(2)	2	2			
1922																																						
1923																																						
1924					1	1	1	(1)														1	W1															
1925																		(1)	1		1																	
1926	3	3	(3)																(3)	3	3	3	E(3)	4,(3)	4	(4)	3	3	(3)	(4)	(4),1	(4),1	1	1	(1)			
1927																																						
1928																								(4)	(4)	4	4	4	4	4	4	(4)	(4)					
1929				(2)	2	2	(2)	(2)														3	E3	3												2	2	
1930																																						
1931																																						
1932																																						
1933																							E(1)	(1)	(3)	3	(2)	(2)	2	3	1,3	1,(3)	(1,3)					
1934																																						
1935									2	2						(3)	(3)	(3)	(3)	(4)	(4)	(4)	E5,W(1)	(5),2	2													
1936		(3)	3	3	(3)																																	
1937																																						
1938																																						
1939			1	1	1	1	(1)																							1	1	(1)	(1)					
1940																																						
1941						(2)	2	2														2	E(2)	2														
1942																																						
1943																																						
1944																(3)	(3)	3	3	3	3	(3)	W(3)											(2)	(2)	2	2	(2)
1945														1	1	1	1						E3	3	(3)		2	2	(2)									
1946																1	1	1	1	(1)	(1)																	
1947																				(2)	2	2	1	(4),1	4,1	4	3	(3)	(3)	(4)	(4)	(4)	(4)	(4)				
1948																						3	3,2	(3),2	(3,2)	4	2	(2)		2								
1949												(1)	(1)	(1)											(3)	3	(3)	(3)	(3)	3	4	(3)	(3)	(3)					
1950	(1)									(3)	3	3	3	3	(3)	(3)							W(3)	3	3	(3)	2	2	2	(3)								
1951																																						
1952																																						
1953				(1)	1																																	
1954																																						
1955																																						
1956		(1)	1	1																																		
1957																																						
1958																																						
1959																																						
1960																				3	3	4	E4	(4)	(4)		(2)	(2)	(2)					2	2	2	(2)	
1961																																						
1962																																						
1963																																						
1964																						2	W(2)	2	2	2,2	(2)			1,2	1	1	(1)		(2)	2	2	(2)
1965																						(2)	E3	(3)	(3)													
1966							2	2	2	2	(2)	(2)				(2)	(2)	(2)	(2)	(2)	(2)		1																
1967																																						
1968														2	2	(2)	(2)	(2)																				
1969																																						
1970																																						
1971																																						
1972					(1)	1	1	(1)																															
1973																																						
1974																																						
1975																																						


MD.
DEL.
N.J.
YEAR
WORCESTER
SOMERSET
ST. MARYS
CALVERT
ANNE ARUNDEL
BALTIMORE ##
HARFORD
CECIL
KENT
QUEEN ANNES
TALBOT
CAROLINE
DORCHESTER
WICOMICO
SUSSEX
KENT
NEW CASTLE
SALEM
CUMBERLAND
CAPE MAY
ATLANTIC
BURLINGTON
OCEAN
MONMOUTH
MIDDLESEX
HUDSON
BERGEN
1900
1901
1902
1903
1904
1905
1906
1907
1908
1909
1910
1911
1912
1913
1914
1915
1916
1917
1918
1919
1920
1921
1922
1923
1924
1925
1926
1927
1928
1929
1930
1931
1932
1933
1934
1935
1936
1937
1938
1939
1940
1941
1942
1943
1944
1945
1946
1947
1948
1949
1950
1951
1952
1953
1954
1955
1956
1957
1958
1959
1960
1961
1962
1963
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
INCLUDES THE INDEPENDENT CITY OF BALTIMORE.
1 1 1 1 1
(2) (2) (2) (2)
(3*)
(3*)
(3*) (3*) (3*) (3*) (3*)
2* (2*) (2*) (2*)
(3*)
(3*)
(3*) (3*) (3*) (3*) (3*)

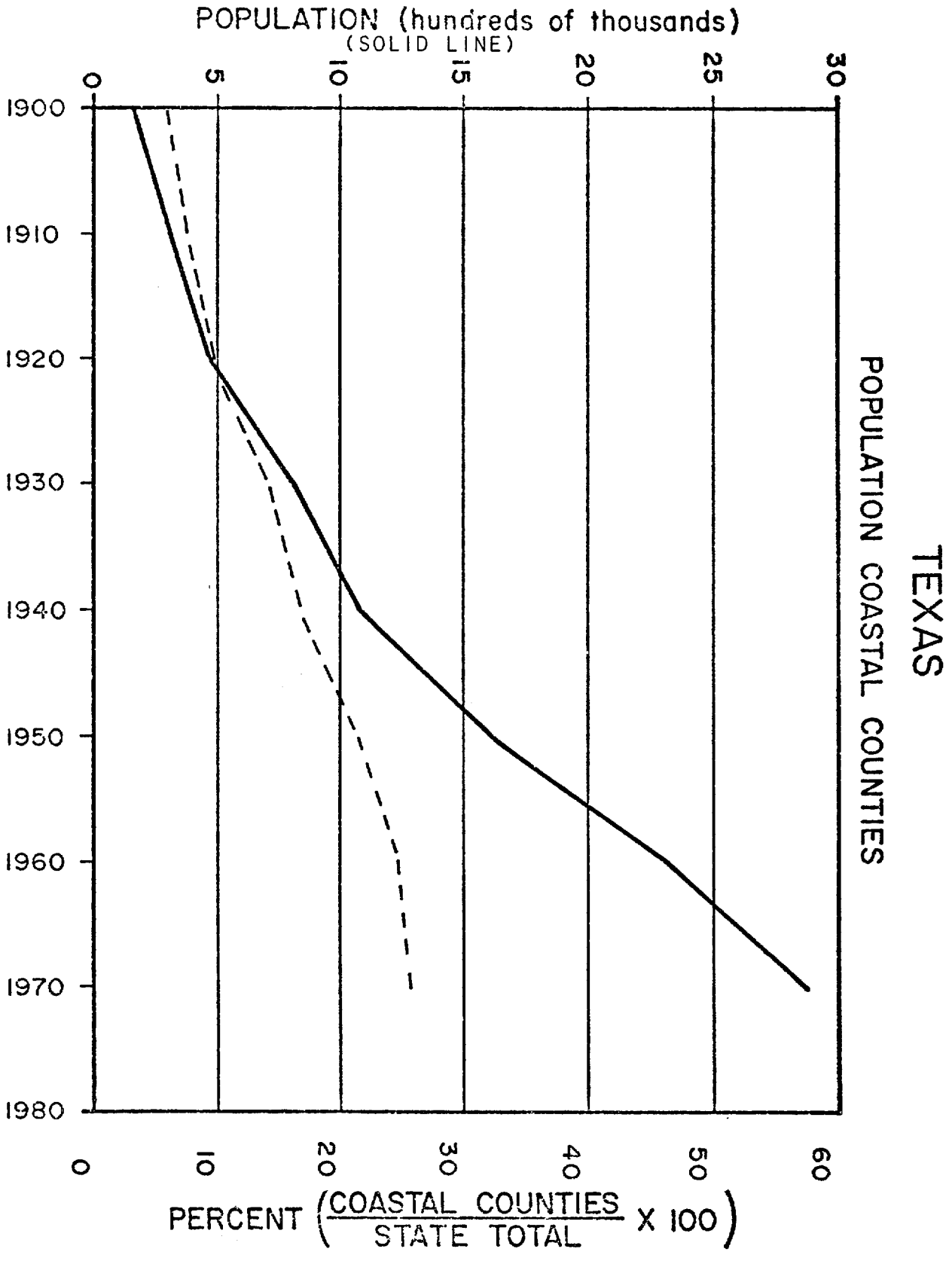
YEAR	N.Y.								CONN.				R.I.					MASS.								N.H.							ME.							
	RICHMOND	NEW YORK	KINGS	QUEENS	NASSAU	SUFFOLK	BRONX	WESTCHESTER	NEW LONDON	MIDDLESEX	NEW HAVEN	FAIRFIELD	NEWPORT	BRISTOL	PROVIDENCE	KENT	WASHINGTON	BRISTOL	DUKES	NANTUCKET	BARNSTABLE	PLYMOUTH	NORFOLK	SUFFOLK	ESSEX	ROCKINGHAM	YORK	CUMBERLAND	SAGADAHOC	LINCOLN	KNOX	WALDO	HANCOCK	WASHINGTON						
1900																																							
1901																																							
1902																																							
1903		1	1	1	1	(1)	1		1	1																													
1904																																							
1905																																							
1906																																							
1907																																							
1908																																							
1909																																							
1910																																							
1911																																							
1912																																							
1913																																							
1914																																							
1915																		(1)	1	1	1	1																	
1916																																							
1917																																							
1918																																							
1919																																							
1920																																							
1921																																							
1922																																							
1923																																							
1924																																							
1925																																							
1926																																							
1927																																							
1928																																							
1929																																							
1930																																							
1931																																							
1932																																							
1933																																							
1934																																							
1935																																							
1936																																							
1937																																							
1938		(3*)	(3*)	(3*)	(3*)	3*	(3*)	(3*)		3*	3*	3*	3*		3*	3*	3*	3*	3*		3*	(3*)	(3*)	(3*)	(3*)	3*	(3*)	(3*)	(3*)	(3*)									
1939																																							
1940																																							
1941																																							
1942																																							
1943																																							
1944		(3*)	(3*)	(3*)	(3*)	3*	(3*)	(3*)		(3*)	(3*)	(3*)	3*		3*	3*	(3*)	(3*)	3*		2*	2*	(2*)	2*	2*	2*	2*	(2*)											
1945																																							
1946																																							
1947																																							
1948																																							
1949																																							
1950																																							
1951																																							
1952																																							
1953																																					1*		
1954					(3*)	3*				(3*)	(3*)	(3*)	3*		3*	3*	3*	3*	3*		(3*)	(3*)	3*	(3*)	3*	(3*)	3*	(3*)	3*	(3*)							1*		
1955																																							
1956																																							
1957																																							
1958																																							
1959						3*					(2*)	2*			2*	2*	2*	2*	2*		(2*)	(2*)	(2*)	(2*)	(2*)	1*	1*	1*		1*		1*	1*	1*	1*				
1960																																							
1961																																							
1962																																							
1963																																							
1964																																							
1965																																							
1966																																							
1967																																							
1968																																					1		
1969																																							
1970																																							
1971																																							
1972					1	(1)				1	(1)																												
1973																																							
1974																																							
1975																																							

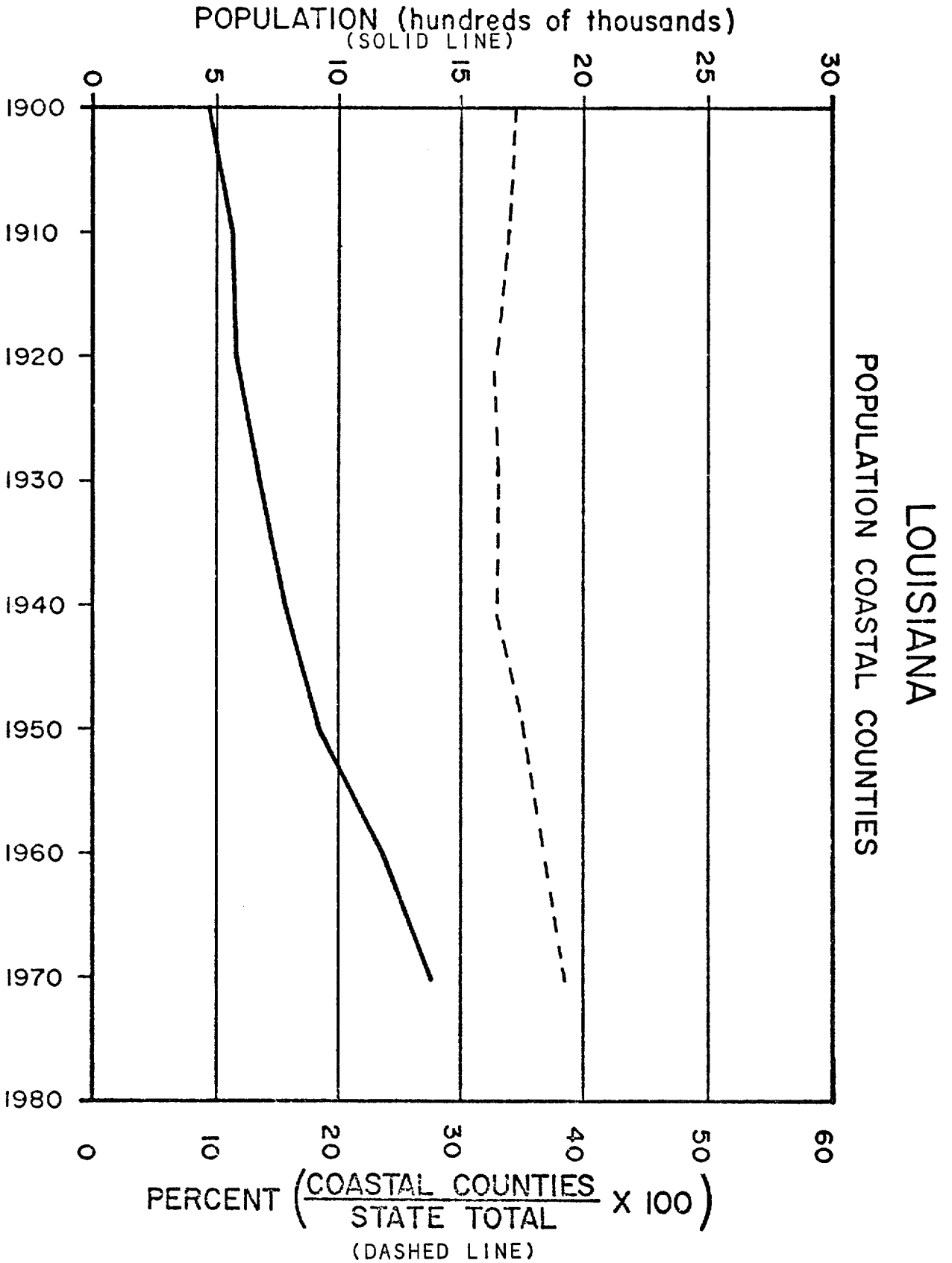
APPENDIX D

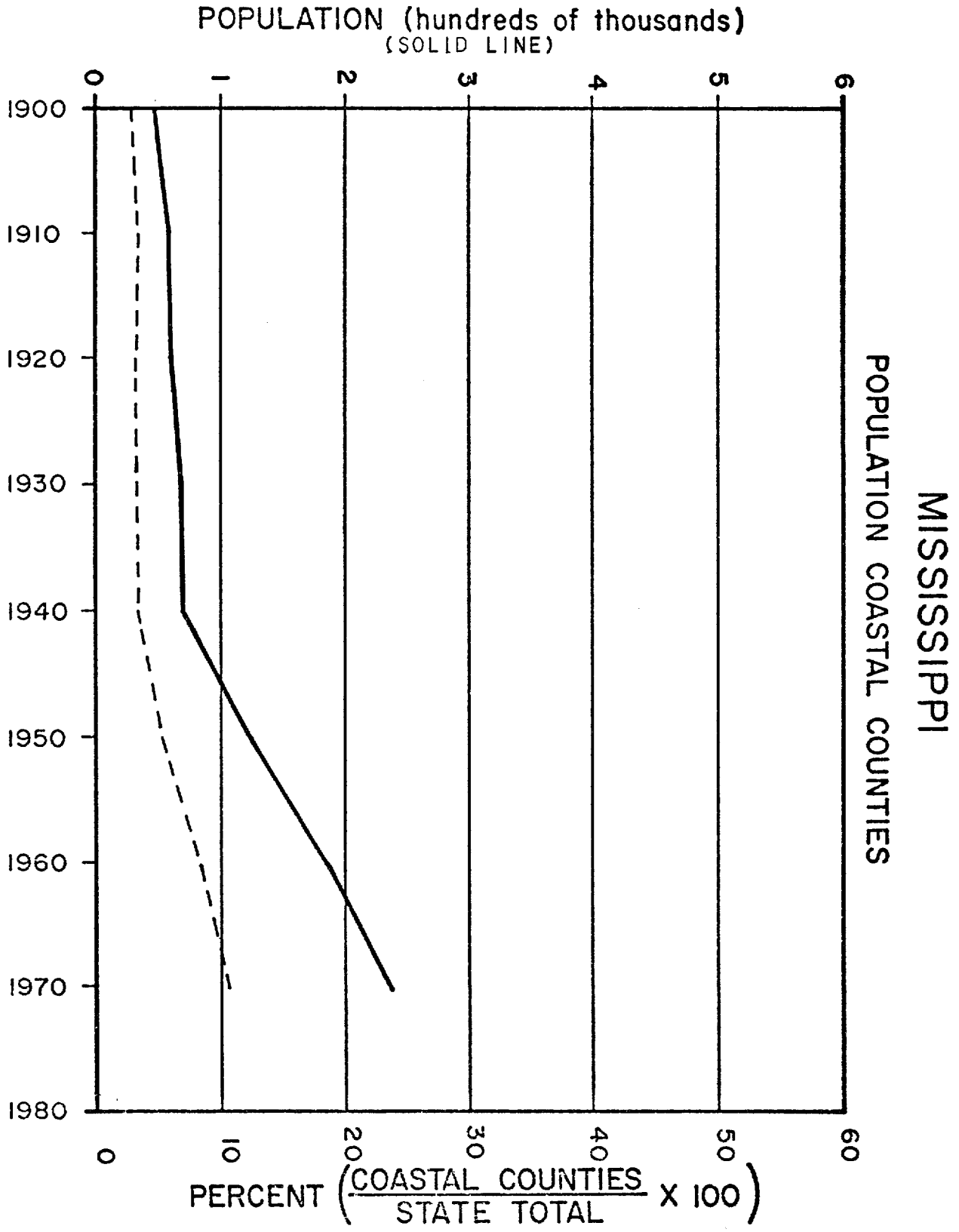
STATE COASTAL COUNTY POPULATIONS AND PERCENTAGE OF STATE POPULATIONS IN COASTAL COUNTIES, TEXAS TO MAINE

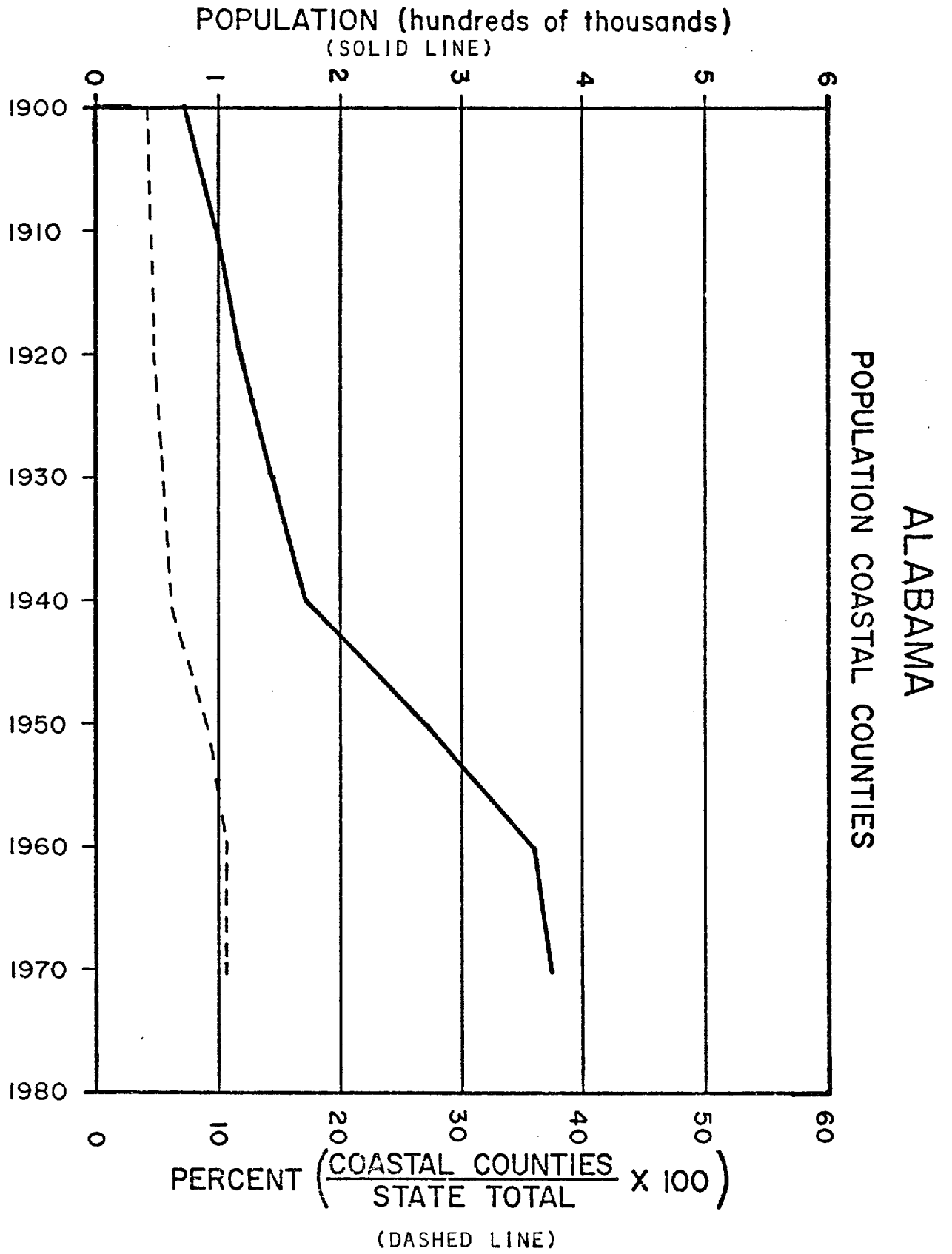
The main purpose of this set of graphs is to illustrate the growth rates of coastal populations by states and to indicate that a higher percentage of most state populations live along the coast now as compared to earlier years.

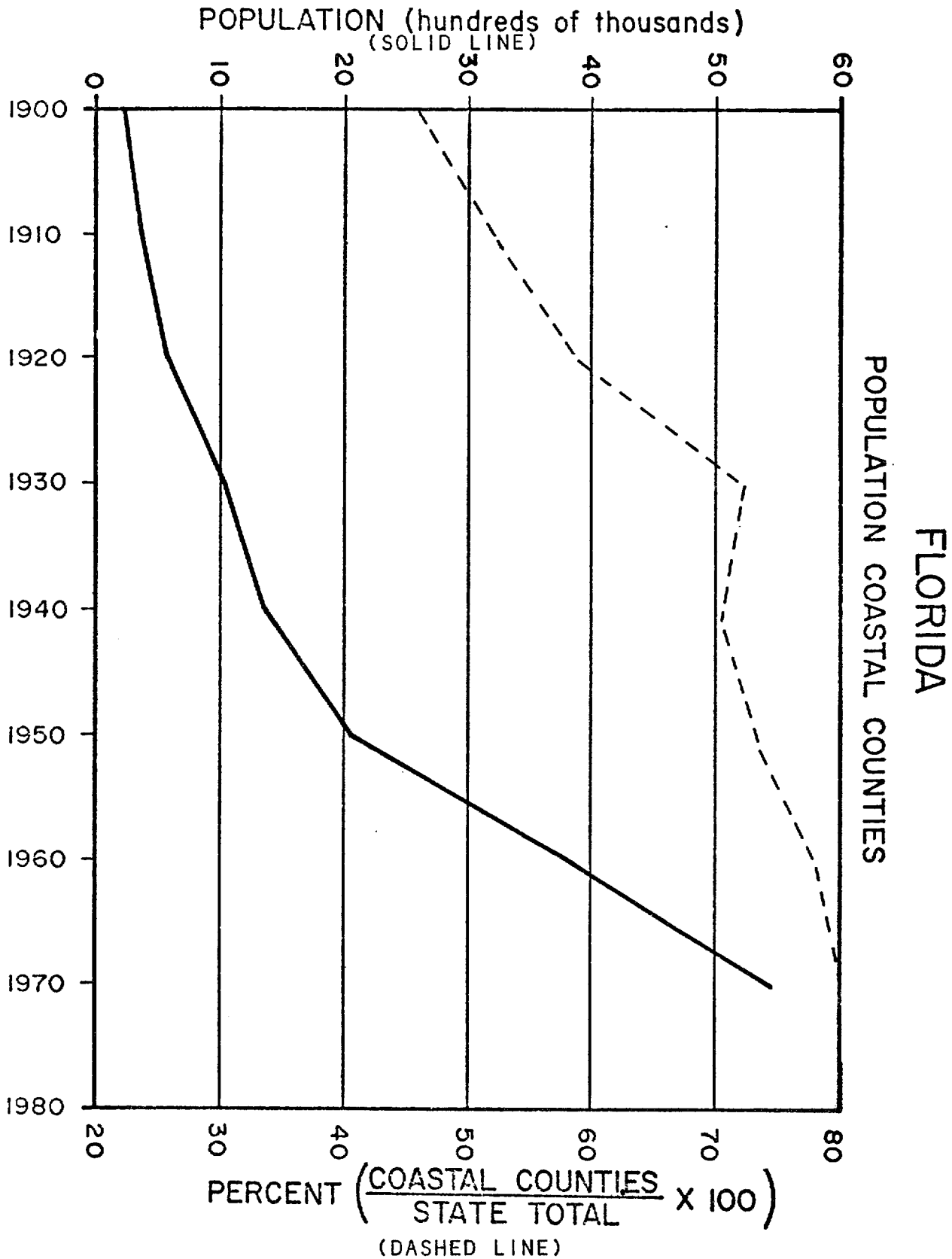
State population graphs (coastal counties only) are presented for each of the 18 Gulf and Atlantic coastal states for the period 1900-1970. Also shown is the percentage of each total state population in the coastal counties.

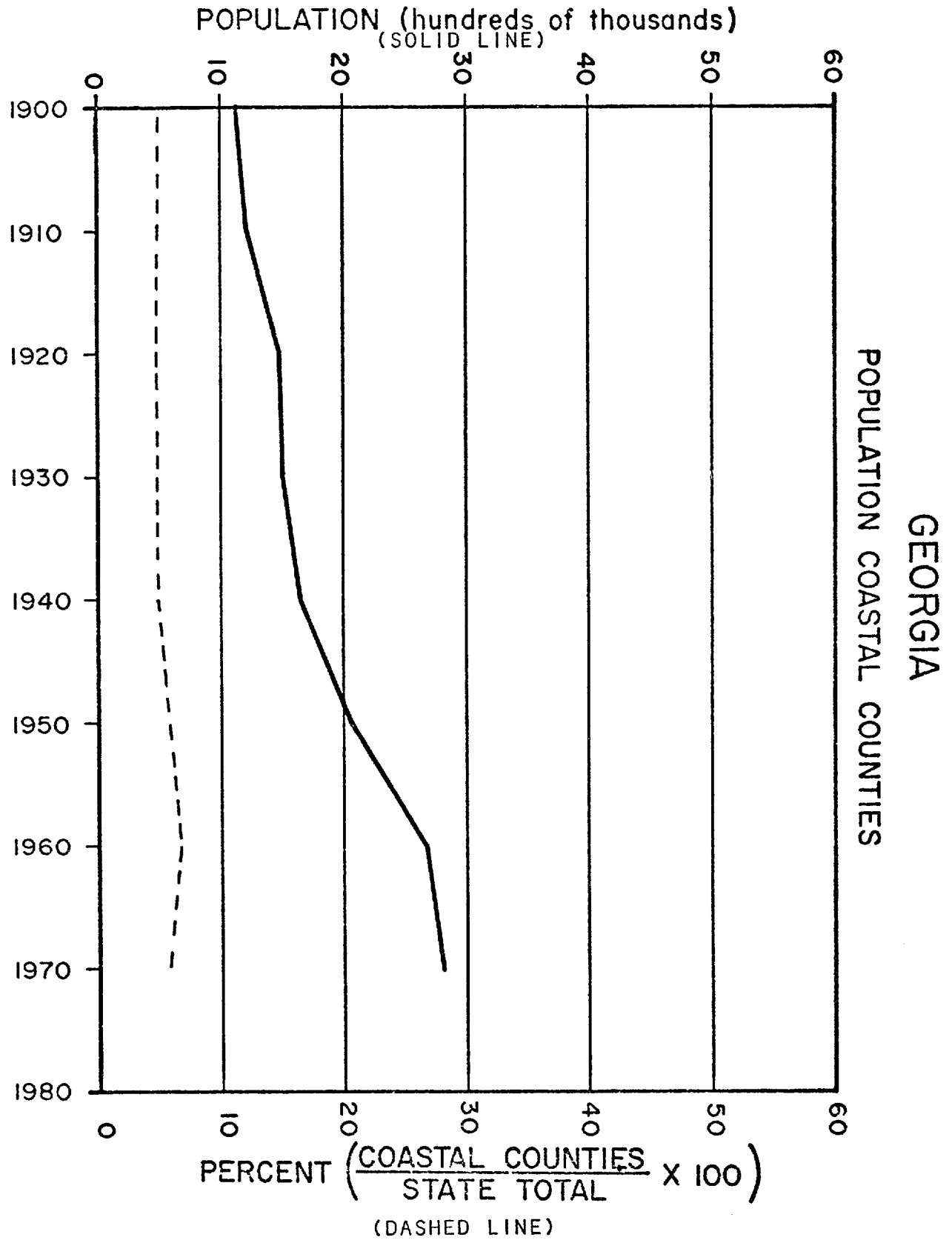

POPULATION (hundreds of thousands)
(SOLID LINE)
0
5
10
15
20
25
30
1900
1910
1920
1930
1940
1950
1960
1970
1980
TEXAS
POPULATION COASTAL COUNTIES
0
10
20
30
40
50
60
PERCENT (COASTAL COUNTIES / STATE TOTAL X 100)
(DASHED LINE)

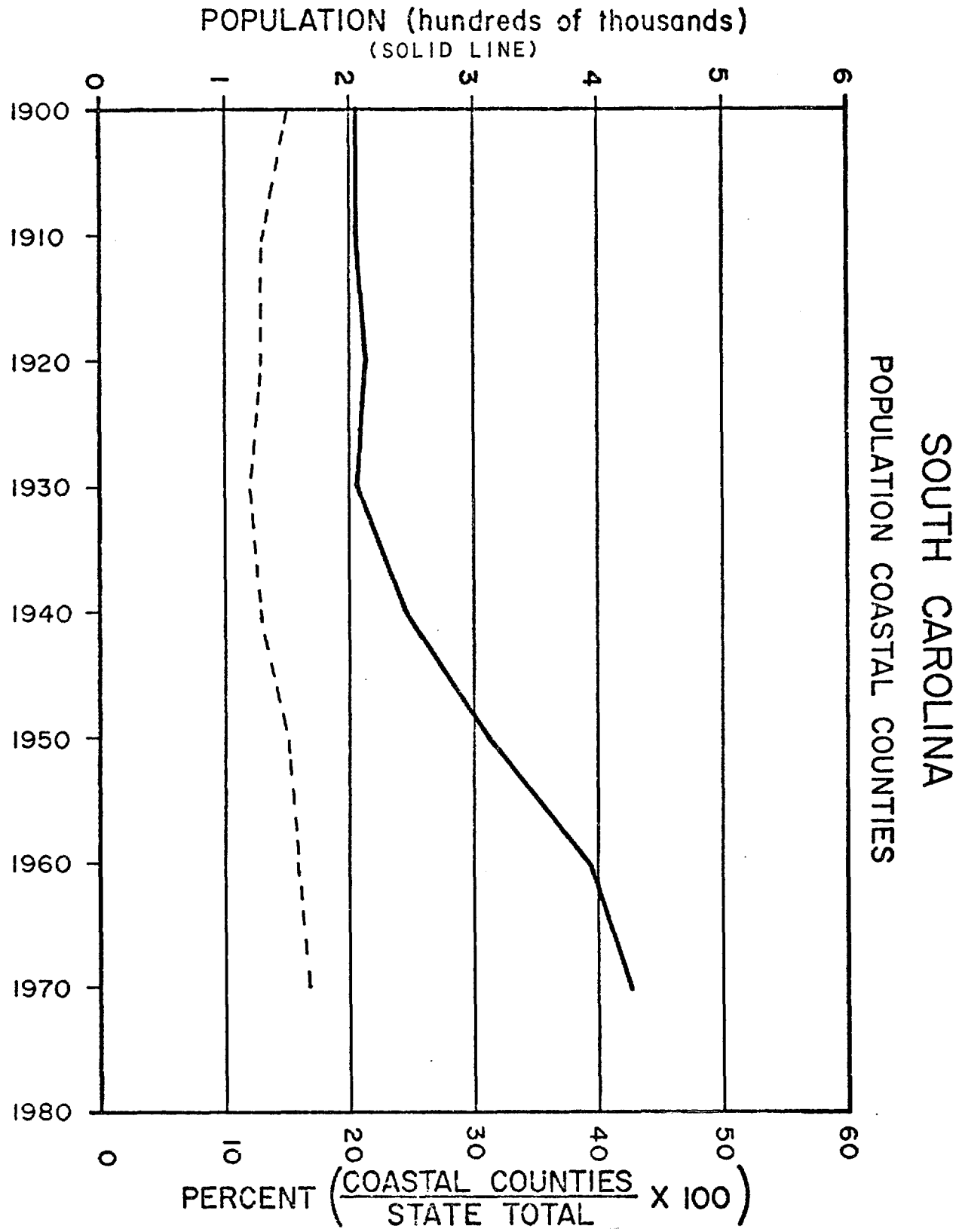

POPULATION (hundreds of thousands)
(SOLID LINE)
0
5
10
15
20
25
30
1900
1910
1920
1930
1940
1950
1960
1970
1980
LOUISIANA
POPULATION COASTAL COUNTIES
0
10
20
30
40
50
60
PERCENT (COASTAL COUNTIES / STATE TOTAL X 100)
(DASHED LINE)

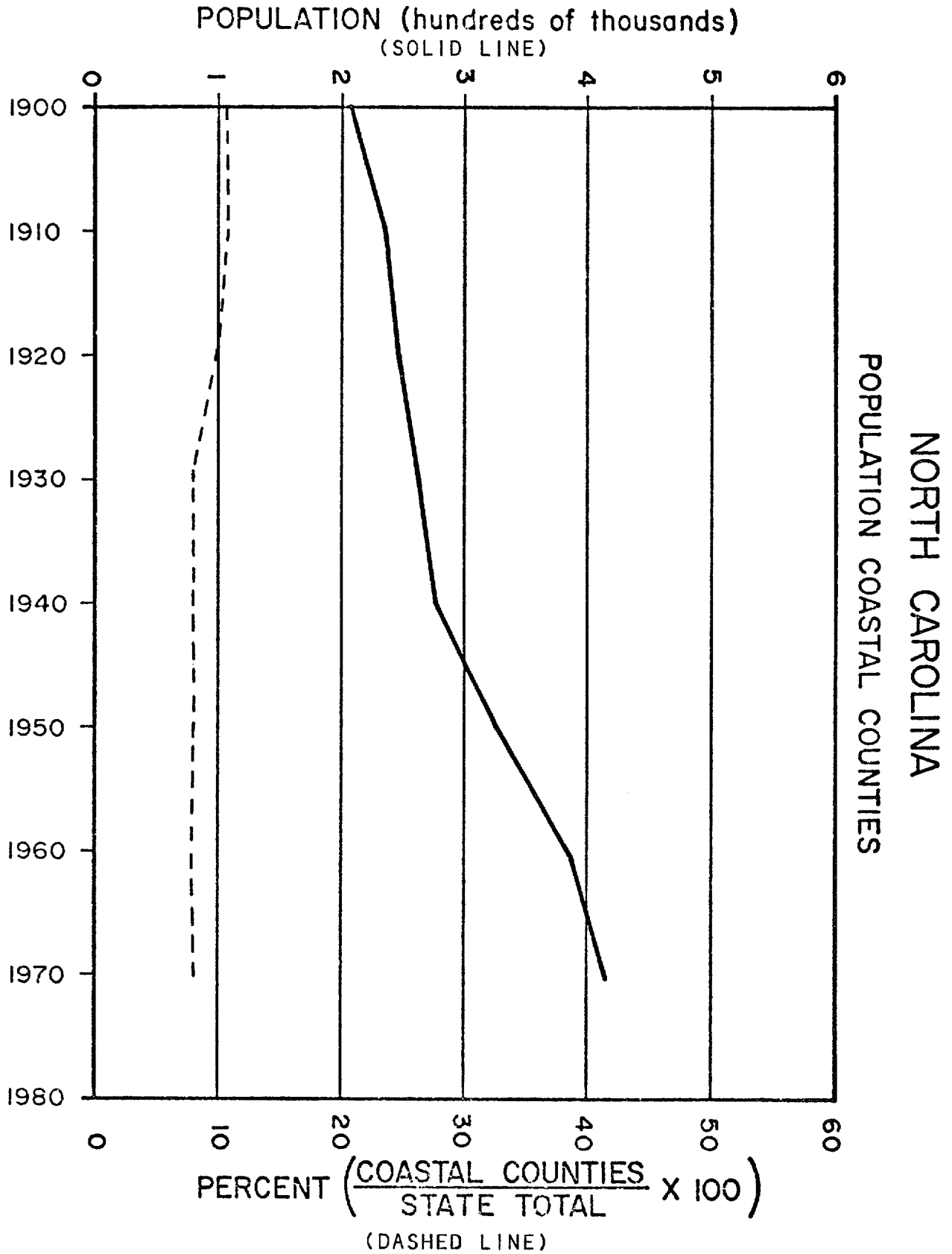

POPULATION (hundreds of thousands)
(SOLID LINE)
0
1
2
3
4
5
6
1900
1910
1920
1930
1940
1950
1960
1970
1980
0
10
20
30
40
50
60
PERCENT (COASTAL COUNTIES / STATE TOTAL X 100)
(DASHED LINE)
MISSISSIPPI
POPULATION COASTAL COUNTIES

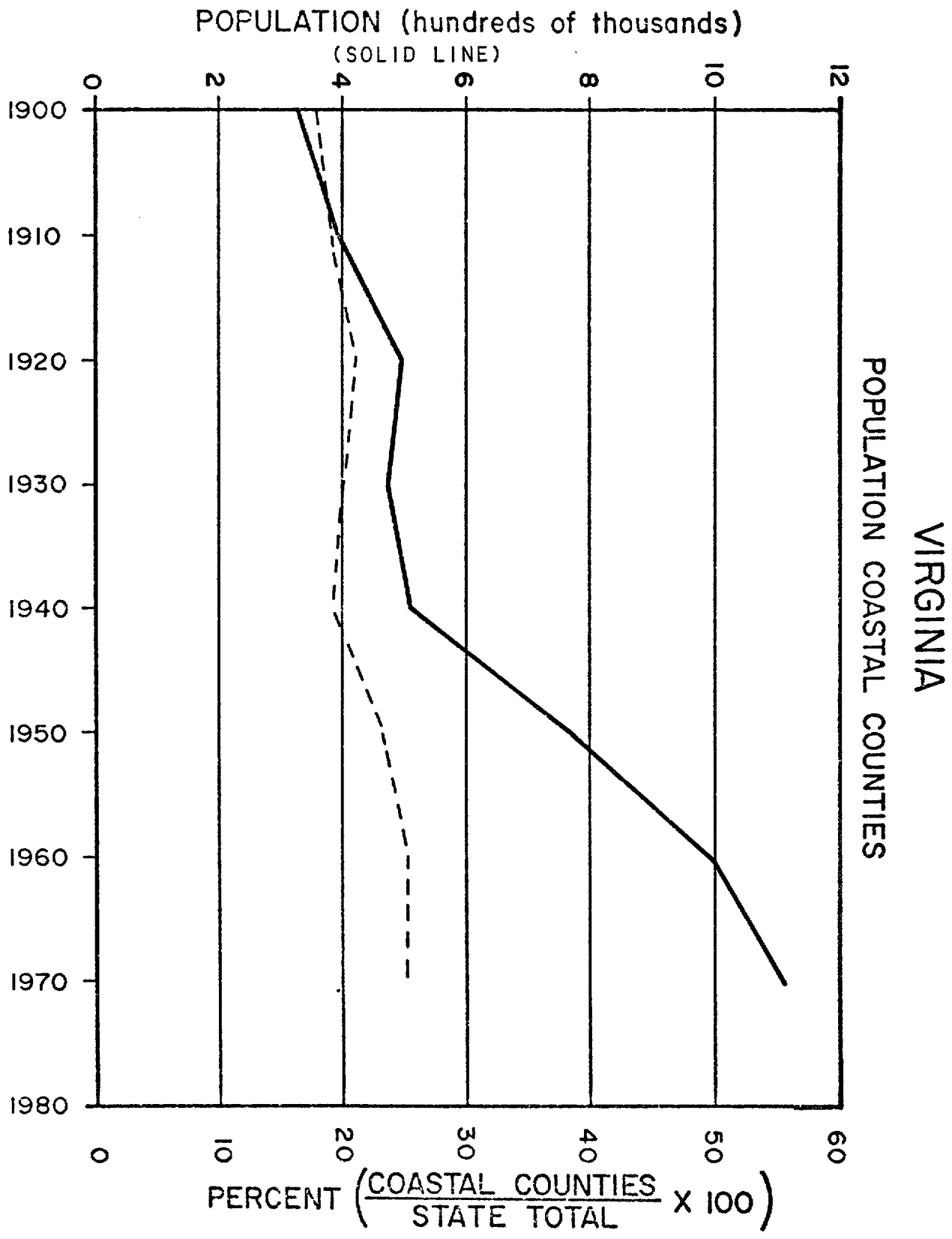

POPULATION (hundreds of thousands)
(SOLID LINE)
0
1
2
3
4
5
6
1900
1910
1920
1930
1940
1950
1960
1970
1980
ALABAMA
POPULATION COASTAL COUNTIES
0
10
20
30
40
50
60
PERCENT (COASTAL COUNTIES / STATE TOTAL X 100)
(DASHED LINE)

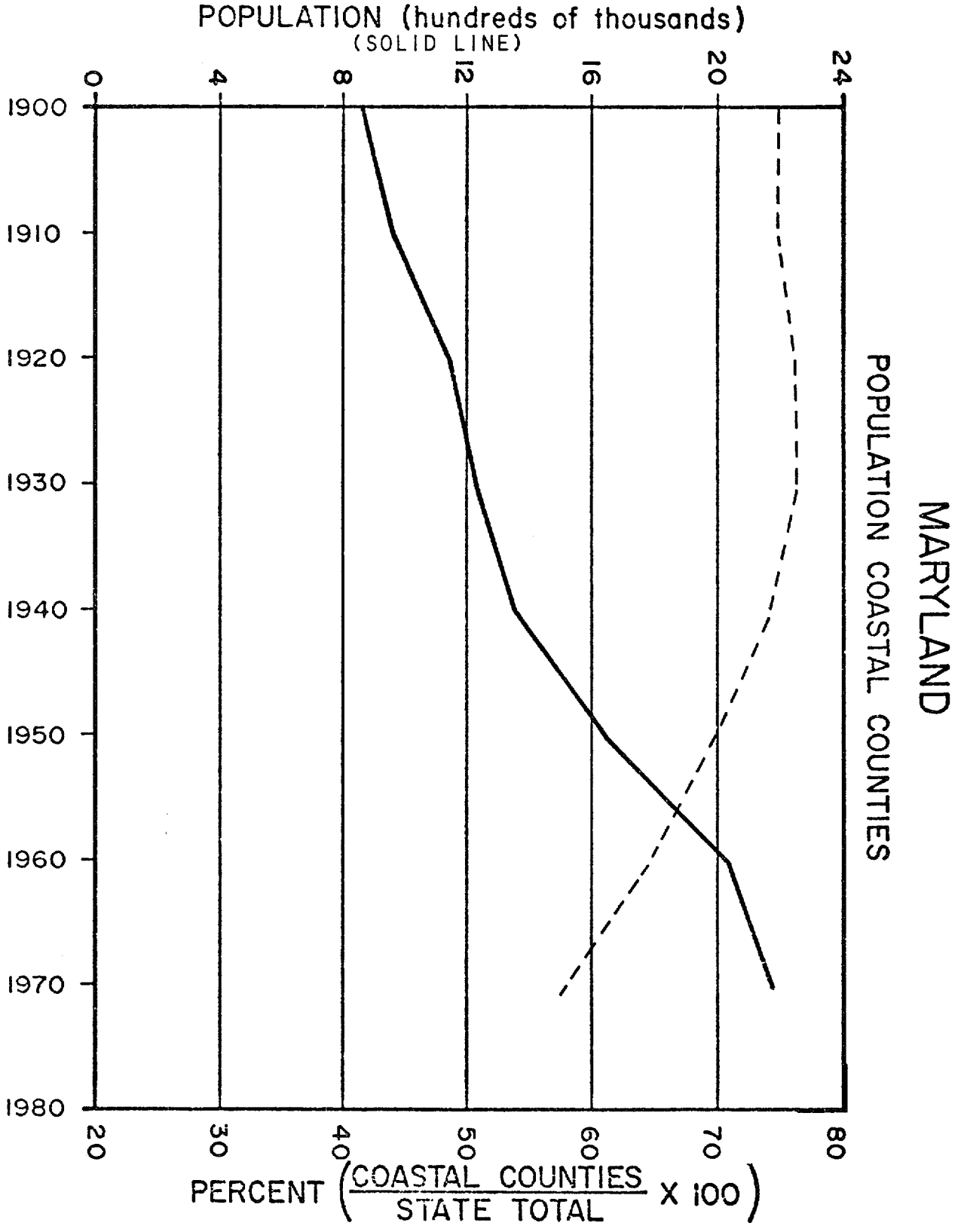

POPULATION (hundreds of thousands)
(SOLID LINE)
0
10
20
30
40
50
60
1900
1910
1920
1930
1940
1950
1960
1970
1980
20
30
40
50
60
70
80
PERCENT (COASTAL COUNTIES / STATE TOTAL X 100)
(DASHED LINE)
FLORIDA
POPULATION COASTAL COUNTIES

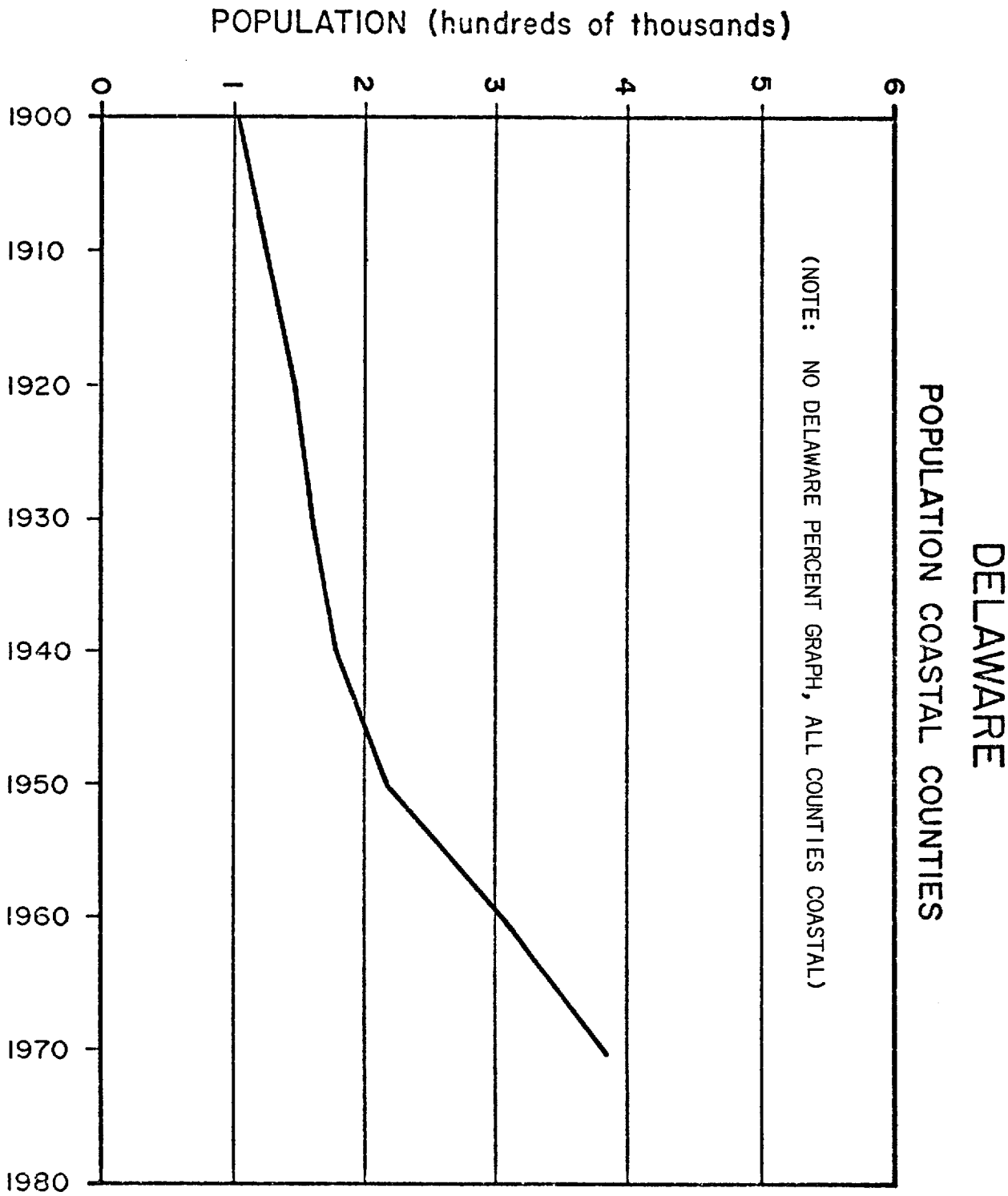

POPULATION (hundreds of thousands)
(SOLID LINE)
0
10
20
30
40
50
60
1900
1910
1920
1930
1940
1950
1960
1970
1980
GEORGIA
POPULATION COASTAL COUNTIES
PERCENT (COASTAL COUNTIES / STATE TOTAL X 100)
(DASHED LINE)

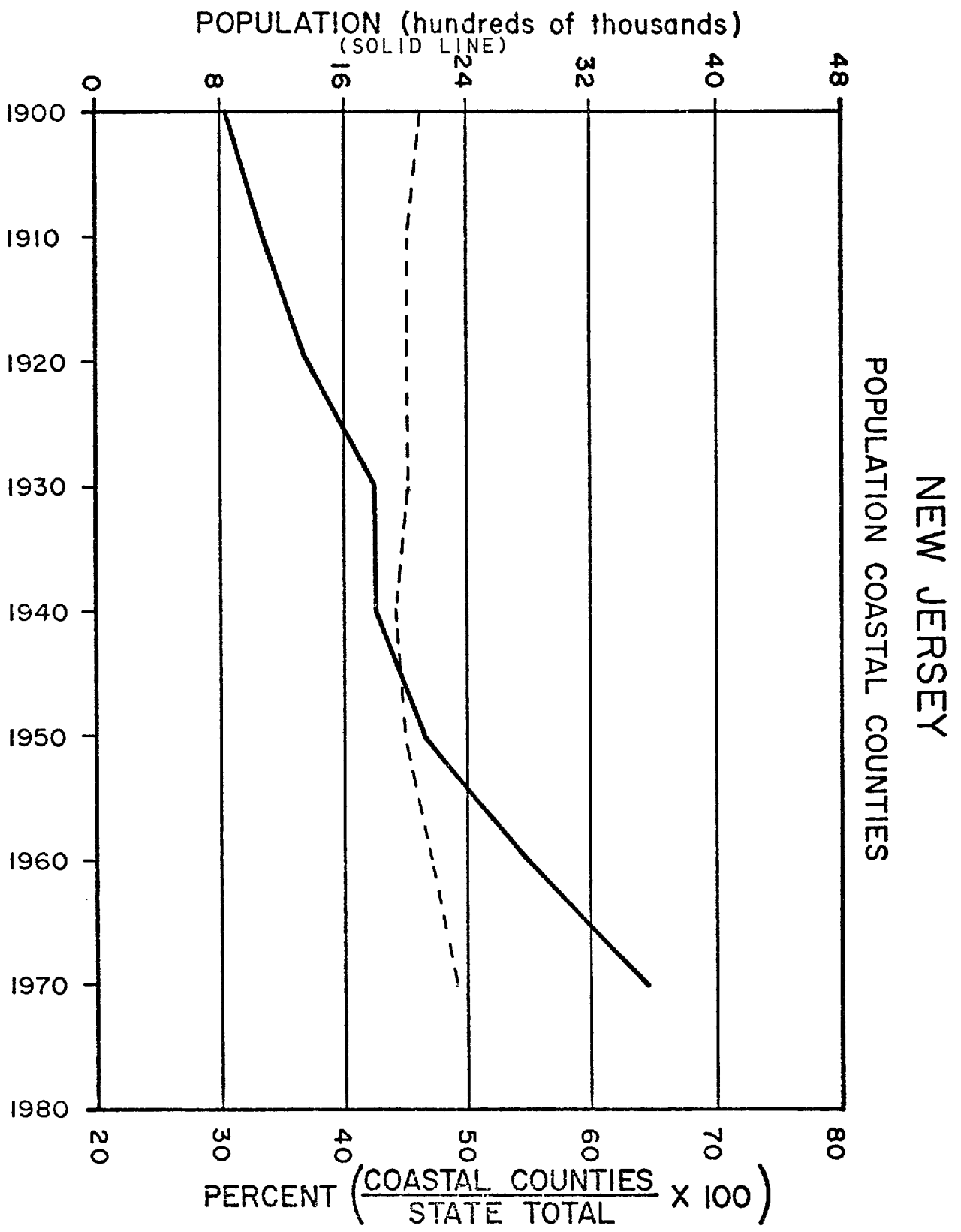

POPULATION (hundreds of thousands)
(SOLID LINE)
0
1
2
3
4
5
6
1900
1910
1920
1930
1940
1950
1960
1970
1980
SOUTH CAROLINA
POPULATION COASTAL COUNTIES
0
10
20
30
40
50
60
PERCENT (COASTAL COUNTIES / STATE TOTAL X 100)
(DASHED LINE)

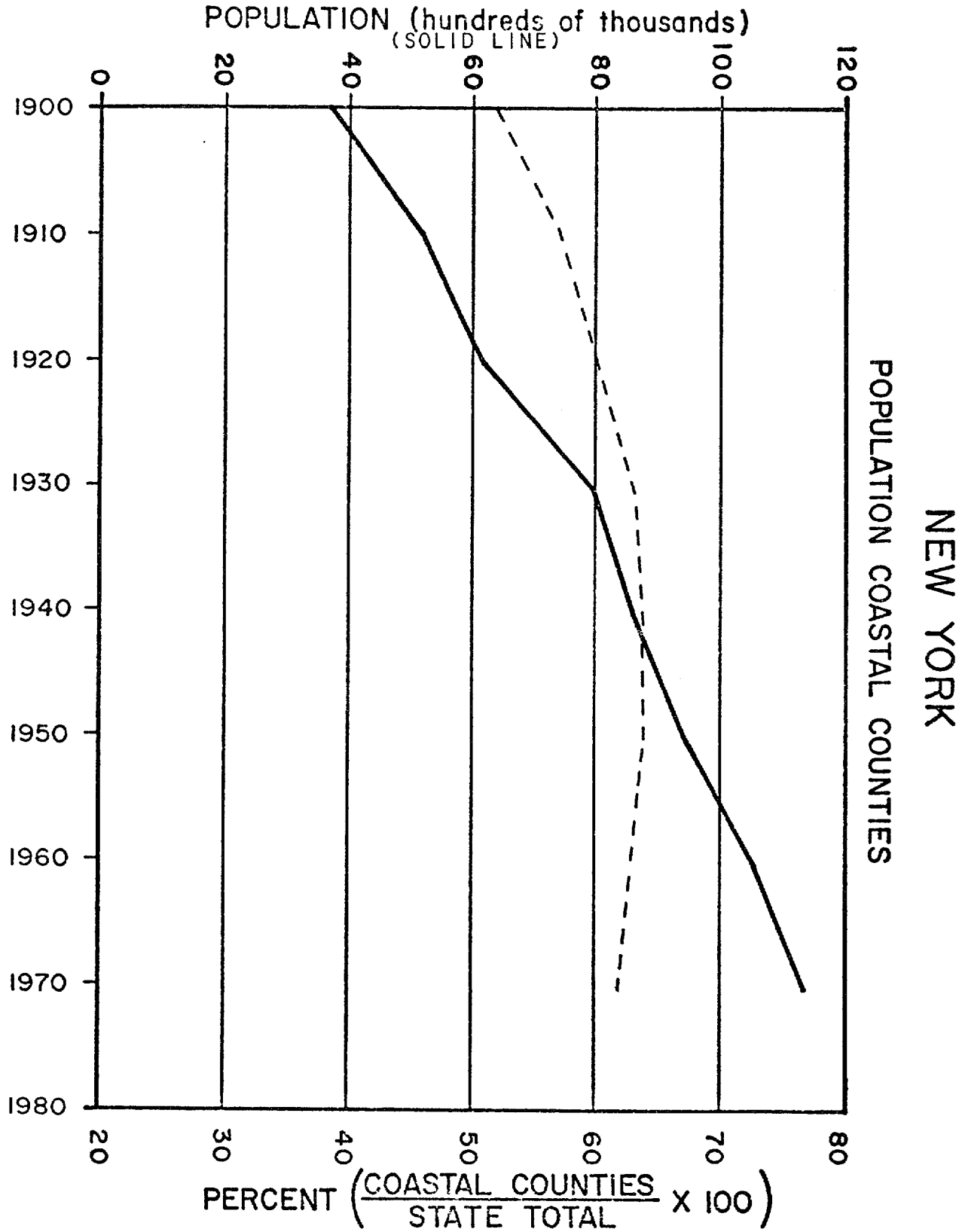

POPULATION (hundreds of thousands)
(SOLID LINE)
0
1
2
3
4
5
6
1900
1910
1920
1930
1940
1950
1960
1970
1980
0
10
20
30
40
50
60
PERCENT (COASTAL COUNTIES / STATE TOTAL X 100)
(DASHED LINE)
NORTH CAROLINA
POPULATION COASTAL COUNTIES

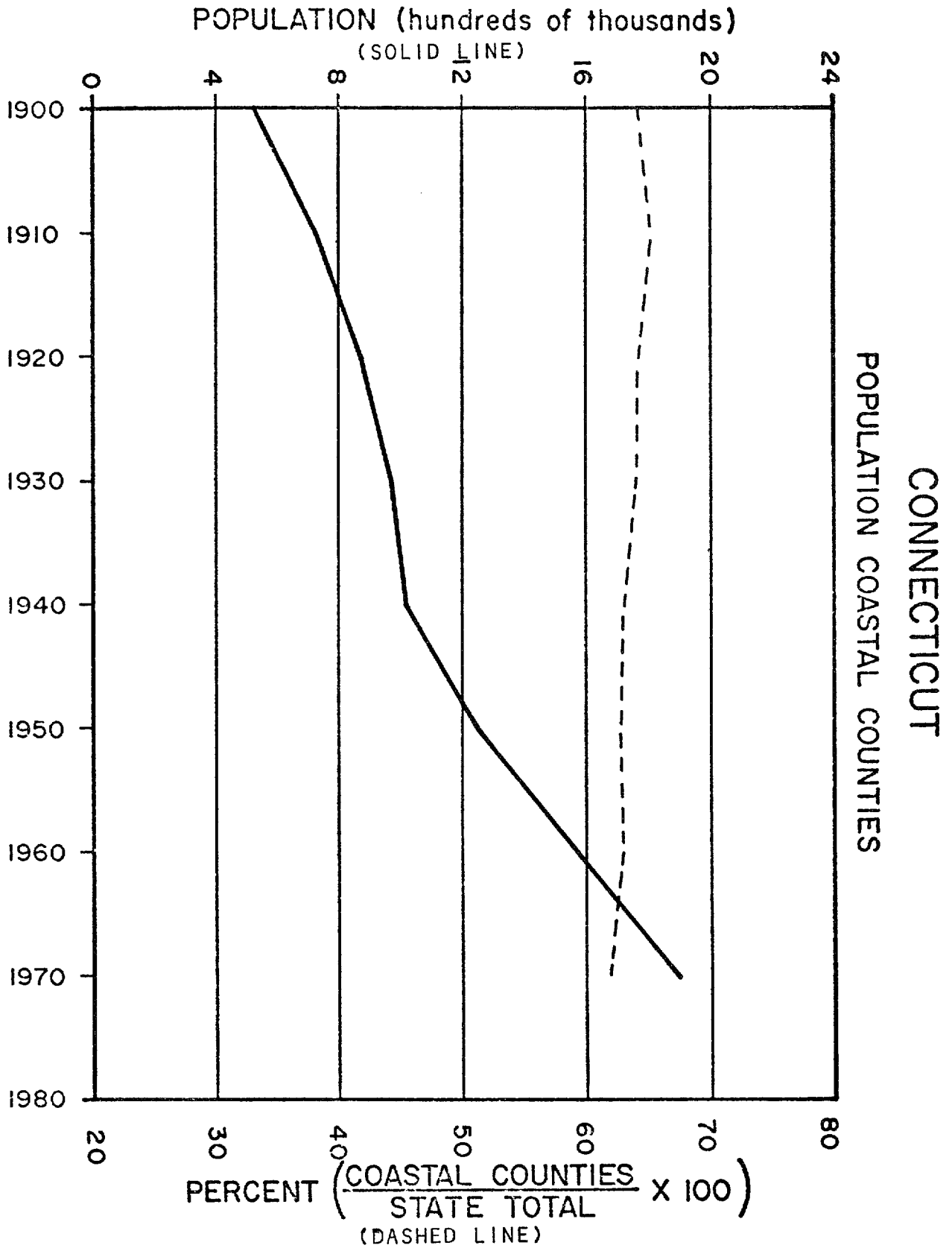

POPULATION (hundreds of thousands)
(SOLID LINE)
0
2
4
6
8
10
12
1900
1910
1920
1930
1940
1950
1960
1970
1980
VIRGINIA
POPULATION COASTAL COUNTIES
0
10
20
30
40
50
60
PERCENT (COASTAL COUNTIES / STATE TOTAL X 100)
(DASHED LINE)

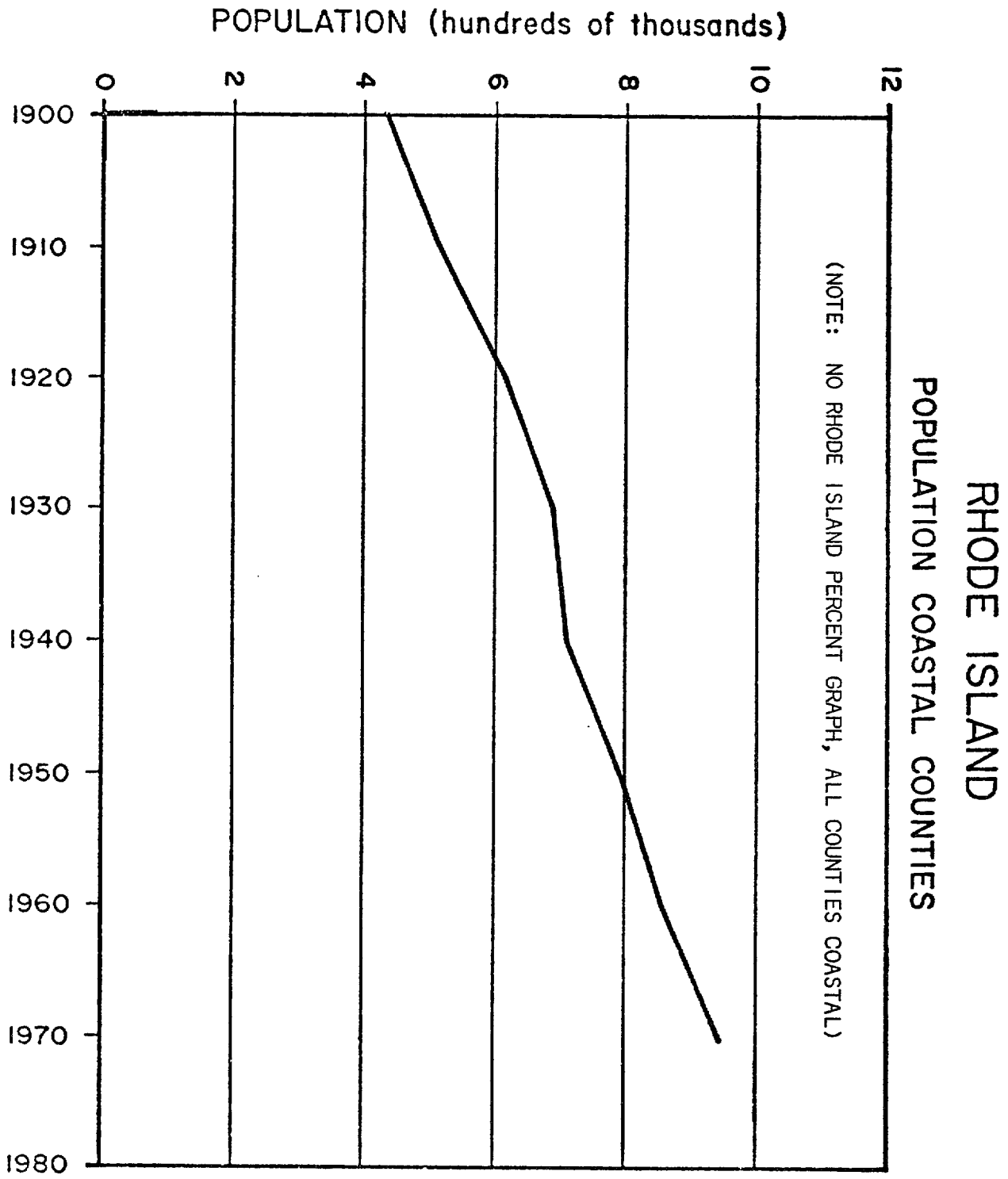

POPULATION (hundreds of thousands)
(SOLID LINE)
0
4
8
12
16
20
24
1900
1910
1920
1930
1940
1950
1960
1970
1980
20
30
40
50
60
70
80
PERCENT (COASTAL COUNTIES / STATE TOTAL X 100)
(DASHED LINE)
MARYLAND
POPULATION COASTAL COUNTIES

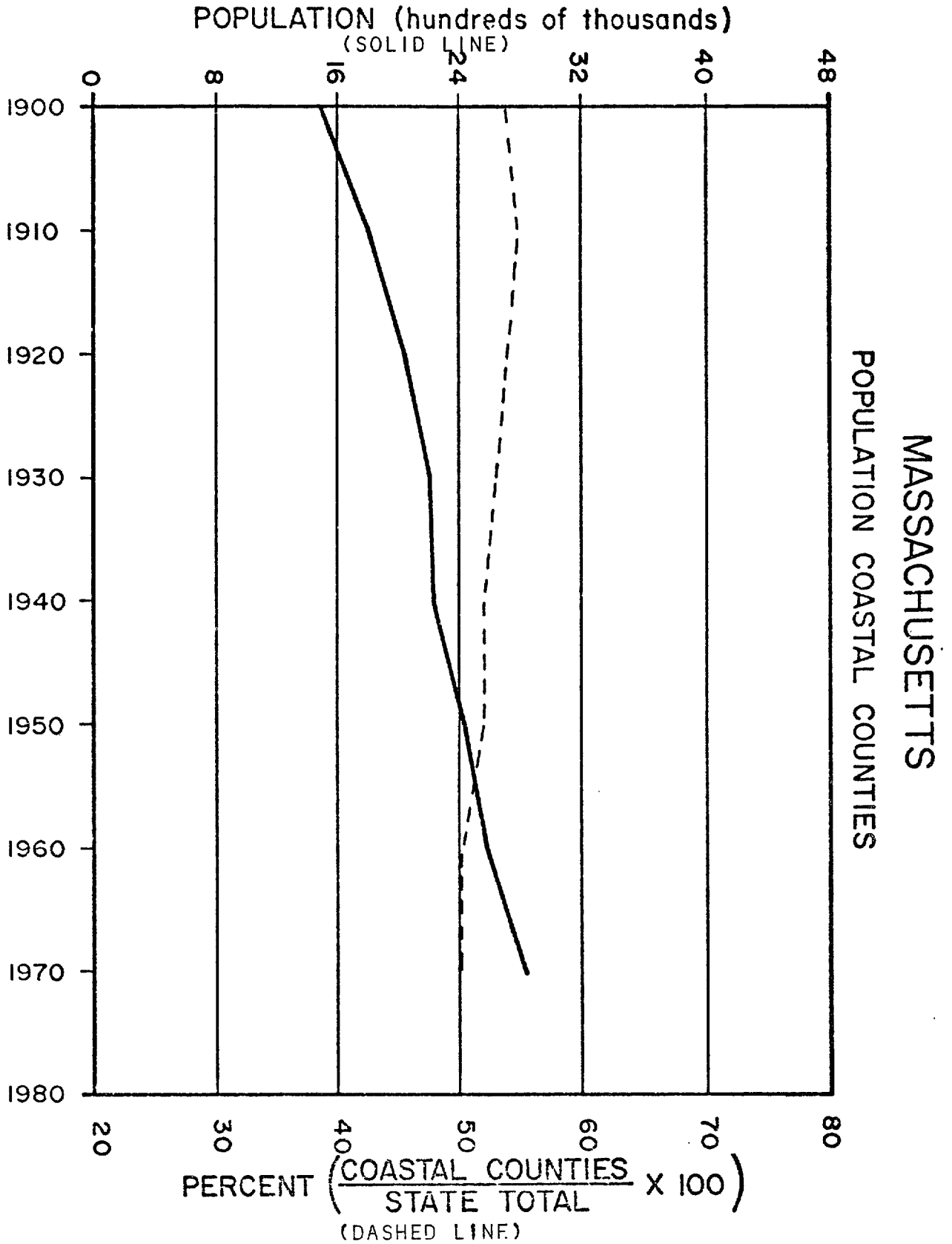

DELAWARE
POPULATION COASTAL COUNTIES
(NOTE: NO DELAWARE PERCENT GRAPH, ALL COUNTIES COASTAL)
POPULATION (hundreds of thousands)
0
1
2
3
4
5
6
1900
1910
1920
1930
1940
1950
1960
1970
1980

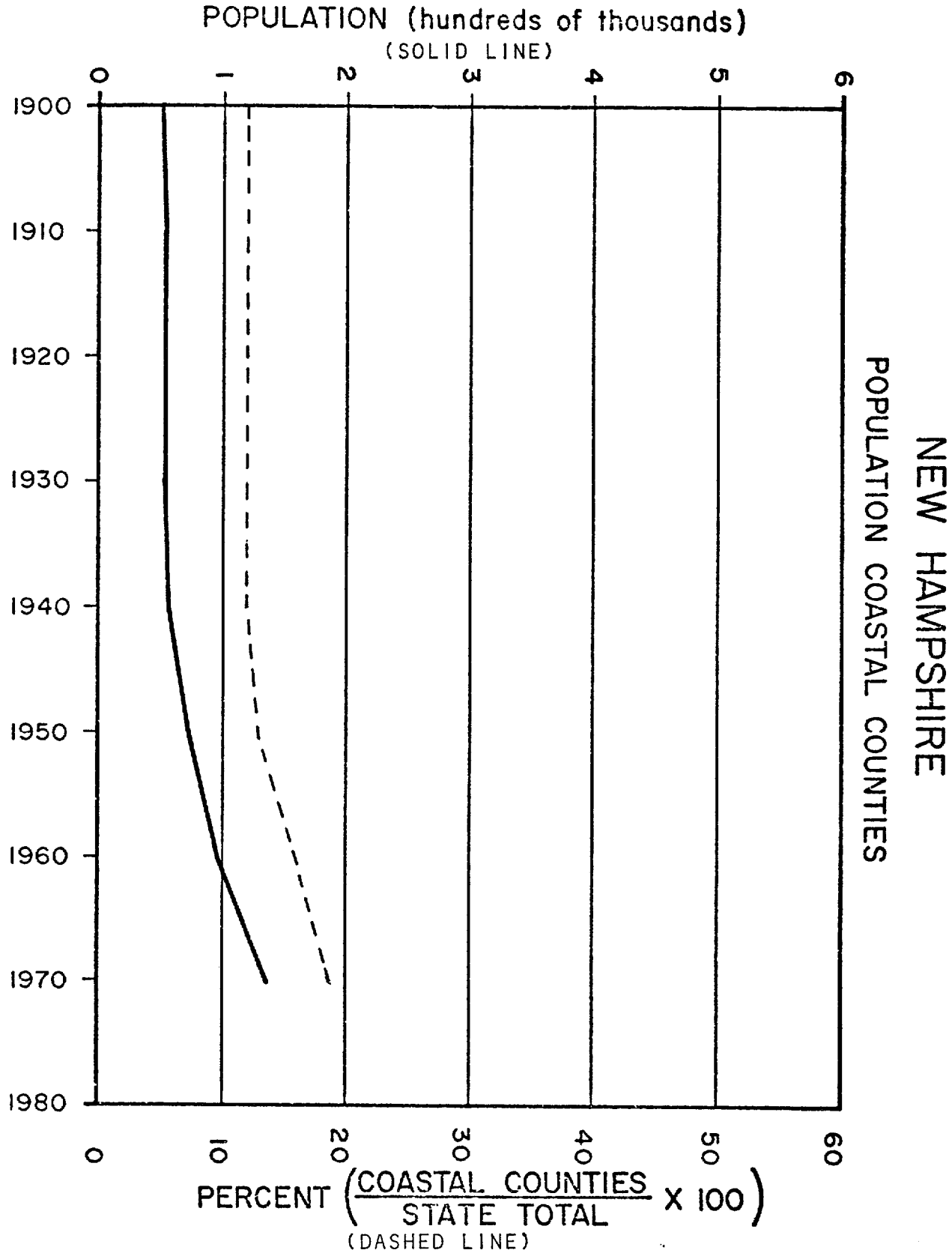

POPULATION (hundreds of thousands)
(SOLID LINE)
0
8
16
24
32
40
48
1900
1910
1920
1930
1940
1950
1960
1970
1980
20
30
40
50
60
70
80
PERCENT (COASTAL COUNTIES / STATE TOTAL X 100)
(DASHED LINE)
NEW JERSEY
POPULATION COASTAL COUNTIES

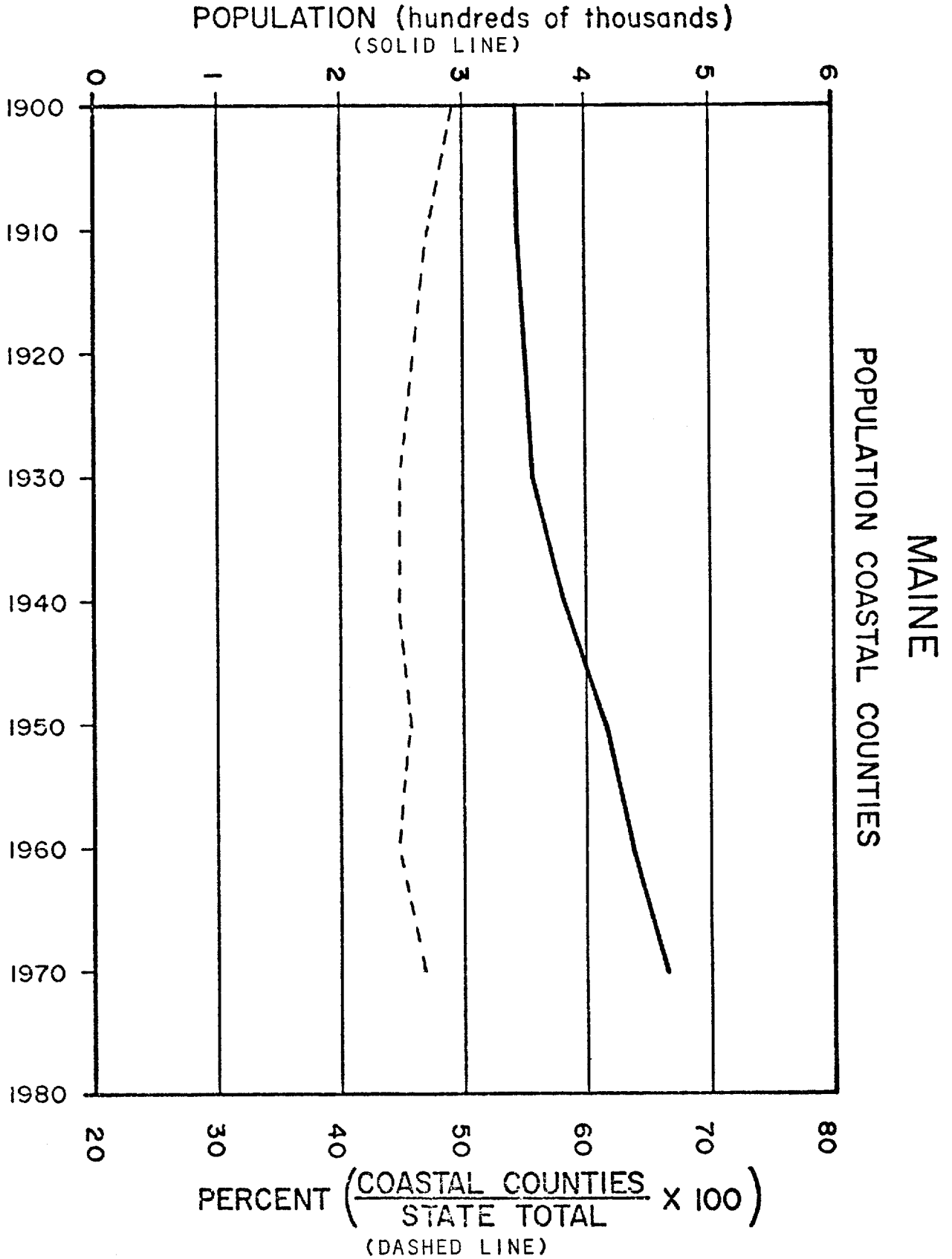

POPULATION (hundreds of thousands)
(SOLID LINE)
0
20
40
60
80
100
120
1900
1910
1920
1930
1940
1950
1960
1970
1980
NEW YORK
POPULATION COASTAL COUNTIES
20
30
40
50
60
70
80
PERCENT (COASTAL COUNTIES / STATE TOTAL X 100)
(DASHED LINE)


POPULATION (hundreds of thousands)
(SOLID LINE)
0
4
8
12
16
20
24
1900
1910
1920
1930
1940
1950
1960
1970
1980
20
30
40
50
60
70
80
PERCENT (COASTAL COUNTIES / STATE TOTAL X 100)
(DASHED LINE)
CONNECTICUT
POPULATION COASTAL COUNTIES


POPULATION (hundreds of thousands)
0
2
4
6
8
10
12
1900
1910
1920
1930
1940
1950
1960
1970
1980
RHODE ISLAND
POPULATION COASTAL COUNTIES
(NOTE: NO RHODE ISLAND PERCENT GRAPH, ALL COUNTIES COASTAL)


POPULATION (hundreds of thousands)
(SOLID LINE)
0
8
16
24
32
40
48
1900
1910
1920
1930
1940
1950
1960
1970
1980
MASSACHUSETTS
POPULATION COASTAL COUNTIES
20
30
40
50
60
70
80
PERCENT (COASTAL COUNTIES / STATE TOTAL X 100)
(DASHED LINE)

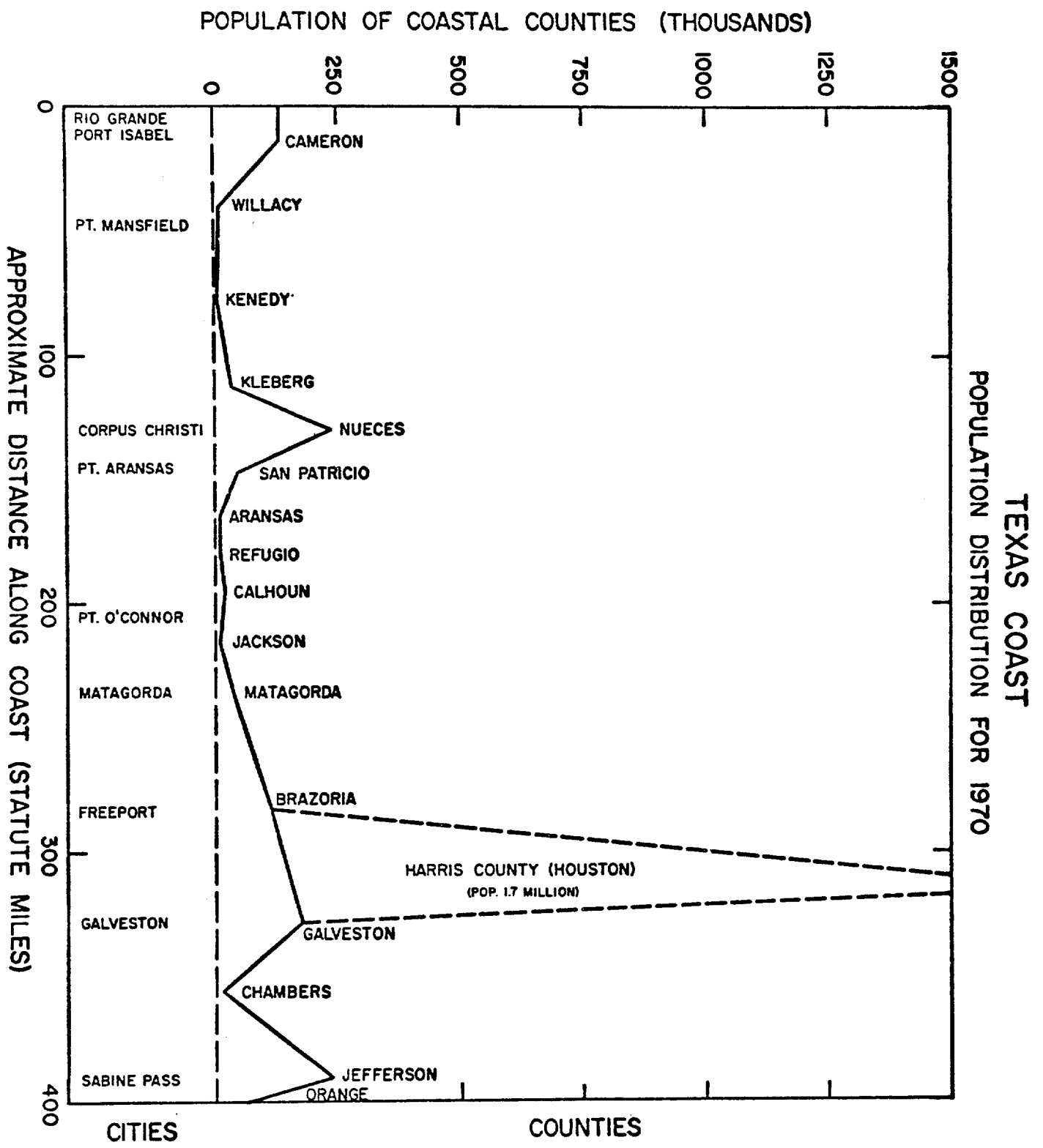

POPULATION (hundreds of thousands)
(SOLID LINE)
0
1
2
3
4
5
6
1900
1910
1920
1930
1940
1950
1960
1970
1980
0
10
20
30
40
50
60
PERCENT (COASTAL COUNTIES / STATE TOTAL X 100)
(DASHED LINE)
NEW HAMPSHIRE
POPULATION COASTAL COUNTIES

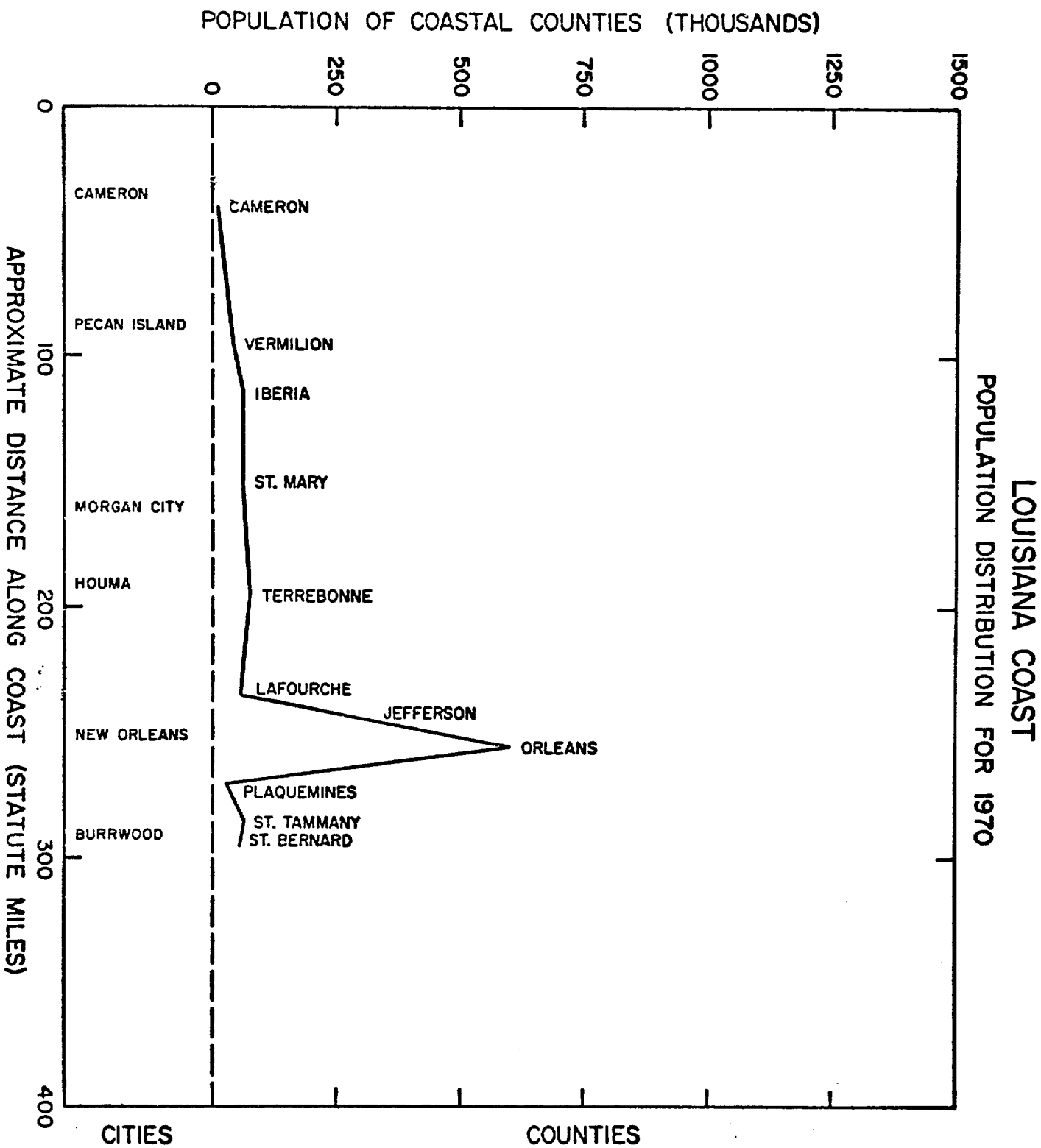

POPULATION (hundreds of thousands)
(SOLID LINE)
0
1
2
3
4
5
6
1900
1910
1920
1930
1940
1950
1960
1970
1980
20
30
40
50
60
70
80
PERCENT (COASTAL COUNTIES / STATE TOTAL X 100)
(DASHED LINE)
MAINE
POPULATION COASTAL COUNTIES

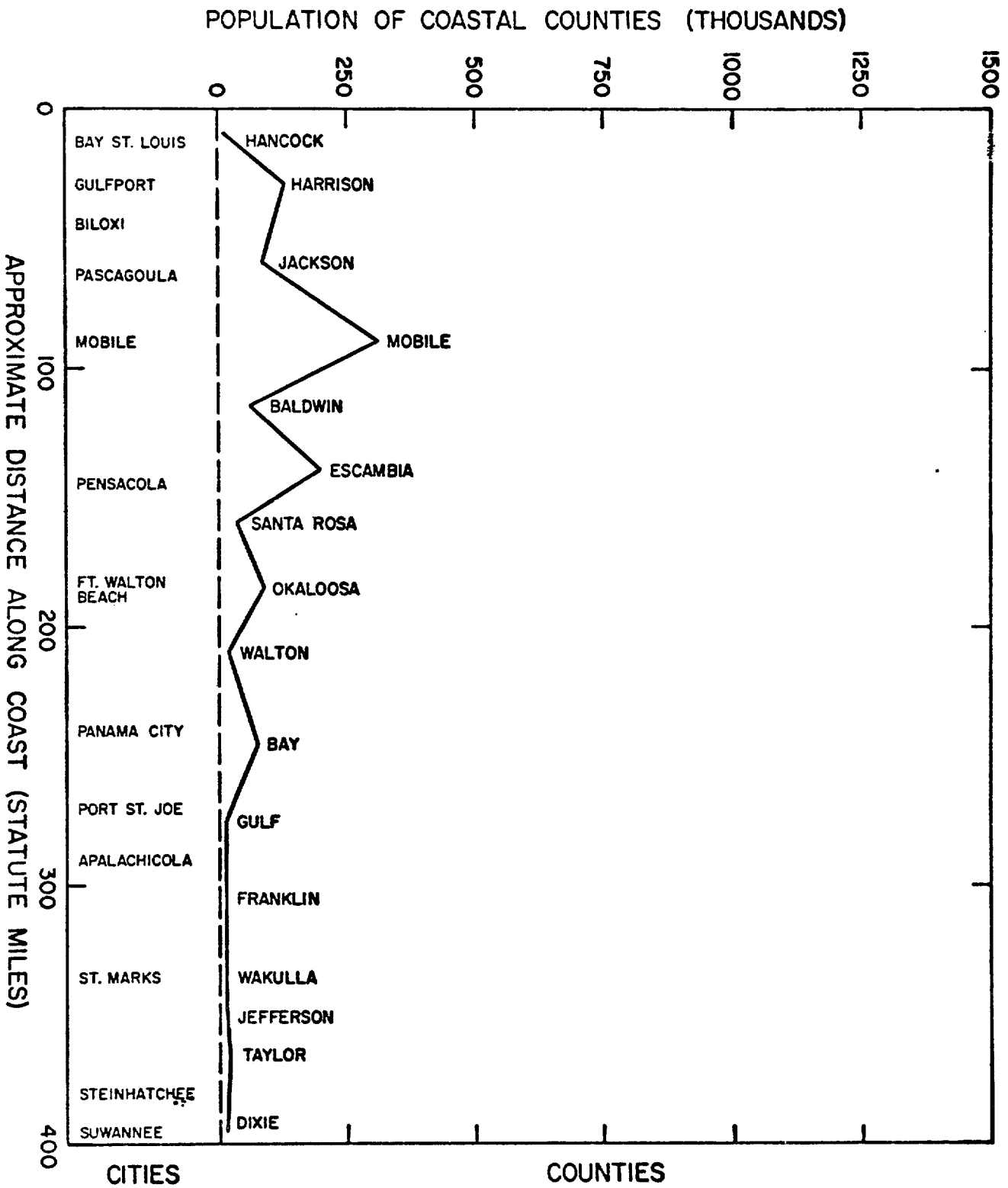
APPENDIX E

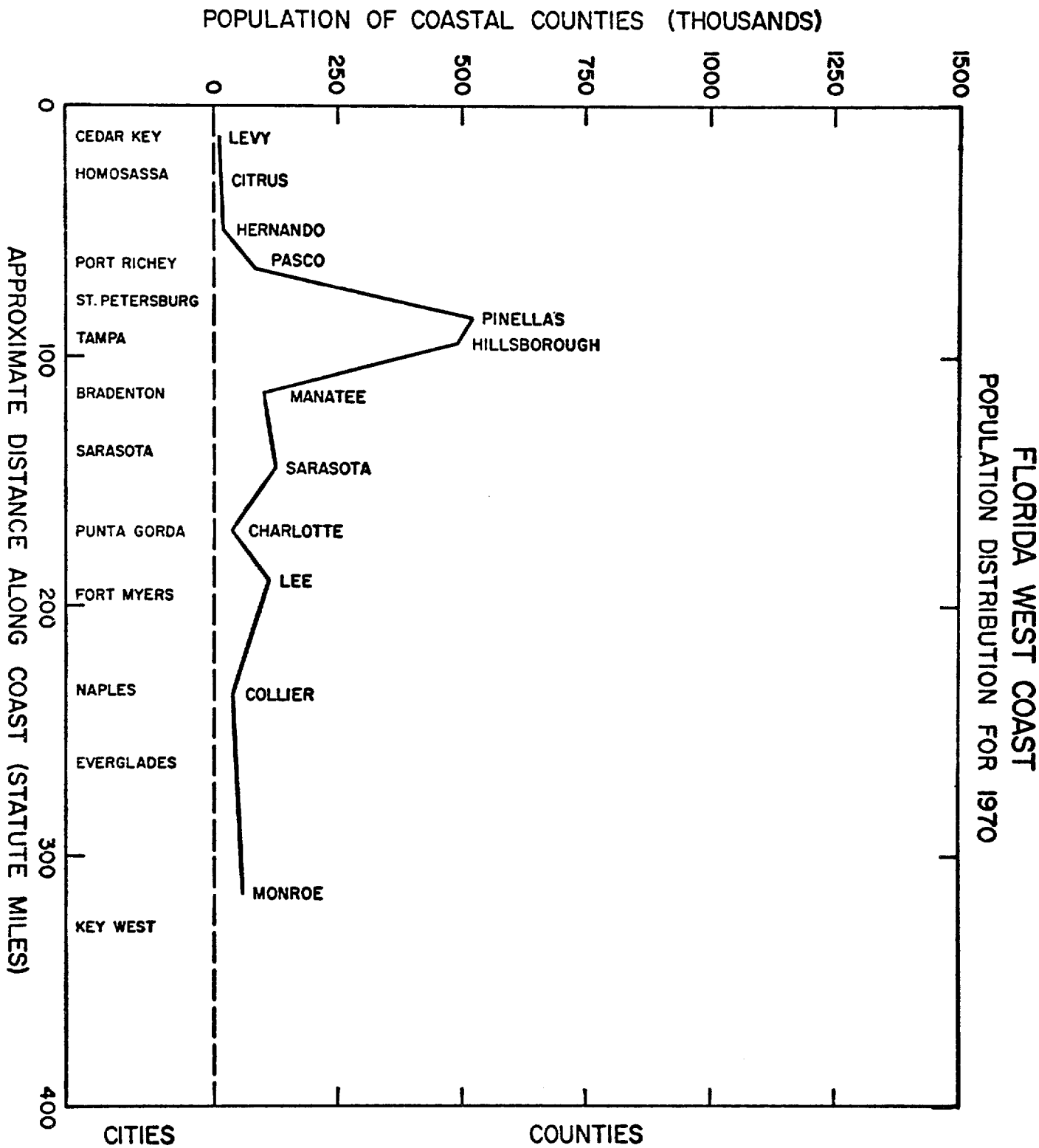
GULF AND ATLANTIC COASTAL POPULATION DISTRIBUTION - 1970

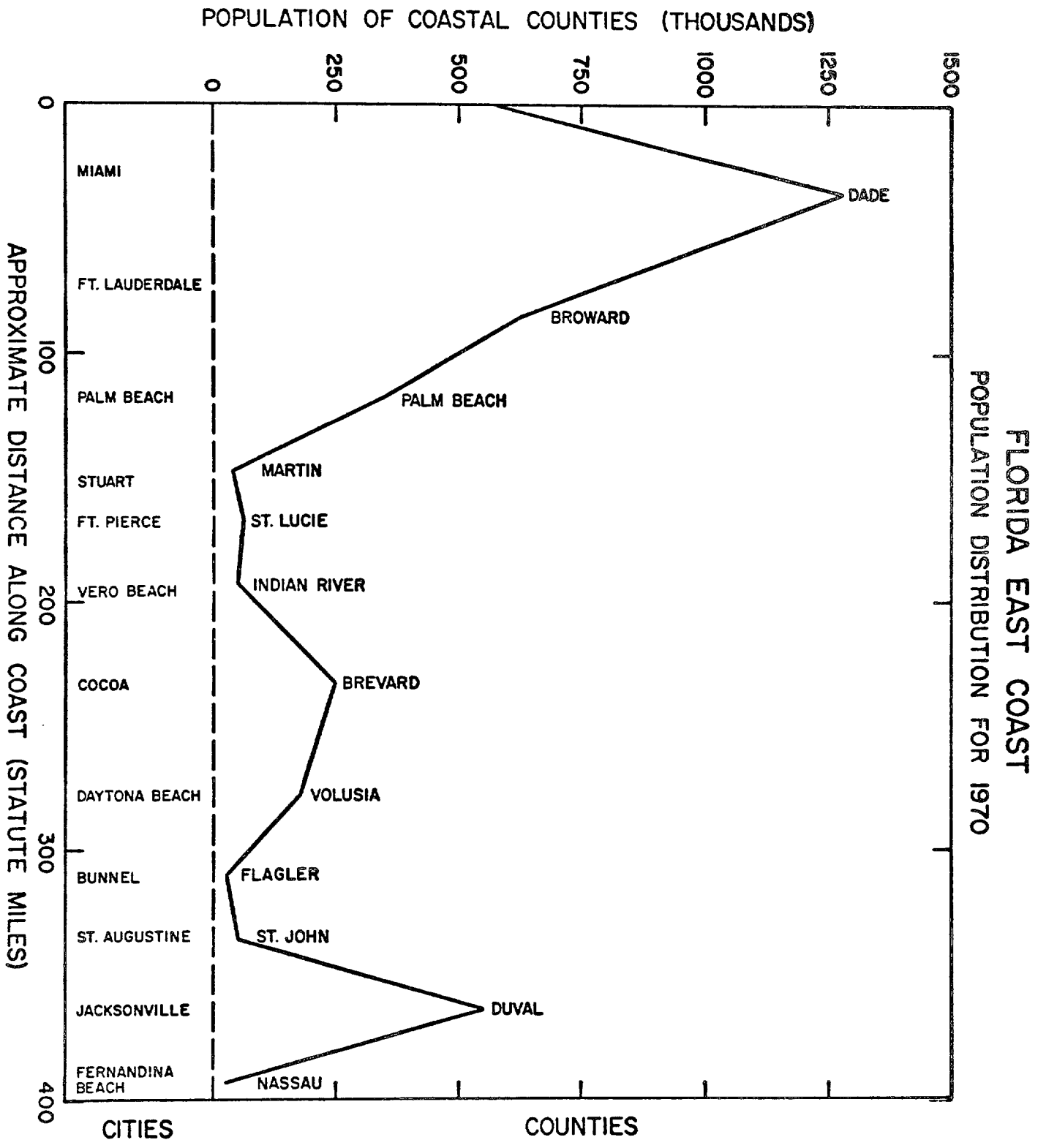
This set of nine graphs was designed as a rough guide to indicate approximately how many persons reside along any particular segment of coastline from Texas to Maine. The same distance scale was used for all states, so the graphs can be regarded as continuous when the appropriate end points are connected.

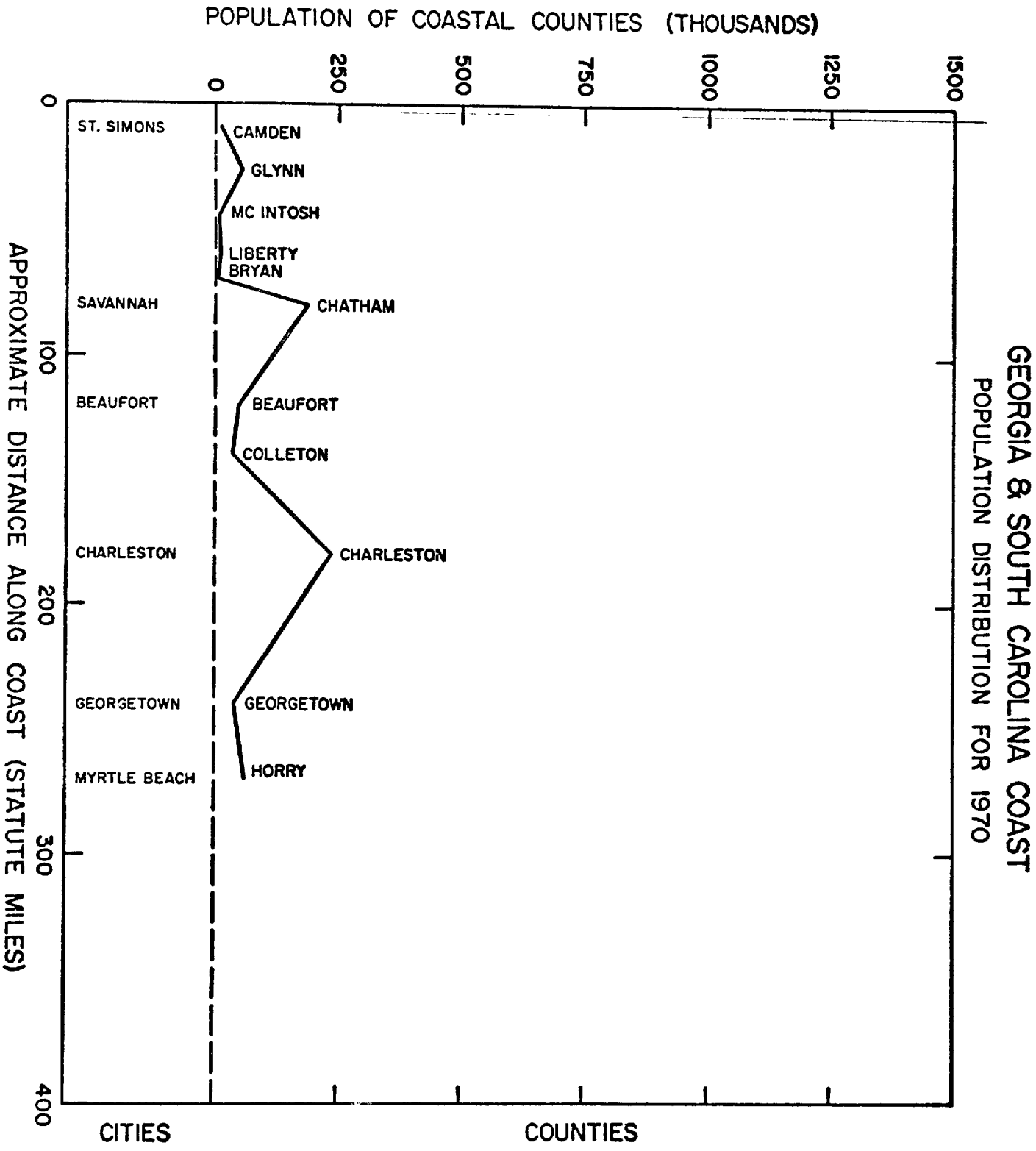

POPULATION OF COASTAL COUNTIES (THOUSANDS)
0
250
500
750
1000
1250
1500
APPROXIMATE DISTANCE ALONG COAST (STATUTE MILES)
0
100
200
300
400
RIO GRANDE
PORT ISABEL
PT. MANSFIELD
CORPUS CHRISTI
PT. ARANSAS
PT. O'CONNOR
MATAGORDA
FREEPORT
GALVESTON
SABINE PASS
CAMERON
WILLACY
KENEDY
KLEBERG
NUECES
SAN PATRICIO
ARANSAS
REFUGIO
CALHOUN
JACKSON
MATAGORDA
BRAZORIA
HARRIS COUNTY (HOUSTON)
(POP. 1.7 MILLION)
GALVESTON
CHAMBERS
JEFFERSON
ORANGE
CITIES
COUNTIES
TEXAS COAST
POPULATION DISTRIBUTION FOR 1970

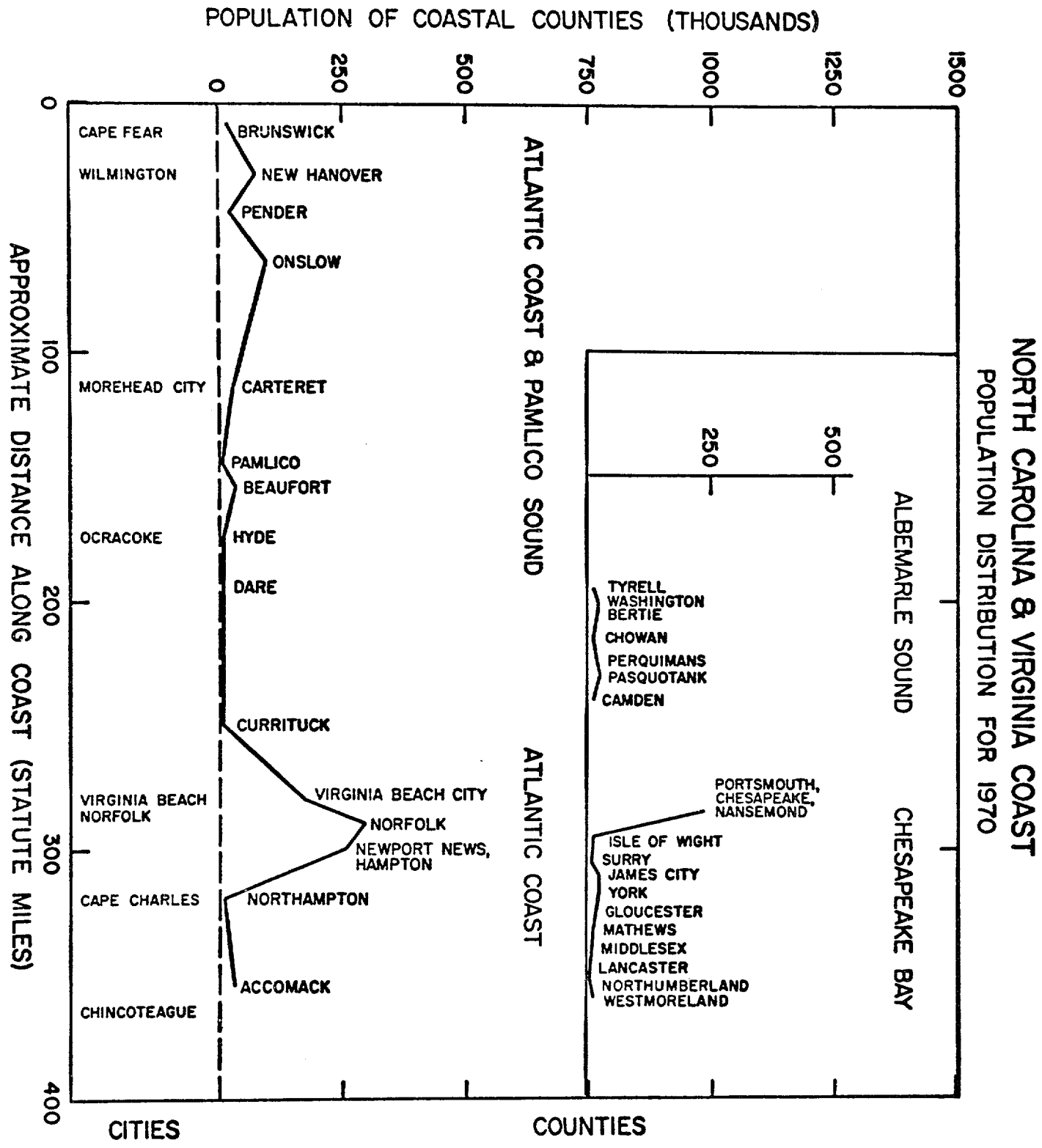

POPULATION OF COASTAL COUNTIES (THOUSANDS)
0
250
500
750
1000
1250
1500
APPROXIMATE DISTANCE ALONG COAST (STATUTE MILES)
0
100
200
300
400
CAMERON
PECAN ISLAND
MORGAN CITY
HOUMA
NEW ORLEANS
BURRWOOD
CAMERON
VERMILION
IBERIA
ST. MARY
TERREBONNE
LAFOURCHE
JEFFERSON
ORLEANS
PLAQUEMINES
ST. TAMMANY
ST. BERNARD
CITIES
COUNTIES
LOUISIANA COAST
POPULATION DISTRIBUTION FOR 1970

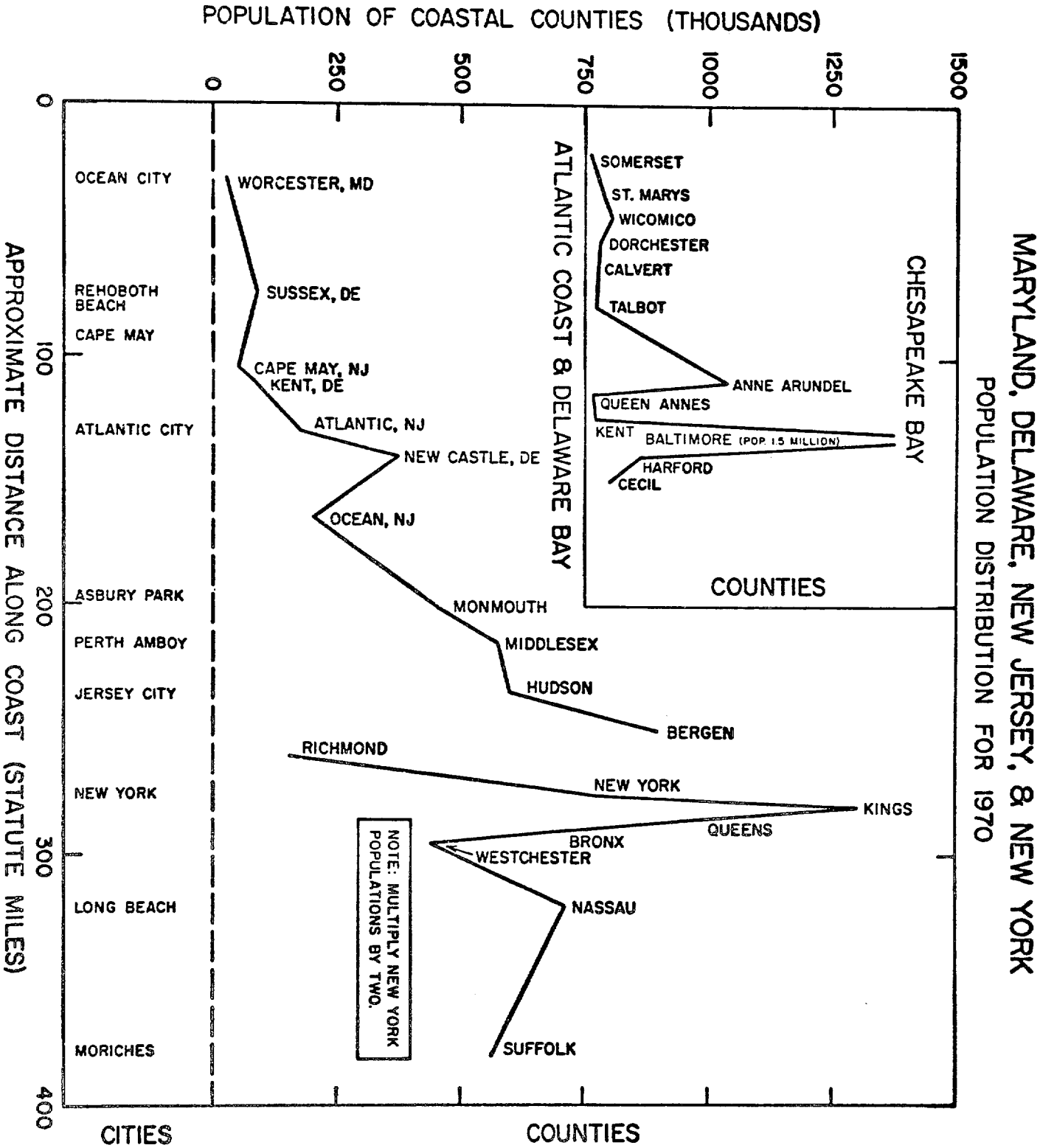

POPULATION OF COASTAL COUNTIES (THOUSANDS)
0
250
500
750
1000
1250
1500
APPROXIMATE DISTANCE ALONG COAST (STATUTE MILES)
0
100
200
300
400
BAY ST. LOUIS
GULFPORT
BILOXI
PASCAGOULA
MOBILE
PENSACOLA
FT. WALTON BEACH
PANAMA CITY
PORT ST. JOE
APALACHICOLA
ST. MARKS
STEINHATCHEE
SUWANNEE
HANCOCK
HARRISON
JACKSON
MOBILE
BALDWIN
ESCAMBIA
SANTA ROSA
OKALOOSA
WALTON
BAY
GULF
FRANKLIN
WAKULLA
JEFFERSON
TAYLOR
DIXIE
CITIES
COUNTIES
MISSISSIPPI, ALABAMA, FLORIDA (WEST OF 83° W.) COAST
POPULATION DISTRIBUTION FOR 1970

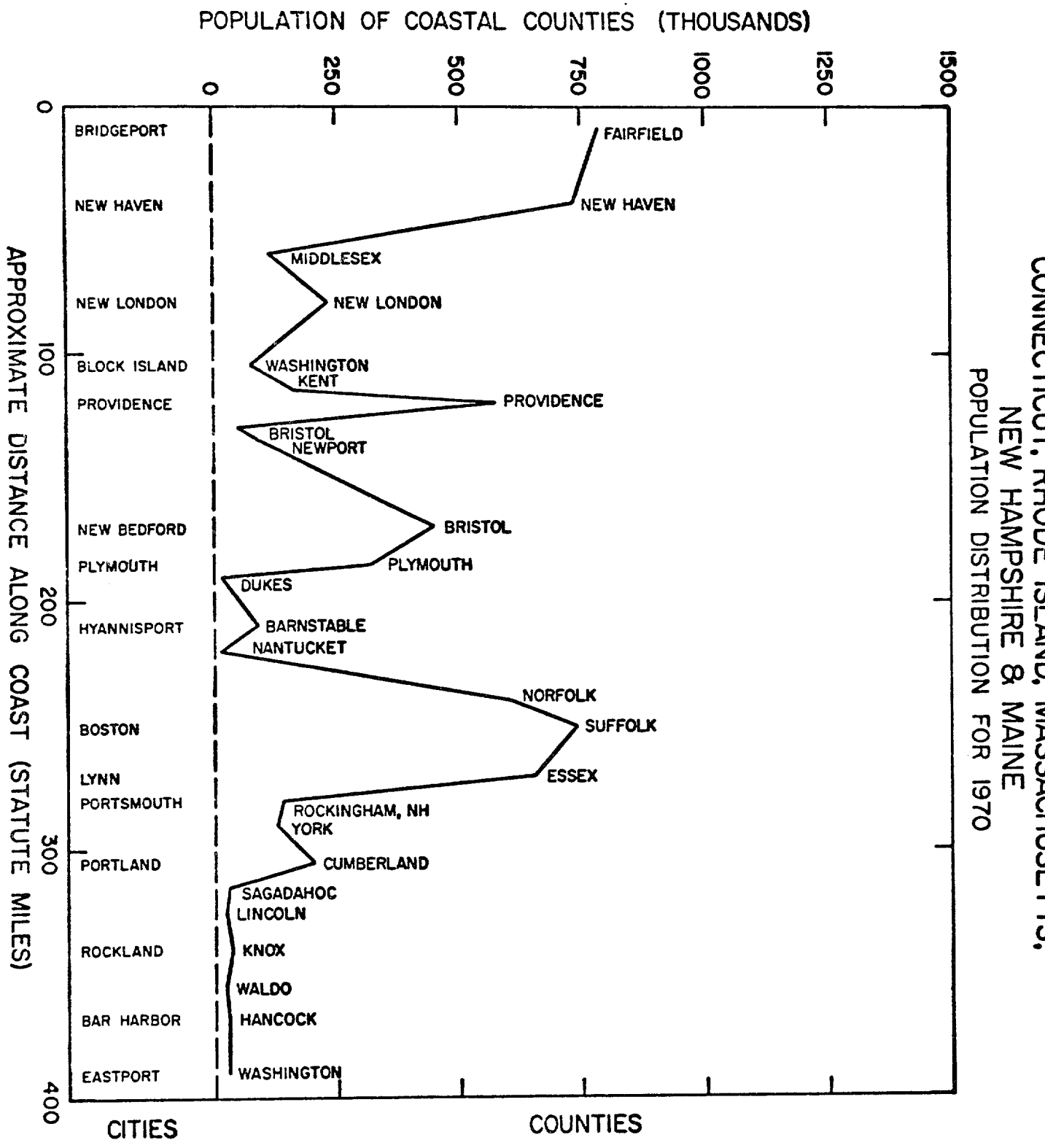

POPULATION OF COASTAL COUNTIES (THOUSANDS)
0
250
500
750
1000
1250
1500
APPROXIMATE DISTANCE ALONG COAST (STATUTE MILES)
0
100
200
300
400
CEDAR KEY
HOMOSASSA
PORT RICHEY
ST. PETERSBURG
TAMPA
BRADENTON
SARASOTA
PUNTA GORDA
FORT MYERS
NAPLES
EVERGLADES
KEY WEST
LEVY
CITRUS
HERNANDO
PASCO
PINELLAS
HILLSBOROUGH
MANATEE
SARASOTA
CHARLOTTE
LEE
COLLIER
MONROE
CITIES
COUNTIES
FLORIDA WEST COAST
POPULATION DISTRIBUTION FOR 1970


POPULATION OF COASTAL COUNTIES (THOUSANDS)
0
250
500
750
1000
1250
1500
APPROXIMATE DISTANCE ALONG COAST (STATUTE MILES)
0
100
200
300
400
MIAMI
FT. LAUDERDALE
PALM BEACH
STUART
FT. PIERCE
VERO BEACH
COCOA
DAYTONA BEACH
BUNNEL
ST. AUGUSTINE
JACKSONVILLE
FERNANDINA BEACH
CITIES
DADE
BROWARD
PALM BEACH
MARTIN
ST. LUCIE
INDIAN RIVER
BREVARD
VOLUSIA
FLAGLER
ST. JOHN
DUVAL
NASSAU
COUNTIES
FLORIDA EAST COAST
POPULATION DISTRIBUTION FOR 1970


POPULATION OF COASTAL COUNTIES (THOUSANDS)
0
250
500
750
1000
1250
1500
APPROXIMATE DISTANCE ALONG COAST (STATUTE MILES)
0
100
200
300
400
ST. SIMONS
SAVANNAH
BEAUFORT
CHARLESTON
GEORGETOWN
MYRTLE BEACH
CAMDEN
GLYNN
MC INTOSH
LIBERTY
BRYAN
CHATHAM
BEAUFORT
COLLETON
CHARLESTON
GEORGETOWN
HORRY
CITIES
COUNTIES
GEORGIA & SOUTH CAROLINA COAST
POPULATION DISTRIBUTION FOR 1970


NORTH CAROLINA & VIRGINIA COAST
POPULATION DISTRIBUTION FOR 1970
POPULATION OF COASTAL COUNTIES (THOUSANDS)
0
250
500
750
1000
1250
1500
APPROXIMATE DISTANCE ALONG COAST (STATUTE MILES)
0
100
200
300
400
CAPE FEAR
WILMINGTON
MOREHEAD CITY
OCRACOKE
VIRGINIA BEACH
NORFOLK
CAPE CHARLES
CHINCOTEAGUE
CITIES
BRUNSWICK
NEW HANOVER
PENDER
ONSLOW
CARTERET
PAMLICO
BEAUFORT
HYDE
DARE
CURRITUCK
VIRGINIA BEACH CITY
NORFOLK
NEWPORT NEWS, HAMPTON
NORTHAMPTON
ACCOMACK
ATLANTIC COAST & PAMLICO SOUND
ATLANTIC COAST
250
500
ALBEMARLE SOUND
CHESAPEAKE BAY
TYRELL
WASHINGTON
BERTIE
CHOWAN
PERQUIMANS
PASQUOTANK
CAMDEN
PORTSMOUTH, CHESAPEAKE, NANSEMOND
ISLE OF WIGHT
SURRY
JAMES CITY
YORK
GLOUCESTER
MATHEWS
MIDDLESEX
LANCASTER
NORTHUMBERLAND
WESTMORELAND
COUNTIES


MARYLAND, DELAWARE, NEW JERSEY, & NEW YORK
POPULATION DISTRIBUTION FOR 1970
POPULATION OF COASTAL COUNTIES (THOUSANDS)
0
250
500
750
1000
1250
1500
APPROXIMATE DISTANCE ALONG COAST (STATUTE MILES)
0
100
200
300
400
OCEAN CITY
REHOBOTH BEACH
CAPE MAY
ATLANTIC CITY
ASBURY PARK
PERTH AMBOY
JERSEY CITY
NEW YORK
LONG BEACH
MORICHES
CITIES
WORCESTER, MD
SUSSEX, DE
CAPE MAY, NJ
KENT, DE
ATLANTIC, NJ
NEW CASTLE, DE
OCEAN, NJ
MONMOUTH
MIDDLESEX
HUDSON
BERGEN
RICHMOND
NEW YORK
KINGS
QUEENS
BRONX
WESTCHESTER
NASSAU
SUFFOLK
NOTE: MULTIPLY NEW YORK POPULATIONS BY TWO.
ATLANTIC COAST & DELAWARE BAY
SOMERSET
ST. MARYS
WICOMICO
DORCHESTER
CALVERT
TALBOT
ANNE ARUNDEL
QUEEN ANNES
KENT
BALTIMORE (POP 1.5 MILLION)
HARFORD
CECIL
CHESAPEAKE BAY
COUNTIES
COUNTIES


POPULATION OF COASTAL COUNTIES (THOUSANDS)
0
250
500
750
1000
1250
1500
APPROXIMATE DISTANCE ALONG COAST (STATUTE MILES)
0
100
200
300
400
BRIDGEPORT
NEW HAVEN
NEW LONDON
BLOCK ISLAND
PROVIDENCE
NEW BEDFORD
PLYMOUTH
HYANNISPORT
BOSTON
LYNN
PORTSMOUTH
PORTLAND
ROCKLAND
BAR HARBOR
EASTPORT
FAIRFIELD
NEW HAVEN
MIDDLESEX
NEW LONDON
WASHINGTON
KENT
PROVIDENCE
BRISTOL
NEWPORT
BRISTOL
PLYMOUTH
DUKES
BARNSTABLE
NANTUCKET
NORFOLK
SUFFOLK
ESSEX
ROCKINGHAM, NH
YORK
CUMBERLAND
SAGADAHOC
LINCOLN
KNOX
WALDO
HANCOCK
WASHINGTON
CITIES
COUNTIES
CONNECTICUT, RHODE ISLAND, MASSACHUSETTS,
NEW HAMPSHIRE & MAINE
POPULATION DISTRIBUTION FOR 1970