

This document contains the Appendix and Back Cover for the National Estuary Program Coastal Condition Report. The Appendix provides an analysis of the derivation of NEPcoincident counties. The entire report can be downloaded from http://www.epa.gov/owow/oceans/nepccr/index.html

National Estuary Program Coastal Condition Report

Appendix & Back Cover

June 2007

APPENDIX A

PROCEDURES FOR CALCULATING TOTAL POPULATION,
POPULATION GROWTH RATE, AND POPULATION DENSITY
FOR VARIOUS GEOGRAPHIC AREAS



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Introduction

Human population pressures can be evaluated using several measures. For the U.S. Environmental Protection Agency's (EPA's) National Estuary Program Coastal Condition Report (NEP CCR), three measures were used to evaluate the impact of human population pressures on the 28 NEP estuaries of the United States: total population, population growth rate over a specified time interval, and population density (persons/mi² of land area). These population pressures were measured for each individual NEP estuary and compared to those calculated for other NEP estuaries, all coastal areas, all non-coastal areas, and the conterminous United States to assess the relative impacts of human populations on estuarine condition.

The National Oceanic & Atmospheric Administration (NOAA) recently published the report Population Trends along the Coastal United States: 1980–2008 (Crossett et al., 2004), which presents an overview of coastal population trends from 1980 through 2003, projected changes in coastal populations through 2008, and the definition of a NOAA-designated coastal county. The NOAA Special Projects office designates a county as a coastal county if one of the following criteria is met:

- At a minimum, 15% of the county's total land area is located within a coastal watershed
- A portion of a county or an entire county accounts for at least 15% of a cataloging unit.

It should be noted that this NOAA report and the other NOAA report (Culliton et al., 1990) referenced in this Appendix differ from the NEP CCR in that the NOAA reports include the Great Lakes region as a coastal area. In addition, the NEP CCR only covers marine coastal areas in the conterminous 48 states because none of the NEP estuaries are located in Alaska or Hawaii. Population pressures for the one NEP estuary located in Puerto Rico (San Juan Bay Estuary) were evaluated separately for this NEP CCR due to a lack of comparable population data for this region. An overview of this evaluation is provided later in this Appendix.

In order to determine the human population pressures exerted on counties coincident with individual NEP study areas, population data were obtained from the U.S. Census Bureau (1991; 2001). These data were used to calculate total population for 1960, 1970, 1980, 1990, and 2000; population density in 2000; and the population growth rate between 1960 and 2000 for the following:

- Each NEP study area (using all NOAA-designated coastal counties or municipalities coincident with an individual NEP study area)
- All NEP coastal counties collectively (using the NOAA-designated coastal counties coincident with all 27 NEPs located in the conterminous 48 states)
- All NOAA-designated coastal counties (using both NEP and non-NEP coastal counties in the 48 conterminous U.S. states and excluding coastal counties in Puerto Rico and those adjacent to the Great Lakes)

- All non-coastal counties (using all counties in the 48 conterminous U.S. states that are not considered NOAA-designated coastal counties, as well as the NOAA-designated coastal counties that are adjacent to the Great Lakes)
- All counties in the 48 conterminous U.S. states, as a

Population statistics for the study area for Puerto Rico's NEP, the San Juan Bay Estuary Partnership (SJBEP), were calculated differently because of variances in available data for the region. Population data for the SJBEP study area were only available for the year 2000. In addition, Puerto Rico was not included in the available list of NOAA-designated coastal counties, and a separate section in this text has been devoted to describing the processes employed for deriving population density estimates for the SJBEP study area. Due to the differences in methodology and available source data for the SJBEP study area, the results for this NEP estuary are not included in the values cited in Chapter 1 that provide national population data for Figure 1-2.

Selection of Coastal Counties in the **NEP Study Areas**

Geographic information systems (GIS) technology was used to identify which NOAA-designated coastal counties are spatially coincident with NEP study area boundaries. These counties were identified using the following steps:

- A GIS shapefile was developed delineating the NOAA-designated coastal counties
- A separate GIS shapefile delineating the 2003 boundaries of each NEP study area was obtained from EPA
- GIS was used to compare the two shapefiles electronically and identify which NOAA-designated coastal counties overlap the boundaries of a specific NEP study area
- A visual inspection was conducted to refine the selection of NOAA-designated coastal counties in the NEP study area.

For comparison purposes in the NEP CCR, only the NOAA-designated coastal counties in the U.S. regions that contain NEP estuaries were processed as coastal counties. The NOAA-designated coastal counties bordering the Great Lakes were processed as non-coastal counties because there are no NEP estuaries in this region. In addition, this analysis was limited to coastal and non-coastal counties in the conterminous United States because no NEP-designated estuaries are located in Alaska or Hawaii and because insufficient data were available for the island territory of Puerto Rico.

Methodology for the 27 NEPs in the Conterminous U.S.

To identify the NEP-coincident coastal counties for the 27 NEPs in the conterminous United States, a shapefile of NOAA-designated coastal counties was created by electronically linking coastal county data from NOAA (Culliton et al., 1990) to a GIS shapefile of all U.S. counties (National Atlas of the United States, 2005). The coastal county data were obtained from the NOAA report 50 Years of Population Change Along the Nation's Coasts 1960–2010, A Special Earth Week Report (Culliton et. al., 1990), which contains a table entitled "Population and Development in Coastal Areas Coastal Counties List," hereafter referred to as the NOAA Coastal Counties Table. This table presents the land area (in mi²), population, and unique Federal Information Processing Standards (FIPS) code for each coastal county in the conterminous United States.

The NOAA Coastal Counties Table was divided into sections based on the waterbody associated with each coastal county. The sections of the table associated with Great Lakes, Hawaiian, and Alaskan waters were excluded so that only the sections that provided data for the Atlantic, Gulf, and Pacific coasts of the conterminous United Sates were used. The FIPS codes in these sections of the NOAA Coastal Counties Table were linked electronically with the matching FIPS codes in the U.S. counties shapefile to create a subset of NOAAdesignated coastal counties. This subset was saved as a separate shapefile and used in the population calculations described below.

Once the NOAA-designated coastal counties shapefile was created, GIS technology was used to determine which NOAA-designated coastal counties were coincident with NEP study areas. A spatial comparison of the NOAA-designated coastal county boundaries and the NEP study area boundaries was performed. GIS technology automatically selected those counties from the NOAA-designated coastal counties shapefile that spatially intersected NEP study area polygons in the NEP boundary shapefile obtained from EPA.

This automatic selection of spatially coincident counties was further refined using a visual inspection in GIS. When GIS shapefiles are obtained from different sources, slight discrepancies in the scale or accuracy of the polygons in the file are common. For example, when an NEP study area boundary coincided with a county border, the automatic selection process often included the neighboring county due to discrepancies between the two shapefiles. The objective of this visual inspection was to identify any counties that were included in the automatic selection as a result of discrepancies between the polygonal boundaries of the NOAA-designated coastal counties shapefile and the NEP boundary shapefile. These counties were then removed from the NEP-coincident coastal counties shapefile.

Figure A-1 provides an example of how GIS analysis was used to generate the final shapefile of NEP-coincident coastal counties. The NOAA Coastal Counties Table was used to select all of the NOAA-designated coastal counties (shown in yellow and purple). Note that Highlands County (shown in orange) does not meet the NOAA Special Projects office's definition of a coastal county and was not included in the spatial selection. The Indian River Lagoon NEP (IRLNEP) study area boundary polygon from EPA's NEP boundary shapefile is outlined in green. The automatic GIS selection of coincident coastal counties generated an initial data set that included Volusia, Brevard, Indian River, Okeechobee, St. Lucie, Martin, and Palm Beach counties. Visual inspection of the GIS selections revealed that the NEP boundary polygon intersected significant portions of Volusia, Brevard, Indian River, Okeechobee, St. Lucie, and Martin counties, and these counties were included in the final shapefile (shown in purple). However, the NEP boundary polygon did not intersect

a significant portion of Palm Beach County, and the inclusion of this county was likely due to a discrepancy. As a result, Palm Beach County was deselected and excluded from the final NEP-coincident coastal county shapefile for the IRLNEP.

Methodology for the San Juan Bay Estuary Partnership (SJBEP)

Puerto Rico is divided into municipalities rather than counties, and these municipalities were not included in the NOAA Coastal Counties Table or the NOAA-designated coastal counties shapefile. As a result, the methodology for determining the NEP-coincident municipalities for the SJBEP study area differed from the methodology used to identify the NEP-coincident coastal counties for the other 27 NEPs. For Puerto Rico, each NEP-coincident municipality was selected by hand using a visual inspection. The inspection selected all of the municipalities that significantly intersected the boundary of the SJBEP study area polygon. The selected municipalities were then used to create a shapefile for the SJBEP study area.

Calculation of Population Statistics for all U.S. NEPs

When data were available, the total population in 1960, 1970, 1980, 1990, and 2000; population growth rate (1960-2000); and population density in 2000 were calculated for several geographic areas of interest. These geographic areas are the conterminous United States, all NOAA-designated coastal counties (collectively), all NEP-coincident coastal counties (collectively), the coastal counties coincident to each individual NEP study area, and all non-coastal counties (collectively). A unique data set of population and land area data was created for each area of interest, and the same general formulas were used to calculate total population, population growth rate, and population density for each data set. It should be noted that Puerto Rico's population growth rate and total population figures for 1960, 1970, 1980, and 1990 were not calculated because population data for Puerto Rico prior to 2000 were unavailable from the U.S. Census Bureau (1991).

In order to develop a data set for the conterminous United States, land area values and 1960, 1970, 1980, 1990, and 2000 population data for all of the states

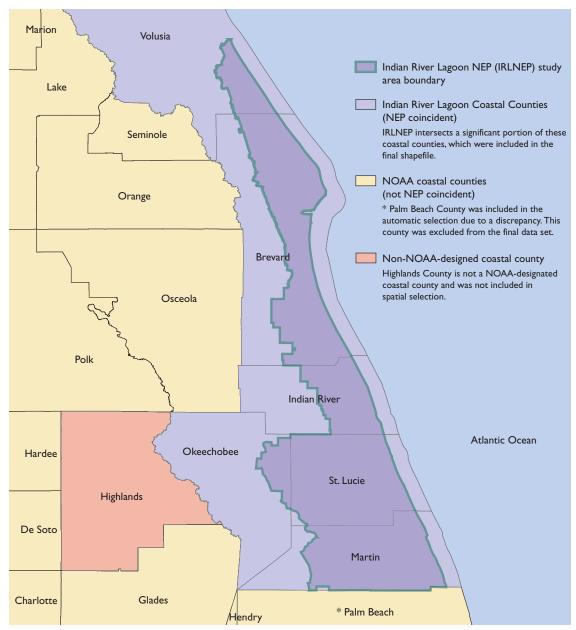


Figure A-I. An example of the spatial selection process used to identify NEP-coincident coastal counties for the Indian River Lagoon NEP.

(excluding Puerto Rico and other commonwealths, territories, and protectorates) were obtained from the U.S. Census Bureau (1991; 2001). The data set was refined to include only the 48 conterminous states by subtracting population data and land area values for Alaska and Hawaii.

The raw data necessary to calculate total population, population growth rate, and population density for all the NOAA-designated coastal counties were obtained from several sources. The land area of each county in

2000 and the population data for each county in 1960, 1970, 1980, and 1990 were obtained from the portions of the NOAA Coastal Counties Table providing data for the Atlantic, Gulf, and Pacific coasts. The population data for each county in 2000 was obtained from the U.S. Census Bureau (2001) and are hereafter referred to as the 2000 Census Counties Table. Both tables were linked by the county FIPS codes to create a population data set that ranged from 1960 to 2000 for all NOAAdesignated coastal counties.

The NOAA-designated coastal counties data set was refined to create the NEP-coincident coastal county data set. During this process, FIPS codes were used to link the NOAA-designated coastal counties data set with the NEP-coincident coastal counties shapefile to isolate the population and land area data for the NEPcoincident coastal counties.

The NEP-coincident coastal counties shapefile contains a field that associates each NEP-coincident coastal county with an individual NEP. This field was retained in the NEP-coincident coastal counties data set and used to create the data sets for each of the 27 individual NEPs in the conterminous United States. For the San Juan Bay Estuary, land area and population data for the SJBEP study area in 2000 were obtained from the U.S. Census Bureau (2001). The SJBEP data set was created by linking the FIPS codes in the SJBEP shapefile to those in the data from the U.S. Census Bureau.

The non-coastal counties data set was generated using the NOAA-designated coastal counties data set and the data set for the conterminous United States.

The population and land area data for all of the noncoastal counties in the 48 conterminous U.S. states were calculated by subtracting the data for the NOAA-designated coastal counties from the data for all of the 48 conterminous U.S. states. This process is demonstrated in the text box below.

The data in each data set were then used to calculate the total population, population growth rate, and population density for each geographic area of interest. The general formulas used to calculate these statistics are presented in the text box below. The results of these calculations and the corresponding variables for the conterminous United States, all NOAA-designated coastal counties (collectively), all NEP-coincident coastal counties (collectively), the coastal counties coincident to each individual NEP study area, and all noncoastal counties (collectively) are summarized in Table A-1. The results for the data sets of coastal counties coincident with each individual NEP study area are presented in the individual NEP discussions within the main body of the NEP CCR.

Formulas: 2000Population_{48States} - 2000Population_{CoastalCounties} = 2000Population_{NonCoastalCounties} $TotalPopulation_{GivenArea} = \Sigma Population_{EachCountv}$ Population Growth Rate = 2000Population_{Total} - 1960Population_{Total} 1960PopulationTotal 2000 Population Density = 2000Population_{Total} **TotalLandArea**

Table A-I. Comparison of U.S. Trends in Total Population, Population Growth Rate, and Population Density for the Nation, NOAA-designated Coastal Counties, NEP-coincident Coastal Counties, and Non-coastal Counties*

Year	Total population (millions)	Growth rate since 1960 (%)	Population density (persons/mi ²)	Land area (mi²)
National (Co	onterminous U.S.)			
1960	178.46		60	
1970	202.23		68	
1980	225.18		76	
1990	247.34		84	
2000	279.58	56.66	94	2,959,065
NOAA-desig	nated coastal counties			
1960	70.05		181	
1970	82.99		214	
1980	92.50		239	
1990	105.89		273	
2000	119.25	70.24	308	387,473
NEP-coincid	ent coastal counties			
1960	51.42		313	
1970	60.55		368	
1980	65.48		398	
1990	73.68		448	
2000	81.91	59.28	498	164,382
Non-coastal	counties			
1960	108.42		42	
1970	119.24		46	
1980	132.68		52	
1990	141.45		55	
2000	160.33	47.88	62	2,571,592

^{*} Excludes population data and land area from Alaska, Hawaii, and Puerto Rico and other commonwealths, territories, and protectorates.





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