

“The Coast” is Complicated: A Model to Consistently Describe the Nation’s Coastal Population

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1 **Introduction**

2 How many people live in coastal areas? Well, it depends, because “the coast” is a complicated
3 management area where no single delineation provides all of the demographic statistics needed
4 to address the full range of policy and management issues (Crowell et al. 2007, Crowell et al.
5 2010). As a result, several different coastal delineations are currently being used, yielding a
6 variety of recent U.S. coastal population statistics (NOEP 2009; Crowell et al. 2010; U.S. Census
7 Bureau 2010; NOAA 2012a). Although each set of statistics can be useful in the appropriate
8 context, they are sometimes applied inappropriately (Crowell et al. 2007), adding confusion to
9 policy discussions and public understanding of coastal issues. For example, statistics on the
10 population in coastal watersheds can be useful when discussing estuarine water quality, because
11 people upstream can affect water quality downstream. These same population statistics,
12 however, may be misleading if used when discussing coastal hazards such as tsunamis or
13 hurricane storm surges.

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15 Even when there is general agreement about a particular framework for population reporting, for
16 example, shoreline-adjacent counties, slightly different county suites have been used. At least
17 three Federal agencies – the U.S. Census, the Federal Emergency Management Agency (FEMA),
18 and the National Oceanic and Atmospheric Administration (NOAA) – have used different lists of
19 shoreline-adjacent counties for the purposes of reporting coastal population. While rational
20 arguments have been made for each delineation, an increasing number of researchers are calling
21 for consistency in reporting U.S. coastal population statistics (Nicholls and Small 2002; Crowell
22 et al. 2007; Kruk et al. 2010; Lichter et al. 2011; Zhang and Leatherman 2011).

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24 The authors propose a simple model for generating and applying coastal population statistics at
25 the national and regional¹ level. This model builds on the long precedent of using counties as the
26 geographic unit to delineate the coast for the purposes of reporting population (Culliton et al.
27 1990; Crossett et al. 2004; Henrie and Plane 2006; U.S. Census Bureau 2010). Although
28 counties are a relatively gross-level of political geography, their major benefit is easy translation
29 of *what's in* and *what's out* to support policy discussions and public engagement. The model
30 includes two major components:

- 31
- 32 • “The population that most directly affects the coast,” represented by the U.S. population
33 that resides in a standard suite of Coastal Watershed Counties where land use and water
34 quality changes most directly impact coastal ecosystems; and
 - 35 • “The population most directly affected by the coast,” represented by the U.S. population
36 that resides in a standard suite of Coastal Shoreline Counties that are directly adjacent to
37 the open ocean, major estuaries, and the Great Lakes, which due to their proximity to
38 these waters, bear a great proportion of the full range of effects from coastal hazards² and
39 host the majority of economic production associated with coastal and ocean resources³.

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41 If accepted by the larger coastal management community, the value of this model is increased
42 consistency in national and regional level reporting of population and other demographic
43 statistics. The model might also be used to consistently report complementary economic
44 production statistics.

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¹ For example, the Gulf of Mexico region.

² Not just storm surge.

³ For example, ports and beach front hotels.

46 **A Proposed Model to Consistently Describe the Nation’s Coastal Population**

47 The Population that Most Directly Affects the Coast

48 The NOAA Coastal Assessment Framework (CAF) is a comprehensive national framework of
49 coastal, estuarine, and associated fluvial drainage units, and provides a consistently derived,
50 watershed-based spatial framework for managers and analysts to organize and present
51 information on the nation's coastal, near-ocean, and Great Lakes' resources. NOAA has derived
52 a suite of Coastal Watershed Counties from quantitative associations with coastal watersheds
53 delineated in the NOAA CAF (NOAA 2012b). When this county selection methodology is
54 applied, a county is considered a Coastal Watershed County if one of the following criteria is
55 met: (1) at a minimum, 15 percent of the county’s total land area is located within a coastal
56 watershed; or (2) a portion of, or an entire county accounts for at least 15 percent of a coastal
57 U.S. Geological Survey (USGS) 8-digit cataloging unit. This “15-percent rule” intends to
58 identify counties that have a more substantial watershed-based impact on coastal and ocean
59 resources. Nationally, five counties are counted as Coastal Watershed Counties that are
60 exceptions to the 15-percent rule. Additionally, since the NOAA CAF does not include Alaska,
61 Hawaii, or the U.S. Territories, all counties (boroughs and census areas in Alaska) that contain
62 the intersection of the shoreline of the 2010 Census County Boundary and a USGS cataloging
63 unit, are also included as Coastal Watershed Counties. This affects all five counties in Hawaii,
64 25 counties in Alaska, and all counties within American Samoa, Guam, Northern Mariana’s
65 Islands, and U.S. Virgin Islands. All counties (or municipalities) in Puerto Rico are included.
66 Figure 1 presents the location of the resulting 769 Coastal Watershed Counties. The NOAA
67 Spatial Trends in Coastal Socioeconomics (STICS) Web site (NOAA 2012c) provides more

68 detail on the county selection methodology, and presents an associated map and summary table
69 of the number of Coastal Watershed Counties by state/territory.

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71 The Population Most Directly Affected by the Coast

72 Shoreline-adjacent counties have been used to characterize the coastal population (NOEP 2009;
73 Crowell et al. 2010; U.S. Census Bureau 2010), and because they are directly adjacent to the
74 open ocean, major estuaries, and the Great Lakes, these counties bear a great proportion of the
75 full range of effects from coastal hazards, and host the majority of economic production
76 associated with coastal and ocean resources. However, several different suites of “shoreline-
77 adjacent” counties have been used, or could be used, for reporting coastal population. Table 1
78 presents a summary analysis of a subset of these county suites, each selected because of either its
79 previous use to report coastal population or, in the opinion of the authors, its potential to serve
80 this purpose.

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82 Comparison using a Geographic Information System of the county suites presented in Table 1
83 suggests that the FEMA county suite will best serve as a standard suite of shoreline-adjacent
84 counties that provides the minimum geographic footprint able to meet the coastal population
85 reporting needs of various federal agencies. In addition, this county suite also has fewer major
86 geographic gaps, as it includes the Great Lakes and the U.S. Territories. Therefore, the authors
87 nominate the FEMA-defined “shoreline-adjacent” counties as Coastal Shoreline Counties. The
88 FEMA county selection methodology includes those counties that (1) have a coastline bordering
89 the open ocean or Great Lakes coasts (or associated sheltered water bodies), or (2) contain
90 FEMA-identified coastal high hazard areas (V-zones, coastal A-zones) (Crowell et al. 2010).

91 Figure 2 presents the location of the resulting 452 Coastal Shoreline Counties. The NOAA
92 STICS Web site (NOAA 2012c) provides more detail on the county selection methodology, and
93 presents an associated map and summary table of the number of Coastal Shoreline Counties by
94 state/territory.

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96 The FEMA National Flood Insurance Program (NFIP) regularly updates floodplain boundaries
97 on its Flood Insurance Rate Maps, or FIRMs, and this process could potentially alter the
98 associated suite of counties, if the same county selection methodology is applied in a few years.
99 The authors propose that the current list of Coastal Shoreline Counties derived from this
100 methodology at this time be used consistently through the release of the Census 2020. This
101 approach will maintain a standard suite of Coastal Shoreline Counties, but allow periodic re-
102 assessment of this county suite as floodplain boundaries change through time.

104 **Discussion and Conclusion**

105 The proposed 769 Coastal Watershed Counties, inclusive of the Great Lakes region and the U.S.
106 Territories, have been used for reporting coastal population statistics in the peer-reviewed
107 literature (Henrie and Plane 2006; Strobl 2008; Brody et al. 2011), in federal agency reports and
108 Web sites (Culliton et al. 1990; Crossett et al. 2004; Bricker et al. 2007; Crossett et al. 2008;
109 NOAA 2008; NOAA 2012a), and by nonprofit organizations (NOEP 2009; NACO 2012). The
110 authors propose that the Coastal Watershed Counties continue to serve as a standard suite of
111 counties to be used when describing “the population that most directly affects the coast.” In
112 2010, 52 percent of the nation’s population lived in the Coastal Watershed Counties,
113 representing less than 20 percent of the nation’s land area, excluding Alaska (NOAA 2012a). At

114 the same time, the authors propose that the 452 Coastal Shoreline Counties, also inclusive of the
115 Great Lakes region and the U.S. Territories, now begin serving as a standard suite of counties to
116 be used when describing “the population most directly affected by the coast.” In 2010, 39
117 percent of the nation’s population lived in the Coastal Shoreline Counties, representing less than
118 10 percent of the nation’s land area, excluding Alaska (NOAA 2012d).

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120 The authors recognize that the proposed model does not incorporate often significant influxes of
121 transient visitors to the coast, for example, for summer beach vacations. This model is most
122 appropriate for describing the permanent coastal population. The authors also recognize that
123 there will be the need for other national and regional coastal population assessments where this
124 model may not be appropriate, such as the population residing on coastal barrier islands (Zhang
125 and Leatherman 2011). However, where the required assessment framework is similar to the
126 coastal county suites proposed in this model, it will provide a good baseline from which to easily
127 describe needed additions and exclusions. As an example, the NOAA Economics: National
128 Ocean Watch, or ENOW, product, which describes the value of the ocean and Great Lakes-
129 dependent economy (NOAA CSC 2012), includes economic production in Multnomah County,
130 Oregon, which contains the port of Portland. Currently, Multnomah County is not included in
131 the proposed Coastal Shoreline County suite, but it is one of a few additions or exceptions.
132 Lastly, even with acceptance of the proposed model, there is a continuing need to describe the
133 coastal population that is most vulnerable to coastal inundation and long-term sea level rise,
134 which will be more accurately described using a sub-county delineation of the coast.

135

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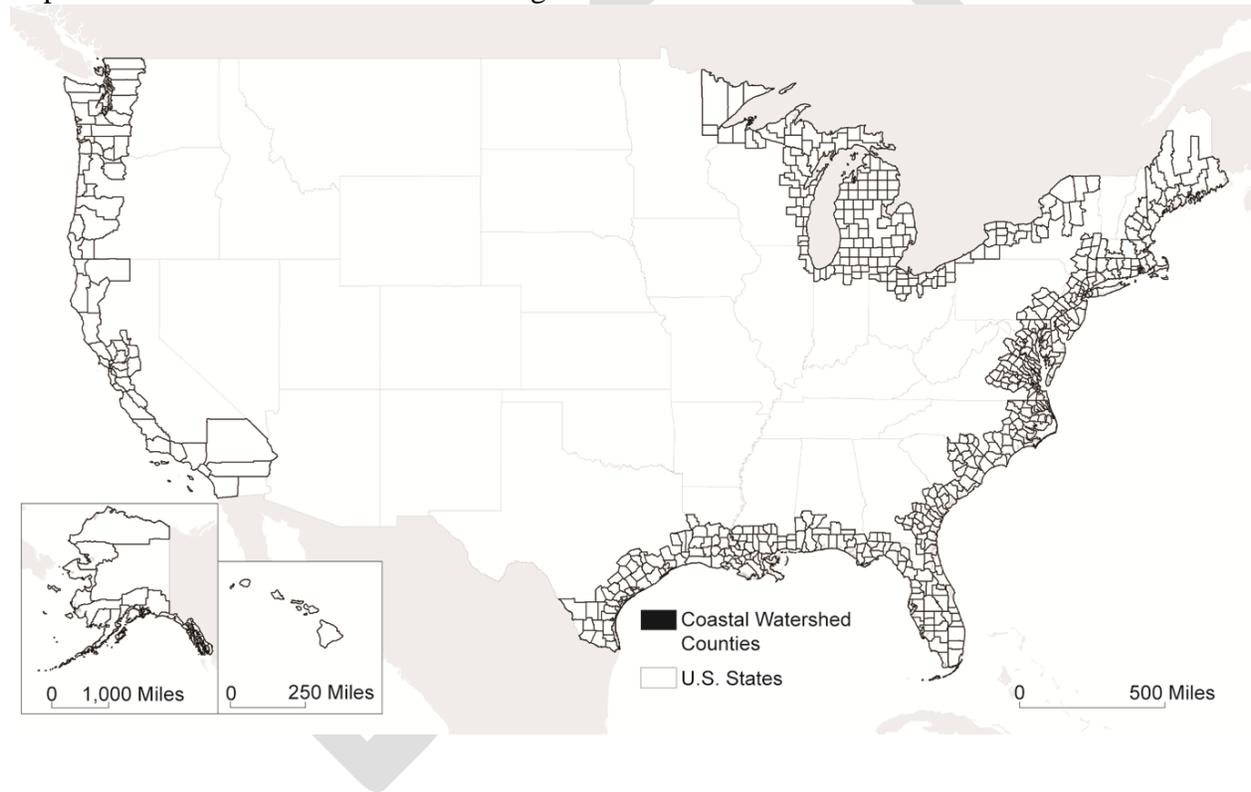
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Figure 1. Location of the Coastal Watershed Counties. A list of Coastal Watershed Counties can be downloaded from the NOAA STICS Web site at <http://www.coastalsocioeconomics.noaa.gov/coastdefined>.



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Table 1. Summary Analysis of Selected Shoreline-Adjacent County Suites that Have Been Used, or Could Be Used, for Reporting Coastal Population.

Source	General Definition of County Inclusion	Total Number of Counties	Approximate Percent of 2010 U.S. Population	Notes on Geographic Extent
FEMA	Counties that (1) have a coastline bordering the open ocean or Great Lakes coasts (or associated sheltered water bodies), or (2) contain FEMA-identified coastal high hazard areas (V-zones and/or Coastal A zones). (Crowell et al. 2007 and Crowell et al. 2010).	452	39%	Excludes unorganized atolls in American Samoa (Rose Island and Swains Island)
NOAA	Counties that intersect NOAA's Medium Resolution Shoreline. This shoreline extends inland to the head of tide. (NOAA 2012e).	422	42%	Excludes Alaska and U.S. Territories
National Ocean Economics Program	Counties that intersect, in whole or in part, state Coastal Zone as delineated under the authority of the Coastal Zone Management Act of 1972, which are adjacent to an ocean, Great Lake, or included river or bay (NOEP 2009 and personal communication with NOEP)*.	355	37%	Excludes U.S. Territories
U.S. Census Bureau	Counties adjacent to water classified as either coastal water or territorial sea in their Topologically Integrated Geographic Encoding and Referencing (TIGER) system (U.S. Census Bureau 2010).	311	31%	Excludes Great Lakes
U.S. Geological Survey	Counties where some portion of the land was directly exposed to the Pacific Ocean, Atlantic Ocean, or Gulf of Mexico as identified by an intersection with the Coastal Vulnerability Index shoreline (Boruff et al. 2005).	219	26%	Excludes Great Lakes

* NOEP 2009 reports demographic and economic statistics using a slightly different shoreline adjacent county suite than is considered here.

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Figure 2. Location of the Coastal Shoreline Counties. A list of Coastal Shoreline Counties can be downloaded from the NOAA STICS Web site at <http://www.coastalsocioeconomics.noaa.gov/coastdefined>.



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