THE ECONOMIC VALUE OF THE COASTAL ZONE*

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ABSTRACT

This article provides a methodology for estimating the economic value of the coastal zone. That methodology is used to construct estimates of "GNP-originating" in the coastal zone, in aggregate, and as a percent of individual coastal states' and national Gross National Product (GNP). The results are quite dramatic: in 1985, GNP-originating in the coastal zone totalled approximately $1.5 trillion, or some 31 percent of U.S. GNP. The coastal zone has become more important over time. Coastal states vary, however, in their economic reliance on their coastal zones. Even when states' required matches are included, the ratio of federal Coastal Zone Management Act spending to coastal GNP is almost 1:2000. Given the fragility of the coastal environment and its considerable importance to the U.S. economy, those ratios seem quite favorable and tilt in favor of continued spending on coastal zone management programs.

Proponents of coastal zone protection legislation typically claim that special action is needed to preserve the "value" of the coastal zone. As long ago as 1969, the Stratton Commission issued a seminal report as part of the 1966 Marine Resources and Development Act which stated that "the coast is, in many respects, 'the Nation's most valuable geographic feature' where the greater part of our trade

and industry takes place. . ." [quoted in [1], p. 1219]. Yet, only a few researchers have attempted to quantify that "value." That quantification is necessary to establish a baseline for further benefit-cost analyses of coastal protection activities.

This article provides a methodology for estimating the economic value of the coastal zone. That methodology is used to construct estimates of "GNP-originating" in the coastal zone, in aggregate, and as a percent of individual coastal states' and national Gross National Product (GNP). The results are quite dramatic: in 1985, GNP-originating in the coastal zone totalled approximately $1.5 trillion, or some 31 percent of U.S. GNP. These figures are sensitive to the way the coastal zone and coastal value are defined.

In the following sections, the article defines "coastal zone" and "coastal value," reviews some earlier work on the topic, explains how our methodology differs from that of earlier studies, and presents estimates of coastal value for 1978 and 1985 for thirty coastal states and three coastal territories. Finally, the article draws some implications for coastal policy.

DEFINING THE COASTAL ZONE
AND COASTAL ZONE VALUE

The Coastal Zone

We define the coastal zone as the 413 counties in thirty states and five territories that are either adjacent to or within fifty miles of the oceans, bays, or Great Lakes, or lie within an estuarine region.[1] This designation of coastal zone counties is strictly objective, based on the coastal/estuarine proximity criterion and an examination of detailed maps. All but twenty-four of the coastal zone counties are also within the coastal zone, as defined by the Office of Ocean and Coastal Resource Management. All but ten of the coastal counties are within the coastal zones defined by their respective states.

An entire county was included in the coastal zone if it is adjacent to an ocean, bay, or Great Lake. Those parts of non-adjacent counties that lie within a fifty mile radius of the coast were also included in the coastal zone. In addition, all parts of the five U.S. territories (American Samoa, Guam, Northern Mariana Islands, Puerto Rico, and the Virgin Islands) were included.

Coastal Zone Value

The value of the economic activity and natural resources found along the 95,000 miles in the United States bordering the Atlantic and Pacific Oceans, estuaries, the

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[1] The fifty mile radius is also used by federal agencies in defining coastal counties. Land within this radius can be expected to have land uses that relate to the coast. Admittedly, there is no specific basis for choosing fifty miles, as opposed to thirty miles, sixty miles, or some other distance. A complete list of coastal zone counties can be obtained from the author, or see [2].

Gulf of Mexico, and the Great Lakes, has two components: the *current market value of all goods and services that are produced directly and indirectly from coastal resources and coast-related activities* (which is equivalent to the gross national product-originating in the coastal zone, or "coastal GNP" for short), and the *intangible value of recreation and other activities and resources that people enjoy, but for which they do not pay directly* (termed "non-market" values).

PREVIOUS STUDIES OF COASTAL ZONE VALUE

Economists have measured coastal value by focusing on market and non-market values, and by estimating the importance of the coast for the nation as a whole and for specific places and types of activities or coastal resources.

Market Value

Published studies in the early 1970s aggregated the market value of the goods and services produced by a limited set of coast-related industries. For example, the Urban Land Institute [3] and the U.S. Department of Commerce [4] based "value" on the jobs and payroll created in industries that require proximity to the coast, including commercial and sport fisheries, coastal recreation and tourism, mineral extraction, and ports. Even this limited definition of "coast-related" industries can generate large coastal values. For example, fishing contributed more than $30 billion to the U.S. economy in 1987, and recreation and tourism added more than $8 billion to the economy [5]. In addition, more than 12 percent of the United States' oil production, and 25 percent of the national gas production, took place in coastal counties in 1987, accounting for at least $20 billion more in value [6, 7].

More recent studies, by Pontecorvo [8] and Pontecorvo, et al. [9], expand the definition of "coast-related," and consequently, provide higher estimates of coastal value. Those studies focus on the entire "ocean sector," rather than on selected industries. Pontecorvo's "ocean sector product" equals

> . . . the value added by those establishments within 66 GPO (Gross Product Originating) sectors . . . that either utilize an ocean resource in the production process or exist because the demand for the establishments' final output is due to some attribute of the ocean sector [8, p. 9].

His estimate of "ocean sector originating" for 1987 was $109 billion, or 2.6 percent of GNP.

Gosselink, Odum, and Pope argue that these types of studies understate the true value of the coastal environment [10]. Those authors estimate coastal value by converting the "total embodied energy of the environment" including solar energy and human-made fuel based systems, to dollar equivalents. Using that approach, they estimated unaltered wetlands to be worth $82,000 per acre. If that estimate

were correct, total coastal wetland value would have been approximately $715 billion in 1974 [6, p. 36]. Total coastal value would have been even higher. Shabman and Batie, among others, criticize Gosselink, Odum, and Pope's technique because it "fail[s] to recognize the nature of the process by which economic values are determined and made an illegitimate marriage of the principles of systems ecology and economic theory" [11].

The Non-Market Value of the Coastal Zone

The studies summarized above also may understate the worth of the coastal zone to society because economic resources, including the coast, can have "value" that is not based directly on market prices, or cannot be converted directly into dollars. Therefore, economists have devised different methods to approximate the non-market value of coastal resources.

In short, these methods attempt to attach a value to the use of the coast for fishing, recreation, or related uses, when no direct payments are made for that use; to the importance of the coast for purposes not directly related to the oceans and wetlands; and to the utility people derive from the mere existence of coastal resources, whether or not they actually use them. The methods include estimating: the cost people would incur to travel to the coast (for example, Raphael and Jaworski [12]); the amount by which the existence of wetlands reduces the cost of flood control and pollution abatement (Shabman and Batie [11]); the degree to which the existence of wetlands and coastal fishing grounds reduces prices of seafood and related goods, thereby producing consumer or producer surplus (Lynne, Conroy, and Prochaska [13] and Freeman [14]); people's willingness-to-pay for the "beach experience," the use of the beach for a day, or the restoration of the beach to some uneroded or unlittered condition (Lindsey and Tupper [15], Silberman and Klock [16], and Bell and Leeworthy [17]); and the degree to which proximity to the beach adds value to coastal property, because of all the benefits such proximity provides (Wilman [18], Anderson and Edwards [19], Brown and Pollakowski [20], and Terich and Gabriel [21]). A more complete literature review is found in [2].

These approaches are important to note, but they are not practical to use for the purpose of creating a national estimate of coastal zone value. Each of the studies noted above is based on data from particular places, and for particular types of coastal activities or resources. Conceptually, those micro-estimates could be aggregated into a national total, but the data needs to do so would be monumental.

Summary of the Literature

The studies we have reviewed above provide different estimates for the economic value of the coast, or its components. These are summarized in Table 1. These estimates have one common interpretation: regardless of how one measures coastal value, it is sizable. Looking at current market values of goods and services

Table 1. Estimates of Coastal "Value"

Methodology Suggested By	Estimate	Year; Scope
Gosselink, Odum, and Pope [10]	$715 billion	1974; all coastal wetlands.
Urban Land Institute [3] U.S. Department of Commerce [4]	$58 billion	1987; fishing, recreation and tourism, off-shore and related oil and gas.
Pontecorvo [8]	$109 billion	1987; "ocean sector-originating."
Raphael and Jaworski [12]	$51.8 billion	1978; fish, wildlife and recreation in Michigan's coastal wetlands.
Lynne, Conroy, and Prochaska [13]	$3 per acre	Florida wetlands based on blue crab production.
Lindsey and Tupper [15]	$47	Mean willingness-to-pay for a one-time beach experience.
Bell and Leeworthy [17] Silberman and Klock [16]	$1-5	Willingness-to-pay for one-time beach use or to have beach restored.
Anderson and Edwards [19]	$11-102	Value of a foot of water frontage (additional rent).
Anderson and Edwards [19]	$4,275-20,000 per site	Asset value of a view.

produced by just three coast-related industrial sectors, the value was $58 billion in 1987. When the list of sectors is expanded to some sixty industries, the estimate of coastal value doubles. When coastal value is measured in terms of the market value of the embodied energy at the coast, rather than in terms of standard transactions, the value is still higher. As high as these figures are, they still may understate the full value of the coast since they exclude the consumer surplus that is created by people's willingness-to-pay for beach access, coastal proximity, and coastal views, in excess to what they are actually charged.

NEW ESTIMATES OF COASTAL ZONE VALUE

We estimate the economic value of the coast using an approach similar to Pontecorvo's [8, 9]. This approach achieves the broad coverage most useful for national policy-making purposes and is well-placed within an economics literature on "national income accounting."[2]

[2]It is important to note an important limitation of this approach, as well: GNP is but one of several measures of economic welfare. There are other "social indicators" of welfare, and values that do not occur in the marketplace are not captured by GNP. In addition, we could argue from a strict environmental perspective that an increase in economic activity, as measured by GNP, has a negative long-run effect on environmental quality at the coast, which may or may not result in lower coastal GNP.

We modify Pontecorvo's approach because we judge his definition of "ocean sector" to be too narrow. "Coastal zone" activities include more than those endeavors that relate directly to the ocean. We identify three types of economic activities that create value in the coastal zone:

1. *Coast-dependent activities*, or economic activities located in the coastal zone that are locationally dependent on coastal resources—specifically, the ocean, bays, Great Lakes, and estuaries, and their contents. These include, for example, fisheries, yacht clubs, off-shore energy production, beach-related recreation, marine research, and ocean transport and shipping. These can only be performed in the coastal zone.
2. *Coast-linked activities*, or economic activities that use the ocean, bays, Great Lakes, and estuaries, and their contents, in the production process, or that produce intermediate inputs for coast-related activities, but are not necessarily in the coastal zone. These include fish processing and packing, and the production of fishing and other equipment used in the oceans, bays, Great Lakes, or estuaries. These would not exist if there were no coastal zone. They do not have to be located within the coastal zone, but are likely to be nearby.
3. *Coastal service activities*, or economic activities not included in 1), that are located in the coastal zone and provide service to residents and visitors to the coastal zone. These coastal services include real estate, wholesale and retail operations, non-ocean-related recreation, and business and professional services. The viability of these depends on the size and income of the coastal population and the success of other coast-related economic activity. In economic terms, we include these in order to capture some of the multiplier effects of coast-dependent activities. They create additional income that is likely to stay in the coastal zone.

The sum of the value produced by these types of activities can be considered to be the *gross* economic value of the coastal zone. That is not meant to suggest that U.S. GNP without the zone would be lower by the full amount of the total. Clearly, if there were no coast, people would go elsewhere in the United States for recreation – for example, to lakes and mountain areas. The level of economic activity would be higher in those places than it is now, then. However, a change in the venue for recreation from a person's first-best, utility-maximizing choice (the beach), to his/her second-best choice (lakes or mountains), entails a loss in welfare. Moreover, some activities—especially those that are *coast-dependent* and *coast-linked*—do not have substitutes elsewhere in the United States. And, it is likely that some tourists would not substitute other forms of recreation for coastal recreation. If no coastal areas were available in the United States, or the quality of coastal areas deteriorated, that group is likely to spend their dollars in foreign coastal locations. That happens in Europe, where German, Austrian, Dutch, Swiss, and others without access to

warm water coastal areas in their own countries vacation in Italy, southern France, Greece, and Spain.

One could define the economic value of the coastal zone even more broadly than we have above, as the sum of *all* economic activity in the coastal zone (including exporting industries that do not use coastal resources), plus what we called *coast-linked* economic activity. This definition is based on geographic location as well as on the characteristics of industries. We include this alternative in the analysis for comparison purposes.

Whatever the definition of coastal zone value, we interpret it to be the "value at risk." Some of that value could be moved inland if the coast were threatened or degraded, but even then, there would be considerable transaction costs and leakage.

The raw measures of "economic activity" that we use are employment and payroll (P), largely because of data availability. We assume that GNP is a relatively space-invariant multiple of those variables in order to approximate GNP-originating. Thus, if P_{US}/GNP_{US} = constant, then $GNP_{CZ} = P_{CZ}$/constant (see Pontecorvo, et al. [9]). On the factor input side of the GNP equation, GNP = $\sum_i (P_i + \pi_i + r_i + X_i + D_i)$, where i is the relevant industry and P = payroll, π = profits, r = interest payments, X = indirect business taxes, and D = total capital consumption allowance.

We classify industries into *coast-dependent*, *coast-linked*, and *coastal service* activities based on information provided in the Census Bureau's *SIC Classification Manual* [22]. In some cases employment and payroll amounts are available at the 3-digit level only. In those instances we multiply the employment or payroll value by the proportion of "qualifying" 4-digit industries to 3-digit industries. The list of industries included in *coast-dependent*, *coast-linked*, and *coastal service* activities is shown in Table 2.

In 1985, 779,000 workers were employed in *coast-dependent* activities (requiring proximity to the coast), with a payroll of approximately $15.8 billion. Another 239,000 workers were employed in *coast-dependent* economic activities (backward- and forward-linked businesses not necessarily in the coastal zone), with a payroll of $4.59 billion. The *coastal service* activities (located in the coastal zone, providing services to residents and visitors) is the largest of the three categories, with 27.3 million workers and $459.5 billion in payroll.

These employment and payroll totals have increased since 1978. In 1978, 445,500 workers were employed in *coast-dependent* activities, 174,600 in *coast-linked* activities, and 21,390,000 workers in *coastal service* activities. The 1978 GNP-originating was $15.05 billion, $7.46 billion, and $597.7 billion for each of the activity types. The largest increases have been in *coast-dependent* and *coast-linked* activities.

Table 3 shows these employment and payroll figures, as well as the "coastal GNP" originating from each of the activity types. The sum of "GNP-originating"

Table 2. Industry Composition of Activity Types

SIC[b]	Sector Definition	Subsector[c]	Partial	Percent	Percent Estimated By	Data Sources
Coast-Dependent:						
0273	Animal aquaculture	1	Yes	80	guess by sic	
0279	Animal specialties, nec (alligator)	1	Yes	15	guess by sic	fish stat[d]
091	Commerical fishing	1	No			fish stat
092	Fish hatcheries and preserves	1	No			
2048	Prepared feeds (fish foods, oyster shell, etc.)	1	Yes	10	shipment value	asm[e]
2077	Animal and marine fats and oils	1	Yes	20	shipment value	asm
2091	Canned and cured seafoods	1	No			asm
2092	Fresh or frozen packaged fish	1	No			asm
2819	Industrial inorganic chemicals, nec (salt cake)	1	Yes	2	shipment value	asm
2833	Medic chemicals/botanical products (fish liver, oils, agar-ag)	1	Yes	2	shipment value	asm
2843	Surface active agents, etc. (cod oil, sulfonated, etc.)	1	Yes	5	shipment value	asm
2899	Chemicals/chemical preparation, nec (salt)	1	Yes	6	shipment value	asm
373	Ship and boat building and repairing	1	No			asm
3799	Transportation equipment, nec (boat trailers)	1	Yes	15	guess by sic	asm
442	Deep sea domestic transportation of freight	1	No			
443	Freight transportation on Great Lakes	1	No			
446	Water transportation services	1	No			
448	Water transportation of passengers	1	N			
449	Services incidental to water transportation	1	No			
79	Amusement and recreational services[a]	1	Yes			
84	Museums, botanical, zoological gardens[a]	1	Yes			
Coast-Linked:						
221	Weaving skills, cotton (nets, sailcloth, etc.)	2	Yes	3	shipment value	asm
2298	Cordage and twine (fishnets, lines, seines, etc.)	2	Yes	5	guess by sic	asm
2329	Men's and boy's clothing, nec (bathing suit, swimsuits)	2	Yes	10	shipment value	asm
2339	Women's, misses' outwear, nec (bathing suits, swimsuits)	2	Yes	10	shipment value	asm
2369	Girls', children's, and infants' outwear, nec (bath)	2	Yes	3	guess by sic	asm

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Code	Description					
2394	Canvas and related products (sails)	2	Yes	10	shipment value	asm
2599	Furniture and fixtures, nec (ship furniture)	2	Yes	5	guess by sic	asm
285	Paints, varnishes, lacquers, enamels (marine paints, etc.)	2	Yes	5	guess by sic	asm
3357	Drawing and insulating of nonferrous wire (shipboard cables)	2	Yes	5	guess by sic	asm
3362	Brass, bronze, copper foundries (propellers, ship, screws)	2	Yes	5	guess by sic	asm
3429	Hardware, nec (marine hardware)	2	Yes	2	shipment value	asm
3441	Fabricated structural metal (ship sections)	2	Yes	15	shipment value	asm
3443	Fabricated plate work (buoys, etc.)	2	Yes	10	shipment value	asm
3448	Prefabricated metal buildings and components (docks)	2	Yes	15	guess by sic	asm
3462	Iron and steel forgings (anchors, etc.)	2	Yes	5	guess by sic	asm
3483	Ammunition (fin assemblies, fuses, etc.)	2	Yes	3	guess by sic	asm
3489	Ordnance and accessory, nec (antisubmarine projectors, etc.)	2	Yes	5	guess by sic	asm
3496	Miscellaneous fabricated wire (antisubmarine/torpedo net)	2	Yes	5	guess by sic	asm
3499	Fabricated metal products, nec (aquarium accessories, etc.)	2	Yes	2	guess by sic	asm
3519	Internal combustion engines, nec (marine engines, etc.)	2	Yes	30	shipment value	asm
3531	Construction machinery (shipcranes/derricks, winches)	2	Yes	5	guess by sic	asm
3536	Overhead traveling, hoists (boat hoists)	2	Yes	10	guess by sic	asm
3537	Industrial trucks, tractors (boat cradles, docks, etc.)	2	Yes	5	shipment value	asm
3551	Food product machine (shell/fish processing machinery)	2	Yes	2	shipment value	asm
3561	Pumps and pumping mach/equipment (hydrojet marine engine)	2	Yes	7	shipment value	asm
3622	Industrial controls (marine and navy auxiliary)	2	Yes	5	guess by sic	asm
3647	Vehicular lighting equipment (boat and ship lighting fixtures)	2	Yes	10	shipment vlaue	asm
3662	Radio/TV communication equipment (marine radio communications)	2	Yes	5	shipment value	asm
381	Engineering and scientific instruments	2	Yes	45	shipment value	asm
3949	Sporting and athletic goods, nec (fishing tackle, etc.)	2	Yes	7	shipment value	asm

[a] This industry is allocated to two subsectors. Data for it will be collected at two levels, county and nation.

[b] In some cases, 5-7 digit sic data are available. In others, we had to adjust 4-digit data using estimates of the ratio between relevant 5-7 digit sectors and 4-digit totals.

[c] For the activities classified in subsectors 1 and 2, national level data were collected. For subsector 3, county level data were collected.

[d] "fish stat" = fishery statistics of the United States.

[e] "asm" = Annual Survey of Manufactures, which has data on value added by manufacturing payroll and employment for most 4-digit level sectors.

[f] "stat abst" = Statistical Abstract, published annually.

[g] "cbp" = County Business Patterns, which has data on employment and payroll for up to 4-digit industries for county, if applicable. But it does not take into account public enterprises.

Table 2. (Cont'd.)

SIC[b]	Sector Definition	Subsector[c]	Partial	Percent	Percent Estimated By	Data Sources
Coast-Linked: (Cont'd.)						
3999	Manufacture industry, nec (beach umbrellas, etc.)	2	Yes	2	shipment value	asm
82	Educational service[a]	2	Yes	5	guess by sic	cbp[g]
Coastal-Services:						
078	Landscape and horticultural services	3	No			cbp
131	Crude oil and natural gas extraction	3	No			cbp
138	Oil and gas field services	3	No			cbp
1442	Construction sand and gravel	3	Yes			cbp
1446	Industrial sand	3	Yes			cbp
1479	Chemical and fertilizer mining, nec. (salt mining, etc.)	3	No			cbp
15	General contractors and operative builders	3	No			cbp
16	Heavy construction contractors	3	No			cbp
17	Special trade contractors	3	No			cbp
271	Newspaper, publishing/printing	3	No			cbp
41	Local and interurban passenger transit	3	No			cbp
42	Trucking and warehousing	3	No			cbp
47	Transportation services	3	No			cbp
48	Communications	3	No			cbp
49	Electric, gas and sanitary services	3	No			cbp
50	Wholesale trade – durable goods	3	No			cbp
51	Wholesale trade – non-durable goods	3	No			cbp
52	Retail – building materials, hardware	3	No			cbp
53	Retail – general merchandise stores	3	No			cbp
54	Food stores	3	No			cbp
55	Automobile dealers and gasoline services	3	No			cbp
56	Apparel and accessory stores	3	No			cbp
57	Home furniture, furnishing equipment	3	No			cbp
58	Eating and drinking places	3	No			cbp

59	Retail-miscellaneous	3	No	cbp
60	Depository institutions	3	No	cbp
61	Nondepository credit institutions	3	No	cbp
62	Security and commodity brokers, dealers, exchanges, services	3	No	cbp
63	Insurance carriers	3	No	cbp
64	Insurance agents, brokers, and services	3	No	cbp
65	Real estate	3	No	cbp
67	Holding and other investment offices	3	No	xbp
70	Hotels, rooming houses, and other lodging places	3	No	cbp
72	Personal services	3	No	cbp
73	Business services	3	No	cbp
75	Automotive repair services	3	No	cbp
76	Miscellaneous repair services	3	No	cbp
782	Motion picture distribution and allied services	3	No	cbp
783	Motion picture theaters	3	No	cbp
784	Video tape rental	3	No	cbp
79	Amusement and recreational services[a]	3	No	cbp
80	Health services	3	No	cbp
81	Legal services	3	No	cbp
82	Educational services[a]	3	No	cbp
83	Social services	3	No	cbp
84	Museums, botanical, zoological gardens[a]	3	No	cbp
86	Membership organizations	3	No	cbp
89	Miscellaneous services	3	No	cbp
	Located in Coastal Zone, all else: Total for Subsector 3.			

[a] This industry is allocated to two subsectors. Data for it will be collected at two levels, county and nation.

[b] In some cases, 5-7 digit sic data are available. In others, we had to adjust 4-digit data using estimates of the ratio between relevant 5-7 digit sectors and 4-digit totals.

[c] For the activities classified in subsectors 1 and 2, national level data were collected. For subsector 3, county level data were collected.

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Table 3. Employment, Payroll, and GNP-Originating
in the Coastal Zone, 1985 and 1978

	Coast-Dependent	Coast-Linked	Coastal Services
1985			
Employment	779,000	239,000	27,304,700
Payroll	$15.8 billion	$4.59 billion	$459.5 billion
GNP-Originating	$42 billion	$12.17 billion	$1.27 trillion
Percent of U.S. GNP	1.05%	0.034%	30.36%
1978			
Employment	445,500	174,600	21,390,000
Payroll	$6 billion	$2.98 billion	$238.4 billion
GNP-Originating[a]	$15.05 billion	$7.46 billion	$597.7 billion
Percent of U.S. GNP	0.7%	0.035%	28.36%

[a]GNP-Originating is based on payroll. The values using employment are similar.

for *coast-dependent* and *coast-linked* activities is $54.17 billion, or approximately 1.1 percent of the U.S. total. Pontecorvo's definition of "ocean sector" is roughly similar to the sum of *coast-dependent* plus *coast-linked* activities. He estimates that 2.6 percent of U.S. economic activity originates in the ocean sector, which is the same order of magnitude as the estimate presented above [8, p. 7].

When the economic value of the coastal zone is defined to originate from *all* activity in coastal counties, it is higher than the figures shown in Table 3. In 1985, 37.7 million workers were employed in coastal counties, or 46.4 percent of the U.S. total. That represented $747 billion in payroll. Coastal counties accounted for almost $2 trillion in GNP in 1985, or 49.4 percent of the U.S. total. (These percentages correspond to the population share of coastal counties, as they have been defined.)

The most inclusive definition of coastal zone-related economic activity is the sum of all activity within coastal counties and *coast-linked* economic activity. By that definition, the coastal zone accounted for approximately 38 million jobs and $752 billion in payroll. These estimates are only slightly higher than those from the definition used in the preceding paragraph. These estimates are biased upwards due to some double counting. We did not have enough data to separate *coast-linked* activities into those occurring outside vs. inside coastal counties. However, based on an examination of the addresses of randomly-

selected businesses in this category, we believe that most of the *coast-linked* activity is in non-coastal counties, so the bias should not be large.

Tables 4 through 7 show the breakdown of coast-related employment and payroll, by state, for 1985 and 1978. We can see that some states are more dependent on their coastal economies than others (by any definition of coastal GNP). The relative importance of the coast depends on the states' particular geography and demographics, the definition of coastal zone that is employed, and whether employment or payroll is used in the calculation. In general, Alaska, California, Delaware, Florida, Hawaii, Massachusetts, New Jersey, New York, and Rhode Island are highly dependent on their coastal zones, with at least 50 percent of their payrolls and 60 percent of their employment generated in those counties in 1985. The coastal states that are least dependent economically on their coastal zones are Alabama, Georgia, Indiana, Minnesota, Mississippi, and North Carolina, with no more than 12 percent of employment and 14 percent of payrolls generated in those counties in 1985.

IMPLICATIONS FOR COASTAL POLICY

The coastal zone is a key economic sector that contributes more than 30 percent of the national GNP. Most of this value comes from the service sector, but even without that type of economic activity, the coastal zone accounted for some $55 billion in 1985. And, the coastal zone has become more important over time, growing from 30.1 percent of the GNP in 1978 to 31.4 percent in 1985.

Because coastal values change over time, it is important to conduct the kind of analysis we have performed here on a regular basis. As the coastal economy grows in size, so too does the value of what is "at risk" from poor management of coastal resources. Even now, the relative importance of the coastal zone to the U.S. economy is one reason that support for coastal zone management legislation is warranted. To date, such legislation has fared well on benefit-cost grounds. States and territories received $33.4 million from the federal government under the Coastal Zone Management Act in 1988 (see [2, Vol. I]). Those grants have been used to manage almost 4000 times their value in economic output, using the preferred measures of "coastal GNP." Even when the states' required matches are included, the ratio of CZMA spending-to-coastal GNP is almost 1:2000. Given the fragility of the coastal environment and its considerable importance to the U.S. economy, those ratios seem quite favorable.

Our estimates indicate, as well, that the coastal zone is critical to the economies of many coastal states and federal territories. In some of our most populous states, 50 percent or more of all economic activity occurs in coastal counties. For that reason, policies to protect and enhance coastal resources are likely to continue to enjoy strong legislative support in the 1990s.

Table 4. Coastal GNP, Employment-Based, 1978

State	Number of Counties	Population	Subsectors 1	Subsectors 2	Subsectors 3	All Activities Coastal Counties	All Activities All Counties	Coastal Generated Total (5+7)	State Coastal Employed (4+5+6)	State Coastal GNP [b]	State Coastal GNP [c]	Percent of Contribution of Coast
1	2	3	4	5	6	7	9	10	11	12	13	14
Alabama	2	4347.0	1.7	3.1	84.4	121.8	1029.0	124.9	89.1	2.7	3.7	8.7%– 12.1%
Alaska	18	2207.0	1.1	0.3	61.7	78.6	105.6	78.9	63.1	1.9	2.4	59.7%– 74.7%
California	22	187093.0	89.1	21.9	4344.7	6477.8	7380.6	6499.7	4455.7	133.6	194.9	60.4%– 88.1%
Connecticut	4	19291.0	9.6	3.4	403.8	694.5	1152.4	697.9	416.8	12.5	20.9	36.2%– 60.6%
Delaware	3	5982.0	2.8	0.6	125.4	200.8	200.8	201.4	128.8	3.9	6.0	64.1%–100.3%
Florida	42	74609.0	32.7	7.7	1726.8	2373.5	2609.8	2381.2	1767.2	53.0	71.4	67.7%– 91.2%
Georgia	7	3320.0	1.3	4.8	64.8	91.5	1620.4	96.3	70.9	2.1	2.9	4.4%– 5.9%
Hawaii	4	8629.0	3.9	0.8	237.0	281.8	281.8	282.6	241.7	7.2	8.5	85.8%–100.3%
Illinois	2	57748.0	33.2	12.2	1509.5	2415.6	4127.2	2427.8	1555.0	46.6	72.8	37.7%– 58.8%
Indiana	3	7526.0	3.6	5.3	136.7	259.9	1798.9	265.2	145.6	4.4	8.0	8.1%– 14.7%
Louisiana	25	25023.0	10.7	3.5	581.8	779.5	1169.1	783.0	596.0	17.9	23.5	51.0%– 67.0%
Maine	10	7857.0	3.0	0.9	144.8	220.4	308.0	221.3	148.7	4.5	6.6	48.3%– 71.9%
Maryland	17	30960.0	11.6	3.5	609.2	842.7	1187.9	846.2	624.3	18.7	25.4	52.6%– 71.2%
Massachusetts	9	43015.0	22.3	6.2	1094.2	1620.9	2104.8	1627.1	1123.4	33.7	48.8	53.4%– 77.3%
Michigan	42	50512.0	22.4	8.7	837.1	1555.8	2921.6	1564.5	867.2	26.0	46.9	29.7%– 53.5%
Minnesota	3	2369.0	1.0	4.1	46.9	71.1	1383.4	75.2	52.0	1.6	2.3	3.8%– 5.4%
Mississippi	3	2967.0	1.1	1.8	45.1	80.1	602.3	81.9	48.0	1.4	2.5	8.0%– 13.6%
New Hampshire	2	2668.0	1.0	0.9	44.4	71.4	289.6	72.3	46.2	1.4	2.2	16.0%– 25.0%
New Jersey	15	60245.0	26.1	7.1	1221.4	1900.7	2389.7	1907.8	1254.6	37.6	57.2	52.5%–79.8%
New York	27	148301.0	68.6	17.1	3443.2	4989.5	5770.1	5006.6	3529.0	105.8	150.1	61.2%– 86.8%
North Carolina	20	5925.0	1.6	5.5	77.1	117.3	1860.5	122.8	84.2	2.5	3.7	4.5%– 6.6%

Ohio	9	28888.0	15.4	10.9	663.5	1118.1	3676.5	1129.0	689.8	20.7	33.9	18.8%– 30.7%
Oregon	9	10989.0	5.9	2.4	308.7	430.2	798.5	432.6	317.0	9.5	13.0	39.7%– 54.2%
Pennsylvania	4	30347.0	14.1	11.6	681.3	1024.2	3922.5	1035.8	707.0	21.2	31.1	18.0%– 26.4%
Rhode Island	5	9572.0	4.5	1.0	186.9	329.2	329.2	330.2	192.4	5.8	9.9	58.4%–100.3%
South Carolina	9	7039.0	2.2	2.7	112.1	158.9	911.5	161.6	117.0	3.5	4.8	12.8%– 17.7%
Texas	19	37061.0	19.3	13.1	1018.7	1404.4	4400.5	1417.5	1051.1	31.5	42.5	23.9%– 32.2%
Virginia	37	18494.0	9.9	4.3	534.1	721.6	1463.2	725.9	548.4	16.4	21.8	37.5%– 49.6%
Washington	17	28517.0	12.1	3.4	608.9	879.3	1149.2	882.7	624.4	18.7	26.5	54.3%– 76.8%
Wisconsin	15	18804.0	10.3	4.6	435.0	745.7	1557.2	750.3	449.9	13.5	22.5	28.9%– 48.2%
Puerto Rico		3122.0	8.2	0.9	289.7	298.8	298.8	298.8	298.8	9.0	9.0	100.0%–100.0%
Guam		101.5			10.7	10.7	10.7	10.7	10.7	0.3	0.3	100.0%–100.0%
Virgin Islands		88.4			15.8	15.8	15.8	15.8	15.8	0.5	0.5	100.0%–100.0%
Northern Marianas		15.8										
American Samoa		31.2										
United States	404	943663.9	445.5	174.6	21390.0	32382.2	58827.1	32556.8	22010.1	659.8	976.0	

US Subsectors' Total	22010.1
US All Activities	70289.2
US GNP ($Billion)	2107.6
US Coastal GNP[b]	660.0
Coastal GNP Modif[c]	976.2
% Contr of Coast	31.3-46.3[d]

NOTE: Employment = thousands; GNP = $billion; 1978.
[a] Data not available or calculation not defined for blank places.
[b] Coastal GNP = (subsectors 1+2+3) x (US GNP) / (US all activities).
[c] GNP modified = (coast generated) x (US GNP) / (US all activities).
[d] The bottom of range is from US coastal GNP; the top is from coastal GNP modified.

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Table 5. Coastal GNP, Employment-Based, 1985

State	Number of Counties	Population	Subsectors			All Activities		Coastal Generated Total (5+7)	State Coastal Employed (4+5+6)	State Coastal GNP^b	State Coastal GNP^c	Percent of Contribution of Coast
			1	2	3	Coastal Counties	All Counties					
1	2	3	4	5	6	7	9	10	11	12	13	14
Alabama	2	464.6	2.7	3.9	102.9	130.4	1126.3	134.4	109.5	5.4	6.6	9.7%– 11.9%
Alaska	18	392.6	2.4	0.5	98.9	116.6	149.6	117.1	101.8	5.0	5.8	68.0%– 78.3%
California	22	21211.7	169.6	32.8	5660.4	8201.6	9368.8	8234.4	5862.8	289.8	407.1	62.6%– 87.9%
Connecticut	4	1973.9	17.3	4.8	550.6	838.6	1378.0	843.4	572.7	28.3	41.7	41.6%– 61.2%
Delaware	3	622.1	5.1	0.9	166.6	246.8	247.0	247.7	172.5	8.5	12.2	69.9%–100.3%
Florida	42	9246.8	53.4	13.1	2532.5	3064.9	3734.8	3078.0	2609.0	129.0	152.2	69.9%– 82.4%
Georgia	7	376.4	2.3	7.3	84.0	112.5	2086.3	119.8	93.6	4.6	5.9	4.5%– 5.7%
Hawaii	4	1053.5	6.8	1.2	289.0	327.3	328.4	328.4	296.9	14.7	16.2	90.4%–100.0%
Illinois	2	5763.5	48.4	14.3	1659.1	2342.8	4088.0	2357.1	1721.9	85.1	116.5	42.1%– 57.7%
Indiana	3	726.3	4.4	6.3	132.1	212.7	1804.8	219.0	142.8	7.1	10.8	7.9%– 12.1%
Louisiana	25	3467.8	17.2	4.5	653.3	829.8	1272.6	834.3	674.9	33.4	41.2	53.0%– 65.6%
Maine	10	831.9	3.8	1.2	132.2	183.7	355.6	184.9	137.3	6.8	9.1	38.6%– 52.0%
Maryland	17	3159.9	21.7	5.3	768.5	1048.1	1507.3	1053.4	795.4	39.3	52.1	52.8%– 69.9%
Massachusetts	9	4373.6	43.4	9.2	1501.1	2099.6	2636.1	2108.8	1553.8	76.8	104.3	58.9%– 80.0%
Michigan	42	4851.2	29.9	10.4	916.1	1445.6	2953.6	1456.0	956.3	47.3	72.0	32.4%– 49.3%
Minnesota	3	217.7	1.2	5.5	35.6	59.4	1571.5	64.9	42.3	2.1	3.2	2.7%– 4.1%
Mississippi	3	327.9	1.6	2.2	51.7	77.4	635.9	79.6	55.6	2.7	3.9	8.7%– 12.5%
New Hampshire	2	306.7	2.0	1.4	73.4	96.3	390.4	97.7	76.7	3.8	4.8	19.7%– 25.0%
New Jersey	15	5972.8	47.8	10.1	1648.0	2311.8	2886.2	2321.9	1705.9	84.3	114.8	59.1%– 80.4%
New York	27	14887.1	116.8	22.8	4187.4	5648.0	6505.0	5670.8	4326.9	213.9	280.3	66.5%– 87.2%
North Carolina	20	655.8	3.3	7.8	113.6	161.9	2220.0	169.7	124.7	6.2	8.4	5.6%– 7.6%

Ohio	9	2796.0	22.2	12.9	733.7	1074.6	3677.0	1087.5	768.8	38.0	53.8	20.9%– 29.6%
Oregon	9	1125.6	8.6	2.9	320.6	417.5	830.5	420.4	332.1	16.4	20.8	40.0%– 50.6%
Pennsylvania	4	3004.1	21.7	14.3	788.8	1049.5	4066.3	1063.7	824.8	40.8	52.6	20.3%– 26.2%
Rhode Island	5	966.8	7.6	1.3	239.8	366.3	367.6	367.6	248.7	12.3	18.2	67.6%–100.0%
South Carolina	9	817.7	4.4	3.7	169.5	214.5	1047.5	218.1	177.6	8.8	10.8	17.0%– 20.8%
Texas	19	4438.0	34.3	19.7	1268.2	1661.0	5625.1	1680.7	1322.3	65.4	83.1	23.5%– 29.9%
Virginia	37	3103.1	24.4	6.5	782.3	1177.8	1858.7	1184.3	813.2	40.2	58.6	43.7%– 63.7%
Washington	17	3291.4	19.8	4.7	707.2	958.6	1336.7	963.3	731.7	36.2	47.6	54.7%– 72.1%
Wisconsin	15	1865.8	14.9	5.7	480.3	721.2	1624.7	726.9	500.9	24.8	35.9	30.8%– 44.7%
Puerto Rico		3293.0	18.2	1.5	422.3	442.0	442.0	442.0	442.0	21.9	21.9	100.0%–100.0%
Guam		124.0			12.9	12.9	12.9	12.9	12.9	0.6	0.6	100.0%–100.0%
Virgin Islands		109.0			22.2	22.2	22.2	22.2	22.2	1.1	1.1	100.0%–100.0%
Northern Marianas		19.6										
American Samoa		37.1										
United States	404	105875.0	779.0	238.9	27304.7	37673.9	68157.4	37912.8	28322.6	1400.2	1850.6	
US Subsectors' Total	28322.55											
US All Activities	81119.30											
US GNP ($Billion)	4010.30											
US Coastal GNP^b	1400.20											
Coastal GNP Modif^c	1874.30											
% Contr of Coast	34.3-46.1^d											

NOTE: Employment = thousands; GNP = $billion; 1985.
[a] Data not available or calculation not defined for blank places.
[b] Coastal GNP = (subsectors 1+2+3) x (US GNP) / (US all activities).
[c] GNP modified = (coast generated) x (US GNP) / (US all activities).
[d] The bottom of range is from US coastal GNP; the top is from coastal GNP modified.

Table 6. Coastal GNP, Payroll-Based, 1978

State	Number of Counties	Subsectors			All Activities		Coastal Generated Total (6+4)	State Coastal Pay (3+4+5)	State Coastal GNP[b]	State Coastal GNP[c]
		1	2	3	Coastal Counties	All Counties				
1	2	3	4	5	6	7	8	9	9	10
Alabama	2	18.6	44.8	766.1	1261.4	10751.4	1306.2	829.5	2.1	3/3
Alaska	18	21.1	8.2	1026.2	1434.1	1975.7	1442.3	1055.5	2.6	3.6
California	22	1244.6	393.7	50627.9	84605.7	94499.8	84999.4	52266.2	131.0	213.1
Connecticut	4	129.2	60.7	4198.4	8781.4	14565.5	8842.1	4388.3	11.0	22.2
Delaware	3	40.1	11.4	1231.6	2727.8	2727.8	2739.2	1283.1	3.2	6.9
Florida	41	348.0	108.0	15950.6	23658.8	25911.6	23766.8	16406.6	41.1	59.6
Georgia	7	13.2	71.2	565.4	895.1	17085.1	966.3	649.8	1.6	2.4
Hawaii	4	43.6	12.3	2287.9	2961.1	2961.1	2973.4	2343.8	5.9	7.5
Illinois	2	491.0	226.7	18986.9	33378.7	54419.7	33605.4	19704.7	49.4	84.2
Indiana	3	58.3	93.9	1481.5	3965.2	22547.1	4059.1	1633.8	4.1	10.2
Louisiana	25	130.5	54.9	5761.2	8873.7	13181.5	8928.6	5946.7	14.9	22.4
Maine	10	32.4	12.5	1307.1	2199.4	3004.2	2211.9	1352.0	3.4	5.5
Maryland	17	143.4	58.0	6077.2	9745.2	13915.0	9803.2	6278.5	15.7	24.6
Massachusetts	9	279.1	100.8	11360.7	18974.9	24193.0	19075.7	11740.6	29.4	47.8
Michigan	42	346.0	178.8	8998.6	23519.3	42910.2	23698.1	9523.4	23.9	59.4
Minnesota	3	12.6	66.8	459.8	859.5	16027.0	926.3	539.2	1.4	2.3
Mississippi	3	11.9	23.1	357.8	807.8	5534.0	830.9	392.7	1.0	2.1
New Hampshire	2	10.3	12.3	408.9	698.0	2960.9	710.3	431.5	1.1	1.8
New Jersey	15	362.0	128.9	13549.5	24607.3	30924.5	24736.2	14040.3	35.2	62.0
New York	27	967.0	319.5	41593.6	65733.0	76684.4	66052.5	42880.1	107.5	165.6
North Carolina	20	14.9	77.2	627.8	1012.9	18517.0	1090.1	719.9	1.8	2.7

Ohio	9	227.5	200.1	7322/5	15467.4	48023.7	15667.5	7750.1	19.4	39.3
Oregon	9	77.3	39.0	3370.7	5258.0	9349.2	5297.0	3487.0	8.7	13.3
Pennsylvania	4	183.7	197.7	7209.8	12487.6	47437.4	12685.3	7591.2	19.0	31.8
Rhode Island	5	50.2	14.2	1807.9	3414.4	3428.6	1872.4		4.7	8.6
South Carolina	9	20.6	37.8	895.4	1402.6	9076.6	1440.4	953.9	2.4	3.6
Texas	19	266.1	210.7	11491.2	18091.0	50572.8	18301.7	11968.0	30.0	45.9
Virginia	40	114.1	64.7	5192.7	7759.7	15517.0	7824.4	5371.5	13.5	19.6
Washington	15	172.4	61.7	6955.2	11718.1	14815.3	11779.8	7189.3	18.0	29.5
Wisconsin	15	137.2	76.0	4303.4	9227.1	18241.7	9403.1	4516.6	11.3	23.6
Puerto Rico		93.0	8.9	2031.7	2133.6	2133.6	2133.6	2133.6	5.3	5.3
Guam					81.1	81.1	81.1	81.1	0.2	0.2
Virgin Islands				136.2	136.2	136.2	136.2	136.2	0.3	0.3
Northern Marianas										
American										
Samoa										
United States	404	6001.5	2975.4	238422.5	407977.1	714095.5	410952.5	247456.9	774.6	1030.2

US All Activities	840.7
US GNP ($Billion)	2107.6
US Coastal GNP[b]	620.2
Coastal GNP Modified[c]	1030.2
% Contr of Coast	29.2–48.6[d]

NOTE: Payroll = million dollars; GNP = billion dollars; 1978.

[a] Data not available or calculation not defined for blank places.
[b] Coastal GNP = (subsectors 1+2+3) x (US GNP) / (US all activities).
[c] GNP modified = (coast generated) x (US GNP) / (US all activities).
[d] The bottom of range is from US coastal GNP; the top is from coastal GNP modified.

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Table 7. Coastal GNP, Payroll-Based, 1985

State	Number of Counties	Subsectors			All Activities		Coastal Generated Total (6+4)	State Coastal Pay (3+4+5)	State Coastal GNP[b]	State Coastal GNP[c]
		1	2	3	Coastal Counties	All Counties				
1	2	3	4	5	6	7	8	9	10	11
Alabama	2	44.3	64.9	1354.7	2086.4	18245.3	2151.2	1463.8	3.9	5.7
Alaska	18	66.9	14.7	2132.5	3156.0	4141.5	3170.7	2214.1	5.9	8.4
California	22	3653.6	684.3	103329.2	172251.9	192416.6	172936.3	107667.0	285.4	458.3
Connecticut	4	379.6	101.7	9190.1	17895.1	28592.6	17996.8	9671.3	25.6	47.7
Delaware	3	107.6	18.1	2509.6	5074.1	5076.6	5092.2	2635.3	7.0	13.5
Florida	41	1045.9	212.1	35769.4	49308.1	59630.3	49520.1	37027.3	98.1	131.2
Georgia	7	37.3	128.5	1022.4	1760.5	36136.7	1889.0	1188.3	3.1	5.0
Hawaii	4	110.8	18.6	4237.7	5222.3	5224.0	5240.8	4367.1	11.6	13.9
Illinois	2	1077.3	294.3	30872.0	50790.0	82759.8	51084.3	32243.6	85.5	135.4
Indiana	3	92.0	117.1	1888.7	4335.3	32921.2	4452.4	2097.8	5.6	11.8
Louisiana	25	309.2	78.5	9580.6	14578.2	22078.2	14656.7	9968.3	26.4	38.8
Maine	10	50.4	19.6	1824.6	2374.4	5520.7	2394.1	1894.6	5.0	6.3
Maryland	17	356.7	96.8	9304.2	16815.5	27227.3	16912.3	9757.7	25.9	44.8
Massachusetts	9	870.2	177.9	25619.7	41027.9	50008.5	41205.7	26667.8	70.7	109.2
Michigan	42	655.8	226.8	14020.1	31388.3	63783.0	31615.2	14912.7	39.5	83.8
Minnesota	3	12.0	102.9	941.0	564.6	28940.1	667.5	1055.9	2.8	1.8
Mississippi	3	26.4	32.7	558.2	1246.8	9188.4	1279.5	617.3	1.6	3.4
New Hampshire	2	25.4	23.7	724.6	1198.7	6660.6	1222.4	773.7	2.1	3.2
New Jersey	15	989.9	209.6	28852.1	46668.5	68927.0	46878.1	30051.5	79.6	124.2
New York	27	2639.3	494.1	83725.7	124432.3	138937.6	124926.5	86859.2	230.2	331.1
North Carolina	20	45.9	125.8	1159.4	2164.8	35374.0	2290.6	1331.1	3.5	6.1

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Ohio	9	464.3	252.5	11080.1	21890.1	71007.8	22142.6	11796.9	31.3	58.7
Oregon	9	158.4	50.6	4725.9	7466.8	14239.5	7517.5	4935.0	13.1	19.9
Pennsylvania	4	434.2	262.9	12968.6	20471.9	73921.9	20734.8	13665.8	36.2	55.0
Rhode Island	5	126.0	21.1	3268.6	5940.9	5942.5	5962.0	3415.7	9.1	15.8
South Carolina	9	63.4	57.8	2004.1	2986.9	16240.5	3044.6	2125.2	5.6	8.1
Texas	19	743.9	377.8	21938.8	35072.7	106227.9	35450.5	23060.5	61.1	94.0
Virginia	40	449.9	114.6	11729.8	21209.6	32233.0	21324.3	12294.4	32.6	56.5
Washington	15	396.0	89.6	11342.8	18668.6	25196.4	18758.3	11828.4	31.3	49.7
Wisconsin	15	288.3	101.1	6653.4	13592.6	28436.7	13693.8	7042.9	18.7	36.3
Puerto Rico		207.0	17.4	4656.2	4880.6	4880.6	4880.6	4880.6	12.9	12.9
Guam				150.9	150.9	150.9	150.9	150.9	0.4	0.4
Virgin Islands				338.8	338.8	338.8	338.8	338.8	0.9	0.9
Northern Marianas										
American Samoa										
United States	404	15844.5	4590.1	459474.5	747010.1	1290606.8	751600.2	480000.5	1271.9	1992.0

US All Activities: 1513.1
US GNP ($Billion): 4010.3
US Coastal GNP[b]: 1271.9
Coastal GNP Modified[c]: 1992.0
% Contr of Coast: 32.1–49.3[d]

NOTE: Payroll = million dollars; GNP = billion dollars; 1985.
[a] Data not available or calculation not defined for blank places.
[b] Coastal GNP = (subsectors 1+2+3) x (US GNP) / (US all activities).
[c] GNP modified = (coast generated) x (US GNP) / (US all activities).
[d] The bottom of range is from US coastal GNP; the top is from coastal GNP modified.

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