WORLD COASTLINE MEASUREMENTS

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NOTE BY THE DIRECTING COMMITTEE OF THE INTERNATIONAL HYDROGRAPHIC BUREAU

The Directing Committee considers that the article printed below will be of great interest to all countries concerned with the development of an accurate hydrographic survey of the coastlines of the entire world.

It is pointed out that this article has been developed purely from the technical point of view and with no political implications in its considerations or grouping.

That it will be subject to considerable discussion and disagreement is to be expected, but it is hoped that it is precisely from suggestions and observations made that a more accurate set of figures for these measurements will be obtained.

The Committee therefore invites criticism and comments on the details given below and hopes that the publication of this article will lead to the establishment of final and complete information in this important matter.

The Bureau will publish in future editions of the « International Hydrographic Bulletin » all corrections to these figures.

Lengths of national segments of the vast line of demarcation between land and sea are frequently sought for a variety of purposes. For obvious reasons, measuring the shoreline is a complicated task. Ocean tides ranging from almost imperceptible changes in certain areas increase to a maximum of over fifty feet in other localities.

The endless shift in coastline goes on relentlessly. Each ebb tide leaves behind a new boundary marking the high water line. These high water marks are averaged to obtain the accepted shoreline for mapping and charting purposes. This is the line that is measured to obtain the desired lengths. The accuracy with which the high water line is charted determines the degree of accuracy that can be expected in measuring the length of a given segment of coastline.

Hydrographic surveying methods have been greatly improved in recent decades and considerable areas are now being surveyed with new electronic devices. Modern photogrammetric techniques are being used effectively in locating shorelines or the mean high water line which is the intersection of the plane of mean high water with the land.

Unfortunately, shoreline surveys by highly refined methods are confined to very limited areas, but even with adequate surveys absolute precision in measure-

ment is still unobtainable. In most regions, it is possible to make little more than an intelligent estimate and no opportunity is afforded to study the cycle of shoreline changes by comparing successive surveys of a given area.

Thus, studies of this feature of the physical dimensions of the earth are handicapped by : lack of surveys of vast areas over the globe, incomplete or inadequate and outdated surveys, constant changes occurring as a result of tides and currents, wind-driven storm waves, erosion represented by the never-ending battle between land and water, and lack of uniformity in methods that have been used by the various countries bordering the oceans.

The Coast and Geodetic Survey of the United States Department of Commerce has compiled figures on lengths in statute miles of domestic areas by states classified as general coastline; tidal shoreline, general; and tidal shoreline, detailed. These measurements include Alaska and island possessions of the United States.

The general coastline was measured in units of 30 minutes of latitude on charts as near the scale of 1 :1,200,000 as possible. The general tidal shoreline was measured in units of three statute miles on charts at a scale ranging from 1 : 200,000 to 1 : 400,000, and the detailed tidal shoreline was measured on the largest-scale maps and charts available in 1940.

Figures for the shorelines of the world, other than domestic areas, are generally available only in the first category. Therefore, only general coastline measurements are given for the United States in statute miles as follows :

Atlantic Coast	1,888
Gulf Coast	1,659
Pacific Coast	1,293
Total for Continental U.S.	4,840

Territories and Possessions

Alaska	6,640
Baker Island	3
Christmas Island	80
Guam Islands	78
Hawaiian Islands	775
Howland Island	4
Jarvis Island	5
Palmyra Island	9
Panama Canal Zone	20
Puerto Rico	311
Samoa Islands	76
Virgin Islands	117
Wake Island	12

Measurements of coastlines exclusive of domestic areas were based on the best available general maps of large regional components. The mainland coasts of the countries of the world were measured in units of 50 statute miles, islands of less than 100 miles in circumference were measured in units of either 10 or 20 miles, and the lengths of shoreline of small islands were estimated. Coastal indentations, such as bays, rivers, and inlets, with widths of less than 10 statute miles between the mainland shores at the entrance were disregarded. Shores of these indentations or breaks were measured when the entrance widths were 10 statute miles or more across. These measurements were extended inland until the water distance across measured no more than 10 miles.

The mainland measurements as well as those of larger islands are considered reasonably accurate with a margin of error ranging to not more than 5 to 10 per cent. The method used results in measurements somewhat in excess of the values for general coastlines given for the United States and possessions. This difference reflects the manner in which identations were treated, such as large bodies of water which were measured as a part of the general coastline by the formula noted above.

NORTH AMERICA (except United States)		
Greenland		8,650
Canada. — Atlantic coastline, including Hudson Bay	4,500	
Northern coastline	6,400	
Northern islands	16,605	
Pacific coastline	1,150	
Islands	1,150	
Gulf of St. Lawrence Is	700	
Islands in Hudson Bay	760	
Newfoundland	1,800	
Total Canadian coastline		33,065
Mexico. — Gulf of Mexico	1,820	
Pacific coast	4,500	6,320
Caribbean Area:		
Bahamas		1,580
Cuba		2,100
Jamaica		325
Haiti		675
Dominican Republic		600
Lesser Antilles		600
Trinidad, including Tobago		260
Netherlands West Indies		140
CENTRAL AMERICA		
British Honduras		250
Guatemala. — Caribbean coast	75	
Pacific coast	155	230

Honduras. — Caribbean coast	450	
Pacific coast (Including disputed Mosquitia Terr.)	65	515
El Salvador		170
Nicaragua. — Caribbean coast	350	
Pacific coast	225	575
Costa Rica. — Caribbean coast	120	
Pacific coast	485	605
Panama. — Caribbean coast	450	
Pacific coast	650	1,100
Grand Total mileage for North and Central America		69,688

SOUTH AMERICA

Colombia. — Caribbean coast	710	
Pacific coast	580	
Venezuela (Including Margarita and Tortuga Is.)		1,785
British Guiana		325
Surinam (Dutch Guiana)		250
French Guiana		230
Brazil		6,019
Uruguay		425
Argentina		2,940
Ecuador (Including Galapagos Is.)		1,278
Peru		1,475
Chile		7,746
Falkland Islands		610
South Georgia		270
South Orkney Island		140
Grand Total mileage for South America		24,783

AFRICA

Egypt. — Mediterranean coast	565	
Red Sea coast	850	
Libya		1,000
Tunisia		655
Algeria		725
Spanish Morocco. — Mediterranean coast	225	
Atlantic coast	60	285
French Morocco. — Atlantic coast	525	
Mediterranean coast	9	534
Tangier		27
Canary Islands		467

Spanish Sahara	670	
Ifni	36	706
French West Africa. — Mauritania	375	
Senegal	275	
French Guinea	200	
Ivory Coast	300	
Togo	40	
Dahomey	55	1,245
Sierre Leone		275
Liberia		315
Portuguese Guinea	200	
Bijagos I.	80	280
Gold Coast		335
Gambia		55
Nigeria		600
Spanish Guinea. — Rio Muni	100	
Fernando Poo	100	200
French Equatorial Africa. — Cameroons	150	
Gabon	500	
Middle Congo	100	750
Belgian Congo		30
Angola	925	
Cabinda	55	
Sâo Tomé	60	1,040
South-West Africa		900
Union of South Africa		1,700
Mozambique		1,500
Tanganyika Territory		500
Zanzibar		180
Kenya		325
Somalia		1,400
French Somaliland		160
British Somaliland		435
Ethiopia		675
Sudan		450
Socotra I.		200
Madagascar	2,600	
Comores	230	2,830
Seychelles		45
Reunion I.		120
Mauritius I.		110
Grand Total mileage of coastline of Africa		22,469

EUROPE

Great Britain :		
Northern Ireland	150	
England	1,150	
Wales	335	
Scotland	445	
Outer Hebrides	240	
Channel Islands	45	
Orkneys	100	
Shetlands	160	
Isle of Man	50	2,675
Ireland		800
Norway	3,100	
Svalbard	1,400	
Jan Mayen	65	4,565
Sweden	1,850	
Oland	190	
Gotland	250	2,290
Finland	1,322	
Aland	140	1,462
Estonia	300	
Khiuma	95	
Sarema	160	555
Latvia		325
Lithuania		80
Germany. — Baltic Sea coast	380	
North Sea coast	300	680
Poland		275
Denmark	1,000	
Bornholm	57	
Faeroes	140	1,197
Iceland		1,400
Netherlands		315
Belgium		41
France. — Atlantic coast	1,675	
Mediterranean coast	350	
Corsica	275	2,300
Spain. — Atlantic coast	650	
Mediterranean coast	750	
Balearic Is.	270	1,670

Portugal	485	
Azores	320	
Madeira	88	
Cape Verde	364	1,257
Monaco		12
Italy	1,720	
Sardinia	455	
Sicily	470	
Elba	40	2,685
Malta		62
Trieste		(app.) 8
Yugoslavia. — Adriatic coast		900
Albania		175
Greece	1,870	
Aegean Is.	900	
Crete	360	3,130
Bulgaria. — Black Sea		175
Romania. — Black Sea		150
Grand Total mileage of coastline of Europe (Excluding U.S.S.R.)		29,184

UNION OF SOVIET SOCIALIST REPUBLICS

Measurements of coastline of the Union Soviet Socialist Republics are listed separately and are not included in either Europe or Asia.

U.S.S.R. — Arctic coast (From the Finnish frontier to Mys Dezhneva) (Bering Sea)	10,850	
Kolguev	135	
Novaya Zemlya	1,700	
Vaigach	165	
Bely	100	
Oleni	85	
Sibiryakova	75	
Severnaya Zemlya	950	
Novo Sibirskie	975	
Franz Josef Land	700	
Vrangelya	237	15,972
U.S.S.R. — Pacific coast (From Mys Dezhneva to Korean frontier)	7,100	
Karaginski	150	
Komandorskie	165	
Sakhalin	1,465	
Shantarskie	160	
Kurilskie Is.	750	9,790

U.S.S.R. — Baltic coast (Excluding Estonia, Latvia, and Lithuania		400
U.S.S.R. — Black Sea coast (Including Sea of Azov)		1,925
U.S.S.R. — Caspian Sea coast		2,700
Total mileage of the U.S.S.R. coastline		30,787

ASIA

Turkey. — Black Sea	950	
Mediterranean Sea	1,225	
European Turkey	400	2,575
Syria		110
Lebanon		130
Israel. — Mediterranean	115	
Gulf of Aqaba	6	121
Gaza Strip		25
Jordan. — Gulf of Aqaba		4
Cyprus (British)		360
Saudi Arabia. — Red Sea	1,300	
Persian Gulf	350	1,650
Yemen. — Red Sea		275
Aden Protectorate. — Gulf of Aden		750
Oman. — Arabian Sea		1,225
Trucial Oman. — Persian Gulf		550
Qatar. — Persian Gulf		250
Bahrein. — Persian Gulf		90
Neutral Territory. —Persian Gulf		50
Kuwait. — Persian Gulf		190
Iraq. — Persian Gulf		40
Iran. — Persian Gulf	1,275	
Caspian Sea	375	1,650
India. — Arabian Sea and Bay of Bengal	3,350	
Islands	815	4,165
Portuguese India		87
Ceylon		725
Pakistan, West. — Arabian Sea	525	
Pakistan, East. — Bay of Bengal	440	965

Burma		1,650
Thailand. — Andaman Sea	450	
Gulf of Siam	890	1,340
Malaya		900
Singapore		60
Cambodia		220
Vietnam, North		425
Vietnam, South		1,025
China	3,800	
Hainan I.	450	4,250
Formosa (Including Pescadores)		555
Korea		1,610
Japan. — Home Islands		5,500
Hong Kong		125
Macau		20
Philippines		6,790
Sarawak		450
North Borneo		775
Brunei		75
Portuguese Timor		375
Indonesia		16,450
Grand Total mileage of coastline of Asia (Excluding U.S.S.R.)		58,582

PACIFIC OCEAN ISLANDS AND AUSTRALIA

Netherlands New Guinea		3,050
Australian New Guinea		4,400
Australia	11,650	
Tasmania	900	12,550
New Zealand. — North Island	1,650	
New Zealand. — South Island	1,350	3,000
Ryukyu, including Okinawa		280
Marianas		220
Carolines		375
Marshalls		75

Gilberts	100
Ellice	50
Solomons	2,200
New Hebrides	1,300
New Caledonia	800
Fiji	925
Phoenix	50
Tokelau (Union)	70
Samoa	300
Line	110
Tonga	200
Cook	90
Society	375
Tubai	45
Others	300

ANTARCTICA

Antarctica	estimated at	13,500	
Kerguelen		300	13,800
Grand Total mileage of coastline of New Guinea, Australia, New Zealand, Oceania, and Antarctica			44,665

The figure given above does not include the Hawaiian Islands which are listed with U. S. possessions. Other island possessions in the Pacific Ocean are repeated, however, in this figure. Measurements for island groups in the Pacific that include U. S. possessions, such as Guam in the Marianas, are not adjusted for the single island measurements given in the U. S. summary. This results in a minor repetition of measurements in reporting certain of the island groups.

Countless islets, atolls, and reefs are not included in these measurements. It is estimated, however, that the total of all such unmeasured specks of land scattered throughout the oceans will amount to not more than several thousand miles. The method used affords an overall measurement for the world of approximately 280,000 statute miles. The measurements are only as accurate as the charts and maps from which they were scaled. Greater accuracy and refinements in these dimensions must wait for the execution of adequate hydrographic and topographic surveys for vast areas where this work has not been accomplished.