

## Section 5

# GEOGRAPHY AND ENVIRONMENT

This section relates to land and water areas, physical geography, climate, air and water quality, and other geographic and environmental measurements of Hawaii. Most statistics on land use and ownership, however, appear in Section 6.

The State consists of eight major islands and 124 minor islands with a total land area of 6,423 square miles and a general coastline of 750 miles. Honolulu is 214 miles from Hilo, 1,367 miles from Kure Atoll (the westernmost end of the State), 2,397 miles from San Francisco, and 4,829 miles from Washington, D.C. The highest peak in the State is Mauna Kea, 13,796 feet above sea level; the longest stream is Kaukonahua Stream, Oahu, 33 miles in length; the most extensive lake or similar body is Kawainui Marsh, 1,000 acres; and the highest named waterfall is Kahiwa, Molokai, a 1,750-foot cascade. Various measures of air pollution, such as suspended particulate matter, indicate that Honolulu is one of the cleanest cities in the nation. The 167 major beaches and streams surveyed in 1990 were found to have enterococci levels per 100 ml. ranging from 0.5 to 258.3, and 78 percent were within EPA standards. More than 500 species, subspecies, and varieties of native fauna and flora have been proposed or accepted for inclusion on lists of endangered, threatened, or extinct organisms.

Climatically, Hawaii is marked by remarkably balmy temperatures and wide variations in rainfall. The all-time temperature range at Honolulu International Airport, for example, was from 53° to 94°F. Average precipitation, however, ranges from less than nine inches at Kawaihae to 444 inches atop Waialeale. The volcanic eruption that began in 1983 had produced more than 1.5 billion cubic meters of lava by September 1991. Hawaii's worst recorded earthquake (1868) attained 7.5 on the Richter scale by retrospective estimate, the highest tsunami wave (1946) reached 56 feet, and the most destructive hurricane (Iwa, 1982) gusted to 117 miles per hour. Water withdrawn for use in 1985 averaged 1.4 billion gallons per day, compared with 2.9 billion in 1980 and 2.8 billion in 1975.

Important sources of data include the U.S. Geological Survey, National Ocean Survey, National Weather Service, U.S. Bureau of the Census Geography Division, the Division of Water and Land Development of the State Department of Land and Natural Resources, the State Department of Health, and the University of Hawaii Institute of Geophysics. Detailed information is given in Atlas of Hawaii, 2nd edition, published by the University of Hawaii Press in 1983. National data are reported in Statistical Abstract of the United States: 1991, Section 6.

Table 121.-- GREAT CIRCLE DISTANCES BETWEEN SPECIFIED PLACES

Places	Statute miles	Nautical miles	Kilo- meters
DISTANCES FROM HONOLULU INTERNATIONAL AIRPORT			
Hawaiian Islands locations:			
Hilo, Hawaii .....	214	186	344
Kailua, Kona, Hawaii .....	168	146	270
Kahului, Maui .....	98	85	158
Lanai Airport .....	72	63	116
Molokai Airport .....	54	47	87
Lihue, Kauai .....	103	90	166
Puuwai, Niihau .....	152	132	245
Nihoa .....	283	246	455
Necker Island .....	520	452	837
French Frigate Shoals .....	556	483	895
Gardner Pinnacles .....	688	598	1,107
Maro Reef .....	851	739	1,369
Laysan Island .....	936	813	1,506
Lisianski Island .....	1,065	925	1,714
Pearl and Hermes Atoll .....	1,208	1,050	1,944
Midway Islands .....	1,309	1,137	2,106
Kure Atoll .....	1,367	1,188	2,200
Other Pacific locations:			
Apra Harbor, Guam .....	3,806	3,307	6,124
Auckland, New Zealand .....	4,393	3,817	7,068
Hong Kong .....	5,541	4,815	8,915
Johnston Atoll .....	820	713	1,319
Kingman Reef .....	1,073	932	1,726
Kiritimati (Christmas Island), Kiribati .....	1,344	1,168	2,163
Majuro, Marshall Islands .....	2,271	1,973	3,654
Manila, Philippines .....	5,293	4,599	8,516
Nuku Hiva, Marquesas Islands .....	2,400	2,086	3,864
Pago Pago, American Samoa .....	2,606	2,265	4,193
Palmyra Atoll .....	1,101	957	1,772
Papeete, Tahiti .....	2,741	2,382	4,410
Suva, Fiji .....	3,159	2,745	5,083
Sydney (Port Jackson), Australia .....	5,070	4,406	8,158
Tokyo, Japan .....	3,847	3,343	6,190
Wake Island .....	2,294	1,993	3,691
North and South American locations:			
Anchorage, Alaska .....	2,781	2,417	4,475
Cape Horn, Chile .....	7,457	6,480	11,998

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Table 121.-- GREAT CIRCLE DISTANCES BETWEEN SPECIFIED PLACES -- Con.

Places	Statute miles	Nautical miles	Kilo-meters
DISTANCES FROM HONOLULU INT. AIRPORT--Con.			
North and South American locations, con.:			
Chicago, Illinois .....	4,179	3,631	6,724
Cristobal, Canal Zone .....	5,214	4,531	8,389
Los Angeles, California .....	2,557	2,222	4,114
Miami, Florida .....	4,856	4,220	7,813
New York, New York .....	4,959	4,309	7,979
Portland, Oregon .....	2,595	2,255	4,175
San Diego, California .....	2,610	2,268	4,199
San Francisco, California .....	2,397	2,083	3,857
Seattle, Washington .....	2,679	2,328	4,311
Vancouver, B.C. ....	2,709	2,354	4,359
Tijuana, Mexico .....	2,616	2,273	4,209
Washington, D.C. ....	4,829	4,196	7,770
London, England .....	7,226	6,279	11,627
Bombay, India .....	8,010	6,960	12,888
Ghanzi, Botswana 1/ .....	12,417	10,790	19,979
Equator, due south of Honolulu .....	1,470	1,277	2,367
North Pole .....	4,740	4,119	7,631
OTHER DISTANCES			
Hilo to --			
Los Angeles, California .....	2,447	2,126	3,937
San Francisco, California .....	2,315	2,012	3,725
Kure Atoll to --			
Cape Kumukahi, Puna, Hawaii 2/ .....	1,523	1,323	2,451
Log Point, Elliot Key, Florida 3/ .....	5,852	5,085	9,416
Tokyo, Japan .....	2,486	2,160	4,000
West Quoddy Head, Maine .....	5,788	5,030	9,313

1/ Ghanzi, Botswana, is Honolulu's antipode, that is, the point precisely opposite to it on the globe.

2/ Cape Kumukahi and Kure Atoll are the points farthest apart in the Hawaiian Archipelago and State of Hawaii.

3/ Log Point and Kure Atoll are the points farthest apart in the 50 states.

Source: U. S. Department of the Interior, Geological Survey, Elevations and Distances in the United States (1980), pp. 22-23, and records.

Table 122.-- TIME DIFFERENTIALS BETWEEN HONOLULU AND SELECTED CITIES: 1991

City	June		December	
	Day	Hour	Day	Hour
Honolulu .....	Same	12:00 N	Same	12:00 N
Los Angeles .....	Same	3:00 PM	Same	2:00 PM
Denver .....	Same	4:00 PM	Same	3:00 PM
Houston .....	Same	5:00 PM	Same	4:00 PM
Chicago .....	Same	5:00 PM	Same	4:00 PM
Atlanta .....	Same	6:00 PM	Same	5:00 PM
Washington .....	Same	6:00 PM	Same	5:00 PM
New York .....	Same	6:00 PM	Same	5:00 PM
London .....	Same	11:00 PM	Same	10:00 PM
Singapore .....	Next	6:00 AM	Next	6:00 AM
Hong Kong .....	Next	6:00 AM	Next	6:00 AM
Manila .....	Next	6:00 AM	Next	6:00 AM
Tokyo .....	Next	7:00 AM	Next	7:00 AM
Sydney .....	Next	8:00 AM	Next	9:00 AM

Source: Hawaiian Telephone Co., Oahu Telephone Book 1991-1992, p. 37A; consulates; airlines.

Table 123.-- LATITUDES AND LONGITUDES OF SELECTED PLACES

Island and place	Latitude (North)	Longitude (West)
Hawaii:		
Hilo (International Airport).....	19°43'	155°04'
Cape Kumukahi .....	19°31'	154°49'
Ka Lae .....	18°56'	155°41'
Keahole Point .....	19°44'	156°04'
Upolu Point .....	20°16'	155°51'
Geographic center of State (off Maui).	20°15'	156°20'
Maui:		
Wailuku .....	20°53'	156°30'
Kahului (Airport) .....	20°54'	156°26'
Hana .....	20°45'	155°59'
Cape Hanamanioa .....	20°35'	156°25'
Lahaina .....	20°52'	156°41'
Kahoolawe:		
Puu Moaulanui .....	20°34'	156°34'
Lanai:		
Airport .....	20°48'	156°57'
Molokai:		
Kaunakakai .....	21°05'	157°02'
Laau Point .....	21°06'	157°19'
Cape Halawa .....	21°10'	156°43'
Oahu:		
Honolulu: International Airport ...	21°20'	157°55'
Aloha Tower .....	21°19'	157°52'
Kaena Point .....	21°35'	158°17'
Kahuku Point .....	21°43'	157°59'
Makapuu Point .....	21°19'	157°39'
Diamond Head .....	21°16'	157°49'
Kauai:		
Lihue (Kauai Airport) .....	21°59'	159°21'
Mana .....	22°02'	159°46'
Kilauea Point .....	22°14'	159°24'
Niihau:		
Puuwai .....	21°54'	160°12'
Kure Atoll .....	28°25'	178°22'

Source: U.S. Board on Geographic Names, Gazetteer No. 24, Hawaiian Islands (1956); U.S. Geological Survey, Elevations and Distances in the United States (1980), pp. 17 and 22-23; U.S. Department of Commerce, National Climatic Data Center, Local Climatological Data, Annual Summary with Comparative Data, 1984 for Hilo, Kahului, Honolulu, and Lihue; Bernice P. Bishop Museum, records; Hawaii State Department of Accounting and General Services, Survey Division, records.

Table 124.-- WIDTHS AND DEPTHS OF CHANNELS

Channel <u>1/</u>	Width <u>2/</u>		Depth <u>3/</u>	
	Statute miles	Kilometers	Feet	Meters
Alenuihaha (Hawaii-Maui) .....	29.6	47.6	6,810	2,076
Alalakeiki (Kahoolawe-Maui) .....	6.7	10.8	822	251
Kealaikahiki (Kahoolawe-Lanai) .....	17.8	28.6	1,086	331
Auau (Lanai-Maui) .....	9.5	15.3	252	77
Kalohi (Lanai-Molokai) .....	9.2	14.8	540	165
Pailolo (Maui-Molokai) .....	8.8	14.2	846	258
Kaiwi (Molokai-Oahu) .....	25.8	41.5	2,202	671
Kauai (Oahu-Kauai) .....	72.1	116.0	10,890	3,319
Kaulakahi (Kauai-Niihau) .....	17.2	27.7	3,570	1,088
Niihau-Kaula .....	21.5	34.6	5,364	1,635
Niihau-Nihoa .....	133.9	215.5	14,550	4,435
Nihoa-Necker I. ....	179.6	289.0	12,600	3,840
Necker I.-French Frigate Shoals .....	100.3	161.4	12,780	3,895
French Frigate Shoals-Gardner Pinnacles ..	137.0	220.5	11,448	3,489
Gardner Pinnacles-Marø Reef .....	155.5	250.3	12,300	3,749
Marø Reef-Laysan I. ....	65.9	106.1	8,280	2,524
Laysan I.-Lisianski I. ....	137.4	221.1	16,830	5,130
Lisianski I.-Pearl and Hermes Atoll .....	162.6	261.7	17,400	5,304
Pearl and Hermes Atoll-Midway Islands ....	86.9	139.9	15,840	4,828
Midway Islands-Kure Atoll .....	57.1	91.9	12,960	3,950

1/ Listed in geographic order, from east to west. The channels between major islands were measured between the following points:

Alenuihaha: Upolu Pt., Hawaii, to Puhilele Pt., Maui;  
 Alalakeiki: Lae o ka Ule, Kahoolawe, to Nukuele Pt., Maui;  
 Kealaikahiki: Makaalae, Kahoolawe, to Kamaiki Pt., Lanai;  
 Auau: Kikoa Pt., Lanai, to Lahaina, Maui;  
 Kalohi: Wahie Pt., Lanai, to Kamalo, Molokai;  
 Pailolo: Lipoa Pt., Maui, to Pohakuloa, Molokai;  
 Kaiwi: Ilio Pt., Molokai, to Makapuu Pt., Oahu;  
 Kauai: Kaena Pt., Oahu, to Kamilo Pt., Kauai;  
 Kaulakahi: Mana Pt., Kauai, to Kaunuopou, Niihau.

2/ Width measured in statute miles between designated points on National Ocean Survey and Coast and Geodetic Survey charts. Width in kilometers calculated from miles (1 mile = 1.60934 km.).

3/ Depths given are the deepest soundings noted at or near the line joining the two designated points, on National Ocean Survey and Coast and Geodetic Survey charts. Depths measured in fathoms and converted to feet and meters (1 fathom = 6 feet = 1.8288 meters).

Source: Compiled by Lee S. Motteler, Geography and Map Division, Bernice P. Bishop Museum, in November 1980.

Table 125.-- GENERAL COASTLINE AND TIDAL SHORELINE OF COUNTIES AND ISLANDS

County and island	General coastline <u>1/</u>		Tidal shoreline <u>2/</u>	
	Statute miles	Kilo-meters <u>3/</u>	Statute miles	Kilo-meters <u>3/</u>
State total .....	750	1,207	1,052	1,693
Counties:				
Hawaii .....	266	428	313	504
Maui, including Kalawao .....	210	338	343	552
Honolulu .....	137	220	234	377
Kauai .....	137	220	162	261
Islands: <u>4/</u>				
Hawaii .....	266	428	313	504
Maui .....	120	193	149	240
Kahoolawe .....	29	47	36	58
Lanai .....	47	76	52	84
Molokai .....	88	142	106	171
Oahu .....	112	180	209	336
Kauai .....	90	145	110	177
Niihau .....	45	72	50	80
Kaula .....	2	3	2	3
Northwestern Hawaiian Islands <u>5/</u> ..	25	40	25	40
Niihoa .....	3	5	3	5
Necker Island .....	2	3	2	3
French Frigate Shoals .....	6	10	6	10
Laysan Island .....	6	10	6	10
Lisianski Island .....	3	5	3	5
Kure Atoll .....	5	8	5	8

1/ Figures are lengths of general outline of seacoast. Data for the four islands of Maui County are not consistent with the reported county total.

2/ Shoreline of outer coast, offshore islands, bays, rivers, and creeks is included to the head of tidewater or to a point where tidal waters narrow to a width of 100 feet.

3/ Derived from data expressed in statute miles; independently rounded and accordingly may not add exactly to indicated totals and subtotals.  
1 mi. = 1.609 km.

4/ Data are not available for five minor islands: Molokini, Lehua, Gardner Pinnacles, Maro Reef, and Pearl and Hermes Atoll.

5/ Excludes the Midway Islands, which are part of the Hawaiian Archipelago but not legally part of the State of Hawaii. Midway has a general coastline of 20 miles and a tidal shoreline of 33 miles.

Source: U.S. Department of Commerce, National Ocean Survey, The Coastline of the United States (1975) and records.

Table 126.-- LAND AND WATER AREA OF COUNTIES AND ISLANDS: 1989

[See maps on pages 6 and 7]

County or island	Square miles		
	Total	Land <u>2/</u>	Inland water <u>3/</u>
State total .....	6,470.8	6,425.2	45.6
Counties: <u>4/</u>			
Hawaii .....	4,035.2	4,034.2	1.0
Maui .....	1,171.0	1,161.6	9.4
Kalawao .....	14.3	13.3	1.0
Honolulu <u>5/</u> .....	620.5	596.3	24.2
Kauai <u>5/</u> .....	629.8	619.8	10.0
Islands: <u>4/</u>			
Hawaii .....	4,035.2	4,034.2	1.0
Maui <u>6/</u> .....	734.5	728.6	5.9
Kahoolawe .....	45.9	45.0	0.9
Lanai .....	141.2	140.4	0.8
Molokai .....	263.7	260.9	2.8
Oahu .....	617.6	593.6	24.0
Kauai .....	558.2	549.4	8.8
Niihau <u>7/</u> .....	71.1	70.0	1.1
Kaula .....	0.4	0.4	-
Northwestern Hawaiian Islands <u>8/</u> ....	2.910	2.690	0.220
Nihoa .....	0.238	0.238	-
Necker Island .....	0.105	0.105	-
French Frigate Shoals .....	0.081	0.081	-
Gardner Pinnacles .....	0.011	0.011	-
Maro Reef .....	Awash	Awash	Awash
Laysan Island .....	1.454	1.234	0.220
Lisianski Island .....	0.586	0.586	-
Pearl and Hermes Atoll .....	0.106	0.106	-
Kure Atoll .....	0.329	0.329	-

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Table 126.-- LAND AND WATER AREA OF COUNTIES AND ISLANDS: 1989 -- Con.

County or island	Square kilometers <u>1/</u>		Acres <u>1/</u>	
	Total	Land <u>2/</u>	Total	Land <u>2/</u>
State total .....	16,759.3	16,641.2	4,141,312	4,112,128
Counties: <u>4/</u>				
Hawaii .....	10,451.1	10,448.5	2,582,528	2,581,888
Maui .....	3,032.9	3,008.5	749,440	743,424
Kalawao .....	37.0	34.4	9,152	8,512
Honolulu <u>5/</u> .....	1,607.1	1,544.4	397,120	381,632
Kauai <u>5/</u> .....	1,631.2	1,605.3	403,072	396,672
Islands: <u>4/</u>				
Hawaii .....	10,451.1	10,448.5	2,582,528	2,581,888
Maui <u>6/</u> .....	1,902.3	1,887.1	470,080	466,304
Kahoolawe .....	118.9	116.5	29,376	28,800
Lanai .....	365.7	363.6	90,368	89,856
Molokai .....	683.0	675.7	168,768	166,976
Oahu .....	1,599.6	1,537.4	395,264	379,904
Kauai .....	1,445.7	1,422.9	357,248	351,616
Niihau <u>7/</u> .....	184.1	181.3	45,504	44,800
Kaula .....	1.0	1.0	256	256
Northwestern Hawaiian Islands <u>8/</u>	7.5	7.0	1,862	1,722
Nihoa .....	0.6	0.6	152	152
Necker Island .....	0.3	0.3	67	67
French Frigate Shoals .....	0.2	0.2	52	52
Gardner Pinnacles .....	0.0	0.0	7	7
Maro Reef .....	Awash	Awash	Awash	Awash
Laysan Island .....	3.8	3.2	931	790
Lisianski Island .....	1.5	1.5	375	375
Pearl and Hermes Atoll .....	0.3	0.3	68	68
Kure Atoll .....	0.9	0.9	211	211

1/ Areas in square kilometers and acres were calculated directly from the figures shown for square miles; these equivalents were independently rounded, and hence may not add exactly to the indicated totals and subtotals. 1 square mile = 640 acres = 2.58999 square kilometers.

2/ Dry land and land temporarily or partially covered by water, as marshland, swamps, etc.; streams and canals under one-eighth statute mile wide; and lakes, reservoirs, and ponds under 40 acres of area.

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Table 126.-- LAND AND WATER AREA OF COUNTIES AND ISLANDS: 1989 -- Con.

3/ Permanent inland water surface, such as lakes, reservoirs, and ponds having 40 acres or more of area; streams, sloughs, estuaries, and canals one-eighth statute mile or more in width; deeply indented embayments and sounds, and other coastal waters behind or sheltered by headlands or islands separated by less than 1 nautical mile of water, and islands having less than 40 acres of area.

4/ Because of rounding, island figures may not add to county figures.

5/ Reflects inclusion of Kaula in the County of Kauai rather than in the City and County of Honolulu. Kaula was transferred to the County of Kauai by Act 245, S.L.H. 1988, approved June 9, 1988.

6/ Molokini, offshore of Maui, not measured; other sources give the area of Molokini as 18.6 acres (0.03 square miles or 0.075 square kilometers).

7/ Includes Lehua, elsewhere reported as 243 acres (0.38 square miles or 0.98 square kilometers).

8/ Exclusive of the Midway Islands, which are part of the Hawaiian Archipelago but not legally part of the State of Hawaii.

Source: Unpublished data supplied by the Geography Division, U.S. Bureau of the Census, May 5, 1983; cited in the Hawaii State Department of Planning and Economic Development, Remeasurements of the Area of Hawaii, 1982 (Statistical Memorandum 83-6, May 18, 1983).

Table 127.-- LAND AND WATER AREA WITHIN THE FISHERY CONSERVATION ZONE

[Land and water area within the 200 nautical mile Fishery Conservation Zone surrounding the Hawaiian Archipelago]

Unit	Total area	Land area	Water area
Square nautical miles .....	634,023	4,852	629,171
Square statute miles .....	839,623	6,425	833,198
Square kilometers .....	2,174,626	16,641	2,147,985

Source: Marine Surveys and Maps, National Ocean Survey, National Oceanic and Atmospheric Administration, information supplied September 15, 1978.

Table 128.-- MAJOR AND MINOR ISLANDS IN THE HAWAIIAN ARCHIPELAGO

Classification	Number of islands		Land area (square miles)
	Total	Inhabited, 1990 <u>1/</u>	
All named islands .....	137	12	6,427.0
Major islands .....	8	7	6,419.4
Named minor islands <u>2/</u> .....	129	5	7.6
Offshore of major islands .....	96	3	2.6
Northwestern Hawaiian Islands <u>3/</u> .....	33	2	4.9
Part of State .....	28	1	2.9
Not part of State (Midway Islands) ....	5	1	2.0

1/ For populations, see present volume, table 4.

2/ For individual data, see DPED Report GN-6, pp. 3-7.

3/ Includes individual islets in the 10 Northwestern Hawaiian Islands.

Source: Hawaii State Department of Planning and Economic Development, Geographic Names Approved, Second Quarter 1969 (Report GN-6, July 8, 1969), p. 8; Data Book 1986, table 152.

Table 129.-- AREA AND DEPTH OF SELECTED CRATERS

Island and crater	Area (acres)	Maximum depth (feet)
Hawaii:		
Kilauea Caldera .....	2,319	476
Mokuaweoweo Crater <u>1/</u> .....	2,221	572
Maui:		
Haleakala Crater <u>2/</u> .....	12,575	3,028
Oahu:		
Diamond Head Crater .....	255	562
Koko Crater .....	133	968
Punchbowl Crater .....	62	140

1/ Data exclude North and South Pits.

2/ Data exclude Koolau and Kaupo Gaps.

Source: Measured from U.S. Geological Survey maps by DBED.

Table 130.-- ELEVATIONS OF MAJOR SUMMITS

[Elevation of the highest point on each island  
and other important peaks]

Island and summit	Feet	Meters
Hawaii:		
Mauna Kea 1/ .....	13,796	4,205
Mauna Loa 2/ .....	13,679	4,169
Hualalai .....	8,271	2,521
Kaumu o Kaleihoohe .....	5,480	1,670
Kilauea (Uwekahuna) .....	4,093	1,248
Kilauea (Halemaumau Rim) .....	3,660	1,116
Kahoolawe:		
Puu Moaulanui .....	1,483	452
Puu Moaulaiki .....	1,434	437
Molokini .....	160	49
Maui:		
Haleakala (Red Hill) .....	10,023	3,055
Haleakala (Kaupo Gap) .....	8,201	2,500
Puu Kukui .....	5,788	1,764
Iao Needle .....	2,250	686
Lanai:		
Lanaihale .....	3,366	1,026
Molokai:		
Kamakou .....	4,961	1,512
Olokui .....	4,606	1,404
Kaumuohua .....	4,535	1,382
Kalaupapa Lookout .....	1,600	488
Mauna Loa (Kukui) .....	1,430	436
Oahu:		
Kaala .....	4,003	1,220
Puu Kalena .....	3,504	1,068
Konahuanui .....	3,150	960
Tantalus .....	2,013	614
Olomana .....	1,643	501
Koko Crater (Kohelepelepe) .....	1,208	368
Nuuanu Pali Lookout .....	1,186	361
Diamond Head .....	760	232
Koko Head .....	642	196
Punchbowl .....	500	152

Continued on next page.

Table 130.-- ELEVATIONS OF MAJOR SUMMITS -- Con.

Island and summit	Feet	Meters
Kauai:		
Kawaikini .....	5,243	1,598
Waialeale .....	5,148	1,569
Namolokama Mountain .....	4,421	1,348
Kalalau Lookout .....	4,120	1,256
Haupu .....	2,297	700
Sleeping Giant (Nonou) .....	1,241	378
Niihau:		
Paniau .....	1,250	381
Lehua .....	699	213
Kaula .....	548	167
Nihoa:		
Millers Peak .....	903	275
Necker Island:		
Summit Hill .....	276	84
French Frigate Shoals:		
La Perouse Pinnacles .....	120	37
Gardner Pinnacles .....	190	58
Maro Reef .....	Awash	Awash
Laysan Island .....	40	12
Lisianski Island .....	40	12
Pearl and Hermes Atoll .....	10	3
Midway Islands .....	12	4
Kure Atoll .....	20	6

1/ According to the 1991 Guinness Book of World Records (p. 142), "The world's tallest mountain measured from its submarine base (3,280 fathoms) in the Hawaiian Trough to its peak is Mauna Kea ... with a combined height of 33,476 ft., of which 13,796 ft. are above sea level."

2/ Guinness (pp. 142-143) describes Mauna Loa as having "dimensions, but not height, [which] exceed those of Mt. Everest .... The axes of its elliptical base, 16,322 ft below sea level, have been estimated at 74 miles and 53 miles."

Source: Hawaii State Department of Accounting and General Services, Survey Division, data provided July 15, 1991; U.S. National Cartographic Information Center, data provided October 11, 1978; U.S. Geological Survey topographic maps, 1981-1984; Hawaiian Government Survey (for Nihoa and Molokini); U.S.S. Tanager survey, 1923 (for Necker Island, French Frigate Shoals, Laysan, Lisianski, Pearl and Hermes Atoll and Kure Atoll).

Table 131-- LENGTH AND WIDTH OF SELECTED BEACHES

[Includes the longest white sand beach on each inhabited island, plus other important beaches]

Island and beach	Length (miles)	Width <sup>1/</sup> (feet)
Hawaii:		
Hapuna .....	0.5+	200+
Maui:		
Spreckelsville .....	2+	(NA)
Kaanapali .....	1.5	60-80
Lanai:		
Polihua .....	1.5+	(NA)
Molokai:		
Papohaku .....	2+	300
Oahu:		
Waikiki .....	2	(NA)
Waimanalo .....	3.5-4.5	(NA)
Sunset .....	2-3+	200
Kauai:		
Polihale to Kekaha .....	15	300
Polihale .....	3	300
Niihau:		
Keawanui .....	3.5	175

NA Not available.

<sup>1/</sup> Summer averages. Many beaches in Hawaii are seasonally reduced in width by winter storms.

Source: Hawaii State Department of Planning and Economic Development, Hawaii's Shoreline (1965), pp. 33, 47, 55, 62, 68, and 100; John R. K. Clark, Beaches of the Big Island (1985), p. 132, The Beaches of Maui County (1980), pp. 10, 62, 84-85, and 114, The Beaches of O'ahu (1977), pp. 45, 125, and 177, and Beaches of Kaua'i and Ni'ihau (1990), pp. 48-49 and 84.

Table 132.-- MAJOR STREAMS, BY ISLANDS: 1991

Island	Feature or stream	Length or ave. discharge
Longest water feature (miles):		
Hawaii .....	Wailuku River .....	32.0
Maui .....	Kalialinui-Waiale Gulch ....	18.0
Kahoolawe .....	Ahupu Gulch .....	4.0
Lanai .....	Maunalei-Waialala Gulch ....	12.9
Molokai .....	Wailau-Pulena Stream .....	6.5
Oahu .....	Kaukonahua Stream (So. Fork)	33.0
Kauai .....	Waimea River-Poomau Stream .	19.5
Niihau .....	Keanaulii-Puniopo Valley ...	5.9
Largest perennial stream (miles): <u>1/</u>		
Hawaii .....	Wailuku River .....	22.7
Maui .....	Palikea Stream .....	7.8
Molokai .....	Wailau-Pulena Stream .....	6.5
Oahu .....	Kaukonahua Stream .....	30.0
Kauai .....	Waimea River .....	19.7
Streams with greatest average discharge (million gal./day):		
Hawaii .....	Wailuku River .....	250
Maui .....	Iao Stream .....	45
Molokai .....	Wailau Stream .....	30
Oahu .....	Waikele Stream .....	25
Kauai .....	Hanalei River .....	140

1/ Estimated on basis of drainage area rather than stream runoff. Other major streams include Wailoa River, Hawaii (1/2-mile long); Honokohau Stream (9.4 miles long) and Iao Stream (5), both on Maui; Halawa Stream (6.4), Waikolu Stream (4.7), and Pelekunu (2.3), all on Molokai; Waikele Stream (15.3), Kipapa Stream (12.8), Waiakakalua Stream (11.8), Nuuanu Stream (4), and Ala Wai Canal (1.9), all on Oahu; and the Makaweli River (15.1), Wainiha River (13.8), Hanapepe River (13.3), and Wailua River (11.8), all on Kauai.

Source: Longest water feature from U.S. Geological Survey, records; other data from Hawaii State Department of Land and Natural Resources, Division of Water and Land Development, records.

Table 133.-- LAKES AND LAKE-LIKE WATERS, BY ISLANDS: 1991

Island and lake	Type	Elevation (feet)	Area 1/ (acres)	Maximum depth (feet)
<b>Hawaii:</b>				
Aimakapa .....	Coastal pool .	(SL)	15	(NA)
Green Lake .....	Lake .....	3	2	20
Lake Waiiau 2/ .....	Lake .....	13,020	2	10
Waiakea Pond .....	Tidal pond ...	(SL)	27	7
<b>Maui:</b>				
Kanaha Pond .....	Marsh .....	(SL)	41	3
Kealia Pond .....	Marsh .....	(SL)	500	(NA)
Waieleele .....	Pond .....	6,690	0.5	21
<b>Molokai:</b>				
Kauhako .....	Pool .....	(SL)	0.9	814
Kualapuu Reservoir ..	Reservoir ....	821	100	50
Meyer Lake .....	Impoundment ..	2,021	6-10	5
<b>Oahu:</b>				
Ho'omaluhia .....	Reservoir ....	202	90	90
Kaelepulu Pond .....	Lake .....	(SL)	198	(NA)
Kawainui Marsh .....	Marsh .....	(SL)	1,000	(NA)
Wahiawa Reservoir ...	Reservoir ....	842	302	85
<b>Kauai:</b>				
Nomilu Fishpond .....	Pond .....	(SL)	20	66
Waita Reservoir .....	Reservoir ....	241	424	23
<b>Niihau:</b>				
Halalii Lake .....	Playa .....	(SL)	841-865	(NA)
Halulu Lake .....	Playa .....	(SL)	182-371	(NA)
<b>Laysan:</b>				
Laysan Lagoon .....	Closed lagoon	(SL)	161	16

NA Not available.

SL Sea level.

1/ Ranges shown for Meyer Lake, Halalii Lake, and Halulu Lake reflect differences in estimates between sources.

2/ Highest lake in the State and third highest in the United States.

Continued on next page.



Table 133.-- LAKES AND LAKE-LIKE WATERS, BY ISLANDS: 1991 - Con.

Source: J.A. Maciolek, Lakes and Lake-like Waters of the Hawaiian Archipelago (Bernice P. Bishop Museum, Occasional Papers, Vol. XXV, No. 1, April 30, 1982); Hawaii State Department of Land and Natural Resources, Division of Water and Land Development, April 15, 1991; Hawaii State Department of Planning and Economic Development, Resource Management Plan for Kawainui Marsh (March 1983); William H. Meyer, U.S. Fish and Wildlife Service, transmittal letter (to DPED, Coastal Zone Management Program), for Kealia Pond National Wildlife Refuge, Maui, Hawaii, Final EIS (August 1981).

Table 134.-- MAJOR NAMED WATERFALLS, BY ISLANDS: 1991

Island	Waterfall	Height (feet)		Horizontal distance (feet)
		Sheer drop	Cascade	
Hawaii ..	Kaluahine .....	...	620	400
	Akaka .....	442	...	...
Maui ....	Honokohau .....	...	1,120	500
Molokai .	Kahiwa .....	...	1,750	1,000
	Papalaua .....	...	1,200	500
Oahu ....	Kaliuwaa (Sacred) ....	<u>1/</u> 80	1,520	3,000
Kauai ...	Waipoo (2 falls) .....	...	800	600
	Awini .....	...	480	500

1/ Refers to northernmost fall of a cascade of six falls.

Source: U.S. Geological Survey, records; Hawaii State Department of Land and Natural Resources, Division of Water and Land Development, records.

Table 135.-- MISCELLANEOUS GEOGRAPHIC STATISTICS, BY ISLANDS

Island	Extreme length (miles)	Extreme width (miles)	Miles of sea cliffs with heights 1,000 ft. or more <sup>1/</sup>	Miles from coast of most remote point	Percent of area within 5 miles of coast
The State ..	...	...	33	28.5	48.6
Hawaii .....	93	76	4	28.5	30.0
Maui .....	48	26	-	10.6	76.1
Kahoolawe .....	11	6	-	2.4	100.0
Lanai .....	18	13	1	5.2	100.0
Molokai .....	38	10	14	3.9	100.0
Oahu .....	44	30	-	10.6	79.0
Kauai .....	33	25	11	10.8	65.0
Niihau .....	8	6	3	2.4	100.0
Island	Percent of area with elevation --		Approximate mean altitude (feet)	Percent of area with slope --	
	Less than 500 feet	2,000 feet or more		Less than 10 percent	20 percent or more
The State ..	20.8	50.9	3,030	63.5	17.0
Hawaii .....	12.0	68.4	3,950	76.0	4.0
Kauai .....	24.9	41.4	2,390	38.5	36.0
Kahoolawe .....	38.9	0	600	60.0	9.0
Lanai .....	24.8	6.3	1,140	61.0	16.0
Molokai .....	37.3	17.8	1,150	53.0	26.0
Oahu .....	45.3	4.6	860	42.5	45.5
Kauai .....	35.6	24.0	1,380	33.5	50.5
Niihau .....	78.2	0	530	68.0	12.5

<sup>1/</sup> According to Lee S. Motteler, Geography and Map Division, Bernice P. Bishop Museum, the sea cliffs along the northeastern coast of Molokai between Umilehi Point and Puukaoku Point drop 3,250 feet at an average slope of 58 degrees. These cliffs have been described by The Guinness Book of World Records (1991 edition, p. 148) as "the highest sea cliffs yet pinpointed anywhere in the world."

Source: Hawaii State Department of Planning and Economic Development, Hawai'i the Natural Environment (1974), p. 19; U.S. Geological Survey, Elevations and Distances in the United States (1978), pp. 4-5.

Table 136.-- VOLCANIC ERUPTIONS: 1969 TO 1991

[Complete through September 1, 1991. Four volcanoes have erupted in historical times: Haleakala, last active around 1790; Hualalai, last active in 1800-1801; and Kilauea and Mauna Loa, both active in recent years and included in this table]

Volcano and date of outbreak	Repose period since previous eruption (months)	Duration (days)	Location <u>1/</u>	Elevation (meters)	Area (square km.)	Volume (mil. cubic meters)
Mauna Loa:						
1975: July 5	301	<1	S	3,900	13.5	30.0
1984: March 25	104	22	S, ER	4,030-2,870	28.5±	176.0
Kilauea:						
1969: Feb. 22	4.0	6	ER	930-870	6.0	16.1
May 24	2.0	867	ER	940	12.5	176.7
1971: Aug. 14	-	<1	C	1,100-1,080	3.1	9.1
Sept. 24	-	5	C, SWR	1,120-820	3.9	7.7
1972: Feb. 4	4.3	455	ER	940	35.1	119.6
1973: May 5	-	<1	ER	1,000-980	0.3	1.2
Nov. 10	-	30	ER	980-870	1.0	2.7
Dec. 12	0.1	203	ER	940	8.1	28.7
1974: July 19	-	3	C, ER	1,080-980	3.1	6.6
Sept. 19	2.0	<1	C	1,100	1.0	10.2
Dec. 31	3.4	<1	SWR	1,080	7.5	14.3
1975: Nov. 29	11.0	<1	C	1,080-1,060	0.3	0.2
1977: Sept. 13	21.5	18	ER	620-480	7.8	32.9
1979: Nov. 16	26.3	1	ER	980-960	0.3	0.6
1982: April 31	29.5	<1	C	1,080	0.3	0.5
Sept. 25	4.8	<1	C	1,080	>1.0	3.0
1983: Jan. 3 <u>2/</u>	3.3	3,162	ER	780-650	75.0	1,493.0

1/ C, caldera; ER, east rift; S, summit; SWR, southwest rift.

2/ Still in progress, September 1, 1991. As of that time, there had been 48 separate episodes. These had destroyed 179 housing units and added over 290 acres to the area of the island.

Source: Gordon A. Macdonald, Agatin T. Abbott, and Frank L. Peterson, Volcanoes in the Sea, 2nd ed. (1983), pp. 64-65 and 80-81, as updated by the staff of the Hawaiian Volcano Observatory.

Table 137.-- EARTHQUAKES OF MAGNITUDE 5 OR GREATER: 1975 TO 1991

[Complete to August 31, 1991]

Date and time (HST)	Location	Magnitude (Richter scale)
1975: Jan. 2, 3:27 AM ...	Near Pahala, Hawaii .....	5.0
Nov. 29, 3:35 AM ..	Puna, Hawaii .....	5.7
Nov. 29, 4:47 AM ..	Puna, Hawaii .....	7.2
1976: Feb. 20, 7:51 PM ..	Between Maui and Hawaii ..	5.1
1977: Jan. 22, 12:36 PM .	100 miles S. of Kauai ....	5.1
Apr. 20, 6:49 PM ..	Hamakua, Hawaii .....	5.0
Jun. 5, 11:42 PM ..	Puna, Hawaii .....	5.1
1979: Mar. 29, 11:06 PM .	40 miles S.W. of Oahu ....	5.5
Sept. 21, 9:59 PM .	Puna, Hawaii .....	5.5
1981: Mar. 5, 4:09 AM ...	Molokai area .....	5.3
Nov. 10, 3:02 AM ..	Kilauea, Hawaii .....	5.3
1982: Jan. 21, 11:52 AM .	Mauna Loa, Hawaii .....	5.5
Jan. 21, 12:29 PM .	Mauna Loa, Hawaii .....	5.5
May 14, 6:26 AM ...	Off Kawaihae, Hawaii .....	5.0
1983: Mar. 20, 5:18 PM ..	Off Kalapana, Hawaii .....	5.0
Sept. 9, 6:30 AM ..	Off Kalapana, Hawaii .....	5.4
Nov. 16, 6:13 AM ..	S.E. flank of Mauna Loa ..	6.7
1984: Jun. 8, 5:34 PM ...	80 miles S. of Honolulu ..	5.3
1986: Apr. 26, 7:19 AM ..	28 miles N.E. of Maui ....	5.1
1987: Feb. 3, 4:22 PM ...	26 miles S. of Kahoolawe .	5.0
1988: March 24, 2:30 PM .	30 miles S. of Kahoolawe .	5.0
March 27, 5:33 PM .	30 miles S. of Kahoolawe .	5.5
June 7, 12:49 AM ..	S. flank of Kilauea .....	5.0
July 3, 7:38 PM ...	Near Pahala .....	5.3
July 22, 10:29 AM .	Near French Frigate Shoals	5.0
1989: June 25, 5:27 PM ..	Kalapana area .....	6.1
Dec. 27, 11:13 PM .	Kilauea East Rift Zone ...	5.1
1990: Aug. 8, 4:06 PM ...	Kilauea East Rift Zone ...	5.4
1991: May 7, 10:21 PM ...	13 miles W. of Kailua-Kona	5.3

Source: Hawaii Institute of Geophysics, records; Hawaii Volcano Observatory Summaries; U.S. Geological Survey, National Earthquake Information Service. Data provided by Professor Augustine S. Furumoto, Hawaii Institute of Geophysics, University of Hawaii at Manoa, November 4, 1991.

Table 138.-- EARTHQUAKES WITH HONOLULU INTENSITIES OF  
V OR GREATER: 1859 TO 1991

[Complete to August 31, 1991]

Date	Epicentral location	Magnitude (Richter scale)	Honolulu average intensity (Modified Mercalli Scale <u>1/</u> )
1861: Dec. 5 ..	Molokai-Lanai vic. (?) .	(NA)	Mid V
Dec. 15 .	Molokai-Lanai vic. (?) .	(NA)	Lower V - mid V
1868: Apr. 2 ..	SE coast of Hawaii .....	7.5	Upper IV - lower V
Apr. 4 ..	Maui group vicinity (?)	(NA)	Lower V
1871: Feb. 19 .	S coast of Lanai .....	7.0	Upper VI - lower VII
1895: Dec. 8 ..	Oahu vicinity (?) .....	(NA)	Mid V
1926: Mar. 19 .	N of Kohala, Hawaii ....	(NA)	Upper IV - lower V
1929: Oct. 5 ..	W of Kona, Hawaii .....	6.5	Lower V
1938: Jan. 22 .	N of Maui .....	6.8	Upper V - lower VI
1948: June 28 .	S coast of Oahu .....	4.8	Mid VI
1964: Oct. 11 .	Ka Lae, Hawaii .....	5.5	Upper IV - lower V
1973: Apr. 26 .	Hamakua coast, Hawaii ..	6.2	Mid V
1981: Mar. 5 ..	Kalohi Channel .....	5.0	Mid V

NA Not available.

1/ Modified Mercalli Scale of 1931, 1956 abridged version further simplified. This scale, which extends from I to XII, reads in part:

IV. Hanging objects swing. Vibration like passing of heavy trucks or sensation of a jolt. Standing autos rock. Windows, dishes, doors rattle. Crockery clashes. In the upper part of range wooden construction creaks.

V. Felt outdoors; direction estimated. Sleepers wakened. Liquids disturbed, some spilled. Small unstable objects displaced or upset. Doors, shutters, pictures swing. Pendulum clocks stop.

VI. Felt by all. Many frightened, run outdoors. Persons walk unsteadily. Windows, dishes, glassware broken. Knickknacks, books thrown off shelves, pictures off walls. Furniture moved, overturned. Weak plaster and masonry cracked. Small bells ring. Trees, bushes noticeably shaken.

VII. Difficulty in standing. Noticed by drivers of autos. Hanging objects quiver. Furniture broken. Damage to weak masonry. Weak chimneys broken at roof line. Fall of plaster, loose bricks, etc. Some cracks in ordinary masonry. Waves on ponds. Small slides on sand and gravel banks. Large bells ring. Irrigation ditches damaged.

Source: Doak C. Cox, "Earthquake Experience in Honolulu," The Hawaiian Journal of History, Vol. 21 (1987), pp. 98-109, as updated by Augustine S. Furumoto, Hawaii Institute of Geophysics, University of Hawaii at Manoa, November 4, 1991.

Table 139.-- TSUNAMIS WITH RUN-UP OF 2 METERS (6.6 FEET) OR MORE:  
1946 TO 1991

[Complete to October 7, 1991]

Date	Maximum height in Hawaii		Deaths in Hawaii	Damage in Hawaii (dollars)
	Meters	Feet		
1946: April 1 .....	17.0	55.8	159	26,000,000
1952: Nov. 4 .....	6.1	20.0	-	1,000,000
1957: March 9 .....	16.0	52.5	-	5,000,000
1960: May 22 .....	10.5	34.5	61	23,000,000
1964: March 27 ....	4.8	15.7	-	67,590
1975: Nov. 29 .....	14.6	48.0	2	1,500,000

Source: George Pararas-Carayannis, Catalog of Tsunamis in the Hawaiian Islands (U.S. Coast and Geodetic Survey, May 1969); Harold G. Loomis, The Tsunami of November 29, 1975 in Hawaii (Hawaii Institute of Geophysics, December 1975), pp. 1 and 10; D.C. Cox and J. Morgan, Local Tsunamis and Possible Local Tsunamis in Hawaii (Hawaii Institute of Geophysics, Report HIG 77-14, November 1977); Doak C. Cox, Tsunami Casualties and Mortality in Hawaii (University of Hawaii, Environmental Center, June 1987), p. 39; Hawaii Institute of Geophysics, records.

Table 140.-- MAJOR DAMS: 1991

Name	Location	Height (ft.)	Length (ft.)	Volume of water impounded (acre-ft.)
Wahiawa Dam ...	Wahiawa, Oahu .....	98	460	7,671
Waita .....	Koloa, Kauai .....	28	3,250	6,500
Kualapuu .....	Kualapuu, Molokai .	58	7,100	4,265
Alexander Dam .	Kalaheo, Kauai ....	119	600	2,500
Ho'omaluhia Dam	Luluku, Oahu .....	132	2,200	2,500
Nuuanu No. 4 ..	Honolulu, Oahu ....	73	1,730	1,420

Source: Hawaii State Department of Land and Natural Resources, Division of Water and Land Development, records.

Table 141.-- WATER USE, BY TYPE, BY ISLANDS: 1985

[Million gallons per day]

Use	State total	Hawaii	Maui	Lanai	Molo-kai	Oahu	Kauai	Niihau
Total .....	1,405.14	165.80	471.96	2.99	12.76	401.56	349.53	0.54
Ground water ....	649.43	72.89	149.72	2.99	5.31	358.14	59.84	0.54
Domestic .....	182.81	15.71	14.09	0.41	1.32	140.53	10.48	0.27
Agricultural ..	333.35	0.30	135.04	2.58	3.99	144.62	46.55	0.27
Industrial ....	16.19	5.26	0.59	-	-	10.03	0.31	-
Thermoelectric	86.04	51.62	-	-	-	34.42	-	-
Commercial ....	31.04	-	-	-	-	28.54	2.50	-
Surface water ...	755.71	92.91	322.24	-	7.45	43.42	289.69	-
Domestic .....	16.96	9.00	7.56	-	0.07	-	0.33	-
Agricultural ..	567.86	46.12	310.26	-	7.38	43.42	160.68	-
Industrial ....	2.70	-	-	-	-	-	2.70	-
Thermoelectric	3.80	-	-	-	-	-	3.80	-
Hydroelectric .	164.39	37.79	4.42	-	-	-	122.18	-

Source: Data compiled by the U.S. Geological Survey and provided by the Hawaii State Department of Land and Natural Resources, Division of Water and Land Development.

Table 142.-- WATER SERVICES AND CONSUMPTION, FOR COUNTY WATERWORKS:  
1990 AND 1991

Geographic area	Number of services, June 30		Consumption (million gallons) <u>1/</u>	
	1990	1991	1990	1991
State total .....	209,475	213,194	70,088	72,642
City and County of Honolulu ....	141,038	142,466	49,727	50,663
Honolulu <u>2/</u> .....	60,387	60,480	27,161	27,111
Rest of Oāhu .....	80,651	81,986	22,566	23,552
Hawaii County .....	29,820	30,848	7,064	7,356
Kauai County .....	14,338	14,949	4,139	4,465
Maui County .....	24,279	24,931	9,158	10,158
Maui .....	22,886	23,513	8,849	9,838
Molokai .....	1,393	1,418	309	320

1/ Year ended June 30.

2/ Maunaloa to Moanalua.

Source: Data compiled by Hawaii State Department of Business and Economic Development from Honolulu Board of Water Supply, Hawaii County Department of Water Supply, Kauai Department of Water, and Maui Department of Water Supply.



Table 143.-- POLLUTION ABATEMENT COSTS AND EXPENDITURES:  
1986 AND 1988

[Millions of dollars. Statistics cover manufacturing establishments with 20 employees or more]

Subject	1986	1988
Total pollution abatement capital expenditures .....	1.8	7.9
Gross annual cost of pollution abatement .....	15.3	16.2
Payments to government units .....	0.7	0.5
Operating costs, total .....	14.6	15.7
Cost recovered through abatement activities .....	0.5	<u>1/</u> 0.8
Operating costs by form of pollutants abated:		
Air .....	3.8	4.8
Water .....	5.6	5.5
Solid waste, hazardous .....	1.1	1.3
Solid waste, non-hazardous .....	4.1	4.2
Operating costs by kind of cost:		
Depreciation .....	2.3	2.4
Labor .....	3.4	3.6
Materials and supplies .....	3.8	4.7
Services, equipment leasing, and other costs .....	5.1	4.9

1/ For water and solid waste pollution only.

Source: U.S. Bureau of the Census, "Pollution Abatement Costs and Expenditures, 1986," Current Industrial Reports, MA-200 (86)-1 (April 1989), pp. 20, 37, and 53, and "Manufacturers' Pollution Abatement Capital Expenditures and Operating Costs, Final Report for 1988," Current Industrial Reports, MA 200 (88)-1 (September 1990), pp. 14, 31, and 48.

Table 144.-- ENVIRONMENTAL HEALTH SCORES AND RANKS: 1991

Category	Number of indicators	Median State score	Hawaii	
			Score	Rank <u>1/</u>
Total .....	256	6,869	5,522	12
Conditions .....	179	4,530	3,283	1
Policies .....	77	2,296	2,239	24

1/ Among 50 States.

Source: Bob Hall and Mary Lee Kerr, 1991-1992 Green Index: A State-by-State Guide to the Nation's Environmental Health (1991), pp. 3-5.

Table 145.-- WATER QUALITY AT PUBLIC BEACHES, BY ISLANDS: 1990

Island	Number of locations	Number of samples	Enterococci density <u>1/</u>			
			Lowest <u>2/</u>	Highest <u>3/</u>	Number over 7	Mean <u>4/</u>
State total ..	167	2,585	0.5	258.3	37	9.6
Hawaii .....	44	274	0.6	107.0	14	11.0
Hilo Shoreline ..	24	177	0.6	107.0	10	16.7
Kona Shoreline ..	20	97	0.9	15.4	4	4.2
Maui .....	31	329	0.8	9.8	1	1.7
Lanai .....	2	19	0.8	3.4	-	2.1
Molokai .....	2	20	5.5	5.8	-	5.6
Oahu .....	66	1,789	0.5	258.3	17	12.9
Kauai .....	22	154	0.7	76.1	5	8.8

1/ Geometric mean, number per 100 ml. The geometric mean standard for Enterococci density is 7 per 100 ml.

2/ The lowest average value in 1990 was that reported for four Oahu locations (three in Kaneohe Bay and one off Sand Island).

3/ The highest average value in 1990 was that reported for the Ala Wai Canal at the McCully Street Bridge on Oahu.

4/ Not weighted by number of samples.

Source: Hawaii State Department of Health, Clean Water Branch, records.

Table 146.-- WATER QUALITY AT SELECTED PUBLIC BEACHES:  
1989 AND 1990

Island and beach	Number of samples		Enterococci density <sup>1/</sup>	
	1989	1990	1989	1990
<b>Hawaii:</b>				
Hapuna Beach .....	12	4	1.5	5.2
Kahaluu Beach .....	12	8	1.0	1.2
Kealakekua Bay (curio stand) .....	12	5	1.5	3.9
Mooheau Park .....	3	11	3.4	5.2
Spencer Beach Park .....	12	4	6.5	2.0
<b>Maui:</b>				
Kapalua (Fleming) Beach .....	3	11	1.1	2.3
Kihei (north) .....	-	12	...	0.9
Makena Beach .....	4	11	0.7	0.8
Seven Pools .....	2	6	16.7	1.2
Sheraton Kaanapali .....	5	11	0.8	1.1
<b>Lanai:</b>				
Hulopoe Bay .....	2	9	6.5	0.8
<b>Molokai:</b>				
Kaunakakai Harbor .....	2	10	26.4	5.5
<b>Oahu:</b>				
Ala Moana Park (center) .....	12	16	1.8	2.4
Ewa Beach Park .....	21	49	1.8	1.4
Haleiwa Beach .....	-	35	...	12.4
Hanauma Bay .....	29	68	8.3	7.1
Kailua Beach Park .....	26	42	4.2	4.3
Kuhio Beach .....	22	49	4.9	11.9
Makaha Beach .....	-	40	...	2.1
Waimea Beach .....	-	36	...	6.4
<b>Kauai:</b>				
Anini Park Pavilion .....	4	8	6.0	4.9
Kalapaki Beach .....	5	11	21.8	4.7
Kekaha (Oomano Pt.) .....	5	9	0.8	1.2
Poipu Beach Pavilion .....	5	11	2.2	1.1
W. of Lydgate Park (wading pool) ..	4	9	3.3	6.5

<sup>1/</sup> See previous table, footnote 1.  
Source: Hawaii State Department of Health, Clean Water Branch, records.

Table 147.-- REFUSE AND SEWAGE STATISTICS FOR OAHU: 1980 TO 1991

[Fiscal years]

Year	Tons of refuse delivered <u>1/</u>			Sewage treated <u>2/</u> (millions of gallons)
	Total	City and County refuse vehicles	Other vehicles	
1980 .....	613,549	325,976	287,573	36,885
1981 .....	714,017	370,946	343,071	35,945
1982 .....	665,276	363,471	301,805	34,830
1983 .....	626,835	360,545	266,290	37,395
1984 .....	611,386	297,215	314,171	38,283
1985 .....	615,574	272,905	342,669	37,817
1986 .....	681,874	375,847	306,027	37,608
1987 .....	678,392	380,810	297,582	38,199
1988 .....	739,820	403,528	336,292	39,757
1989 .....	778,673	302,851	474,822	39,918
1990 .....	954,740	274,509	680,231	41,763
1991 .....	1,209,105	293,857	915,248	44,484

  

Year	Sewage pumped <u>2/</u> (millions of gallons)	Miles of sewers <u>2/</u>	City and County pump stations	City and County treatment plants
1980 .....	45,165	1,592	47	19
1981 .....	43,744	1,623	48	19
1982 .....	44,687	1,646	50	21
1983 .....	48,442	1,670	52	20
1984 .....	48,320	1,691	51	18
1985 .....	49,361	1,711	51	17
1986 .....	48,559	1,736	55	17
1987 .....	49,542	1,752	57	17
1988 .....	51,713	1,769	59	17
1989 .....	51,623	1,805	59	14
1990 .....	50,858	1,828	62	13
1991 .....	52,849	1,859	64	13

1/ Excludes small landfill controlled by armed forces.

2/ Data limited to system maintained by the City and County of Honolulu Public Works Department.

Source: City and County of Honolulu, Departmental and Agency Reports (annual), and City Refuse Division, records.

Table 148.-- HAZARDOUS WASTE SITES ON THE NATIONAL PRIORITY LIST: 1989 AND 1990

Category	Number	Rank <u>1/</u>
1989 .....	7	42
1990 .....	7	42

1/ Among the 50 States. The national total was 1,219 sites in 1989 and 1,207 in 1990.

Source: EPA data cited in Statistical Abstract of the United States for 1990 (p. 205) and 1991 (p. 211).

Table 149.-- LITTER ALONG OAHU HIGHWAYS: 1979 TO 1988

Measure	1979	1981	1985	1988
Visible litter items per mile	1,381	1,672	1,038	892
Visible beer/soft drink containers per mile .....	144	80	49	26
Indiscriminate dumps per 1,000 miles of driving ....	8.2	15.7	19.6	14.1
Abandoned vehicles per 1,000 miles of driving .....	4.9	23.6	57.4	6.8

Source: Daniel B. Syrek, Hawaii Litter: 1988 (Sacramento: The Institute for Applied Research, for the Hawaii State Department of Health, Litter Control Office, May 13, 1988).

Table 150.-- AIR QUALITY IN DOWNTOWN HONOLULU:  
1980 TO 1990

[Annual arithmetic means, in micrograms per cubic meter, for total suspended particulates and sulfur oxides. Sampling is conducted about 46 feet above ground on the roof of the State Health Department building, 1250 Punchbowl Street, Honolulu, Hawaii]

Year	Particulates	Sulfur oxides	Year	Particulates	Sulfur oxides
1980 .....	37	18	1988 .....	26	<5
1981 .....	40	19	1989 .....	30	<5
1982 .....	29	11	1990 .....	30	<5
1983 .....	26	<5	Standards: 1/ Primary ... Secondary .		
1984 .....	25	<5			
1985 .....	24	<5		75	80
1986 .....	25	<5		60	...
1987 .....	26	<5			

1/ Primary and secondary national ambient air quality standards have been promulgated by the Federal government. Primary standards are designed to prevent adverse effects on public health, while secondary standards are designed to prevent adverse effects on public welfare, including effects on comfort, visibility, vegetation, animals, aesthetic values, and soiling and deterioration of materials.

Source: Hawaii State Department of Health, Clean Air Branch, data supplied July 3, 1991.

Table 151.-- AIR QUALITY AT SPECIFIED LOCATIONS: 1990

[24-hour sampling, in micrograms per cubic meter]

Sampling station	Total suspended particulates			Sulfur dioxide		
	Annual range		Arith- metic average	Annual range		Arith- metic average
	Minimum	Maximum		Minimum	Maximum	
Oahu:						
Barbers Point <u>1/</u>	21	38	28	<5	<5	<5
Downtown Honolulu	20	35	30	<5	<5	<5
Liliha .....	24	36	31	...	...	...
Pearl City <u>1/</u> ...	9	16	14	...	...	...
Waimanalo <u>1/</u> ....	11	20	15	...	...	...
Maui:						
Lahaina <u>1/</u> , <u>2/</u> ..	10	24	17	...	...	...
Kauai:						
Lihue <u>1/</u> , <u>3/</u> ....	13	20	17	...	...	...

1/ Particulates data from PM<sub>10</sub> samplers (measuring inhalable particulates of less than 10 micrograms).

2/ Ten months of data.

3/ Seven months of data.

Source: Hawaii State Department of Health, Clean Air Branch, data supplied July 3, 1991.

Table 152.-- ATMOSPHERIC CARBON DIOXIDE MEASUREMENTS AT MAUNA LOA:  
ANNUAL MEAN VALUES, 1958 TO 1990

[Parts per million]

Year	Annual average	Year	Annual average	Year	Annual average
1958 ...	<u>1/</u> 315.17	1969 ...	323.93	1980 ...	338.72
1959 ...	315.83	1970 ...	325.27	1981 ...	340.12
1960 ...	316.75	1971 ...	326.17	1982 ...	341.21
1961 ...	317.49	1972 ...	327.26	1983 ...	342.87
1962 ...	318.30	1973 ...	329.45	1984 ...	344.48
1963 ...	318.83	1974 ...	<u>1/</u> 329.72	1985 ...	345.85
1964 ...	<u>2/</u> 319.04	1975 ...	<u>3/</u> 331.14	1986 ...	347.21
1965 ...	319.87	1976 ...	332.04	1987 ...	348.98
1966 ...	321.21	1977 ...	333.79	1988 ...	351.34
1967 ...	322.02	1978 ...	335.35	1989 ...	352.89
1968 ...	322.83	1979 ...	336.73	1990 ...	354.26

1/ Based on data for 8 months.

2/ Based on data for 9 months.

3/ Based on data for 11 months.

Source: National Oceanic and Atmospheric Administration, Geophysical Monitoring for Climatic Change, records; provided by Saul Price, National Weather Service, Pacific Region, Honolulu.



Table 153.-- TEMPERATURES AND PRECIPITATION FOR SELECTED PLACES

Island and station	Ground elevation (feet)	Average temperature (°F.)		Extreme temperature of record (°F.)		Average annual precipitation (inches)
		Coolest month	Warmest month	Lowest	Highest	
<b>Hawaii:</b>						
Hilo Airport .....	30	71.2	75.9	53	94	128
Hawaii Volcanoes Nat. Park Hdq. .	3,970	57.6	63.2	37	85	101
Naalehu .....	675	70.2	75.2	55	90	47
Kailua .....	30	72.1	77.3	54	93	25
Puako 1/ .....	5	73.1	79.8	52	98	10
Waimea (Kamuela) .....	2,670	61.3	66.8	34	90	31
Honokaa .....	1,070	67.6	75.5	(NA)	(NA)	86
Mauna Kea summit 2/ .....	13,796	31.3	42.5	11	66	20
<b>Maui:</b>						
Hana .....	120	71.3	76.8	50	90	69
Haleakala summit .....	10,025	42.6	50.0	14	73	44
Kihei 3/ .....	85	70.9	78.4	49	98	13
Kahului Airport .....	40	71.5	79.2	48	96	20
Lahaina .....	45	71.5	78.0	52	93	15
<b>Molokai:</b>						
Kaunakakai .....	10	(NA)	(NA)	(NA)	(NA)	14
Molokai Airport .....	450	70.2	77.6	48	90	27
<b>Lanai:</b>						
Lanai City .....	1,620	65.8	72.8	46	88	37
<b>Oahu:</b>						
Honolulu International Airport ..	10	72.6	81.0	53	94	23
Waikiki (Honolulu Zoo) .....	10	71.9	80.6	51	93	25
Manoa (Lyon Arboretum) .....	500	69.4	75.2	(NA)	(NA)	158
Kaneohe (State Hospital) .....	200	71.0	77.5	43	93	71

Continued on next page.

Table 153.-- TEMPERATURES AND PRECIPITATION FOR SELECTED PLACES -- Con.

Island and station	Ground elevation (feet)	Average temperature (°F.)		Extreme temperature of record (°F.)		Average annual precipitation (inches)
		Coolest month	Warmest month	Lowest	Highest	
Oahu (con.):						
Kahuku .....	25	71.6	78.8	49	95	40
Wheeler AFB .....	845	68.2	75.5	52	89	40
Waianae .....	10	72.1	79.7	45	96	20
Kauai:						
Kilauea (town) .....	315	68.7	75.6	49	94	68
Lihue Airport .....	100	71.3	79.1	50	90	44
Poipu (Makahuena Pt.) .....	50	72.4	79.4	50	93	35
Kekaha .....	9	71.0	78.5	48	95	21
Kokee (Kanalohuluhulu) .....	3,600	54.9	65.5	31	83	70
Northwestern Hawaiian Islands:						
Midway .....	10	65.0	78.6	52	89	44

NA Not available.

1/ Temperature data are for Mahukona.

2/ Based on incomplete and non-continuous data for 1966-1972. Precipitation estimated.

3/ Temperature data refer to Puunene Airport.

Source: Hawaii State Department of Land and Natural Resources, Division of Water and Land Development, data supplied May 20, 1991 and September 16, 1991.

Table 154.-- CLIMATIC NORMALS, MEANS, AND EXTREMES FOR  
HILO, KAHULUI, HONOLULU, AND LIHUE AIRPORTS

Subject	Hilo	Kahului	Honolulu	Lihue
Normal temperatures (°F.):				
Daily maximum .....	81.2	83.8	84.2	81.1
Daily minimum .....	65.9	67.2	69.7	69.3
Monthly: Coolest month .....	71.2	71.5	72.6	71.3
Warmest month .....	75.9	79.2	81.0	79.1
Annual .....	73.6	75.5	77.0	75.2
Extreme temperatures (°F.):				
Record highest .....	94	96	94	90
Record lowest .....	53	48	53	50
Normal degree days, base 65°F.:				
Heating .....	-	-	-	-
Cooling .....	3,134	3,851	4,389	3,758
Precipitation (inches):				
Normal .....	128.15	19.85	23.47	44.02
Maximum monthly .....	50.82	14.46	20.79	22.91
Minimum monthly .....	0.28	0.00	T	T
Relative humidity (percent):				
8 A.M. ....	80	75	72	78
2 P.M. ....	68	58	56	67
Wind speed (m.p.h.):				
Mean .....	7.2	12.8	11.4	12.2
Fastest observation, 1 minute <u>1</u> /	35	44	46	65
Percent of possible sunshine .....	41	67	69	56
Mean number of days:				
Clear .....	35.5	131.5	88.2	53.9
Partly cloudy .....	129.6	143.0	180.3	182.2
Cloudy .....	200.2	90.7	96.6	129.3
Precipitation .01 inch or more .	278.7	99.6	99.3	201.0

T Trace amount.

1/ Kahului figure refers to fastest mile.

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center, Local Climatological Data, Annual Summary with Comparative Data, 1990 for Hilo, Kahului, Honolulu, and Lihue.

Table 155.-- MONTHLY AND ANNUAL CLIMATIC DATA FOR HONOLULU INTERNATIONAL AIRPORT

Month	Normal temperature (°F)			Extreme temperature (°F)		Precipitation (inches)			
	Daily maximum	Daily minimum	Monthly	Record highest	Record lowest	Normal total	Maximum monthly	Minimum monthly	Maximum in 24 hours
January ...	79.9	65.3	72.6	87	53	3.79	14.74	0.18	6.72
February ..	80.4	65.3	72.9	88	53	2.72	13.68	0.06	6.88
March .....	81.4	67.3	74.4	88	55	3.48	20.79	0.01	17.07
April .....	82.7	68.7	75.7	89	57	1.49	8.92	0.01	4.21
May .....	84.8	70.2	77.5	93	60	1.21	7.23	0.05	3.44
June .....	86.2	71.9	79.1	92	65	0.49	2.46	T	2.28
July .....	87.1	73.1	80.1	92	66	0.54	2.33	0.03	2.20
August .....	88.3	73.6	81.0	93	67	0.60	3.08	T	2.35
September .	88.2	72.9	80.6	94	66	0.62	2.74	0.05	1.40
October ...	86.7	72.2	79.5	94	64	1.88	11.15	0.11	7.57
November ..	83.9	69.2	76.6	93	57	3.22	14.72	0.03	9.15
December ..	81.4	66.5	74.0	89	54	3.43	17.29	0.06	8.25
Annual .....	84.2	69.7	77.0	94	53	23.47	20.79	T	17.07

Continued on next page.

Table 155.-- MONTHLY AND ANNUAL CLIMATIC DATA FOR HONOLULU INTERNATIONAL AIRPORT -- Con.

Month	Relative humidity (percent)		Wind (miles/hour)		Percent of possible sunshine	Mean sky cover, sunrise to sunset <u>2/</u>	Mean number of days		Precip. .01 inch or more
	8 A.M.	2 P.M.	Mean speed	Fastest obs. <u>1/</u>			Sunrise to sunset		
							Clear	Cloudy	
January ..	81	62	9.7	32	63	5.5	9.3	8.8	9.8
February .	79	59	10.3	35	65	5.6	7.9	7.9	9.3
March ....	73	57	11.4	30	70	5.8	7.2	9.4	8.9
April ....	70	56	11.9	31	67	6.2	5.2	10.5	9.1
May .....	67	54	11.9	30	69	5.9	6.3	9.4	7.3
June .....	66	52	12.7	26	71	5.6	5.9	6.8	5.8
July .....	67	51	13.3	28	74	5.3	7.7	5.2	7.4
August ...	68	52	12.9	28	75	5.2	8.0	6.0	6.2
September	68	52	11.4	26	76	5.2	8.0	5.9	7.1
October ..	70	55	10.6	25	68	5.6	7.4	8.3	8.8
November .	75	58	10.7	46	61	5.7	6.9	9.3	9.3
December .	79	61	10.4	30	59	5.5	8.5	9.2	10.2
Annual ...	72	56	11.4	46	68	5.6	88.2	96.6	99.3

T Trace amount.

1/ Fastest observation, 1 minute, during 10-year period of record.

2/ Sky cover is expressed in a range of 0 for no clouds or obscuring phenomena to 10 for complete sky cover.

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center, Local Climatological Data, Annual Summary With Comparative Data, Honolulu, 1990.

Table 156.-- CLIMATIC DATA FOR HONOLULU INTERNATIONAL AIRPORT: ANNUALLY,  
1980 TO 1990

Year	Average temperature (°F)			Extreme temp. (°F)		Precipitation (inches)
	Annual	Coolest month	Warmest month	Lowest	Highest	
1980 ...	77.5	71.9	81.6	56	91	26.90
1981 ...	77.1	73.2	80.7	53	90	13.41
1982 ...	76.9	71.7	81.4	56	92	34.92
1983 ...	77.2	71.3	82.4	53	92	5.03
1984 ...	78.1	74.1	81.7	57	94	17.08
1985 ...	76.9	71.4	81.9	54	93	17.38
1986 ...	78.3	72.6	82.9	56	94	13.93
1987 ...	77.9	71.2	82.9	55	94	23.53
1988 ...	78.5	73.1	82.1	57	94	16.47
1989 ...	77.5	72.9	81.9	56	92	27.52
1990 ...	77.6	71.5	82.3	57	93	19.84
Year	Relative humidity (percent)		Wind speed (miles/hour)		Percent of possible sunshine	Days with precipitation .01 inch or more
	8 A.M.	2 P.M.	Annual average	Peak gust <u>1/</u>		
1980 ...	75	59	11.9	35	69	115
1981 ...	76	59	10.7	30	72	97
1982 ...	73	59	10.4	46	56	124
1983 ...	75	52	9.8	23	64	78
1984 ...	72	53	10.2	40	71	81
1985 ...	72	55	10.6	46	69	87
1986 ...	74	55	10.1	41	77	88
1987 ...	70	54	9.9	41	73	99
1988 ...	71	53	9.8	39	75	88
1989 ...	72	55	10.5	41	79	82
1990 ...	69	54	11.2	46	77	109

1/ Before 1984, figures refer to fastest mile.

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center, Local Climatological Data, Annual Summary With Comparative Data, Honolulu, Hawaii (annual).

Table 157.-- CLIMATIC DATA FOR THE PERIOD OF RECORD

Subject	Date	Place	Magnitude
Long-term averages:			
Lowest monthly average minimum temp. (°F.) ..	February .....	Mauna Kea summit ..	23.5
Lowest monthly average daily temp. (°F.) ....	February .....	Mauna Kea summit ..	31.3
Highest monthly average maximum temp. (°F.) .	September .....	Kawaihae <u>1</u> / .....	91.9
Highest monthly average daily temp. (°F.) ...	September .....	Kawaihae <u>1</u> / .....	80.8
Lowest average annual rainfall (inches) .....	.....	Kawaihae .....	8.7
Highest average annual rainfall (inches) ....	.....	Waialeale .....	444
Single events:			
Lowest temperature of record (°F.) .....	Jan. 20, 1970 ...	Mauna Kea summit <u>2</u> /	1.4
Highest temperature of record (°F.) .....	April 27, 1931 ..	Pahala .....	100
Lowest annual rainfall of record (inches) ...	1953 .....	Kawaihae .....	0.2
Highest annual rainfall of record (inches) ..	1982 .....	Waialeale .....	666
Highest wind speed of record (m.p.h.) .....	Nov. 23, 1982 ...	Makahuena Pt. <u>3</u> / ..	117

1/ Puukohola Heiau National Historical Site, Kawaihae, Hawaii.

2/ Recorded by Dr. Alfred Woodcock 60 meters inside the Mauna Kea summit cone, at 6:50 a.m. The rim at that time had a temperature of 39° F.

3/ Makahuena Point Coast Guard Station, Poipu, Kauai.

Source: Hawaii State Department of Land and Natural Resources, Division of Water and Land Development, data supplied May 20, 1991.

Table 158.-- RAINFALL AT SPECIFIED LOCATIONS: ANNUALLY, 1980 TO 1990

[In inches]

Year	Hawaii				Maui		
	Hilo Airport	Wai-me <u>1</u> / mea	Kona Village	Naalehu	Kahului Airport	Kihei	Lahaina
1980 ...	127.74	28.31	16.90	45.46	27.87	20.27	22.69
1981 ...	89.91	13.30	7.02	45.86	12.85	9.72	8.13
1982 ...	170.36	56.29	26.88	65.75	34.04	29.11	34.36
1983 ...	68.09	12.95	8.51	21.08	13.05	8.60	9.70
1984 ...	100.08	8.87	8.15	39.51	8.56	5.64	6.30
1985 ...	112.96	16.58	8.60	48.74	20.00	13.86	13.48
1986 ...	171.03	34.67	12.41	64.55	18.39	7.25	7.38
1987 ...	142.41	19.43	10.24	49.13	24.31	14.03	19.72
1988 ...	140.19	12.52	11.70	38.21	26.79	17.03	14.91
1989 ...	166.71	(NA)	13.32	74.79	40.63	27.00	26.95
1990 ...	211.22	23.54	19.80	89.83	35.20	19.17	19.84
Year	Oahu				Kauai		
	Waikiki	Univ. of Hawaii	Nuuanu Res. 4	Kane-ohe <u>2</u> / ohe	Koloa	Lihue Airport	Princeville
1980 ...	28.50	48.52	140.70	78.36	78.78	54.64	130.55
1981 ...	19.09	31.71	112.46	69.65	66.26	38.14	130.72
1982 ...	39.96	57.98	168.16	120.40	96.75	74.40	241.22
1983 ...	9.80	19.77	74.32	43.49	50.69	16.40	46.93
1984 ...	19.35	33.13	71.32	(NA)	48.82	30.12	71.58
1985 ...	25.61	42.19	101.20	(NA)	48.70	28.91	55.22
1986 ...	22.39	32.39	120.60	77.66	64.64	27.99	90.28
1987 ...	27.56	46.52	134.29	77.79	72.53	42.95	94.61
1988 ...	24.50	(NA)	124.42	81.10	63.23	43.06	77.10
1989 ...	(NA)	39.53	129.50	73.53	87.81	56.77	116.65
1990 ...	26.15	40.66	137.81	131.69	73.27	39.37	86.44

NA Not available.

1/ Lalamilo Field Office.2/ Hawaii State Hospital. The August 1990 value is for a comparable station (Pali Golf Course).

Source: U.S. Department of Commerce, National Climatic Data Center, Climatological Data, Annual Summary, Hawaii and Pacific (annual); and Hawaii State Department of Land and Natural Resources, Division of Water and Land Development, records.



Table 159.-- MAJOR HURRICANES: 1950 TO 1991

[Complete to May 20, 1991]

Hurricane name	Date <sup>1/</sup>	Islands most affected	Maximum winds ashore (m.p.h.)		Deaths	Property damage (mil. dol.)
			Sustained	Gusts		
Hiki .....	Aug. 15-17, 1950	Kauai .....	68	(NA)	1	0.2
Della .....	Sept. 4, 1957	French Frig. Shoals	82	109	-	Minor
Nina .....	Dec. 1-2, 1957	Kauai .....	(NA)	92	1	0.1
Dot .....	Aug. 6, 1959	Kauai .....	81	103	-	5.5+
Fico .....	July 18-20, 1978	Hawaii .....	(NA)	58+	-	0.2
Iwa .....	Nov. 23, 1982	Kauai, Oahu .....	65	117	1	234.0
Estelle ...	July 22, 1986	Maui, Hawaii .....	(NA)	55	-	2.0

NA Not available.

<sup>1/</sup> Period affecting the Hawaiian Islands.

Source: Samuel L. Shaw, A History of Tropical Cyclones in the Central North Pacific and the Hawaiian Islands, 1832-1979 (U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, September 1981); Hawaii State Department of Defense, Civil Defense Division, Catalogue of Natural and Man-Caused Incidents and Disasters in the Hawaiian Islands (December 1978); The Governor's Ad Hoc Committee on the Economic Impact of Hurricane Iwa, Hurricane Iwa's Economic Impact on Hawaii (January 1983); "The History of Hurricanes in Hawaii," Honolulu Star-Bulletin, July 18, 1983, p. A-5; "20-Foot Waves Hit Big Isle As Storm Brushes Coastline," Honolulu Advertiser, July 23, 1986, pp. A-1, A-2; "Hawaii Hurricanes," Honolulu Star-Bulletin, August 4, 1988, p. A-8; Hawaii State Department of Land and Natural Resources, Division of Water and Land Development, data provided May 20, 1991.

Table 160.-- TRADE WINDS, HIGH SURF, AND TEMPERATURES IN HAWAIIAN WATERS,  
BY MONTHS

Month	Trade wind frequency <sup>1/</sup> (percent)	Expected days of strong trade winds <sup>2/</sup>	Highest surf <sup>3/</sup> (average number of days)		Water temperature <sup>4/</sup> (°F.)	
			Flat or 1 foot	6 feet or more	Mean maximum	Mean minimum
Jan. ...	42	9	1	19	74.7	71.1
Feb. ...	55	7	1	16	75.6	70.3
March ..	61	10	1	12	76.5	71.8
April ..	74	10	3	7	77.7	73.0
May ....	86	7	8	3	79.5	74.7
June ...	91	7	15	-	81.1	77.7
July ...	95	10	16	-	81.1	78.3
Aug. ...	94	7	15	-	81.9	79.2
Sept. ..	83	4	10	2	81.9	78.4
Oct. ...	71	4	1	12	81.1	77.2
Nov. ...	64	8	-	19	79.3	74.5
Dec. ...	57	9	-	20	75.9	71.4
Ann. ...	73	92	71	110	78.6	74.8

<sup>1/</sup> Mean monthly frequency of trade winds in Hawaiian waters.

<sup>2/</sup> Expected number of hazardous days in Hawaiian waters due to strong trade winds.

<sup>3/</sup> Observations at Sunset Beach, Oahu. Annual averages were: flat or 1 foot, 71 days; 2-5 feet, 184 days; 6-10 feet, 71 days; 11-15 feet, 26 days; 16 feet or higher, 13 days.

<sup>4/</sup> Observations at Kaneohe, Oahu. The mean ranged from 73.0 in January and February to 80.2 in August. Absolute maximums and minimums were respectively 84 (in July, August, and October) and 68 (December and February).

Source: Paul Haraguchi, Weather in Hawaiian Waters (Honolulu: Pacific Weather, Inc., 1979), pages 14, 22, 56, and 74; Hawaii State Department of Land and Natural Resources, Division of Water and Land Development, data provided May 20, 1991.

Table 161.-- AVERAGE WATER TEMPERATURES AT WAIKIKI BEACH

[In Fahrenheit degrees]

Month	Morning	Afternoon
March .....	75	77
August .....	77	82

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center, Local Climatological Data, Annual Summary With Comparative Data, Honolulu, Hawaii, 1983.

Table 162.-- SUNRISE, SUNSET, AND HOURS OF DAYLIGHT AT SELECTED LOCATIONS, AT BEGINNING OF EACH SEASON

[Hawaiian Standard Time]

Subject	Hilo	Kahului	Honolulu	Lihue	Barking Sands
<b>Sunrise (A.M.):</b>					
March 21 .....	6:24	6:29	6:35	6:41	6:42
June 21 .....	5:42	5:45	5:50	5:55	5:56
Sept. 23 .....	6:09	6:15	6:21	6:26	6:28
Dec. 22 .....	6:51	6:58	7:05	7:12	7:14
<b>Sunset (P.M.):</b>					
March 21 .....	6:32	6:37	6:43	6:49	6:51
June 21 .....	7:02	7:10	7:16	7:23	7:25
Sept. 23 .....	6:16	6:21	6:27	6:33	6:35
Dec. 22 .....	5:47	5:50	5:55	6:00	6:01
<b>Hours of daylight:</b>					
March 21 .....	12:08	12:08	12:08	12:08	12:09
June 21 .....	13:20	13:25	13:26	13:28	13:29
Sept. 23 .....	12:07	12:06	12:06	12:07	12:07
Dec. 22 .....	10:56	10:52	10:50	10:48	10:47

Source: Nautical Almanac Office, U.S. Naval Observatory, Tables of Sunrise and Sunset, No. 1083 and 1084, and records. Data provided by Saul Price, Staff Meteorologist, National Weather Service, Pacific Region.

Table 163.-- HAWAII AUDUBON SOCIETY BIRD COUNTS OF THE  
HONOLULU AREA: 1987 TO 1990

[Counts are made in late December, in a circle, 15 miles  
in diameter, centered near Nuuanu Pali]

Species <u>1/</u>	1987	1988	1989	1990
All species:				
Species .....	50	48	48	48
Individual birds ..	29,009	29,909	25,405	18,705
Endemic species:				
'Apapane .....	79	173	21	4
Hawaiian Coot .....	10	38	34	8
Hawaiian Stilt .....	149	135	149	143
Oahu 'Amakihi .....	155	108	107	151
Indigenous species:				
Great Frigatebird .....	15	24	62	82
Red-footed Booby .....	785	748	1,359	363
Introduced species:				
Cattle Egret .....	1,009	789	289	378
Common Myna .....	5,752	5,417	2,756	2,732
House Sparrow .....	2,156	1,426	1,642	849
Japanese White-eye .....	1,455	1,024	1,061	1,061
Red-vented Bulbul .....	2,361	2,256	2,196	1,705
Spotted Dove .....	2,398	2,284	1,972	1,642
Zebra (Barred) Dove .....	5,830	8,739	7,047	4,179
Migratory species:				
Lesser Golden-Plover ...	1,673	2,046	1,601	1,594
Ruddy Turnstone .....	272	373	230	314

1/ Separate data are shown for endemic birds averaging more than 25 individuals in 1975-1979, indigenous birds more than 200, introduced birds more than 500, and migratory species and stragglers more than 100. Endemic birds are those peculiar to a particular region, in this case Hawaii, and therefore found nowhere else in the world; indigenous birds are those native to a given region, in this case Hawaii, but with a total range of distribution encompassing a much wider area. The classification is that in Andrew J. Berger, Hawaiian Birdlife (1972).

Source: Hawaii Audubon Society, 'Elepaio (monthly).

Table 164.-- HAWAII AUDUBON SOCIETY BIRD COUNT OF THE HONOLULU AREA, BY TYPE OF SPECIES: DECEMBER 16, 1990

Type of species <u>1/</u>	Number of species	Number of individuals
All species .....	48	18,705
Endemic .....	7	323
Indigenous .....	6	551
Introduced .....	29	16,175
Migratory .....	6	1,947

1/ For definitions, see preceding table, footnote 1.  
Source: Hawaii Audubon Society, records.

Table 165.-- TREES ALONG STREETS OR IN PARKS UNDER THE JURISDICTION OF THE CITY AND COUNTY OF HONOLULU: 1986 TO 1990

[As of June 30]

Location	1986	1987	1988	1989	1990
Along City and County streets and highways <u>1/</u> ...	120,029	121,100	122,253	123,533	124,650
In City and County parks ....	96,896	97,101	97,434	97,672	98,330

1/ Excludes Federal, State, and private thoroughfares.  
Source: City and County of Honolulu, Department of Parks and Recreation, records.

Table 166.-- THREATENED, ENDANGERED, AND EXTINCT SPECIES OF NATIVE FAUNA AND FLORA: DECEMBER 1990

Type of fauna or flora	Native species	Candidate <u>1/</u>	Proposed endangered <u>1/</u>	Threatened <u>1/</u>	Endangered <u>1/</u>	Extinct <u>2/</u>
Land mammals ....	1	-	-	-	1	-
Marine mammals ..	17	-	-	-	8	-
Reptiles and amphibians ....	5	-	-	3	2	-
Birds .....	77	-	-	1	29	23
Freshwater fish .	5	-	-	-	-	-
Invertebrates ...	(3/)	150	-	-	1	4/ 88
Plants .....	956	280	52	-	19	(NA)

1/ Categories of the Federal List of Endangered and Threatened Species, as published in the Federal Register. Candidate species are those being officially considered for listing as threatened or endangered.

2/ Since 1778.

3/ Not known, but nearly 10,000 native species of insects and more than 1,000 native species of land snails have been estimated.

4/ Incomplete and probably much higher.

Source: U.S. Department of the Interior, Fish and Wildlife Service, Endangered and Threatened Wildlife and Plants (January 1989); P. Q. Tomich, Mammals in Hawaii (1969); Robert L. Pyle, "Checklist of Birds of Hawaii," The Elepaio, November 1983; correspondence from W. C. Gagne, Entomology Department, Bishop Museum, July 3, 1985; H. St. John, List and Summary of the Flowering Plants in the Hawaiian Islands (1973), p. 519; University of Hawaii Department of Geography, Atlas of Hawaii (1983), pp. 80 and 83; Gordon Nishida, Entomology Department, Bishop Museum; Warren L. Wagner, Derral R. Herbst, S.H. Sohmer, Manual of Flowering Plants of Hawaii (1990).