Section 5

GEOGRAPHY AND ENVIRONMENT

This section relates to land and water areas, physical geography, climate, air and water quality, noise, 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 6,425 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. There is also relatively little water pollution: the 34 major beaches surveyed in 1987 were found to have fecal coliform levels per 100 ml. ranging from 2.0 to 89.7, and all of them were within EPA standards. More than 1,200 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 largest volcanic eruption in Island history (begun in 1983) had produced more than one billion cubic yards of lava by August 1988. The worst earthquake (1868) attained 7.5 on the Richter scale, 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 Water withdrawn for use in 1985 averaged 1.4 billion gallons per day, compared with 2.9 billion in 1980 and 2.8 billion in 1975. Among 31 neighborhoods on Oahu, median noise levels in 1981-1982 ranged from 37 decibels (in Mililani) to 57 decibels (in Pawaa).

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: 1988, Section 6.

Table 137.-- GREAT CIRCLE DISTANCES BETWEEN SPECIFIED PLACES

Place	Statute miles	Kilometers
DISTANCES FROM HONOLULU INTERNATIONAL AIRPORT		
Hawaiian Islands locations:		
Hilo, Hawaii	214	344
Kailua, Kona, Hawaii	168	270
Kahului, Maui	98	158
Lanai Airport	72	116
Molokai Airport	54	87
Lihue, Kauai	103	166
Puuwai, Niihau	152	245
Nihoa	283	455
Necker Island	520	837
French Frigate Shoals	556	895
Gardner Pinnacles	688	1,107
Maro Reef	851	1,369
Laysan Island	936	1,506
Lisianski Island	1,065	1,714
Pearl and Hermes Atoll	1,208	1,944
Midway Islands	1,309	2,106
Kure Atoll	1,367	2,200
Other Pacific locations:		
Apra Harbor, Guam	3,806	6,124
Auckland, New Zealand	4,393	7,068
Hong Kong	5,541	8,915
Johnston Atoll	820	1,319
Kingman Reef	1,073	1,726
Kiritimati (Christmas Island), Kiribati	1,344	2,163
Majuro, Marshall Islands	2,271	3,654
Manila, Philippines	5,293	8,516
Nuku Hiva, Marquesas Islands	2,400	3,864
Pago Pago, American Samoa	2,606	4,193
Palmyra Atoll	1,101	1,772
Papeete, Tahiti	2,741	4,410
Suva, Fiji	3,159	5,083
Sydney (Port Jackson), Australia	5,070	8,158
Tokyo, Japan	3,847	6,190
Wake Island	2,294	3,691
North and South American locations:		
Anchorage, Alaska	2,781	4,475
Cape Horn, Chile	7,457	11,998

Continued on next page.

Table 137.-- GREAT CIRCLE DISTANCES BETWEEN SPECIFIED PLACES -- Con.

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

Source: U. S. Department of the Interior, Geological Survey, Elevations and Distances in the United States (1973), pp. 22-23, and distance computations prepared for the Department of Planning and Economic Development.

Table 138.-- TIME DIFFERENTIALS BETWEEN HONOLULU AND SELECTED CITIES: 1982-1987

City	June		December	
	Day	Hour	Day	Hour
Honolulu, Hawaii	Same	12:00 N	Same	12:00 N
Papeete, Tahiti	Same	12:00 N	Same	12:00 N
Anchorage, Alaska	Same	2:00 PM	Same	1:00 PM
San Francisco, California	Same	3:00 PM	Same	2:00 PM
Denver, Colorado	Same	4:00 PM	Same	3:00 PM
Mexico City, Mexico	Same	4:00 PM	Same	4:00 PM
Houston, Texas	Same	5:00 PM	Same	4:00 PM
Chicago, Illinois	Same	5:00 PM	Same	4:00 PM
Atlanta, Georgia	Same	6:00 PM	Same	5:00 PM
Toronto, Canada	Same	6:00 PM	Same	5:00 PM
Washington, D.C.	Same	6:00 PM	Same	5:00 PM
New York, N.Y.	Same	6:00 PM	Same	5:00 PM
Rio de Janeiro, Brazil	Same	7:00 PM	Same	7:00 PM
London, United Kingdom	Same	11:00 PM	Same	10:00 PM
Bonn, West Germany	Same	12:00 Mid.	Same	11:00 PM
Vienna, Austria	Same	11:00 PM	Same	11:00 PM
Cairo, Egypt	Same	12:00 Mid.	Same	12:00 Mid.
Moscow, Soviet Union	Next	2:00 AM	Next	1:00 AM
Bombay, India	Next	3:30 AM	Next	3:30 AM
Singapore, Singapore	Next	6:00 AM	Next	6:00 AM
Hong Kong, Hong Kong	Next	7:00 AM	Next	6:00 AM
Manila, Philippines	Next	6:00 AM	Next	6:00 AM
Shanghai, China	Next	7:00 AM	Next	6:00 AM
Seoul, South Korea	Next	7:00 AM	Next	7:00 AM
Tokyo, Japan	Next	7:00 AM	Next	7:00 AM
Agana, Guam	Next	9:00 AM	Next	8:00 AM
Sydney, Australia	Next	8:00 AM	Next	9:00 AM
Auckland, New Zealand	Next	10:00 AM	Next	11:00 AM
Suva, Fiji	Next	10:00 AM	Next	10:00 AM
Pago Pago, American Samoa	Same	11:00 AM	Same	11:00 AM

Source: Doris Chase Doane, Time Changes in the USA, Rev. Ed. (1985) and Time Changes in the World, Rev. Ed. (1982); The World Almanac 1988, p. 224.

Table 139.-- LATITUDES AND LONGITUDES OF SELECTED PLACES

Island and place	Latitude (North)	Longitude (West)
Hawaii:		
Hilo (General Lyman Field)	19°43'	155°04'
Cape Kumukahi	19°31'	154°49'
Ka Lae	18°55'	155°41'
Keahole Point	19°44'	156°04'
Upolu Point	20°16'	155°51'
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°25'

Source: U.S. Board on Geographic Names, Gazetteer No. 24, Hawaiian Islands (1956); 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, Geography and Map Division, records; Hawaii State Department of Accounting and General Services, Survey Division, records.

Table 140.-- WIDTHS AND DEPTHS OF CHANNELS

Channel 1/	Width 2/		Depth 3/	
	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-Maro Reef	155.5	250.3	12,300	3,749
Maro 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 141.-- GENERAL COASTLINE AND TIDAL SHORELINE OF COUNTIES AND ISLANDS

County and island	General coastline 1/		Tidal shoreline 2/	
	Statute miles	Kilometers 3/	Statute miles	Kilometers 3/
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: 4/				
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 5/	25	40	25	40
Nihoa	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 142.-- LAND AND WATER AREA OF COUNTIES AND ISLANDS: 1982

[See maps on pages 6 and 7]

County or island	Square miles		
	Total	Land 2/	Inland water 3/
State total	6,470.8	6,425.2	45.6
Counties: 4/			
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 5/	620.5	596.3	24.2
Kauai 5/	629.8	619.8	10.0
Islands: 4/			
Hawaii	4,035.2	4,034.2	1.0
Maui 6/	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 7/	71.1	70.0	1.1
Kaula	0.4	0.4	-
Northwestern Hawaiian Islands 8/	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	-

Continued on next page.

Table 142.-- LAND AND WATER AREA OF COUNTIES AND ISLANDS: 1982 -- Con.

County or island	Square kilometers 1/		Acres 1/	
	Total	Land 2/	Total	Land 2/
State total	16,759.3	16,641.2	4,141,312	4,112,128
Counties: 4/				
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 5/	1,607.1	1,544.4	397,120	381,632
Kauai 5/	1,631.2	1,605.3	403,072	396,672
Islands: 4/				
Hawaii	10,451.1	10,448.5	2,582,528	2,581,888
Maui 6/	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 7/	184.1	181.3	45,504	44,800
Kaula	1.0	1.0	256	256
Northwestern Hawaiian Islands 8/	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.

Continued on next page.

Table 142.-- LAND AND WATER AREA OF COUNTIES AND ISLANDS: 1982 -- 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/ Revised to reflect inclusion of Kaula in the County of Kauai rather than in the City and County of Honolulu, as shown in Data Book 1987, table 157. 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 143.-- 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]

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

Source: Charles E. Harrington, Chief Geographer, Marine Surveys and Maps, National Ocean Survey, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, information supplied September 15, 1978.

Table 144.-- MAJOR AND MINOR ISLANDS IN THE HAWAIIAN ARCHIPELAGO

Classification	Number of islands		Land area (square miles)
	Total	Inhabited, 1980 1/	
All named islands	137	15	6,427.0
Major islands	8	7	6,419.4
Named minor islands 2/	129	8	7.6
Offshore of major islands	96	4	2.6
Northwestern Hawaiian Islands 3/	33	4	4.9
Part of State	28	3	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/ The 33 islets are in 10 clusters.
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 145.-- AREA AND DEPTH OF SELECTED CRATERS

Island and crater	Area (acres)	Maximum depth (feet)
Hawaii:		
Kilauea Caldera	2,319	476
Mokuaweoweo Crater 1/	2,221	572
Maui:		
Haleakala Crater 2/	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 Adele M. Carpenter, Land Use Division, DBED.

Table 146.-- 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 Kaleihoohie	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	3,370	1,027
Molokai:		
Kamakou	4,961	1,512
Olokui	4,606	1,404
Kaunuohua	4,535	1,382
Kalaupapa Lookout	1,600	488
Mauna Loa (Kukui)	1,430	436
Oahu:		
Kaala	4,017	1,224
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 146.-- 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	1,281	390
Lehua	699	213
Kaula	550	168
Nihoa:		
Millers Peak	910	277
Necker Island:		
Summit Hill	277	84
French Frigate Shoals:		
La Perouse Pinnacles	135	41
Gardner Pinnacles	190	58
Maro Reef	Awash	Awash
Laysan Island	35	11
Lisianski Island	20	6
Pearl and Hermes Atoll	10	3
Midway Islands	12	4
Kure Atoll	20	6

1/ According to the 1987 Guinness Book of World Records (p. 96), "The world's tallest mountain measured from its submarine base (3,280 fathoms) in the Hawaiian Trough to peak is Mauna Kea ... with a combined height of 33,476 ft, of which 13,796 ft are above sea level."

2/ Guinness (p. 96) 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 mi and 53 mi."

Source: U.S. National Cartographic Information Center, data provided October 11, 1978; U.S. Geological Survey topographic maps; E. D. Baldwin, 1883 Molokini figure on Hawaiian Government Survey Reg. Map No. 1276; National Geodetic Survey 1969 figure for Kaala, provided by U.S. Geological Survey, Honolulu office, July 23, 1984; U.S.S. Tanager survey, 1923 (for Pearl and Hermes Atoll). Data compiled with assistance of Lee S. Motteler, Bernice P. Bishop Museum.

Table 147.-- MAJOR STREAMS, BY ISLANDS

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): 1/		
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	185
Maui	Iao Stream	50
Molokai	Wailau Stream	30
Oahu	Waikele Stream	25
Kauai	Hanalei River	150

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), Waiakakalaua 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 148.-- LAKES AND LAKE-LIKE WATERS, BY ISLANDS: 1988

Island and lake	Type	Elevation (feet)	Area 1/ (acres)	Maximum depth (feet)
Hawaii:				
Aimakapa	Coastal pool .	(SL)	15	(NA)
Green Lake	Lake	3	2	20
Lake Waiau 2/	Lake	13,020	2	10
Waiakea Pond	Tidal pond ...	(SL)	27	7
Maui:				
Kanaha Pond	Marsh	(SL)	41	< 3
Kealia Pond	Marsh	(SL)	500	(NA)
Waieleele	Pond	6,690	0.5	21
Molokai:				
Kauhako	Pool	(SL)	0.9	814
Kualapuu Reservoir ..	Reservoir	821	100	50
Meyer Lake	Impoundment ..	2,021	6-10	5
Oahu:				
Ho'omaluhia	Reservoir	202	90	90
Kaelepulu Pond	Lake	(SL)	198	(NA)
Kawainui Marsh	Marsh	(SL)	1,000	(NA)
Salt Lake	Lake	(SL)	7	2
Wahiawa Reservoir ...	Reservoir	842	302	85
Kauai:				
Nomilu Fishpond	Pond	(SL)	20	66
Waita Reservoir	Reservoir	241	424	23
Niihau:				
Halalii Lake	Playa	(SL)	841-865	(NA)
Halulu Lake	Playa	(SL)	182-371	(NA)
Laysan:				
Unnamed 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 148.-- LAKES AND LAKE-LIKE WATERS, BY ISLANDS: 1988 - 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 4, 1988; 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); Salt Lake planimeter measurement by Office of State Planning, 1988.

Table 149.-- MAJOR NAMED WATERFALLS, BY ISLANDS

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) 1/ .	80	1,520	3,000
Kauai ...	Waipoo (2 falls)	...	800	600
	Awini	...	480	500

1/ Sheer drop 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 150.-- MISCELLANEOUS GEOGRAPHIC STATISTICS, BY ISLANDS

Island	Extreme length (miles)	Extreme width (miles)	Miles of sea cliffs with heights 1,000 ft. or more 1/	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	67.0
Niihau	18	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
Maui	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

1/ 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 (1987 edition, p. 103) 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 151.-- VOLCANIC ERUPTIONS: 1969 TO 1988

[Complete through August 10, 1988. 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 during the past decade and included in this table]

Volcano and date of outbreak	Repose period since previous eruption (months)	Duration (days)	Location 1/	Elevation (feet)	Area (square miles)	Volume (mil. cubic yards)
Mauna Loa:						
1975: July 5	301	<1	S	13,000	5.2	35.0
1984: March 25	104	22	S, ER	13,200-9,400	11±	230.0
Kilauea:						
1969: Feb. 22	4.0	6	ER	3,100-2,900	2.3	22.0
May 24	2.0	867	ER	3,150	19.3	242.0
1971: Aug. 14	-	<1	C	3,660-3,600	0.8	12.4
Sept. 24	-	5	C, SWR	3,740-2,730	1.5	10.5
1972: Feb. 4	4.3	455	ER	3,150	13.5	163.8
1973: May 5	-	<1	ER	3,340-3,250	0.1	1.6
Nov. 10	-	30	ER	3,250-2,900	0.4	3.7
Dec. 12	0.1	203	ER	3,150	3.1	39.3
1974: July 19	-	3	C, ER	3,600-3,520	1.2	9.0
Sept. 19	2.0	<1	C	3,680	0.4	14.0
Dec. 31	3.4	<1	C	3,600	2.9	19.6
1975: Nov. 29	11.0	<1	C	3,600-3,520	0.1	.3
1977: Sept. 13	21.5	18	ER	2,080-1,600	3.0	45.0
1979: Nov. 16	26.3	1	ER	3,270-3,200	0.1.	.8
1982: April 30	29.5	<1	C	3,630	0.1	.26
Sept. 25	4.9	<1	C	3,620	0.3	3.9
1983: Jan. 3 2/	3.3	2,045	ER	2,560-2,120	24.0	1,070.0

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

2/ Still in progress, August 10, 1988. As of that time, there had been 48 separate episodes. These had destroyed 64 housing units and added about 70 acres to the area of the island.

Source: Gordon A. Macdonald and Douglass H. Hubbard, Volcanoes of the National Parks in Hawaii, 8th edition (Hawaii Natural History Association, 1982), pp. 10, 19, 34, and 58, as updated by the staff of the Hawaiian Volcano Observatory, August 10, 1988.

Table 152.-- EARTHQUAKES OF MAGNITUDE 5 OR GREATER: 1973 TO 1988

[Complete to August 9, 1988]

Date and time (HST)	Location	Magnitude (Richter Scale)
1973: Apr. 26	Hawaii	6.2
Oct. 9	Hawaii	4.8-5
1974: Nov. 30	Hawaii	5.5-6
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

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, August 9, 1988.

Table 153.-- EARTHQUAKES WITH HONOLULU INTENSITIES OF V OR GREATER: 1859 TO 1983

[Based on data for 113 earthquakes observed in Honolulu, from 1859 through 1983]

Date	Epicentral location	Magnitude (Richter scale)	Honolulu average intensity (Modified Mercalli Scale 1/)
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.

Table 154.-- TSUNAMIS WITH RUN-UP OF 2 METERS (6.6 FEET) OR MORE: 1946 TO 1988

[Complete to August 12, 1988]

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 155.-- MAJOR DAMS: 1988

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 156.-- 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 157.-- WATER SERVICES AND CONSUMPTION, FOR COUNTY WATERWORKS: 1983 TO 1987

Subject and geographic area	1983	1984	1985	1986	1987
NUMBER OF SERVICES, JUNE 30					
State total	181,980	185,044	188,271	192,261	197,188
City and County of Honolulu	127,540	129,080	130,884	132,775	135,418
Honolulu 1/	58,173	58,462	58,801	59,237	59,590
Rest of Oahu	69,367	70,618	72,083	73,538	75,828
Hawaii County	24,218	24,834	25,315	26,031	26,939
Kauai County	11,049	11,501	11,872	12,360	12,799
Maui County	19,173	19,629	20,200	21,095	22,032
Maui	18,007	18,413	18,964	19,807	20,708
Molokai	1,166	1,216	1,236	1,288	1,324
CONSUMPTION 2/ (MILLION GALLONS)					
State total	59,724	63,670	65,298	61,432	63,186
City and County of Honolulu	44,535	47,389	48,308	44,125	44,839
Honolulu 1/	25,658	26,636	27,218	24,454	24,857
Rest of Oahu	18,877	20,753	21,090	19,671	19,982
Hawaii County	5,066	5,409	5,666	6,039	6,503
Kauai County	3,240	3,492	3,531	3,667	3,472
Maui County	6,883	7,380	7,793	7,601	8,372
Maui	6,592	7,073	7,493	7,314	8,068
Molokai	292	307	300	287	304

1/ Maunalua to Moanalua.
2/ Year ended June 30.
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 158.-- POLLUTION ABATEMENT COSTS AND EXPENDITURES: 1984 AND 1985

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

Subject	1984	1985
Total pollution abatement capital expenditures .	6.8	4.9
Gross annual cost of pollution abatement	10.8	13.3
Payments to government units	0.8	0.6
Operating costs, total	10.0	12.6
Cost recovered through abatement activities	0.6	0.4
Operating costs by form of pollutants abated:		
Air	2.3	3.7
Water	5.1	5.3
Solid waste, hazardous	0.3	0.2
Solid waste, non-hazardous	2.3	3.4
Operating costs by kind of cost:		
Depreciation	1.6	2.0
Labor	2.4	2.9
Materials and supplies	3.3	4.1
Services, equipment leasing, and other costs .	2.7	3.6

Source: U.S. Bureau of the Census, "Pollution Abatement Costs and Expenditures, 1984," Current Industrial Reports, MA-200(84)-1 (May 1986), pp. 16, 34, and 49; "Pollution Abatement Costs and Expenditures, 1985," Current Industrial Reports, MA-200(85)-1 (April 1987), pp. 18, 37, and 52.

Table 159.-- WATER QUALITY AT SPECIFIED PUBLIC BEACHES: 1984 TO 1987

Island and beach	Number of samples, 1987	Fecal coliform density 1/ (geometric mean, MPN/100 ml)			
		1984	1985	1986	1987
Hawaii (Hilo Shoreline Area):					
Exit of Ice Pond	12	15.6	78.2	15.1	19.4
Leileiwi Beach Park	12	109.7	182.1	116.0	89.7
Onekahakaha	12	5.6	8.8	7.4	15.2
Puhi Bay No. 3	12	12.9	286.1	48.8	22.7
Hawaii (Kona Shoreline Area):					
Hapuna Beach	11	5.3	3.9	3.6	3.1
Kahaluu Beach	11	2.6	2.8	2.8	3.2
Kealakekua Bay (curio stand)	11	3.3	4.6	3.9	3.6
Kealakekua Bay (canoe landing)	11	4.4	3.9	4.7	3.6
Magic Sands Beach	11	5.4	4.7	2.3	3.8
Puako Beach Lots (middle)	11	9.5	11.6	4.5	14.5
Puako Beach Lots (south end)	11	46.2	20.6	14.1	20.4
Spencer Beach Park	11	9.8	6.7	7.6	3.1
Maui:					
Hukilau Hotel shoreline	3	3.0	7.4	3.7	4.0
Oahu:					
Ala Moana Park (ewa end)	23	5.7	6.7	3.6	6.3
Ala Moana Park (center)	12	2.7	3.3	2.5	2.2
Ala Moana Park (diamond head)	11	3.1	7.9	3.8	3.4
Elks Club Beach	11	5.4	6.2	2.3	2.1
Ewa Beach	11	4.8	5.1	5.7	2.8
Ft. DeRussy Beach	11	6.8	5.0	4.6	3.6
Gray's Beach	22	5.4	7.3	6.2	4.7
Hanauma Bay	12	9.5	17.7	5.4	17.7
Kahana Park Beach	12	58.2	54.1	23.1	23.9
Kahanamoku Beach	9	2.4	3.7	3.2	3.1
Kahanamoku Lagoon (diamond head)	22	16.8	77.0	12.1	15.4
Kailua Bay outfall shoreline	11	3.8	2.8	3.2	2.0
Kailua Beach Park	12	2.5	5.0	3.9	3.8
Kokokahi Pier	12	12.1	114.5	40.6	19.5
Kuhio Beach	11	8.4	22.5	7.8	35.5
Public Bath Beach	22	3.3	4.8	4.0	4.0
Tavern Beach	11	6.1	9.1	4.6	4.2
Sand Island, Pt. No. 3	12	2.3	4.2	2.1	2.4

Continued on next page.

Table 159.-- WATER QUALITY AT SPECIFIED PUBLIC BEACHES: 1984 TO 1987 - Con.

Island and beach	Number of samples, 1987	Fecal coliform density 1/ (geometric mean, MPN/100 ml)			
		1984	1985	1986	1987
Kauai:					
Brennecke Beach	11	2.5	2.0	2.0	2.2
Hanalei Bay Landing	5	42.8	51.2	76.9	7.0
Poipu Beach	11	4.4	2.0	2.0	4.1

MPN Most probable number.

1/ The geometric mean standard for fecal coliform density is 200 MPN per 100 ml.

Source: Hawaii State Department of Health, Pollution Investigation and Enforcement Branch, data supplied April 12, 1988.

Table 160.-- LITTER ALONG OAHU HIGHWAYS: 1978 TO 1988

Measure	1978	1979	1981	1985	1988
Visible litter items per mile	2,135	1,381	1,672	1,038	892
Visible beer/soft drink containers per mile	292	144	80	49	26
Indiscriminate dumps per 1,000 miles of driving	(NA)	8.2	15.7	19.6	14.1
Abandoned vehicles per 1,000 miles of driving	(NA)	4.9	23.6	57.4	6.8

NA Not available.

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 161.-- REFUSE AND SEWAGE STATISTICS FOR OAHU: 1980 TO 1987

[Fiscal years]

Year	Tons of refuse delivered 1/			Sewage treated 2/ (millions of gallons)
	Total	City and County refuse vehicles	Other vehicles	
1980	686,438	221,774	464,664	36,885
1981	708,164	258,600	449,634	35,945
1982	669,120	244,826	424,294	34,830
1983	645,889	244,812	401,077	37,395
1984	707,473	235,767	471,706	38,283
1985	655,790	216,685	439,105	37,817
1986	729,611	252,081	477,530	37,608
1987	724,448	254,699	469,749	38,199

Year	Sewage pumped 2/ (millions of gallons)	Miles of sewers 2/	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

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 162.-- AIR QUALITY IN DOWNTOWN HONOLULU: 1977 TO 1987

[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
1977	31	17	1985	24	<5
1978	29	18	1986	25	<5
1979	32	22	1987	26	<5
1980	37	18			
1981	40	19			
1982	29	11	Standards: 1/		
1983	26	<5	Primary ...	75	80
1984	25	<5	Secondary .	60	...

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 the effects on comfort, visibility, vegetation, animals, aesthetic values, and soiling and deterioration of materials.

Source: Hawaii State Department of Health, Pollution Investigation and Enforcement Branch, data supplied April 12, 1988.

Table 163.-- AIR QUALITY AT SPECIFIED LOCATIONS: 1987

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

Sampling station	Total suspended particulates			Sulfur dioxide		
	Annual range		Arithmetic average	Annual range		Arithmetic average
	Minimum	Maximum		Minimum	Maximum	
Oahu:						
Barbers Point 1/	10	40	22	< 5	13	< 5
Downtown Honolulu	14	59	26	< 5	11	< 5
Liliha	20	59	32	...	...	...
Pearl City	20	61	34	...	...	...
Waimanalo	13	45	27	...	...	...
Maui:						
Kihei 1/	11	107	28	...	...	...
Lahaina 2/	8	19	15	...	...	...
Kauai:						
Lihue 1/	12	38	20	...	...	...

1/ Particulate data from PM_{10} samplers (measuring inhalable particulates of less than 10 micrograms).

2/ Site established in June, 1987. Sampling with PM_{10} sampler.

Source: Hawaii State Department of Health, Pollution Investigation and Enforcement Branch, data supplied April 12, 1988.

Table 164.-- SOURCES OF AIR POLLUTANT EMISSIONS, BY COUNTIES: 1980

[Percent distributions for the sums of weights of sulfur oxides, particulate matter, carbon monoxide, hydrocarbons, and nitrogen oxide emissions]

Source	State total	Hawaii	Honolulu	Kauai	Maui
All sources	100.0	100.0	100.0	100.0	100.0
Transportation	43.0	38.1	47.4	40.6	35.8
Motor vehicles	40.1	36.2	43.9	35.7	33.1
Aircraft	2.3	1.1	2.9	2.3	1.6
Vessels	0.6	0.8	0.6	2.6	1.1
Fuel combustion in stationary sources	29.7	34.9	26.7	32.2	35.3
Steam electric	23.1	19.8	24.6	18.5	22.4
Gas utilities	0.1	(N)	0.1	(N)	(N)
Agricultural fuel	6.5	15.1	2.0	13.7	12.9
Industrial process losses ..	14.6	7.7	20.3	3.2	3.5
Refinery	4.8	(N)	6.5	(N)	(N)
Petroleum storage	0.7	1.1	0.8	(N)	0.5
Metalurgical	0.1	(N)	0.1	(N)	(N)
Mineral products	6.9	3.9	10.8	0.9	1.1
Off-highway const., farms and industries	2.1	2.7	2.1	2.3	1.9
Municipal incinerator	0.9	(N)	1.3	(N)	(N)
Agricultural burning	11.7	19.3	4.3	24.2	25.4

N Less than 0.05 percent.

Source: Hawaii State Department of Health, Environmental Permits Branch, information provided April 12, 1988.

Table 165.-- NOISE LEVELS DURING DAYLIGHT HOURS IN SPECIFIED NEIGHBORHOODS ON OAHU: 1981-1982

[Noise levels, in decibels, exceeded 10, 50, and 90 percent of the time]

Neighborhood	Manual sampling			Automatic sampling		
	10	50	90	10	50	90
Aina Haina	45.6	42.1	39.5	53.5	46.2	43.2
Aina Koa	48.1	43.1	40.1	52.9	45.8	42.5
Downtown	57	55	54	60	57	55
Hawaii Kai	46.5	41.6	38.9	53.5	46.9	42.9
Kahala	48.0	44.5	42.4	-	-	-
Kaimuki	51.8	44.6	41.7	57.2	47.6	43.3
Kalihi	53.5	49.6	47.4	-	-	-
Kapahulu	47.2	45.0	42.0	-	-	-
Kapalama-Liliha	46.4	45.1	42.5	-	-	-
Kuliouou	48.6	45.9	43.4	52.5	47.9	45.4
Liliha	46	45	43	-	-	-
Makiki	52.7	46.9	45.3	56.5	50.5	48.6
Manoa	45.4	42.6	40.7	51.5	46.0	43.4
Moiliili	53.7	50.2	46.9	60.0	53.4	48.9
Nuuanu	46.6	43.6	40.8	-	-	-
Palolo	49.3	44.6	41.6	65.0	52.4	45.4
Pawaa	59.8	57.1	55.2	60.8	57.1	54.7
Salt Lake	56	52	49	-	56	51
Waikiki	57.8	55.4	54.1	61.6	57.5	55.3
Waialae Iki ...	46.4	43.1	40.6	54.6	44.8	41.7
Aiea	58	54	52	59	56	54
Halawa	52	46	44	55	50	47
Hauula	53	48	45	56	51	47
Kailua	49.2	45.5	42.9	54.9	49.6	45.2
Kaneohe	43.8	40.9	38.9	49.7	43.5	40.9
Mililani	44	37	34	53	46	41
Nanakuli	54	50	47	58	52	48
Pearl City	51	47	45	55	50	48
Wahiawa	47.1	44.7	42.4	51.8	47.3	43.9
Waimanalo	53	50	48	55	51	49
Waipahu	54.1	50.5	47.4	58.8	53.6	50.4

Source: Hawaii State Department of Health, Environmental Protection and Health Services Division, Noise and Radiation Branch, records.

Table 166.-- 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	
Hawaii:						
Hilo Airport	30	71.2	75.9	53	94	129
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
Maui:						
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	19
Lahaina	45	71.5	78.0	52	93	15
Molokai:						
Kaunakakai	10	(NA)	(NA)	(NA)	(NA)	14
Molokai Airport	450	70.2	77.6	48	90	27
Lanai:						
Lanai City	1,620	65.8	72.8	46	88	37
Oahu:						
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 MCAS	10	72.9	79.1	58	90	40

Continued on next page.

Table 166.-- 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	71.2	79.1	50	90	44
Poipu (Makahuena Pt.)	50	72.4	79.4	50	93	35
Kokee (Kanalohuluhulu)	3,600	54.9	65.5	31	83	70
Waialeale	5,075	(NA)	(NA)	(NA)	(NA)	444
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 September 3, 1988.

Table 167.-- 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	74	72	78
2 P.M.	68	58	56	66
Wind speed (m.p.h.):				
Mean	7.1	12.8	11.5	12.1
Fastest observation, 1 minute 1/	35	44	46	65
Percent of possible sunshine	41	68	68	56
Mean number of days:				
Clear	35.9	130.9	87.9	53.7
Partly cloudy	129.1	144.1	179.6	180.6
Cloudy	200.2	90.2	97.7	130.9
Precipitation .01 inch or more	278.2	97.8	99.8	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, 1987 for Hilo, Kahului, Honolulu, and Lihue.

Table 168.-- 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	92	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	67	0.54	2.01	0.03	1.38
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	58	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 168.-- MONTHLY AND ANNUAL CLIMATIC DATA FOR HONOLULU INTERNATIONAL AIRPORT -- Con.

Month	Relative humidity (percent)		Wind (miles/hour)		Percent of possible sun-shine	Mean sky cover, sunrise to sun-set 2/	Mean number of days		
							Sunrise to sunset		Precip. .01 inch or more
	8 A.M.	2 P.M.	Mean speed	Fastest obs. 1/			Clear	Cloudy	
Jan. ...	81	62	9.7	32	63	5.4	9.3	8.7	9.9
Feb. ...	79	59	10.3	30	64	5.6	7.7	8.0	9.2
Mar. ...	73	57	11.5	30	69	5.9	7.3	9.6	9.0
Apr. ...	70	56	12.0	31	67	6.2	5.3	10.5	9.2
May	67	54	12.0	30	69	6.0	6.4	9.5	7.3
June ...	67	53	12.7	26	71	5.6	5.9	6.7	5.9
July ...	68	52	13.4	28	74	5.3	7.4	5.4	7.5
Aug	68	53	13.0	28	75	5.3	7.9	6.3	6.4
Sept. ..	68	52	11.4	26	75	5.3	7.8	6.2	7.0
Oct. ...	69	55	10.7	25	68	5.7	7.4	8.5	8.9
Nov. ...	75	59	10.8	46	61	5.7	7.1	9.2	9.4
Dec. ...	79	61	10.5	29	59	5.5	8.4	9.3	10.2
Ann. ...	72	56	11.5	46	68	5.6	87.9	97.7	99.8

T Trace amount.

1/ Fastest observation, 1 minute, during 7-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, 1987.

Table 169.-- CLIMATIC DATA FOR HONOLULU INTERNATIONAL AIRPORT: ANNUALLY, 1977 TO 1987

Year	Average temperature (°F)			Extreme temp. (°F)		Precipitation (inches)
	Annual	Coolest month	Warmest month	Lowest	Highest	
1977 ...	78.2	73.7	82.2	59	92	12.36
1978 ...	76.8	72.4	80.5	57	91	25.05
1979 ...	77.0	69.9	81.1	57	93	16.93
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

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	Fastest mile 1/		
1977 ...	71	55	12.2	37	68	81
1978 ...	74	58	11.9	34	69	90
1979 ...	74	57	11.4	34	68	89
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

1/ Beginning in 1984, figures refer to peak gust.

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 170.-- 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 1/	91.9
Highest monthly average daily temp. (°F.) ...	September	Kawaihae 1/	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 2/	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. 3/ ..	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 September 3, 1988.

Table 171.-- RAINFALL AT SPECIFIED LOCATIONS: ANNUALLY, 1977 TO 1987

[In inches]

Year	Hawaii			Maui		
	Hilo Airport	Waimea 1/	Kona Village	Kahului Airport	Kihei	Lahaina
1977 ...	90.38	5.42	3.40	11.50	7.88	8.28
1978 ...	119.09	14.83	8.68	19.15	9.91	11.97
1979 ...	158.77	29.23	16.00	26.82	21.32	20.85
1980 ...	127.74	28.31	16.90	27.87	20.27	22.69
1981 ...	89.91	13.30	7.02	12.85	9.72	8.13
1982 ...	170.36	56.29	26.88	34.04	29.11	34.36
1983 ...	68.09	12.95	8.51	13.05	8.60	9.70
1984 ...	100.08	8.87	8.15	8.56	5.64	6.30
1985 ...	112.96	16.58	8.60	20.00	13.86	13.48
1986 ...	171.03	34.67	12.41	18.39	7.25	7.38
1987 ...	142.41	19.43	10.24	24.31	14.03	19.72

Year	Oahu			Kauai		
	Waikiki	Univ. of Hawaii	Nuuanu Res. 4	Koloa	Lihue Airport	Princeville
1977 ...	15.73	32.83	88.96	52.51	40.34	84.55
1978 ...	27.18	41.56	124.42	70.64	39.11	130.82
1979 ...	26.22	46.74	111.56	55.98	37.09	93.19
1980 ...	28.50	48.52	140.70	78.78	54.64	130.55
1981 ...	19.09	31.71	112.46	66.26	38.14	130.72
1982 ...	39.96	57.98	168.16	96.75	74.40	241.22
1983 ...	9.80	19.77	74.32	50.69	16.40	46.93
1984 ...	19.35	33.13	71.32	48.82	30.12	71.58
1985 ...	25.61	42.19	101.20	48.70	28.91	55.22
1986 ...	22.39	32.39	120.60	64.64	27.99	90.28
1987 ...	27.56	46.52	134.29	72.53	42.95	94.61

1/ Lalamilo Field Office.

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 172.-- MAJOR HURRICANES: 1950 TO 1988

[Complete to August 18, 1988]

Hurricane name	Date 1/	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	92	(NA)	4	1.1
Dot	Aug. 7, 1959	Kauai	81	103	-	5.5+
Fico	July 18-20, 1978	Hawaii	(NA)	58+	-	0.2
Iwa	Nov. 24, 1982	Kauai, Oahu	65	117	1	234.0
Estelle ...	July 22, 1986	Maui, Hawaii	(NA)	55	-	2.0

NA Not available.

1/ 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, records.

Table 173.-- TRADE WINDS, HIGH SURF, AND TEMPERATURES IN HAWAIIAN WATERS, BY MONTHS

Month	Trade wind frequency 1/ (percent)	Expected days of strong trade winds 2/	Highest surf 3/ (average number of days)		Water temperature 4/ (°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. ...	65	92	71	110	78.6	74.8

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

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

3/ 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.

4/ 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.

Table 174.-- 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 175.-- SUNRISE, SUNSET, AND HOURS OF DAYLIGHT AT SELECTED LOCATIONS, AT BEGINNING OF EACH SEASON

[Hawaiian Standard Time]

Subject	Hilo	Kahului	Honolulu	Lihue	Barking Sands
Sunrise (A.M.):					
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
Sunset (P.M.):					
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
Hours of daylight:					
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 176.-- HAWAII AUDUBON SOCIETY BIRD COUNTS OF THE HONOLULU AREA: 1980 TO 1987

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

Species 1/	1980-1984 2/	1985	1986	1987
All species:				
Species	46	51	50	50
Individual birds	20,878	28,803	28,690	29,009
Endemic species:				
'Apapane	114	66	85	79
Hawaiian Coot	59	23	23	10
Hawaiian Stilt	96	118	103	149
Oahu 'Amakihi	115	125	110	155
Indigenous species:				
Great Frigatebird	212	194	6	15
Red-footed Booby	723	531	402	785
Introduced species:				
Cattle Egret	589	656	988	1,009
Common Myna	3,195	3,586	5,420	5,752
House Sparrow	1,893	2,793	2,633	2,156
Japanese White-eye	1,207	1,628	1,078	1,455
Red-vented Bulbul	1,556	1,972	2,023	2,361
Spotted Dove	1,561	2,774	2,533	2,398
Zebra (Barred) Dove	4,228	7,299	7,860	5,830
Migratory species:				
Lesser Golden-Plover	1,603	1,846	1,482	1,673
Ruddy Turnstone	323	268	317	272

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).

2/ Annual averages.

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

Table 177.-- HAWAII AUDUBON SOCIETY BIRD COUNT OF THE HONOLULU AREA, BY TYPE OF SPECIES: DECEMBER 1987

Type of species 1/	Number of species	Number of individuals
All species	50	29,009
Endemic	6	427
Indigenous	8	902
Introduced	27	25,569
Migratory	9	2,111

1/ For definitions, see preceding table, footnote 1.
Source: Hawaii Audubon Society, "Honolulu Christmas Count -- 1987," 'Elepaio, March 1988, pp. 19-21.

Table 178.-- TREES ALONG STREETS OR IN PARKS UNDER THE JURISDICTION OF THE CITY AND COUNTY OF HONOLULU: 1983 TO 1987

[As of June 30]

Location	1983	1984	1985	1986	1987
Along City and County streets and highways 1/ ...	114,320	117,133	118,437	120,029	121,100
In City and County parks	96,504	96,873	96,727	96,896	97,101

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

Table 179.-- THREATENED, ENDANGERED, AND EXTINCT SPECIES OF NATIVE FAUNA AND FLORA: NOVEMBER 1986

Type of fauna or flora	Native species	Candidate 1/	Threatened 1/	Endangered 1/	Extinct 2/
Land mammals	1	-	-	1	-
Marine mammals	18	-	-	8	-
Reptiles and amphibians ..	5	-	3	2	-
Birds	87	-	1	29	23
Freshwater fish	6	1	-	-	-
Invertebrates	(3/)	150	-	41	4/ 88
Plants	2,734	787	-	19	4/ 100

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 records; 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.