

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 Puu Wekiu on 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 159 major beaches and streams surveyed in 1991 were found to have enterococci levels per 100 ml. ranging from 0.5 to 427.3, and 69 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 (Iniki, 1992) gusted to 143 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 Water withdrawn for use in 1985 averaged 1.4 billion gallons per day, compared with 2.9 billion in 1980 and 2.8 billion in 1975.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 Resource Management 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: 1992, Section 6.

Table 130.-- 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

Continued on next page.

Table 130.-- 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 131.-- TIME DIFFERENTIALS BETWEEN HONOLULU AND SELECTED CITIES: 1992

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 1992-1993, p. 38; consulates; airlines.

Table 132.-- 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 133.-- 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 134.-- 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
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 135.-- 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 136.-- LAND AND WATER AREA OF COUNTIES: 1990

[See maps on pages 6 and 7]

Measurement unit and type of area	State total	Hawaii	Maui	Kala- wao	Hono- lulu	Kauai
Square miles:						
Land	6,423.4	4,028.2	1,159.3	13.2	600.2	622.5
Inland water <u>1/</u>	35.9	4.4	3.6	-	19.0	8.9
Territorial water <u>2/</u> ..	4,472.4	1,054.3	1,236.0	39.1	1,507.8	635.1
Square kilometers:						
Land	16,636.5	10,433.1	3,002.5	34.2	1,554.5	1,612.2
Inland water <u>1/</u>	92.9	11.5	9.3	-	49.2	22.9
Territorial water <u>2/</u> ..	11,583.4	2,730.7	3,201.2	101.3	3,905.2	1,644.9
Acres:						
Land	4,110,966	2,578,073	741,933	8,451	384,125	398,383
Inland water <u>1/</u>	22,976	2,816	2,304	-	12,160	5,696
Territorial water <u>2/</u> ..	2,862,336	674,752	791,040	25,024	964,992	406,464

1/ Lakes, streams, reservoirs, etc. Includes Pearl Harbor.

2/ Within three miles of coast.

Source: U.S. Bureau of the Census, 1990 Census of Population and Housing,
Summary Population and Housing Characteristics, Hawaii, 1990 CPH-1-13 (August
1991), table 15, and unpublished records.

Table 137.-- LAND AREA OF ISLANDS: 1990

Island	Square miles <u>1/</u>	Square kilometers	Acres <u>1/</u>
State total	6,423.4	16,636.5	4,110,966
Hawaii	4,028.2	10,433.1	2,578,073
Maui	727.3	1,883.7	465,472
Molokini	0.036	0.093	23
Kahoolawe	44.6	115.5	28,543
Lanai	140.5	364.0	89,946
Molokai	260.0	673.5	166,425
Oahu	597.1	1,546.5	382,148
Kauai	552.3	1,430.5	353,484
Niihau	69.5	179.9	44,455
Lehua	0.444	1.149	284
Kaula	0.247	0.640	158
Northwestern Hawaiian Islands <u>2/</u>	3.108	8.049	1,989
Nihoa	0.271	0.701	173
Necker Island	0.071	0.183	45
French Frigate Shoals	0.096	0.249	62
Gardner Pinnacles	0.009	0.024	6
Maro Reef	Awash	Awash	Awash
Laysan Island	1.588	4.114	1,017
Lisianski Island	0.601	1.556	384
Pearl and Hermes Atoll	0.139	0.359	89
Kure Atoll	0.333	0.863	213
OTHER ISLANDS <u>3/</u>			
Johnston Atoll <u>4/</u>	0.5	1.3	320
Kingman Reef <u>4/</u>	3.0	7.8	1,920
Midway Islands	0.55	1.42	352
Palmyra Atoll <u>4/</u>	4.0	10.4	2,560

1/ Areas in square miles and acres were calculated directly from measurements in .001 square kilometer and independently rounded.

1 square mile = 640 acres = 2.58999 square kilometers.

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

3/ In central Pacific, not legally part of the State of Hawaii.

4/ 1980 measurement.

Source: U.S. Bureau of the Census, 1990 Census of Population and Housing, Summary Population and Housing Characteristics, Hawaii, 1990 CPH-1-13 (August 1991), table 15; Summary Tape File 1B; and letter from Geography Division, March 30, 1992.

Table 138.-- 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 5.

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 139.-- 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 140.-- ELEVATIONS OF MAJOR SUMMITS

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

Island and summit	Feet	Meters
Hawaii:		
Mauna Kea <u>1</u> /	13,796	4,205
Mauna Loa <u>2</u> /	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
Kaunuohua	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 140.-- 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 April 21, 1992; 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 141.-- 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 1/ (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.

1/ 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 142.-- MAJOR STREAMS, BY ISLANDS: 1992

Island	Feature or stream	Length or ave. discharge
Longest water feature (miles):		
Hawaii	Wailuku River	32.0
Maui	Kaliialinui-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	Keanauliii-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), 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 143.-- LAKES AND LAKE-LIKE WATERS, BY ISLANDS: 1992

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 Waiiau ^{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)
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:				
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 143.-- LAKES AND LAKE-LIKE WATERS, BY ISLANDS: 1992 - 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 7, 1992; 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 144.-- MAJOR NAMED WATERFALLS, BY ISLANDS: 1992

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 145.-- 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	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
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 (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 146.-- VOLCANIC ERUPTIONS: 1969 TO 1992

[Complete through December 31, 1992. 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 ^{1/}	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 ^{2/}	3.3	3,650	ER	780-650	83.4	^{3/} 1,409.0

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

^{2/} Still in progress, December 31, 1992. As of that time, there had been 52 separate episodes. These had destroyed 181 housing units and added 379 acres to the area of the island.

^{3/} Computed up to February 6, 1992.

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 147.-- EARTHQUAKES OF MAGNITUDE 5 OR GREATER: 1975 TO 1993

[Complete to January 26, 1993]

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
1993: Jan. 26, 5:24 AM ..	Near Pahala, Hawaii	5.0

Source: Hawaii Institute of Geophysics, records; Hawaii Volcano Observatory Summaries; U.S. Geological Survey, National Earthquake Information Service; Honolulu Advertiser, January 27, 1993. Data provided by Professor Augustine S. Furumoto, Hawaii Institute of Geophysics, University of Hawaii at Manoa, January 14, 1993.

Table 148.-- EARTHQUAKES WITH HONOLULU INTENSITIES OF
V OR GREATER: 1859 TO 1993

[Complete to January 13, 1993]

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, as updated by Augustine S. Furumoto, Hawaii Institute of Geophysics, University of Hawaii at Manoa, January 14, 1993.

Table 149.-- TSUNAMIS WITH RUN-UP OF 2 METERS (6.6 FEET) OR MORE:
1946 TO 1993

[Complete to January 13, 1993]

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 150.-- MAJOR DAMS: 1992

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 Resource Management, records.

Table 151.-- 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 Resource Management.

Table 152.-- WATER SERVICES AND CONSUMPTION, FOR COUNTY WATERWORKS:
1991 AND 1992

Geographic area	Number of services, June 30		Consumption (million gallons) <u>1/</u>	
	1991	1992	1991	1992
State total	213,194	216,001	72,642	74,118
City and County of Honolulu	142,466	143,615	50,663	51,241
Honolulu <u>2/</u>	60,480	60,564	27,111	26,734
Rest of Oahu	81,986	83,051	23,552	24,507
Hawaii County	30,848	31,564	7,356	8,025
Kauai County	14,949	15,414	4,465	4,453
Maui County	24,931	25,408	10,158	10,399
Maui	23,513	23,957	9,838	10,071
Molokai	1,418	1,451	320	328

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 153.-- ENVIRONMENTAL QUALITY INDEXES AND RANKS: 1988-1989

Measure	Median State	Hawaii	Hawaii rank <u>1/</u>
Air pollution standard index, 1989 <u>2/</u>	100	44	4
Toxic chemicals released, 1988 (pounds per person) <u>2/</u>	20	3	2
Unsafe drinking water, 1988 (percent of population) <u>3/</u>	9	3	7

1/ States were ranked from 1 (best) to 50 (worst).

2/ EPA data.

3/ Percent of population served by community drinking systems not in compliance with Safe Drinking Water Act of 1974 and 1986, from National Wildlife Federation.

Source: Northwestern National Life Insurance Company, The NWNL State Health Rankings, 1991 Edition, pp. 46-48.

Table 154.-- 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 155.-- WATER QUALITY AT PUBLIC BEACHES, BY ISLANDS: 1991

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 ..	159	3,286	0.5	427.3	49	3.5
Hawaii	43	636	0.6	45.7	14	4.9
Hilo Shoreline ..	22	238	0.6	45.7	12	7.6
Kona Shoreline ..	21	398	0.6	14.2	2	2.1
Maui	31	287	0.5	19.3	1	1.5
Lanai	2	12	0.6	3.8	-	1.9
Molokai	2	18	0.6	6.5	-	6.2
Oahu	54	2,030	0.5	427.3	10	3.8
Kauai	27	303	0.7	97.2	10	4.7

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 1991 was that reported for one Oahu location, the central region of Kaneohe Bay on Oahu.

3/ The highest average value in 1991 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 156.-- WATER QUALITY AT SELECTED PUBLIC BEACHES:
1990 AND 1991

Island and beach	Number of samples		Enterococci density <u>1/</u>	
	1990	1991	1990	1991
Hawaii:				
Hapuna Beach	4	22	5.2	1.1
Kahaluu Beach	10	21	1.2	1.3
Kealahou Bay (curio stand)	6	15	2.9	2.5
Mooheau Park	11	-	5.2	-
Spencer Beach Park	4	22	2.0	1.6
Maui:				
Kapalua (Fleming) Beach	13	9	2.7	2.4
Kihei (north)	12	10	0.9	1.0
Makena Beach	12	12	0.8	0.8
Seven Pools	6	6	1.2	1.5
Sheraton Kaanapali	12	9	1.1	0.8
Lanai:				
Hulopoe Bay	9	6	0.8	0.9
Molokai:				
Kaunakakai Harbor	10	10	5.5	6.5
Oahu:				
Ala Moana Park (center)	17	12	2.4	3.2
Ewa Beach Park	50	51	1.3	2.0
Haleiwa Beach	36	38	12.4	9.0
Hanauma Bay	69	59	6.8	11.3
Kailua Beach Park	43	54	4.3	4.3
Kuhio Beach	50	53	11.8	24.8
Makaha Beach	41	52	2.0	1.1
Waimea Beach	37	50	6.5	3.2
Kauai:				
Anini Park Pavilion	9	12	4.2	3.2
Kalapaki Beach	12	12	5.3	14.6
Kekaha (Oomano Pt.)	9	11	1.2	2.0
Poipu Beach Pavilion	12	13	1.0	2.6
W. of Lydgate Park (wading pool) ..	10	12	8.0	1.1

1/ See previous table, footnote 1.

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

Table 157.-- REFUSE AND SEWAGE STATISTICS FOR OAHU: 1982 TO 1992

[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	
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
1992	1,080,238	317,636	762,602	42,705

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
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
1992	53,290	1,890	65	12

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 158.-- HAZARDOUS WASTE SITES ON THE NATIONAL
PRIORITY LIST: 1990 AND 1991

[Includes both proposed and final sites]

Category	Number	Rank <u>1/</u>
1990	7	42
1991	2	47

1/ Among the 50 States. The national total was 1,207 sites in 1990 and 1,201 in 1991.

Source: EPA data cited in Statistical Abstract of the United States for 1991 (p. 211) and 1992 (p. 215).

Table 159.-- 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 160.-- AIR QUALITY IN DOWNTOWN HONOLULU:
1981 TO 1991

[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	Par- ticu- lates	Sulfur oxides	Year	Par- ticu- lates	Sulfur oxides
1981	40	19	1989	30	< 5
1982	29	11	1990	30	< 5
1983	26	<5	1991	30	< 5
1984	25	<5			
1985	24	<5	Standards: <u>1/</u>		
1986	25	<5	Primary ...	75	80
1987	26	<5	Secondary .	60	...
1988	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 May 4, 1992.

Table 161.-- AIR QUALITY AT SPECIFIED LOCATIONS: 1991

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

Sampling station	Total suspended particulates <u>1/</u>			Sulfur dioxide		
	Annual range		Arith- metic average	Annual range		Arith- metic average
	Minimum	Maximum		Minimum	Maximum	
Oahu:						
Barbers Point <u>2/</u>	12	68	32	<5	<5	<5
Downtown Honolulu	18	54	30	<5	<5	<5
Liliha	19	54	32	...	...	...
Pearl City	8	29	15	...	...	...
Waimanalo	2	41	17	...	...	...
Maui:						
Lahaina	10	30	16	...	...	...
Kauai:						
Lihue	9	41	17	...	...	...

1/ Particulates data for all locations except Downtown Honolulu and Liliha from PM₁₀ samplers (measuring inhalable particulates of less than 10 micrograms).

2/ Sampling site discontinued after April 1991. Four months of data.

Source: Hawaii State Department of Health, Clean Air Branch, data supplied May 4, 1992.

Table 162.-- ATMOSPHERIC CARBON DIOXIDE MEASUREMENTS AT MAUNA LOA:
ANNUAL MEAN VALUES, 1958 TO 1991

[Parts per million]

Year	Annual average	Year	Annual average	Year	Annual average
1958 ...	<u>1/</u> 315.17	1970 ...	325.27	1982 ...	341.21
1959 ...	315.83	1971 ...	326.17	1983 ...	342.87
1960 ...	316.75	1972 ...	327.26	1984 ...	344.48
1961 ...	317.49	1973 ...	329.45	1985 ...	345.85
1962 ...	318.30	1974 ...	<u>1/</u> 329.72	1986 ...	347.21
1963 ...	318.83	1975 ...	<u>3/</u> 331.14	1987 ...	348.98
1964 ...	<u>2/</u> 319.04	1976 ...	332.04	1988 ...	351.34
1965 ...	319.87	1977 ...	333.79	1989 ...	352.89
1966 ...	321.21	1978 ...	335.35	1990 ...	354.26
1967 ...	322.02	1979 ...	336.73	1991 ...	355.45
1968 ...	322.83	1980 ...	338.72		
1969 ...	323.93	1981 ...	340.12		

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 163.-- 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	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
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	20
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 (State Hospital)	200	71.0	77.5	43	93	71

Continued on next page.

Table 163.-- 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 Resource Management, data supplied December 3, 1992.

Table 164.-- 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	12.3
Fastest observation, 1 minute <u>1/</u>	35	44	46	65
Percent of possible sunshine	41	67	69	57
Mean number of days:				
Clear	35.5	131.7	89.3	54.3
Partly cloudy	130.3	143.1	179.9	182.5
Cloudy	199.5	90.5	96.0	128.5
Precipitation .01 inch or more .	278.7	99.2	99.0	201.4

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, 1991 for Hilo, Kahului, Honolulu, and Lihue.

Table 165.-- MONTHLY AND ANNUAL CLIMATIC DATA FOR HONOLULU INTERNATIONAL AIRPORT

Month	Normal temperature (°F)			Extreme temper- ature (°F)		Precipitation (inches)			
	Daily maxi- mum	Daily mini- mum	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 165.-- 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 <u>2/</u>	Mean number of days		
	8 A.M.	2 P.M.	Mean speed	Fastest obs. <u>1/</u>			Sunrise to sunset		Precip. .01 inch or more
							Clear	Cloudy	
January ..	81	61	9.6	32	63	5.4	9.3	8.7	9.7
February .	79	59	10.2	35	65	5.5	8.0	7.9	9.3
March	73	57	11.4	30	69	5.9	7.2	9.6	9.0
April	70	56	11.9	31	68	6.2	5.4	10.3	9.0
May	67	53	11.9	30	69	5.9	6.5	9.2	7.3
June	66	52	12.7	26	72	5.6	6.1	6.7	5.8
July	67	51	13.2	28	75	5.2	7.7	5.2	7.4
August ...	68	52	12.8	28	76	5.2	8.1	6.0	6.2
September	68	52	11.3	26	76	5.2	8.2	5.8	7.0
October ..	70	55	10.5	25	68	5.6	7.5	8.3	8.7
November .	75	58	10.7	46	61	5.7	7.0	9.2	9.2
December .	79	61	10.4	30	60	5.5	8.4	9.3	10.2
Annual ...	72	56	11.4	46	69	5.6	89.3	96.0	99.0

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, 1991.

Table 166.-- CLIMATIC DATA FOR HONOLULU INTERNATIONAL AIRPORT: ANNUALLY,
1981 TO 1991

Year	Average temperature (°F)			Extreme temp. (°F)		Precipitation (inches)
	Annual	Coolest month	Warmest month	Lowest	Highest	
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
1991 ...	77.7	72.4	82.4	55	93	17.94

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>		
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
1991 ...	69	53	10.0	39	67	86

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 167.-- 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 <u>I</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.)	Sept. 11, 1992...	Makahuena Pt. <u>3</u> / ..	143

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 Resource Management, Climatological Section, data supplied December 7, 1992.

Table 168.-- RAINFALL AT SPECIFIED LOCATIONS: ANNUALLY, 1981 TO 1991

[In inches]

Year	Hawaii				Maui		
	Hilo Airport	Wai-me ¹ / _a	Kona Village	Naalehu	Kahului Airport	Kihei	Lahaina
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
1991 ...	153.04	15.73	8.88	44.45	16.09	6.62	11.11
Year	Oahu				Kauai		
	Waikiki	Univ. of Hawaii	Nuuanu Res. 4	Kane-ohe ² / _a	Koloa	Lihue Airport	Princeville
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	88.20	87.81	56.77	116.65
1990 ...	26.15	40.66	137.81	131.69	73.27	39.37	86.44
1991 ...	26.10	42.83	115.02	90.59	71.30	41.63	82.01

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 Resource Management, records.

Table 169.-- MAJOR HURRICANES: 1950 TO 1992

[Complete to December 3, 1992]

Hurricane name	Date <u>1/</u>	Islands most affected	Maximum recorded winds ashore (m.p.h.)		Deaths	Property damage (mil. dol.)
			Sus-tained	Peak 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
Iniki	Sept. 11, 1992	Kauai, Oahu	92	143	4	1,200

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 Resource Management, data provided Dec. 3, 1992.

Table 170.-- TRADE WINDS, HIGH SURF, AND TEMPERATURES IN HAWAIIAN WATERS,
BY MONTHS

Month	Trade wind frequency <u>1/</u> (percent)	Expected days of strong trade winds <u>2/</u>	Highest surf <u>3/</u> (average number of days)		Water temperature <u>4/</u> (°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

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; Hawaii State Department of Land and Natural Resources, Division of Water Resource Management, data provided December 3, 1992.

Table 171.-- 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 172.-- 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 173.-- 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 174.-- 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 175.-- TREES ALONG STREETS OR IN PARKS UNDER THE JURISDICTION
OF THE CITY AND COUNTY OF HONOLULU: 1987 TO 1991

[As of June 30]

Location	1987	1988	1989	1990	1991
Along City and County streets and highways <u>1/</u> ...	121,100	122,253	123,533	124,650	125,236
In City and County parks	97,101	97,434	97,672	98,330	98,599

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

Table 176.-- THREATENED, ENDANGERED, AND EXTINCT SPECIES OF NATIVE FAUNA
AND FLORA: DECEMBER 1990

Type of fauna or flora	Native species	Candi- date <u>1/</u>	Proposed endan- gered <u>1/</u>	Threat- ened <u>1/</u>	Endan- gered <u>1/</u>	Ex- tinct <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	<u>4/</u> 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).