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A STATISTICAL ANALYSIS OF ALA MOANA SURF HEIGHTS

ROBERT Y. G. LEE

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Abstract

A 34-month statistical analysis of observed surf heights at Ala Moana Beach was made. The mean height is about 2 feet. The (standard) deviation is ½ foot. Surf heights greater than 8 feet did not occur during the period.

I. INTRODUCTION

Ala Moana Beach is located on the south shore of the Island of Oahu approximately midway between Honolulu Harbor and the famous Waikiki Beach. Ala Moana is open to southwest and south swell but is protected from west through north to east swell. Coral reefs extend to about one half to one mile offshore.

The Ala Moana observations are used locally for the marine weather program at Honolulu National Weather Service Forecast Office. The observations are classified as unofficial according to the National Weather Service standards but are of consistently good quality. The Ala Moana site is an apparent good location to observe the long period swell originating from southern hemisphere storms near New Zealand during the Hawaiian summer months and the shorter period swell and seas with nearby Kona storms during winter months. Intense tropical cyclones would also be a source of swell but none passed by the islands during the period. Hurricane FICO in July 1978 would be such an example.

The observer at Ala Moana makes three surf observations daily at 0725HST, 1100HST, and 1400HST.

II. DATA

Thirty-four months of available Ala Moana surf reports from February 1979 through January 1982 were analyzed. These data were classified into five height categories as shown in Table 1. Observations were often given as a range, such as 3 to 4 feet, in which case the higher end of the range was used. Individual monthly frequencies within each class interval for the 34 months were tabulated and are listed in Table 2.

Histograms of each of these 34 individual monthly frequencies are constructed in Figures 1, 2, 3, 4, and 5. The combined monthly frequencies were calculated and are shown in Table 3. Histograms of these combined monthly frequencies are found in Figure 6 and 7. August and September data consist of data from only two years since the observation set for these months in 1980 was not available.

III. ANALYSIS

The significant surf heights of 6 to 8 feet occurred mostly in the early spring and summer. Table 4 indicates that 6 to 8 foot surf occurs most frequently from May to August associated with southern hemisphere storms. The January 1980 period of 4 successive days of high surf was due to an intense Kona storm located west of the islands.

Figure 8 protrays the categorical percentage frequencies of the total data set with all months combined.

Table 5 shows the mean and standard deviations derived from the data on the assumption of a normal distribution which perhaps is not the best assumption due to the boundary value of zero so close to the mean.

IV. SUMMARY

Observations of surf heights taken three times a day at Ala Moana Beach over a three-year period were categorized into 5 height groups and percentage frequencies of occurrence were computed for the 34 individual months available in the data set and for the combined calendar months. These summaries, together with a summary of the total data sample, show mean surf heights of about 2.1 feet with roughly two-thirds of the observations between one and three feet. The occasional high surf heights in the 6 to 8 foot category occurred mainly during the summer months and were caused by intense southern hemisphere extratropical storms in the vicinity of New Zealand. Even though the sample period of 3 years is rather short, and there may be considerable year-to-year variation in storminess, this summary should, nevertheless, prove useful in assessing the frequency distribution of surf affecting the south shore of Oahu.

Table 1. Categories of Ala Moana Surf Heights

Category	Surf Height (Feet)
1	0 to 1
2	2 to 3
3	4 to 5
4	6 to 8
5	Greater than 8

Table 2. Frequency Distribution by Height Categories of Ala Moana Surf (Individual Months)

Year/Month		% Frequency					Number of Observations					
		1	2	3	4	5	1	2	3	4	5	N
1979	Feb	29	65	6	0	0	22	49	4	0	0	75
	Mar	13	76	11	0	0	11	65	9	0	0	85
	Apr	28	61	11	0	0	22	49	9	0	0	80
	May	13	60	25	2	0	12	53	22	2	0	89
	Jun	9	44	45	2	0	7	35	36	2	0	80
	Jul	6	66	28	0	0	5	58	25	0	0	88
	Aug	7	86	7	0	0	6	74	6	0	0	86
	Sep	6	90	40	0	0	5	75	3	0	0	83
	Oct	15	83	2	0	0	10	54	1	0	0	65
	Nov	14	81	5	0	0	11	57	2	0	0	70
	Dec	21	77	2	0	0	16	58	1	0	0	75
1980	Jan	10	59	25	6	0	7	40	17	4	0	68
	Feb	20	74	6	0	0	14	51	4	0	0	69
	Mar	11	72	17	0	0	8	53	13	0	0	74
	Apr	1	77	22	0	0	1	50	14	0	0	65
	May	3	56	31	10	0	3	40	22	7	0	72
	Jun	4	67	19	10	0	3	42	12	6	0	63
	Jul	0	54	32	14	0	0	37	22	10	0	69
	Oct	3	78	17	2	0	3	69	15	2	0	89
	Nov	18	82	0	0	0	15	67	0	0	0	82
	Dec	20	66	14	0	0	16	52	11	0	0	79
1981	Jan	1	83	16	0	0	1	74	14	0	0	89
	Feb	3	80	16	1	0	2	66	13	1	0	82
	Mar	8	89	3	0	0	7	81	3	0	0	91
	Apr	5	78	17	0	0	5	69	15	0	0	89
	May	5	76	17	2	0	4	66	15	2	0	87
	Jun	14	67	19	0	0	10	50	14	0	0	74
	Jul	4	87	9	0	0	3	74	8	0	0	85
	Aug	11	78	10	2	0	10	72	9	1	0	92
	Sep	11	78	10	2	0	10	72	9	1	0	92
	Oct	2	87	11	0	0	2	70	9	0	0	81
	Nov	23	75	2	0	0	19	63	2	0	0	84
	Dec	44	48	8	0	0	40	43	7	0	0	90
1982	Jan	36	62	2	0	0	32	55	2	9	9	89

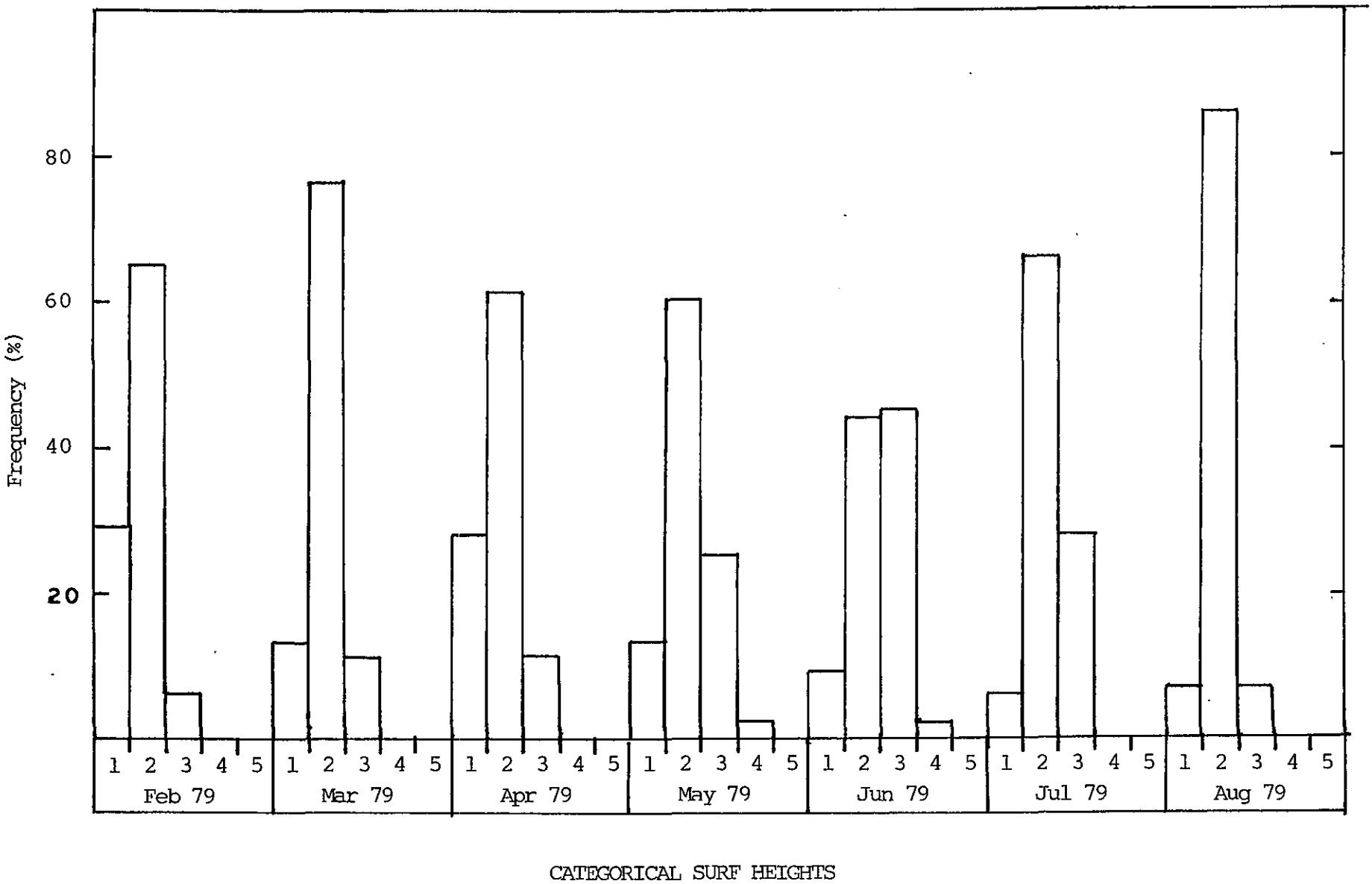

Figure 1. Monthly Categorical Frequencies of Ala Moana Surf From Feb 79 to Aug 79.

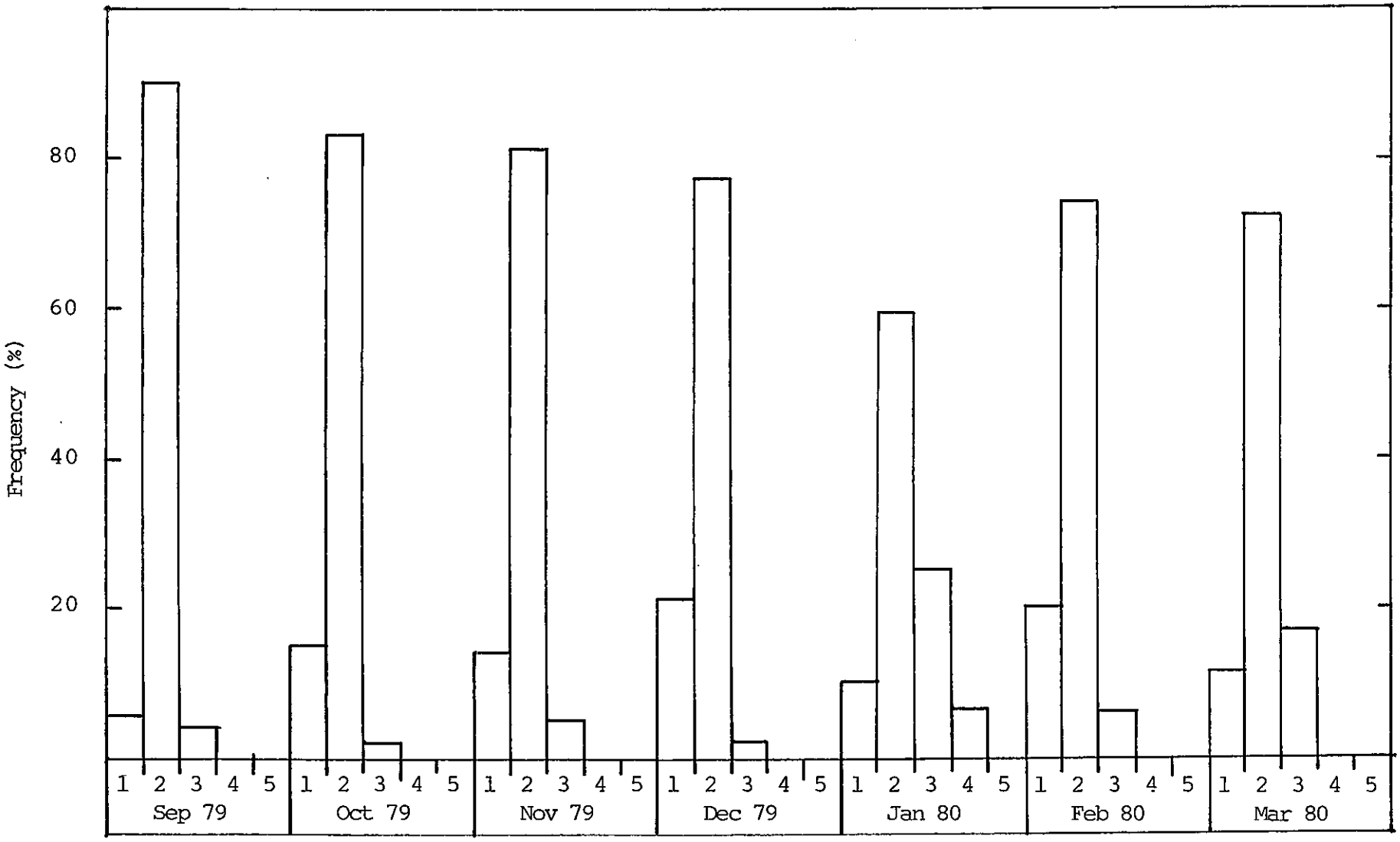

Figure 2. Monthly Categorical Frequencies of Ala Moana Surf From Sep 79 to Mar 80.

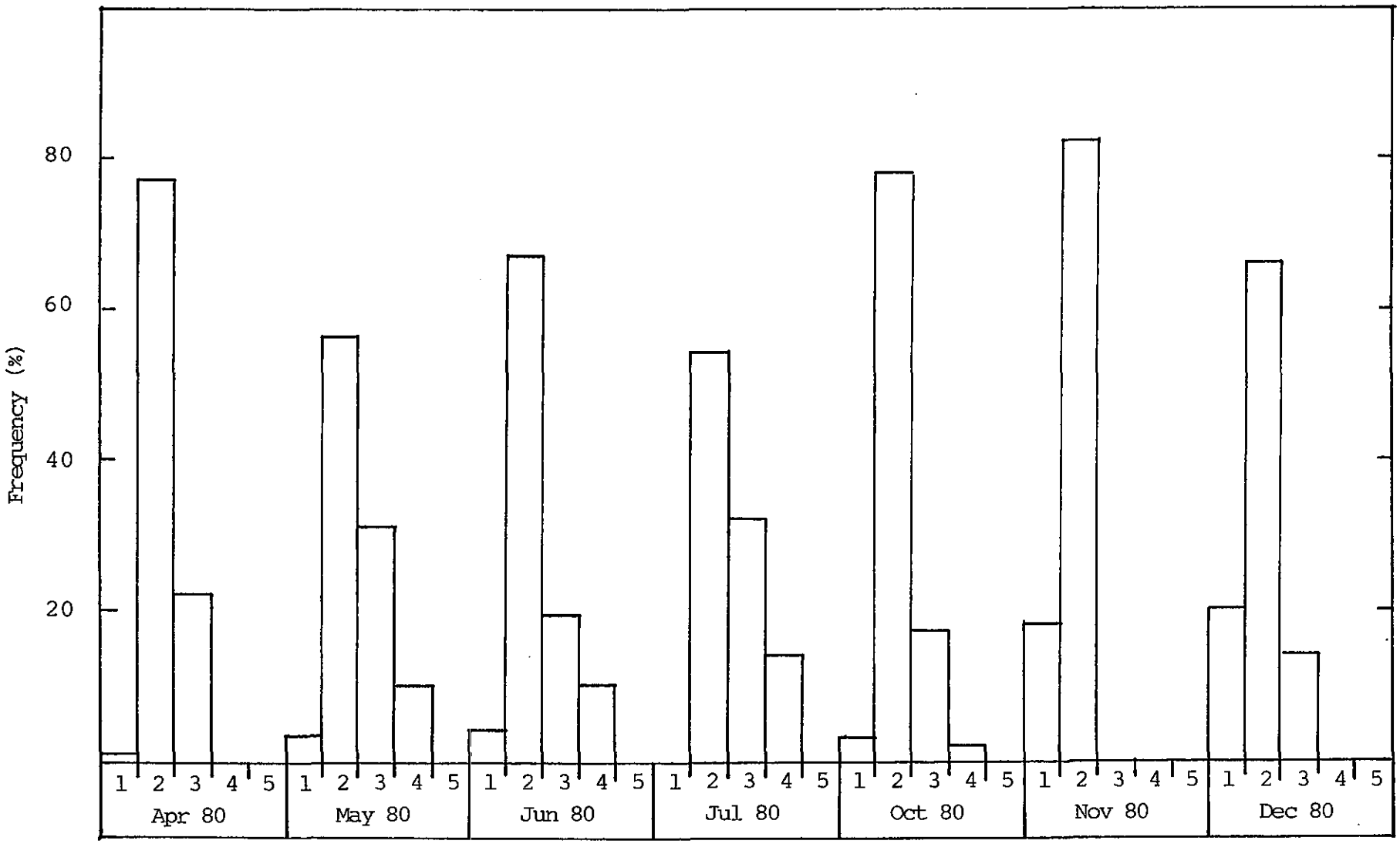

Figure 3. Monthly Categorical Frequencies of Ala Moana Surf From Apr 80 to Dec 80.
(Aug 80 and Sep 80 data are missing)

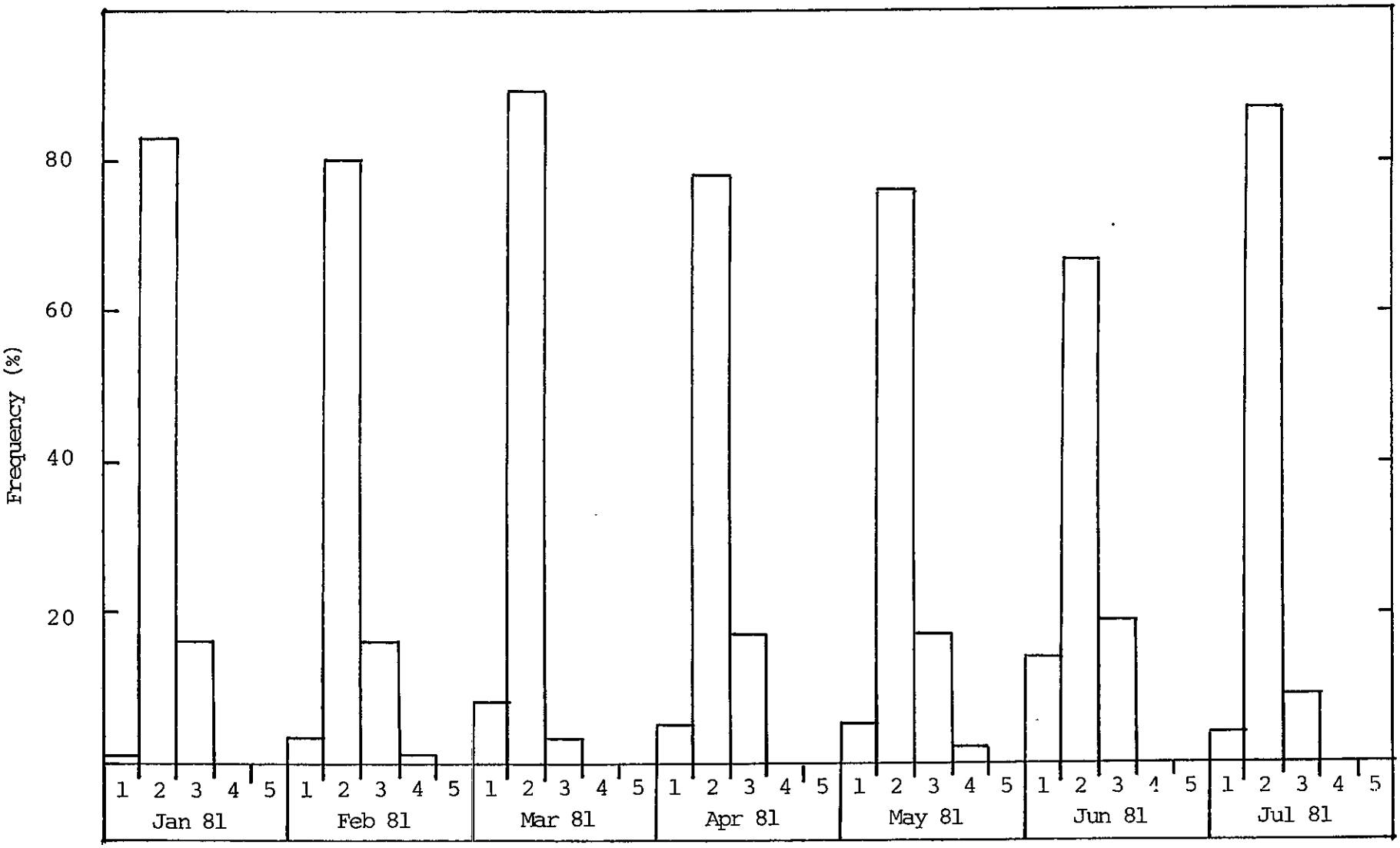

Figure 4. Monthly Categorical Frequencies of Ala Moana Surf From Jan 81 to Jul 81.

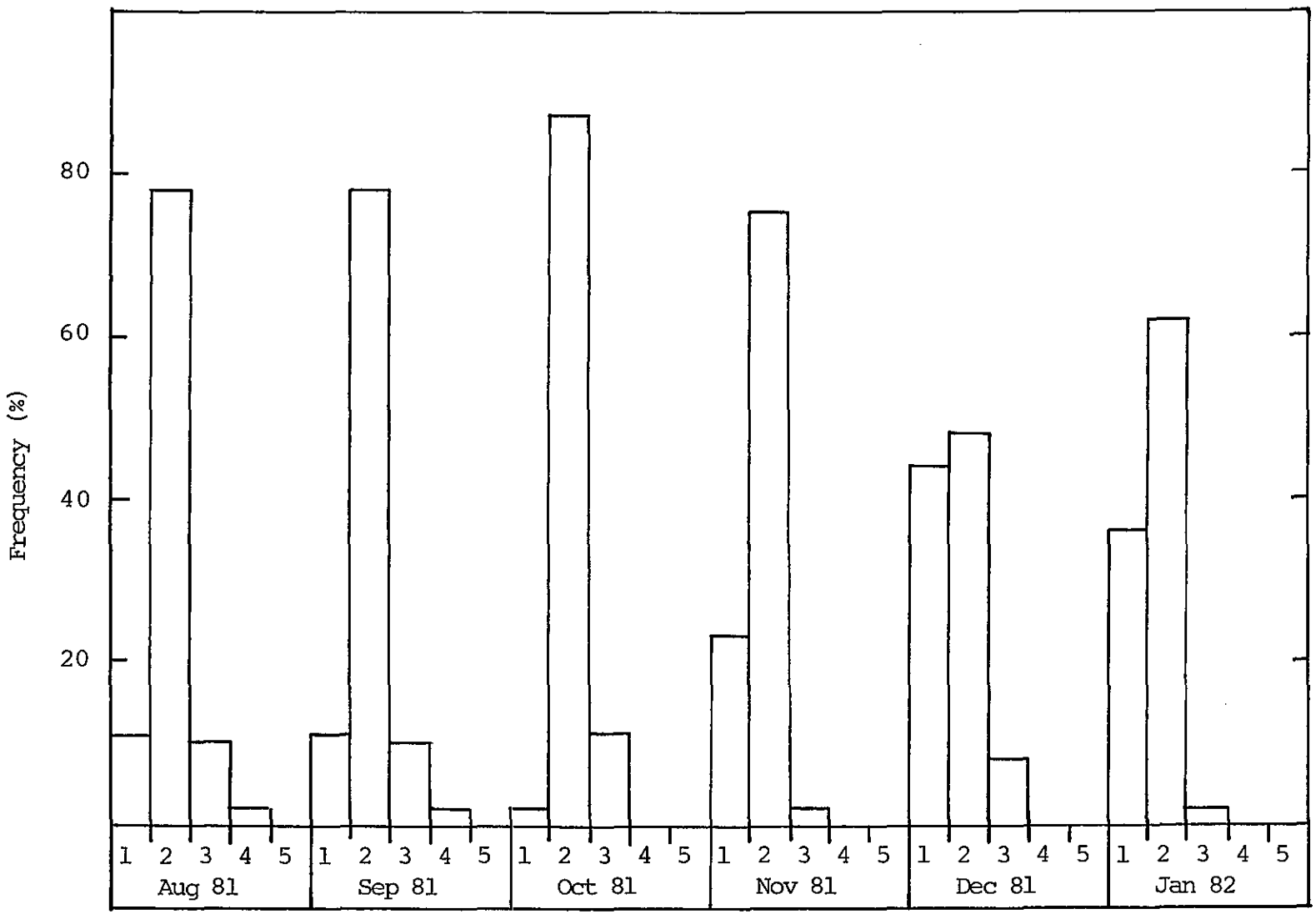

Figure 5. Monthly Categorical Frequencies of Ala Moana Surf From Aug 81 to Jan 82.

Table 3. Combined Monthly Frequencies of Ala Moana Surf by Height Categories

Month	% Frequency					Number of Observations						% of Possible 3-yr Total
	1	2	3	4	5	1	2	3	4	5	N	
Jan	16	67	13	4	0	40	169	33	4	0	246	88
Feb	17	73	9	1	0	38	166	21	1	0	226	89
Mar	10	80	10	0	0	26	199	25	0	0	250	90
Apr	12	72	16	0	0	28	168	38	0	0	234	87
May	8	64	24	4	0	19	159	59	11	0	248	89
Jun	9	59	29	3	0	20	127	62	8	0	217	80
Jul	3	70	23	4	0	8	169	55	10	0	242	87
Aug	9	82	8	1	0	16	146	15	1	0	178	64
Sep	8	84	7	1	0	15	147	12	1	0	175	65
Oct	6	82	11	1	0	15	193	25	2	0	279	84
Nov	19	79	12	0	0	45	187	4	0	0	236	87
Dec	30	63	7	0	0	72	153	19	0	0	244	87
34-month total	13	73	13	1	0	342	1983	368	38	0	3288	83

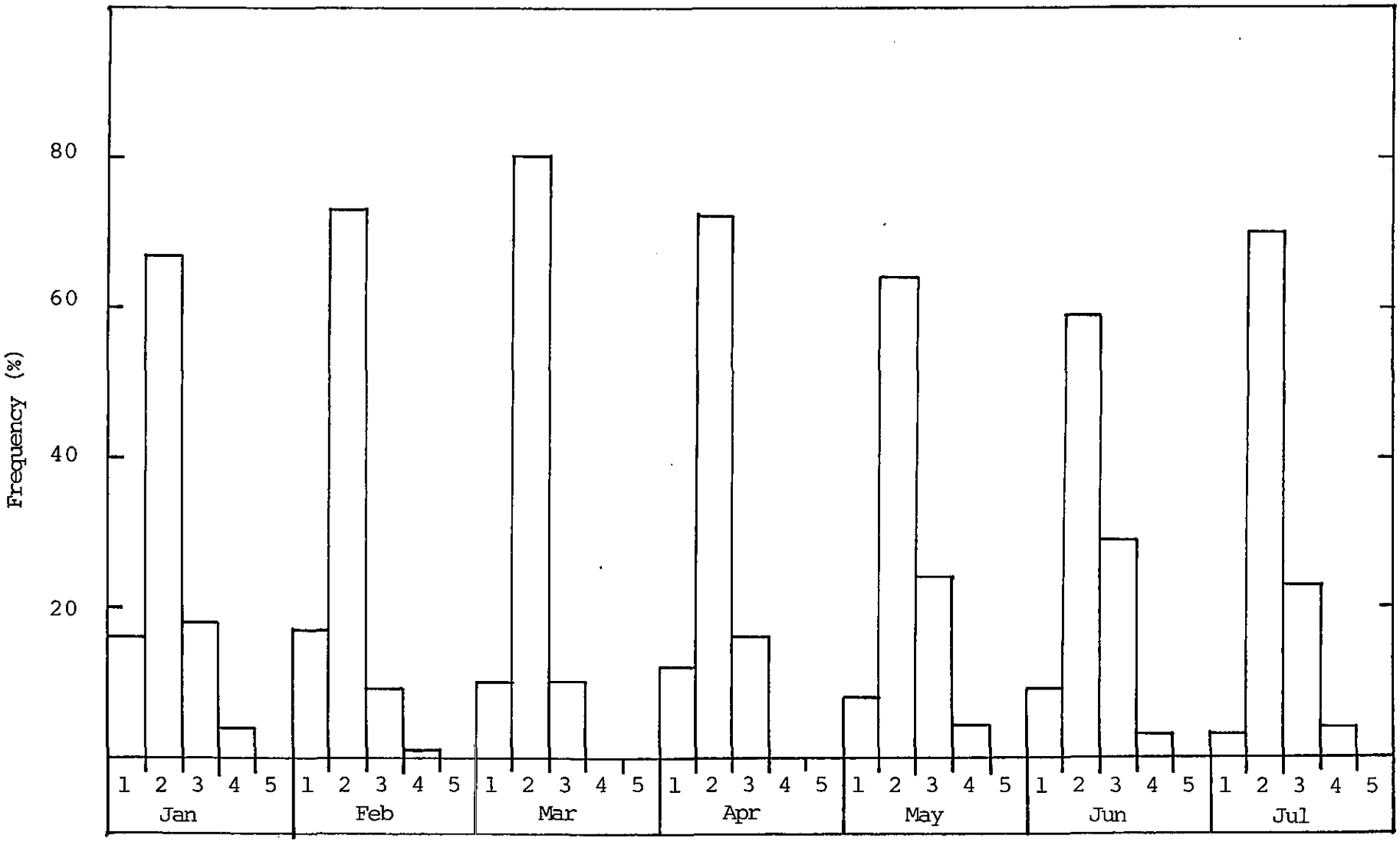

Figure 6. Combined Jan to Jul Monthly Frequencies of Ala Moana Surf (Feb 79 - Jan 82).

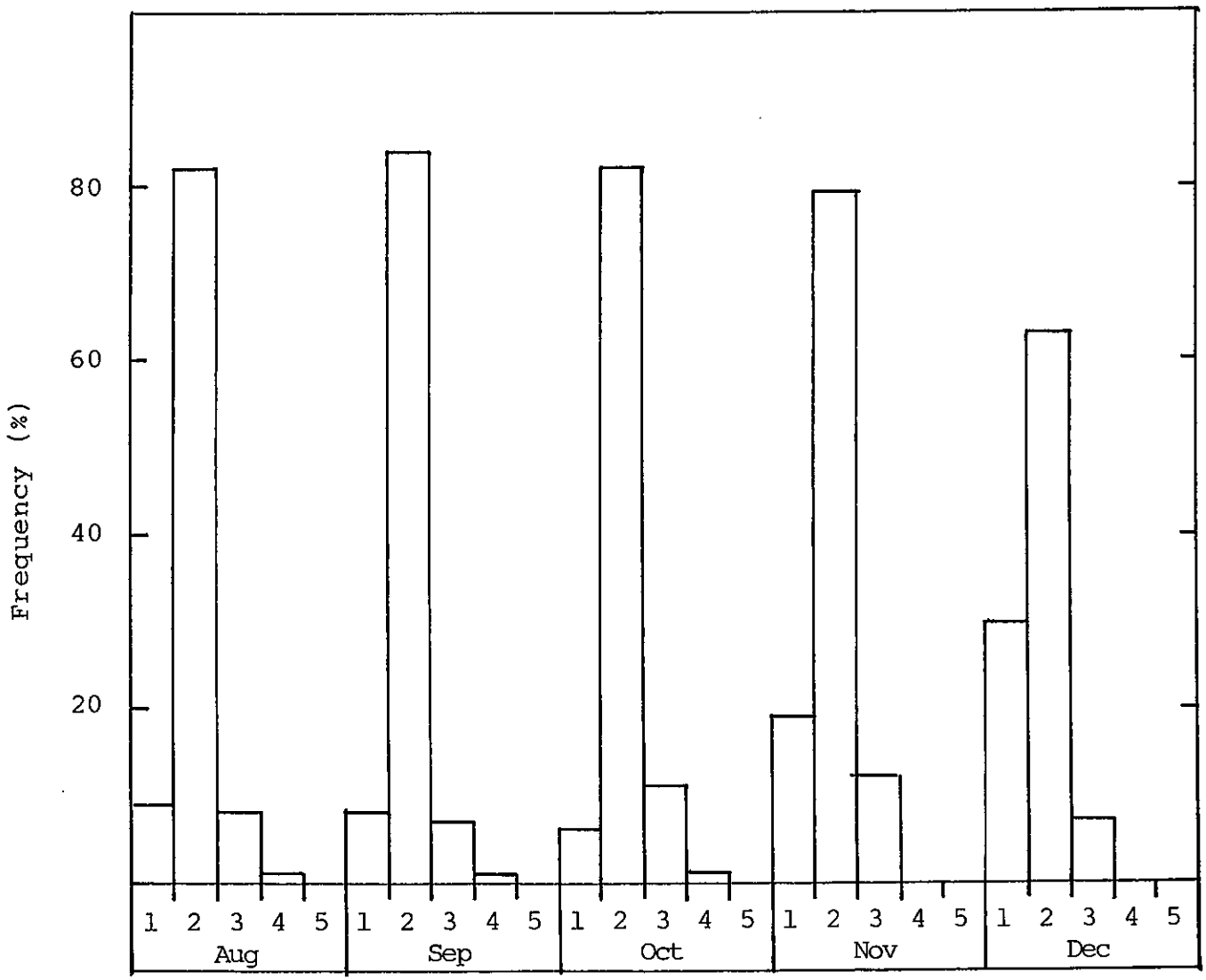

Figure 7. Combined Aug to Dec Monthly Frequencies of Ala Moana Surf (Feb 79 - Jan 82)

Table 4. Dates of Reported 6 to 8-Foot Surf

Year	Month	Dates
1979	May	8
	Jun	13, 15
1980	Jan	9, 10, 11, 12
	May	10, 11, 12, 16, 17
	Jun	7, 8
	Jul	1, 2, 3, 4, 23, 24, 25, 26
	Oct	11
1981	Feb	11
	May	8, 10
	Aug	6

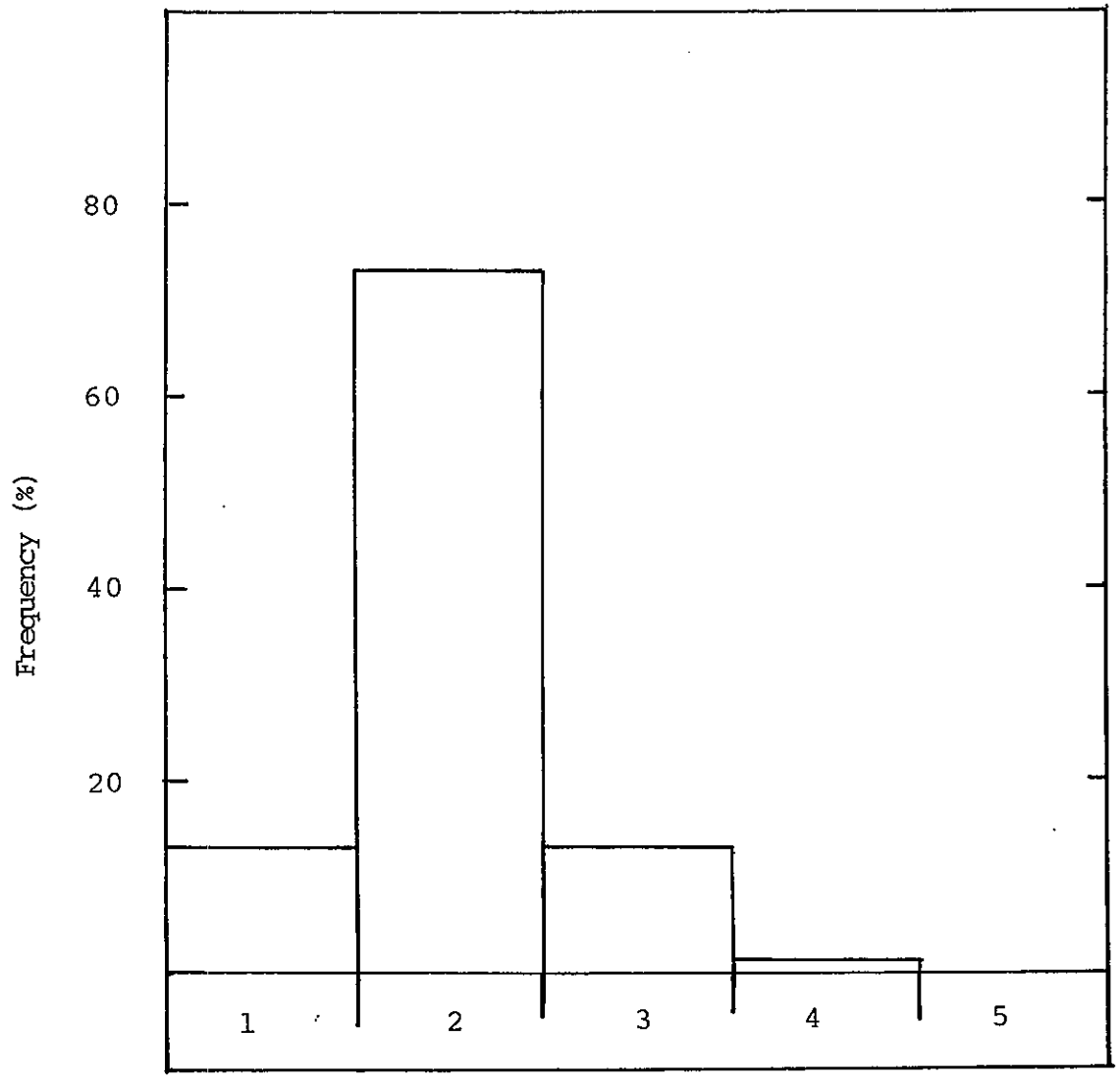

Figure 8. Categorical Frequencies of Total Data Set (All Months Combined) of Ala Moana Surf (Feb 79 - Jan 82).

Table 5. Statistical Results

MEAN = 2.14 FEET

Standard Deviation = $\pm$ 0.51 feet

ZERO percentage occurrence for greater than 8 ft.

2/3 of surf were from 1.6 to 2.6 feet.

Acknowledgement

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