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DESCRIPTIVE STATISTICS ON THE SIZE COMPOSITION OF SKIPJACK TUNA, *KATSUWONUS PELAMIS*, LANDED IN THE HAWAIIAN POLE-AND-LINE FISHERY, 1946-77

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INTRODUCTION

The Hawaiian skipjack tuna, Katsuwonus pelamis, fishery is a pole-and-line or live-bait fishery that is carried out usually within 90 nautical miles (167 km) of the main islands. The fishing boats, or aku sampans, range from 27 to 77 gross tons or 18 to 25 m in length and are generally constructed of wood (Uchida 1966). The landings by the skipjack tuna fleet have varied from 2,700 to 7,300 metric tons (MT) with a mean of about 4,100 MT.

The size composition of the skipjack tuna landings varies seasonally and annually. Fish as small as 30 and as large as 89 cm fork length (FL) are commonly caught. It has been noted that two modal size groups, at 45 and 70 cm FL, are commonly present in the summer. The 70 cm FL group makes up the "season" fish that contributes to the large catches during the summer. As many as three modal size groups, at 35, 50, and 70 cm FL, are sometimes evident during the winter (Rothschild 1965). There are no size restrictions placed on the fishery by the State of Hawaii, the local cannery, nor any of the fresh fish marketing outlets. While there is a market demand for skipjack tuna for all sizes landed, the cannery as well as the fresh fish market prefer fish as large as possible.

Basic Statistics on Length

Fork length statistics are available for analysis from September 1946 through December 1954 and from August 1959 through June 1977, although not for every month. Sampling of the landings at the local cannery is continuing. Certain basic statistics, including the mean, minimum, and maximum, have been calculated on a monthly, quarterly, and yearly basis and are presented here for quarters and years (Table 1).

There is no evidence of a long-term trend in the mean, minimum, or maximum statistics for the history of the fishery (Figure 1). Over the 28 years of the time series, the means of the mean, minimum, and maximum statistics are 60.4, 33.4, and 86.1 cm FL, respectively. The smallest fish measured was 30 cm FL, and the largest was 89 cm FL. These minimum and maximum values occurred in several of the months in different years in the time series.

On a quarterly basis averaged over all 28 years, there are recognizable intrayear trends in the data. The means of the quarterly mean and maximum statistics start at low values in the first quarter and rise to a peak in the third quarter (Figure 2). In the Hawaiian fishery, skipjack tuna landings also reach a peak in the third quarter. The minimum statistic follows a different pattern with the peak occurring in the fourth quarter.

Within the third quarter, the mean of the monthly mean fork length statistics reaches a peak in July whereas the means of the minimum and maximum statistics increase slightly from June through August (Figure 3).

Size-Frequency Distributions

While the basic statistics given in the previous section indicated that length composition of the landings varies both within and between years, these statistics do not provide any information on the length-group (or modal group) composition and its variability. In this section, we present length-frequency distributions for 4 cm FL groups by quarters and months for selected years. Modal groups, which are indicated by arrows in the figures, were selected visually, not by using any statistical procedure. The 4 cm FL grouping is probably too large to follow growth or progression of modes in any but the youngest length-groups.

The quarterly histograms for 1952, 1962, 1972, and 1976 (Figure 4) most clearly show the seasonal variability in the modal group composition of the landings. The third quarter contained only two length-groups (usually 46-49 cm and 70-73 cm FL) in all but 1 year. The exception (1976) contained three length-groups. The second quarter sometimes looks like a summer quarter with two modal groups and sometimes like a winter quarter with up to four modal groups. In the third quarter as few as one length group and as many as three can be seen. The fourth quarter is equally variable, but the maximum number of modal groups reaches four.

Monthly histograms for 1974-77 are presented in Figure 5. The monthly data, of course, shows more variability than the quarterly data and suggest that if the data must be grouped into quarters, these quarters might better be December-January-February, March-April-May, June-July-August, and September-October-November. While it is possible to follow some modal groups from month to month, there is no consistent indication of growth nor is the percent contribution of a given modal group consistent.

Going beyond these simple descriptors of the length statistics for the Hawaiian fishery, we are now attempting to statistically separate length-groups using a modification of a normal distribution separator algorithm written by Yong and Skillman (1975) and used recently by Skillman and Yong (1976).

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Table 1.--Quarterly and yearly fork length (in centimeters) statistics for skipjack tuna from the Hawaiian pole-and-line fishery.

Year	Quarter 1			Quarter 2			Quarter 3			Quarter 4			Year		
	Mean	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.
1946	--	--	--	--	--	--	60.9	39	86	63.9	39	86	62.4	39	86
1947	57.6	38	85	49.0	31	84	58.1	33	85	--	--	--	54.6	31	85
1948	55.8	34	89	45.7	35	83	58.1	34	85	59.4	40	83	51.7	34	89
1949	56.6	50	68	71.7	33	84	63.8	37	85	54.3	40	79	66.5	33	85
1950	55.0	37	81	53.7	34	84	60.3	41	83	64.7	41	81	58.0	34	84
1951	64.2	49	80	62.7	31	81	63.7	36	82	50.4	40	75	61.3	31	82
1952	--	--	--	52.5	33	80	57.3	38	85	49.4	38	74	54.2	33	85
1953	54.7	33	79	59.2	36	81	58.2	37	85	67.8	40	83	59.0	33	85
1954	--	--	--	64.7	37	84	61.4	36	82	63.4	37	85	63.0	36	85
1955-58,	no data														
1959	--	--	--	--	--	--	68.3	42	88	67.3	42	89	67.7	42	89
1960	62.0	32	84	55.1	35	85	65.1	36	87	58.5	41	77	61.2	32	87
1961	54.6	37	84	67.7	34	83	71.3	41	87	62.7	41	84	69.3	34	87
1962	64.6	46	81	59.3	38	86	59.1	38	84	54.2	41	81	59.2	38	86
1963	--	--	--	53.0	37	83	63.6	40	84	--	--	--	57.8	37	84
1964	54.0	33	83	54.6	36	81	64.0	36	88	60.1	33	81	59.7	33	88
1965	56.0	30	82	62.5	37	85	65.7	30	87	63.9	40	87	62.5	30	87
1966	59.4	31	85	66.1	34	85	65.2	30	86	63.2	38	85	64.0	30	86
1967	53.3	30	85	66.4	32	88	63.4	35	88	56.8	38	84	60.7	30	88
1968	53.6	32	85	58.2	35	89	62.8	39	88	60.6	30	83	59.4	30	89
1969	55.5	35	85	54.6	35	82	62.4	31	88	51.7	33	78	57.2	31	88
1970	48.4	30	83	48.6	36	81	61.3	40	86	64.1	37	82	56.4	30	86
1971	57.7	38	82	56.8	39	83	64.1	44	82	61.9	49	79	59.3	38	83
1972	63.0	36	79	71.8	39	81	73.4	46	87	61.0	35	80	68.5	35	87
1973	51.1	32	83	70.0	39	83	--	--	--	--	--	--	62.8	32	83
1974	58.4	33	84	56.7	34	89	60.0	36	88	63.2	36	84	59.9	33	89
1975	61.3	33	89	46.0	31	67	63.4	36	87	55.0	39	85	56.1	31	89
1976	58.0	36	81	55.2	36	79	56.8	38	78	63.1	40	81	59.5	36	81
1977	63.1	37	88	57.0	30	88	--	--	--	--	--	--	60.6	30	88
Mean	57.30	35.7	82.8	58.42	34.9	83.0	62.76	37.3	85.4	60.03	38.7	81.9	60.45	33.43	86.11
Min.	48.4	30	68	45.7	30	67	56.8	30	78	49.4	30	74	51.7	30	81
Max.	64.6	50	89	71.8	39	89	73.4	46	88	67.8	49	89	69.3	42	89

Figure 1. Annual fork length statistics for skipjack tuna from the Hawaiian pole-and-line fishery.

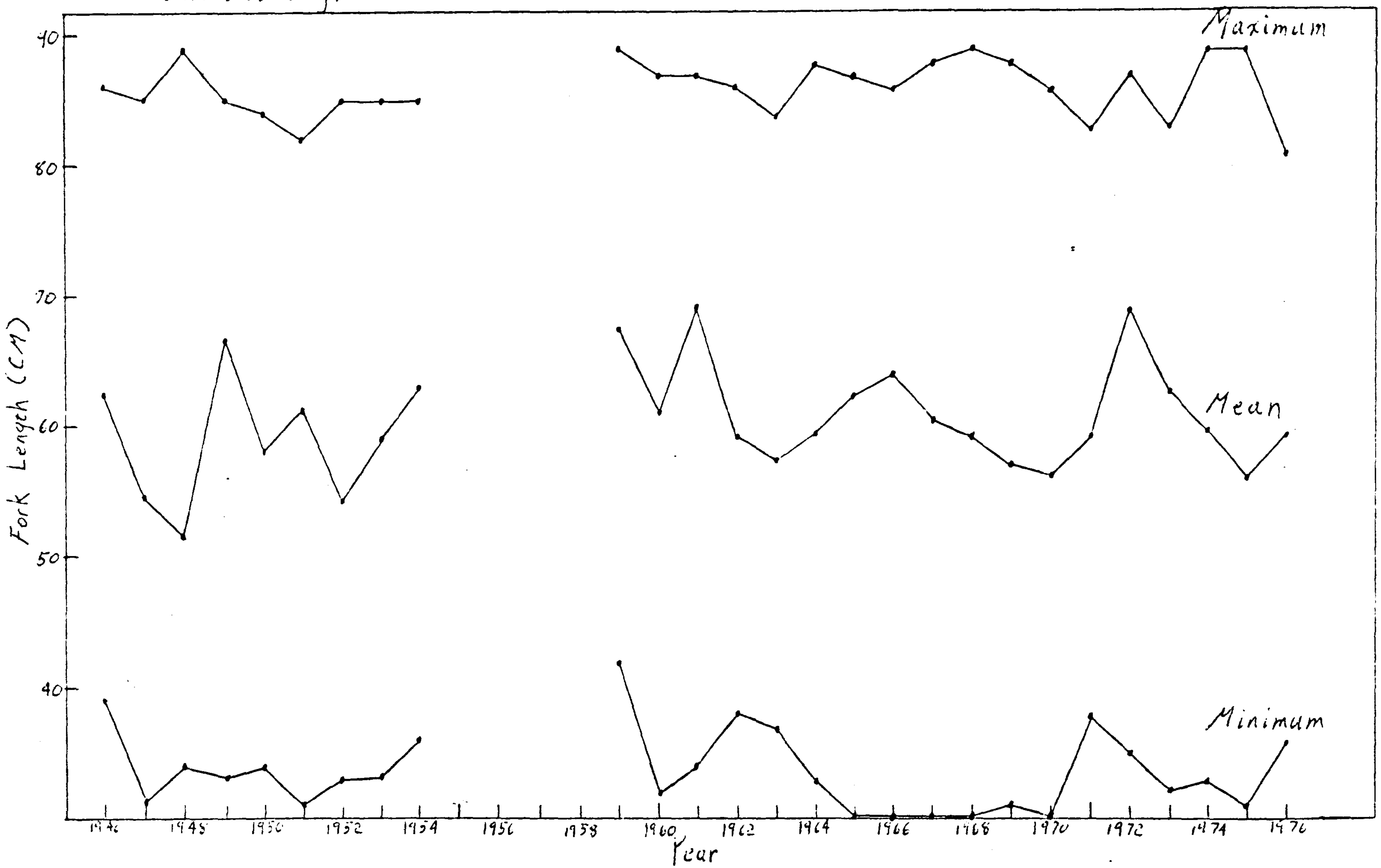


Figure 2. Mean quarterly fork length statistics for skipjack tuna from the Hawaiian pole-and-line fishery, 1946-54 and 1959-76.

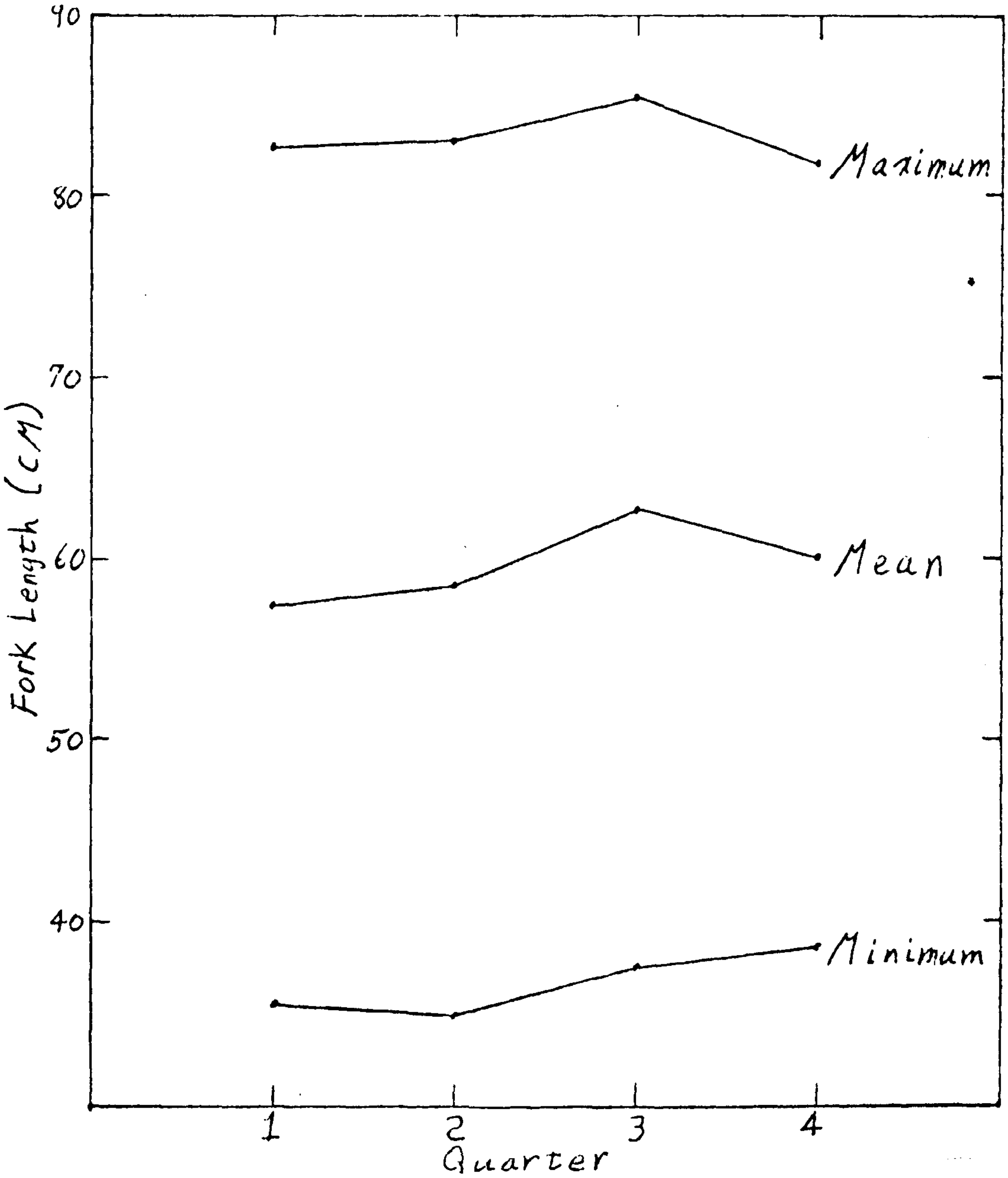


Figure 3. Mean monthly fork length statistics for the third quarter for skipjack tuna from the Hawaiian pole-and-line fishery, 1946-54 and 1959-76.

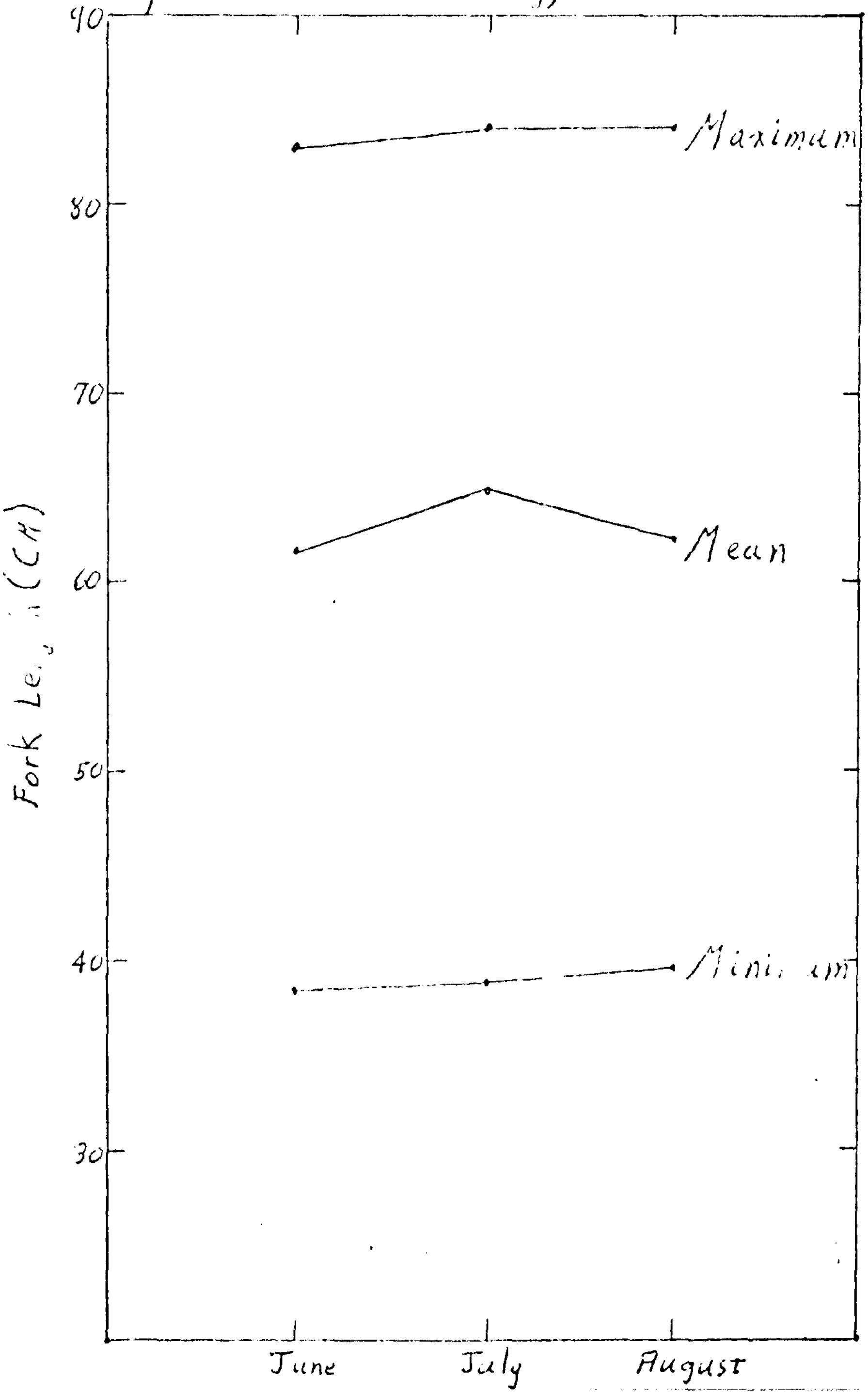
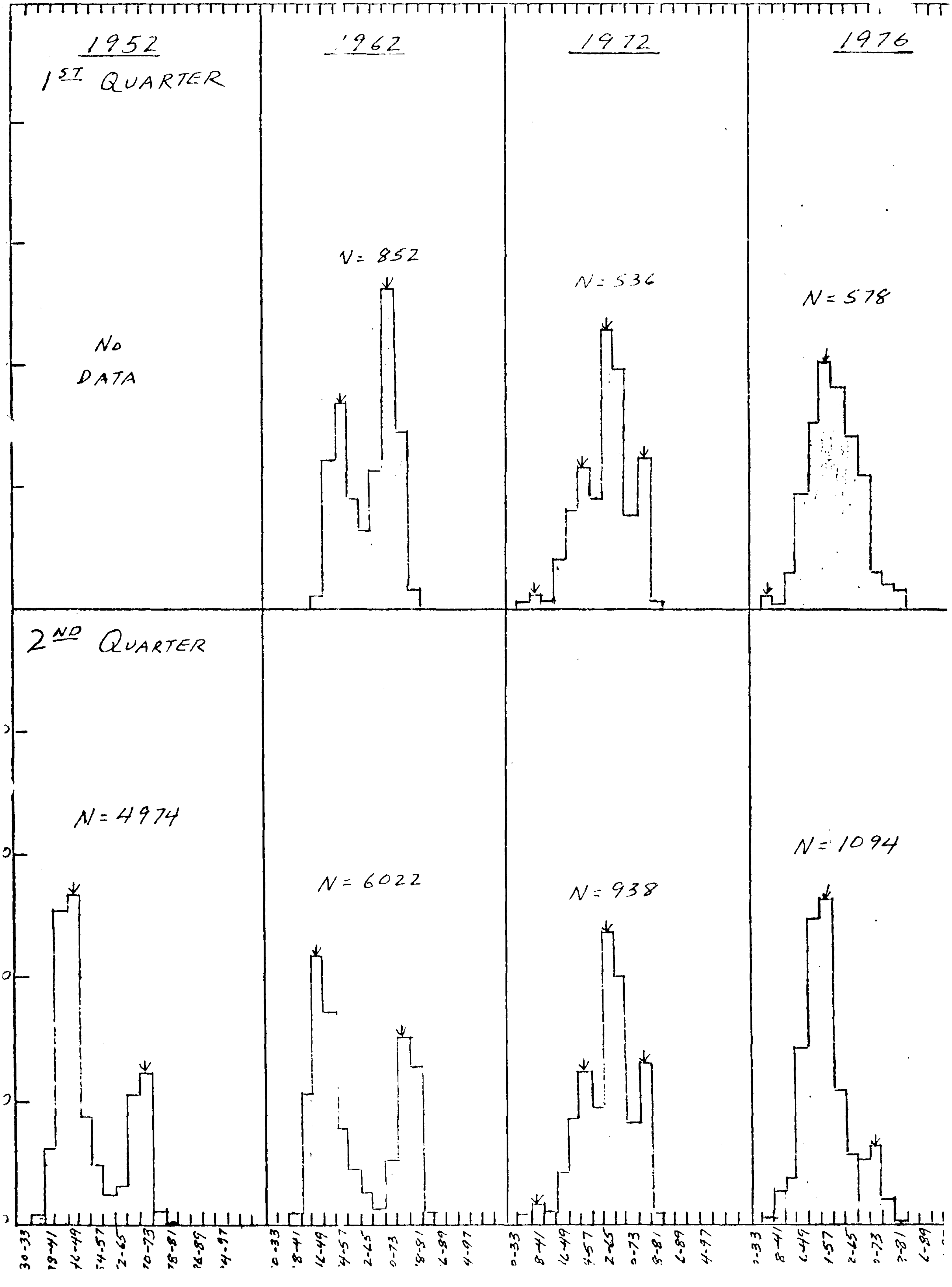


Figure 4. Quarterly fork length frequency distributions for skipjack tuna r
Hawaiian pole-and-line fishery; 1952, 1962, 1972 and 1976.



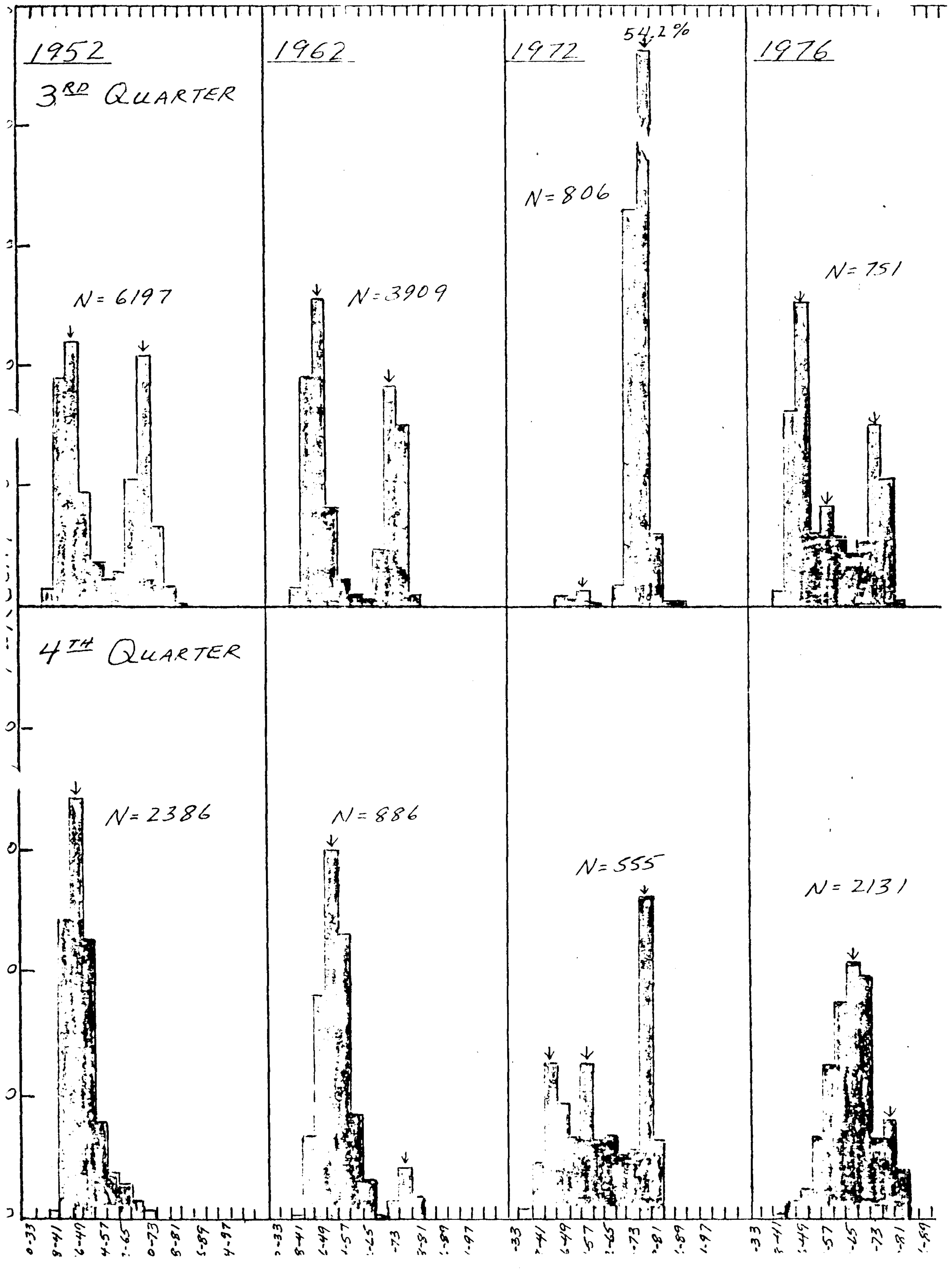
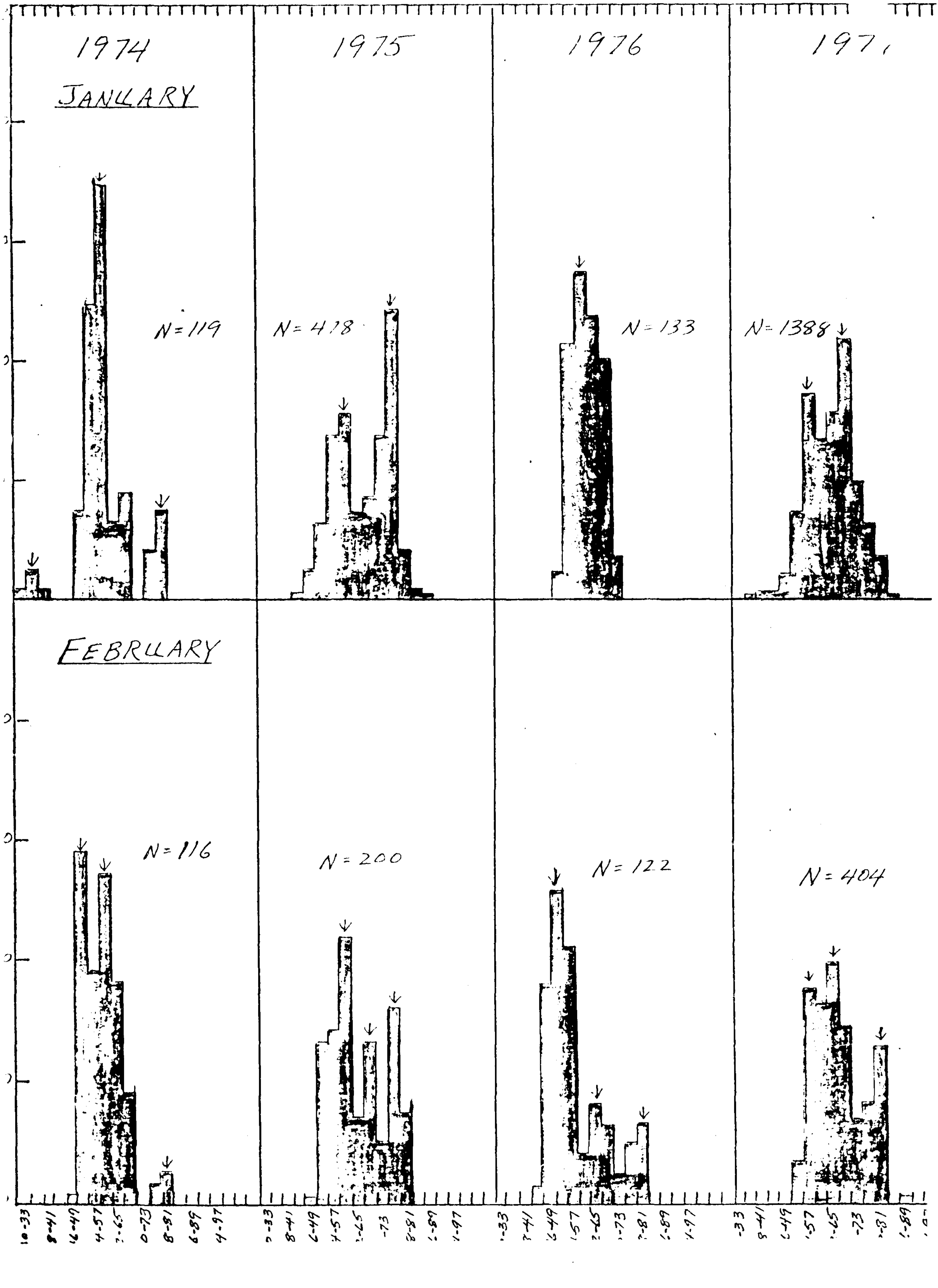
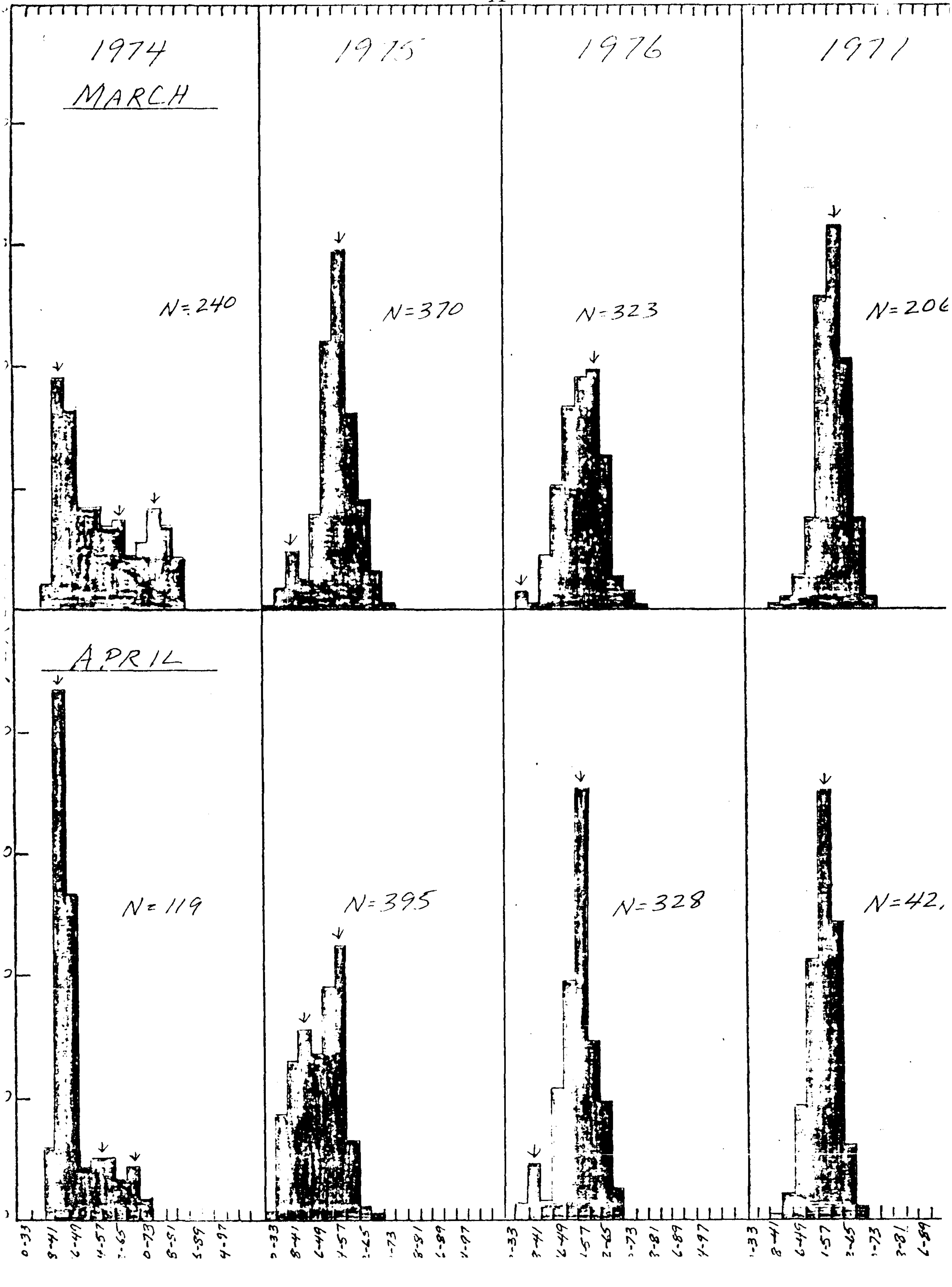
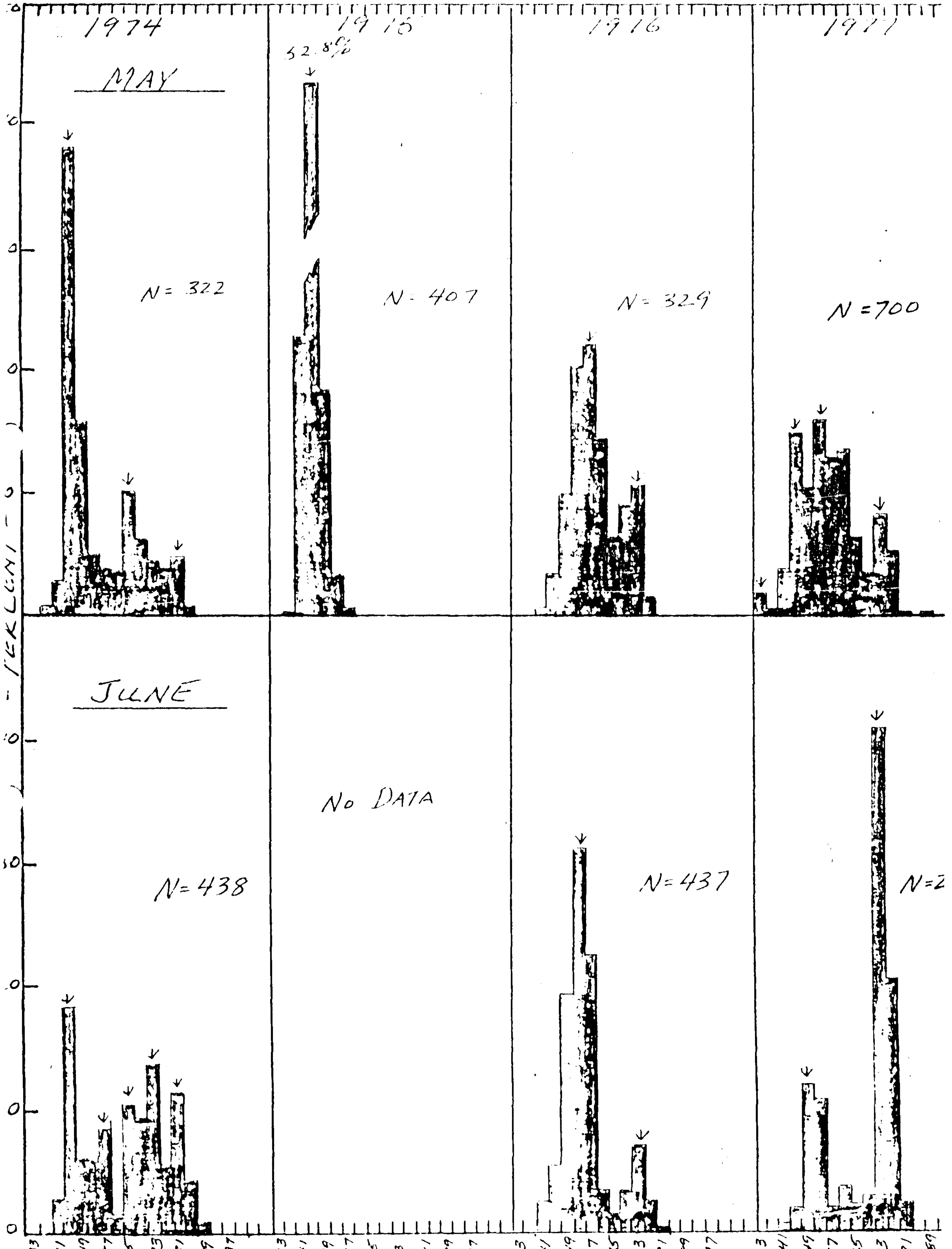

1952
3RD QUARTER
N= 6197
1962
N=3909
1972
54.2%
N=806
1976
N=751
4TH QUARTER
N=2386
N=886
N=555
N=2131

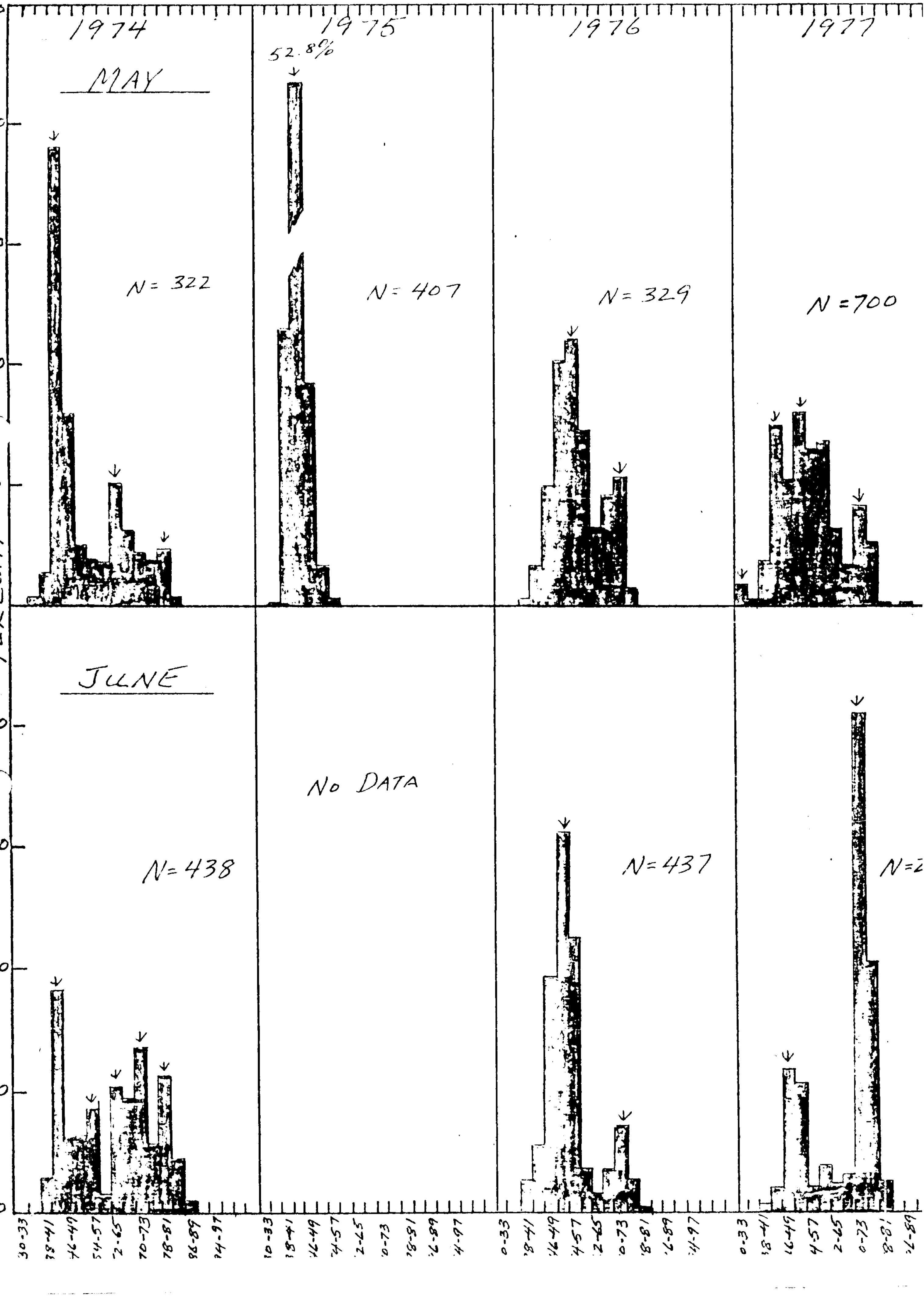
Figure 5. Monthly fork length frequency distributions forskipjack tuna [illegible] the Hawaiian pole-and-line fishery; 1974-75.

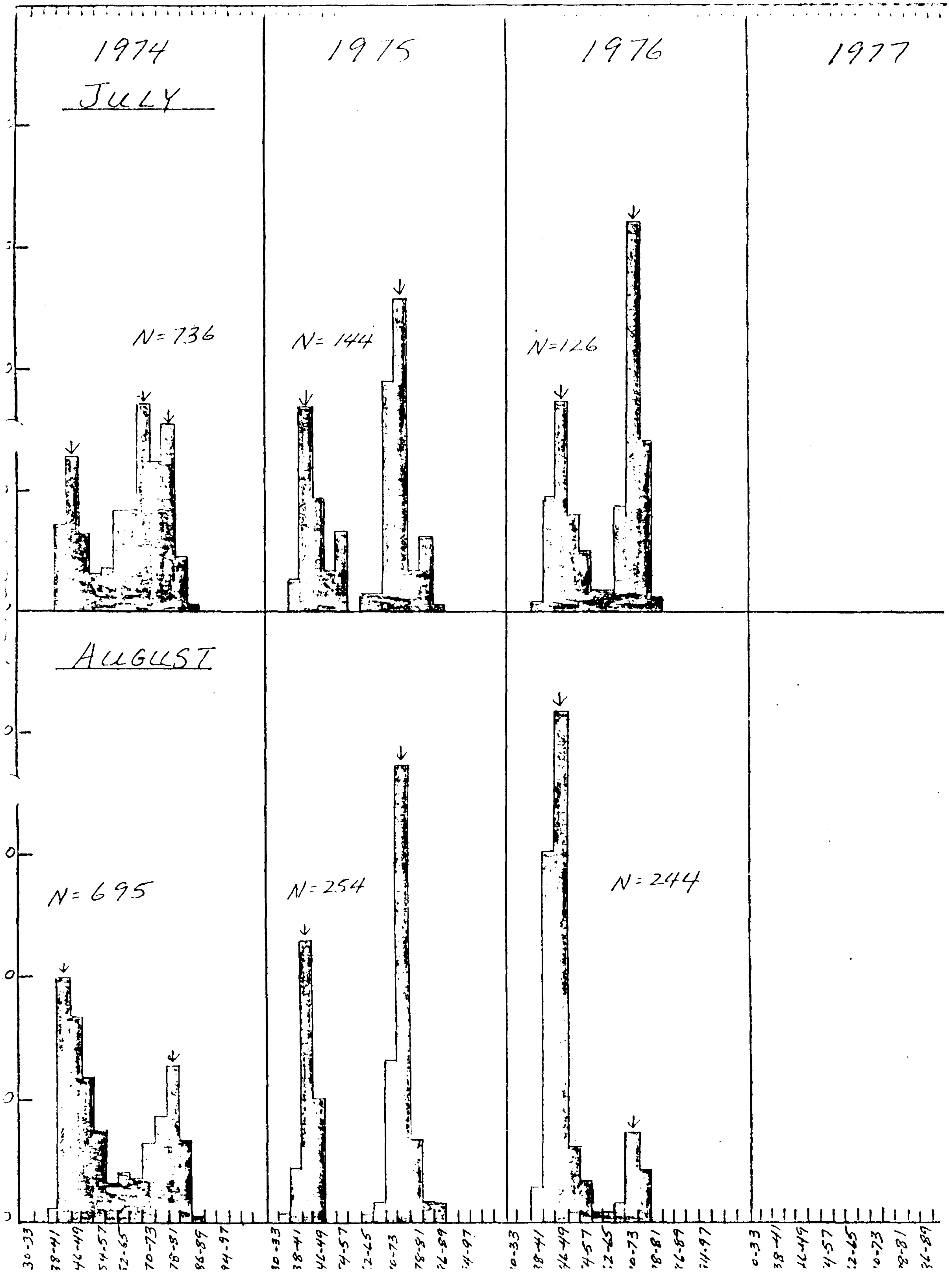



1974
MARCH
APRIL
1975
1976
1977
N=240
N=370
N=323
N=206
N=119
N=395
N=328
N=42

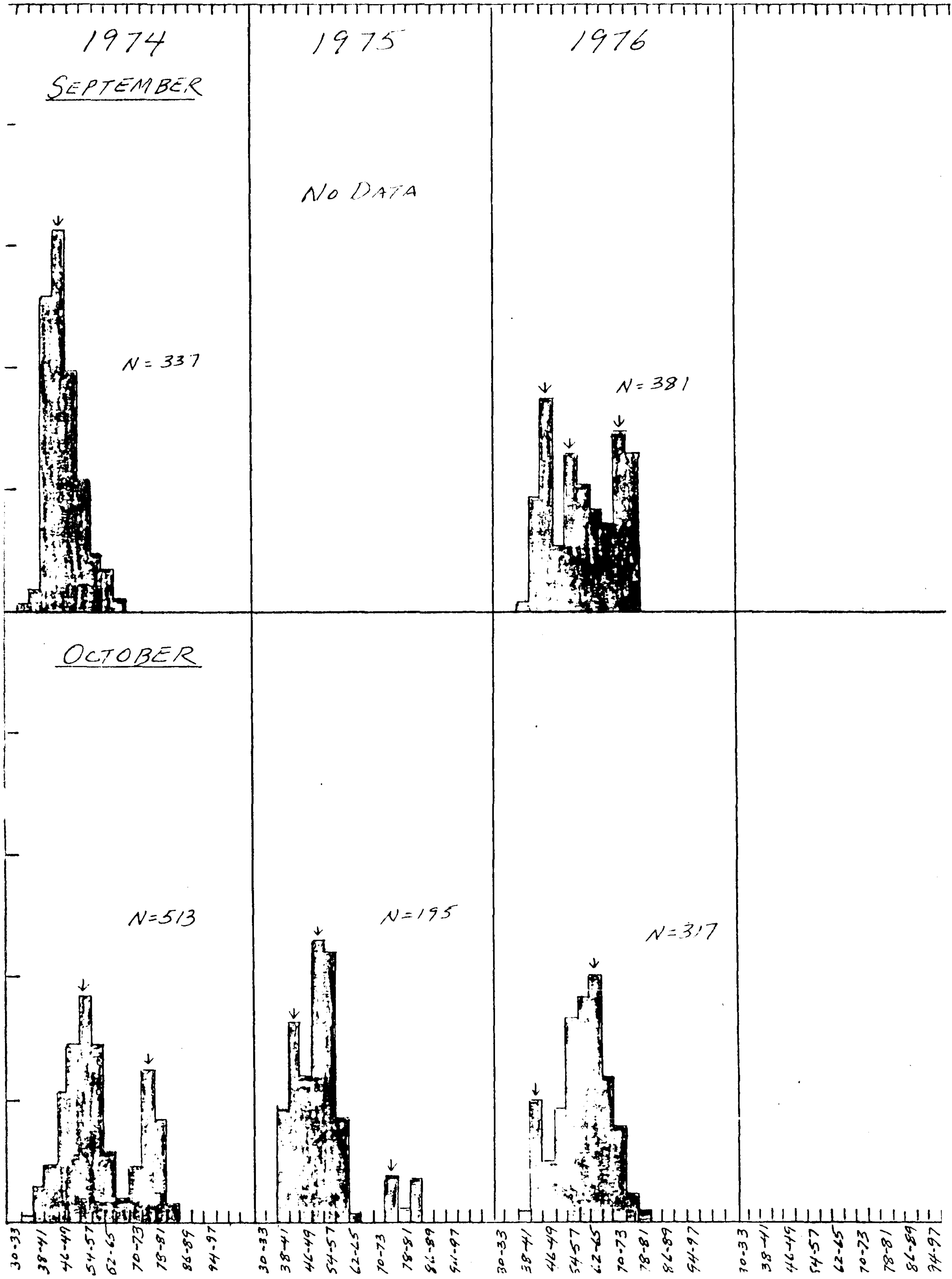


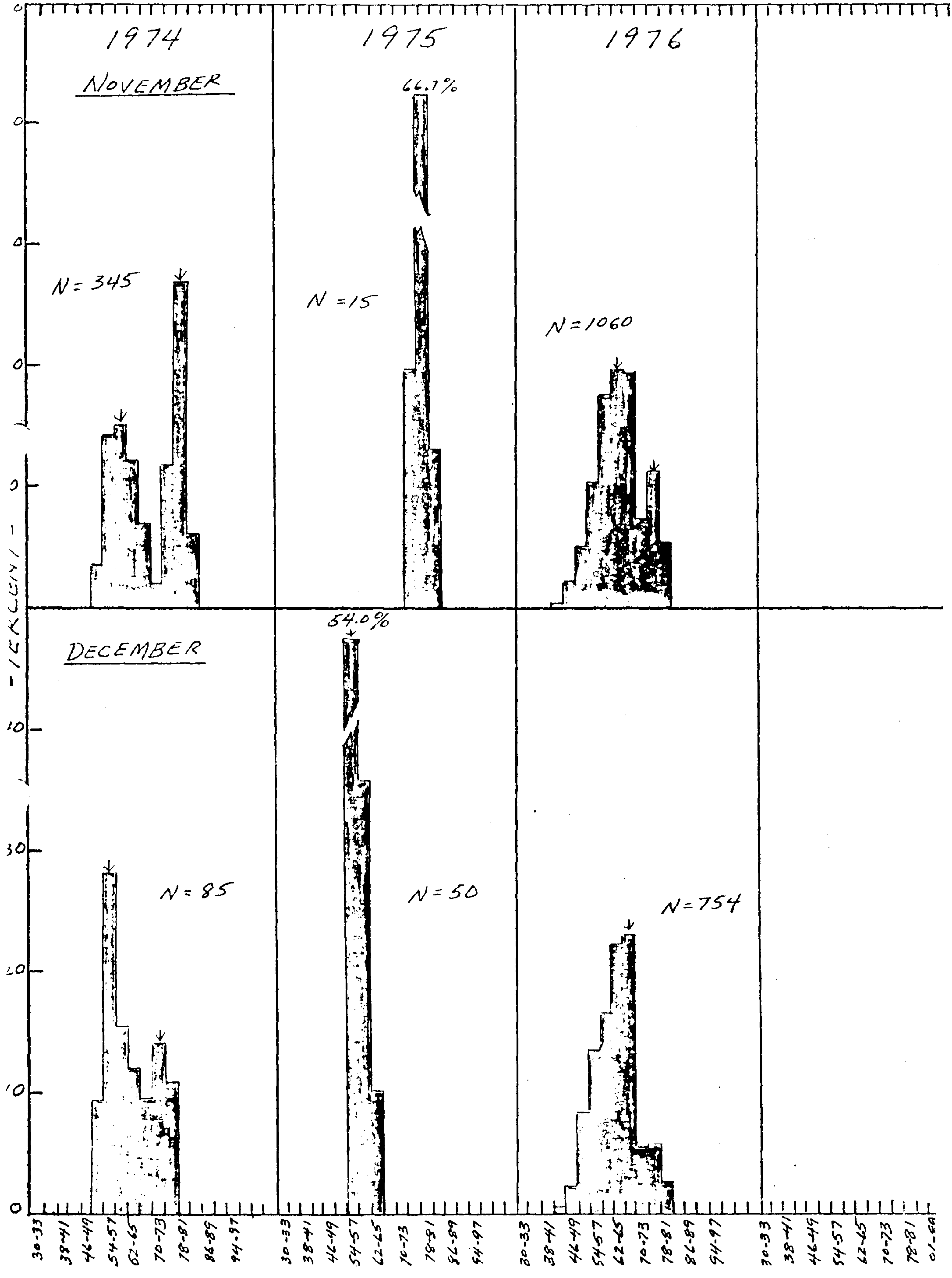
1974
1975
1976
1977
MAY
JUNE
52.8%
N= 322
N- 407
N= 329
N=700
No DATA
N= 438
N= 437
N=2
PERCENT


1974
1975
1976
1977
MAY
JUNE
PERCENT
N= 322
N= 407
N= 329
N=700
52.8%
No DATA
N=438
N=437



1974
1975
1976
1977
JULY
N=736
N=144
N=126
AUGUST
N=695
N=254
N=244
30-33
38-41
46-49
54-57
70-73
78-81
86-89
94-97


1974
1975
1976
SEPTEMBER
OCTOBER
N=337
No DATA
N=381
N=513
N=195
N=317
30-33
38-41
46-49
54-57
62-65
70-73
78-81
86-89
94-97


1974
1975
1976
NOVEMBER
DECEMBER
66.7%
54.0%
N = 345
N = 15
N = 1060
N = 85
N = 50
N = 754
30-33
38-41
46-49
54-57
62-65
70-73
78-81
86-89
94-97
0
10
20
30