NASA Contractor Report 156872

Catalog of Sea State and Wind Speed in the South Atlantic Bight

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Wallops Island, Virginia 23337
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1.0 Introduction

The ability to measure certain ocean wave and wind speed characteristics over large ocean areas and long periods of time could conceivably have significant impact upon open ocean and coastal activities. Ship routing, search and rescue operations, meteorological research, and recreational activities are just a few of the areas where quick and reliable sea state information is desired. With the advent of satellite altimetry, it is now possible to estimate many of these ocean characteristics with surprising accuracy.

Two products which can be estimated from satellite altimetry have particular importance. They are significant wave height (a statistical parameter which relates the height of the ocean waves to mean sea level) and wind speed. Both of these products can be computed on a global basis and in near-real-time.

The GEOS-3 spacecraft (see Figure 1.1) was launched from the Air Force Western Test Range on April 9, 1975. The satellite orbits the earth every 101.8 minutes in a near-circular, 65-degree retrograde orbit. The primary instrument on board the 340 Kg satellite is the radar altimeter, developed for NASA by the General Electric Corporation. The altimeter operates at a frequency of 13.9 GHz, transmitting 100 pulses per second. The pulses transmitted by the altimeter reflect from the earth's surface and are received by the spacecraft. This signal can then be used to precisely determine the altitude of the satellite.

The altimeter is instrumented with 16 sample and hold gates, which provide information about the shape and amplitude of the return waveform. This information can be used to determine

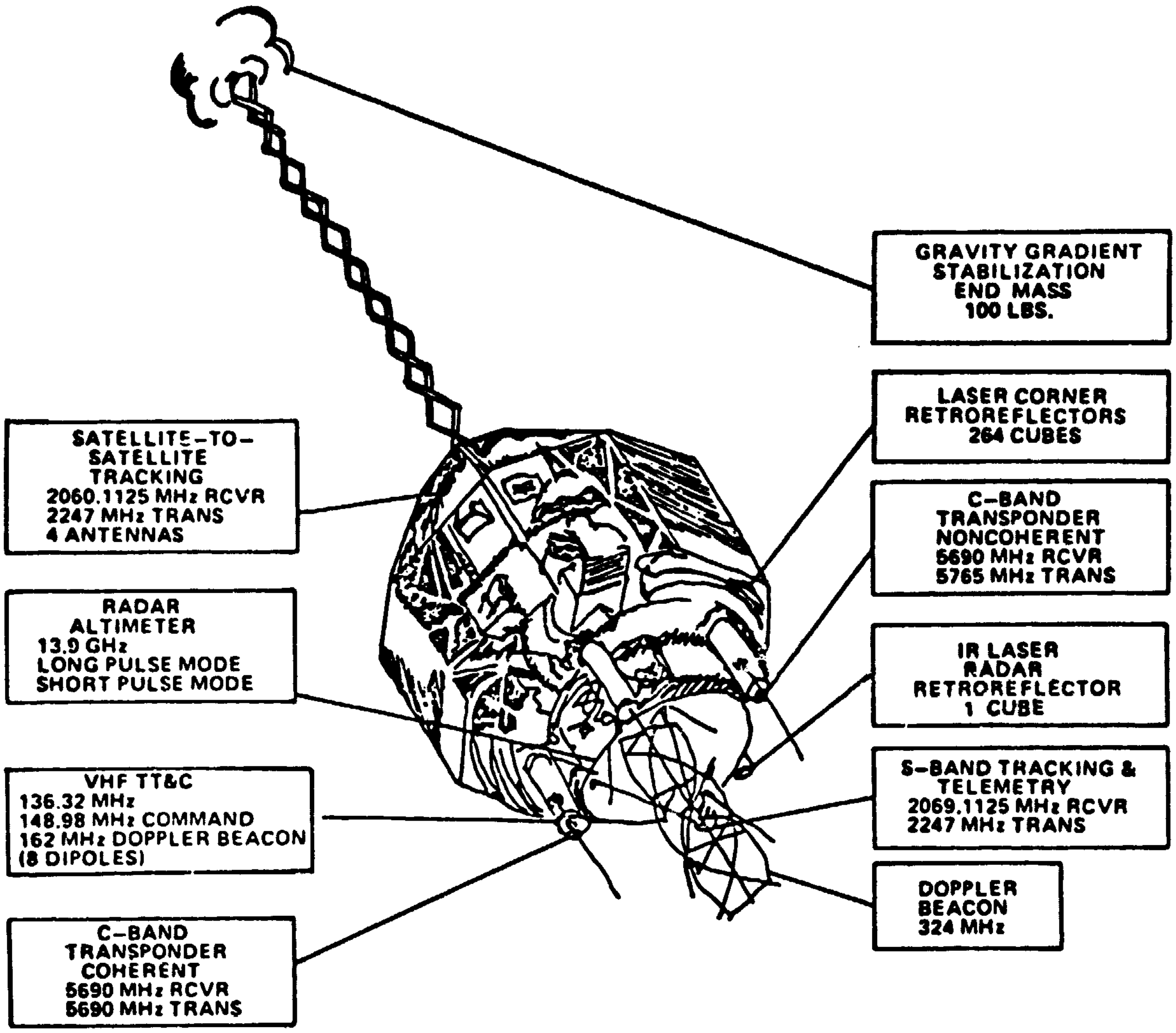


FIGURE 1.1. GEOS–3 SPACECRAFT CUTAWAY

a number of interesting and useful parameters including the spacecraft attitude, water/land and water/ice boundaries, ground wind speed, and significant wave height. Significant wave height and wind speed have been determined in this manner at the Wallops Flight Center (WFC), Wallops Island, Virginia, since the launch of the spacecraft. The estimation algorithms were initially developed and programmed by G. S. Hayne and J. D. McMillan at WFC for use as a quality control check on the GEOS-3 altimeter preprocessing software. The high degree of agreement between these early estimates and ship-based measurements led to various refinements of the algorithm by McMillan and N. A. Roy. Eventually, the estimate was distributed to GEOS-3 principal investigators as an integral part of the altimeter data set.

Various experiments performed at WFC by McMillan and Roy and at other sites by other principal investigators indicated that the GEOS-3 estimate compared favorably with other estimates and measurements of sea state. The first large scale comparison of GEOS-3 SWH data with independently derived sea state information was presented by McMillan and Roy at the GEOS-3 Final Investigators Meeting in New Orleans, Louisiana, in November, 1977. That study presented several variations of the original significant wave height algorithm and estimated the accuracy of the altimeter derived significant wave height to be 55 cm. Other unpublished studies at WFC have estimated the accuracy of the altimeter derived wind speed to be 1 m/sec.

The estimates proved to be so useful that, in 1978, NASA established the GEOS-3 Near-Real-Time Data System for disseminating significant wave height and wind speed estimates. In the near-real-time system, the GEOS-3 data was acquired through the 13 NASA Space Tracking and Data Network locations or the ATS-6 satellite and transmitted to the NASA Goddard Space Flight Center in Greenbelt, Maryland, where it was buffered to magnetic tape in real-time. The buffered data was then transmitted to the Computer Sciences Corporation INFONET center in Beltsville, Maryland, where significant wave height and wind speed were computed and made available to user-supplied terminals on a call-up basis.

2.0 Significant Wave Height Estimation Algorithm

The following section describes the significant wave height algorithm employed in this study.

2.1 Waveform Geometry for Negligible Significant Wave Height

The geometry of a square pulse impinging upon a flat sea surface is illustrated in Figure 2.1. A pulse of duration T leaves the spacecraft (observer) at time $t = 0$ (see Figure 2.2) and traverses a distance H to the sea surface, arriving at time $t = t_1$, where it is reflected back to the satellite at time $t = t_2 = 2t_1$. Therefore

$$t_2 = \frac{2H}{c} \tag{2.1}$$

where c is the speed of light. At $t = t_3 = t_2 + \tau$ where $\tau < T$, the square pulse is observed impinging upon the sea surface, where an expanding circular area is illuminated. The radius r of the area is related to H by

$$r^2 = (H+h)^2 - H^2 = 2Hh + h^2 \approx 2Hh \tag{2.2}$$

since $h^2 << 2Hh$. The time $t = t_3$ is given by

$$t_3 = t_2 + \tau = \frac{2H}{c} + \tau \tag{2.3}$$

and corresponds to the two-way travel time between the satellite and point P on the surface. Therefore

$$\frac{1}{2}\left(\frac{2H}{c} + \tau\right) = \frac{H + h}{c} \tag{2.4}$$

or

$$\frac{H}{c} + \frac{\tau}{2} = \frac{H}{c} + \frac{h}{c} \tag{2.5}$$

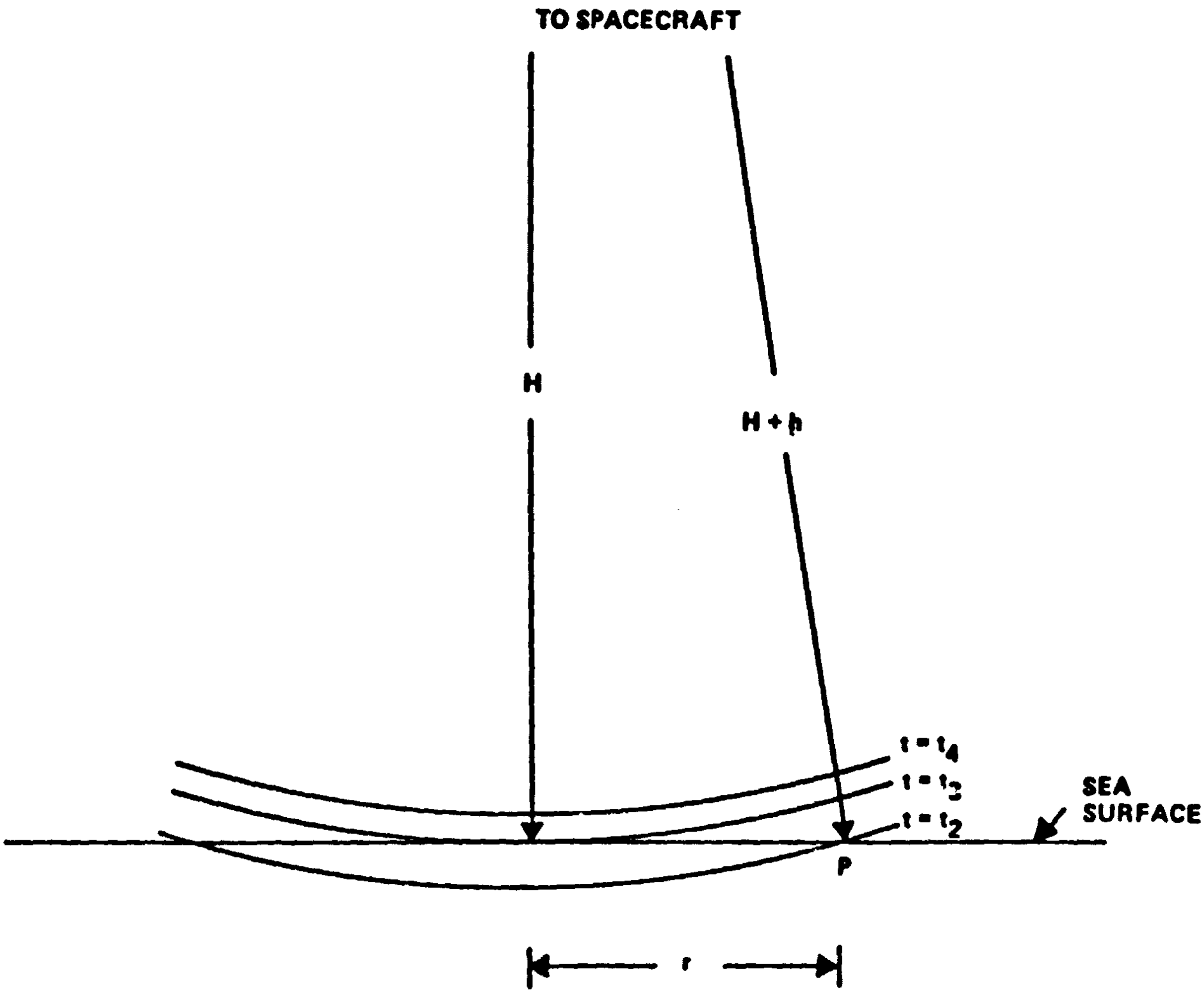


FIGURE 2.1. SQUARE PULSE IMPINGING UPON A FLAT SEA SURFACE

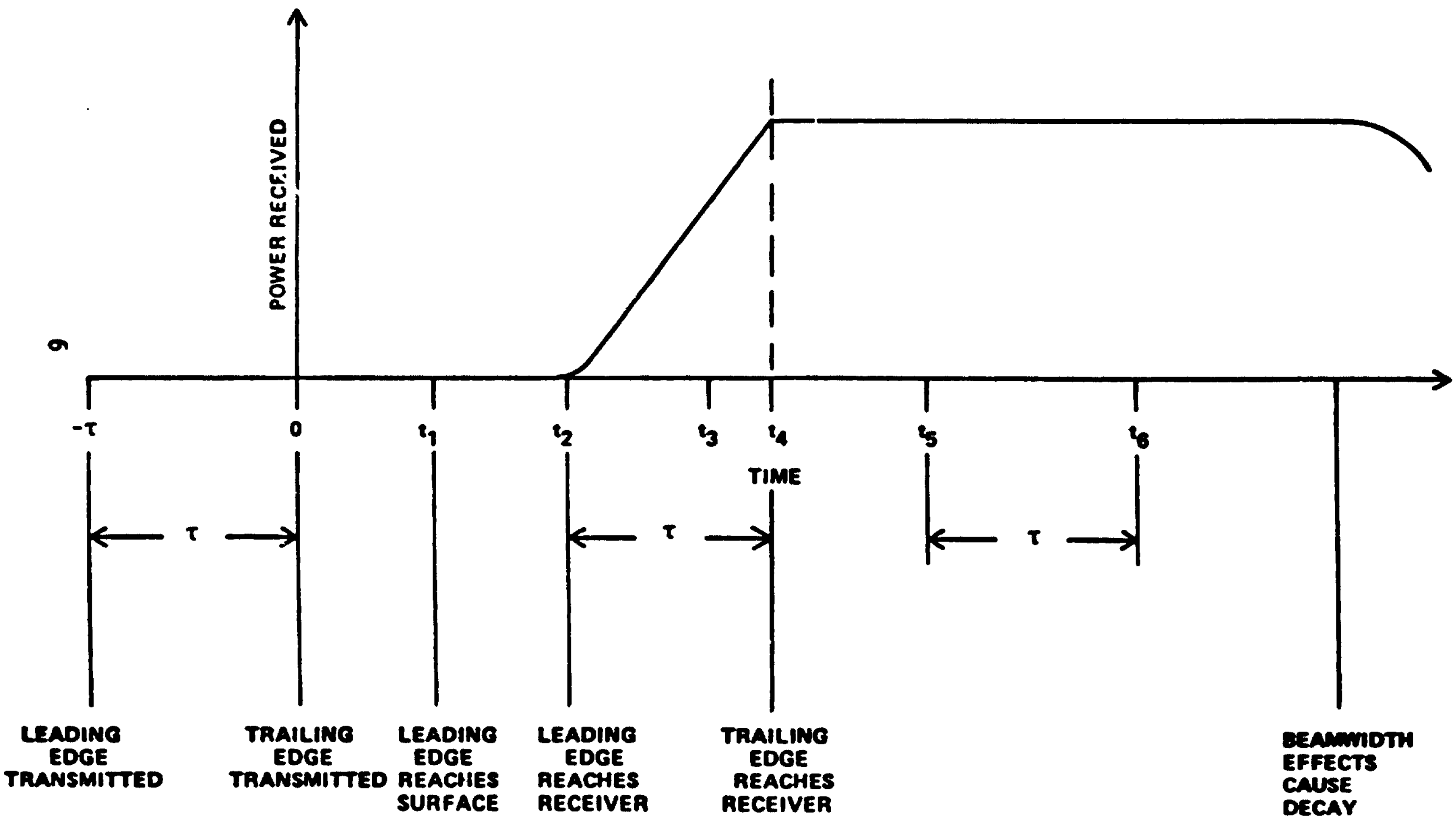


FIGURE 2.2 IDEALIZED MEAN RETURN PULSE SHAPE

which yields

$$h = \frac{c\tau}{2} \tag{2.6}$$

Combining Equations (2.2) and (2.6) yields

$$r^2 = Hc\tau \tag{2.7}$$

and the area of the illuminated region is given by

$$a = \pi r^2 = \pi Hc\tau \tag{2.8}$$

Note that the observed area of the illuminated region, or equivalently the power received by the satellite, increases linearly with time.

When t becomes greater than t_4, the trailing edge of the pulse has reached the sea surface and the area illuminated becomes an annulus with inner radius r_5 and outer radius r_6 given by

$$r_5^2 = Hct_5 \tag{2.9}$$

$$r_6^2 = Hct_6 \tag{2.10}$$

and width W and area A given by

$$W = r_6 - r_5 = \sqrt{Hct_6} - \sqrt{Hct_5} \tag{2.11}$$

$$A = \pi r_6^2 - \pi r_5^2 = \pi Hc(t_6 - t_5) = \pi HcT \tag{2.12}$$

Since the area of the annulus remains constant, the power received at the satellite remains constant until antenna beamwidth effects cause the power received to decay.

The character of a square pulse impinging upon a sea surface with negligible SWH as seen from the satellite can be summarized as follows:

1. no power is received until the leading edge of the pulse is observed striking the sea surface

2. after the leading edge of the pulse reaches the surface and before the trailing edge does, the power received increases linearly with time

3. after the trailing edge of the pulse reaches the surface, the power received remains at a constant plateau value

4. after the antenna beamwidth effects become non-negligible, the power received begins to decay.

These four stages are depicted in Figure 2.2, which represents the mean return pulse shape. Due to the nature of the altimeter, the instantaneous power received fluctuates, making it necessary to average a number of pulses in order to determine the mean pulse shape.

The GEOS-3 satellite receives the return pulses in 16 waveform sampling gates. These 16 values, called Instantaneous Return Samples or IRS's, are collected 100 times per second by the satellite and averaged on-board in an attempt to construct an accurate representation of the mean pulse shape. The 16 values of average IRS's are called Average Return Samples or ARS's and are computed using an exponentially decaying averaging technique over a period of approximately 2 seconds. It is the slope of the ARS's which is examined to determine significant wave height.

2.2 Waveform Geometry for Non-negligible Significant Wave Height

In the case where a square pulse impinges upon an ocean surface with non-negligible significant wave height, the shape of the mean return pulse will be altered. The geometry of a sea surface with non-negligible significant wave height is illustrated in Figure 2.3. Note that the crests of the waves are illuminated prior to the time at which the calm sea would have been illuminated. Similarly, the troughs of the

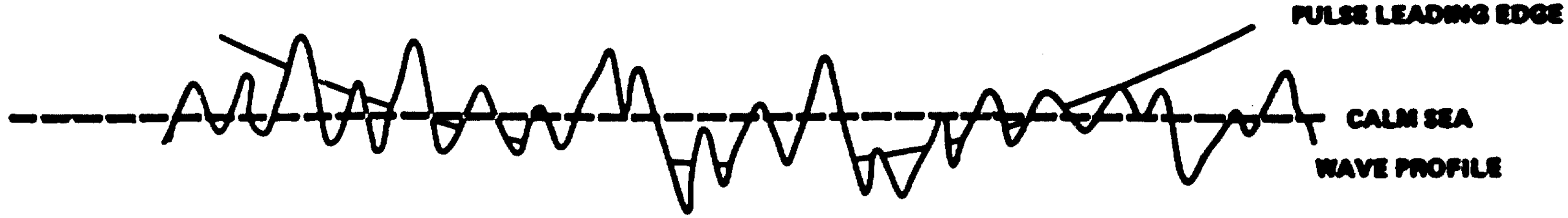


FIGURE 2.3. SQUARE PULSE IMPINGING UPON A ROUGH SEA SURFACE

waves are not illuminated until after the time at which the calm sea would have been illuminated. The net result of these effects is that the mean power received for non-negligible sea state does not reach its full plateau value until after the time at which the mean power received from a calm sea reaches its plateau values.

The leading edge of the mean pulse shape for several non-negligible sea states is characterized in Figure 2.4. From this figure it can be seen that the slope of the mean return pulse is related to significant wave height. If the mean pulse shape for negligible sea state was known precisely, then the significant wave height could be determined by analyzing the departure of the mean return pulse for the non-negligible sea state from the mean return pulse shape for calm sea.

2.3 Choice of Model

It can be shown (see for example Brown, 1977) that the mean return waveform can be conceived of as a convolution of

1. the composite of the transmitted pulse and transmitter and receiver bandwidth effects,

2. the non-coherent surface (calm sea) impulse response,

3. the ocean surface height probability density function, and

4. the tracking loop jitter.

The first and third components can be modeled as Gaussian distributions, the second component can be modeled as a step function, and the fourth component is assumed to be unaffected by sea state.

Assuming that pointing angle errors have negligible effect upon the leading edge of the waveform, Brown and Miller (1974) have shown that a Gaussian function

$$y(t) = a\, P\left(\frac{t-b}{c}\right) + d \qquad (2.13)$$

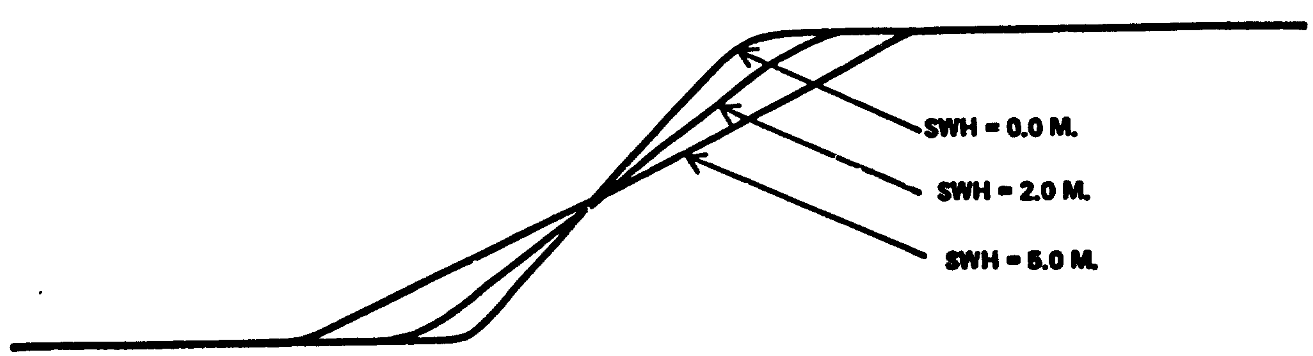


FIGURE 2.4. IDEALIZED MEAN RETURN PULSE SHAPE FOR SEVERAL VALUES OF SWH

where

a = return waveform amplitude
b = time origin
c = return waveform risetime
d = return waveform baseline amplitude

and

$$P(z) = \int_{-\infty}^{z} Z(q)dq$$

$$Z(q) = \frac{1}{\sqrt{2\pi}} \exp(-q^2/2)$$

is a good approximation of the return power as a function of time. Therefore, it is necessary to estimate the four parameters a, b, c, and d from which the slope of the return waveform, and in turn significant wave height, can be determined. The technique used to estimate the four-parameter function y(t) is the method of least squares.

2.4 Derivation

Equation (2.13) can be expanded in a Taylor Series about a point $y_o = y(a_o, b_o, c_o, d_o, t)$ to yield

$$\bar{y}_i = y_o + y_a(a-a_o) + y_b(b-b_o) + y_c(c-c_o) + y_d(d-d_o) \quad (2.14)$$

where

$$y_a = \frac{\partial y}{\partial a}\bigg|_{y=y_o} = P\left(\frac{t-b_o}{c_o}\right) \quad (2.15)$$

$$y_b = \frac{\partial y}{\partial b}\bigg|_{y=y_o} = -\frac{a_o}{c_o} Z\left(\frac{t-b_o}{c_o}\right) \quad (2.16)$$

$$y_c = \frac{\partial y}{\partial c}\bigg|_{y=y_o} = -\frac{a_o}{c_o}\left(\frac{t-b_o}{c_o}\right) Z\left(\frac{t-b_o}{c_o}\right) \quad (2.17)$$

$$y_d = \frac{\partial y}{\partial d}\bigg|_{y=y_o} = 1 \quad (2.18)$$

The traditional least squares estimate of $y(t)$ is obtained by minimizing the sum of the errors squared

$$E = \Sigma(\bar{y}_i - y_i)^2 \tag{2.19}$$

with respect to $(a-a_0)$, $(b-b_0)$, $(c-c_0)$, and $(d-d_0)$. When this is done, the following equations are generated:

1. $$\frac{\partial E}{\partial(a-a_0)} = 0 = 2\Sigma(\bar{y}_i - y_i)\,\frac{\partial(\bar{y}_i - y_i)}{\partial(a-a_0)} = 2\Sigma(\bar{y}_i - y_i)y_a$$

$$0 = \Sigma y_0 y_a + \Sigma y_a^2(a-a_0) + \Sigma y_a y_b(b-b_0) + \Sigma y_a y_c(c-c_0) +$$

$$\Sigma y_a y_d(d-d_0) - \Sigma y_i y_a \tag{2.20}$$

2. $$\frac{\partial E}{\partial(b-b_0)} = 0 = 2\Sigma(\bar{y}_i - y_i)\,\frac{\partial(\bar{y}_i - y_i)}{\partial(b-b_0)} = 2\Sigma(\bar{y}_i - y_i)y_b$$

$$0 = \Sigma y_0 y_b + \Sigma y_a y_b(a-a_0) + \Sigma y_b^2(b-b_0) + \Sigma y_b y_c(c-c_0) +$$

$$\Sigma y_b y_d(d-d_0) - \Sigma y_i y_b \tag{2.21}$$

3. $$\frac{\partial E}{\partial(c-c_0)} = 0 = 2\Sigma(\bar{y}_i - y_i)\,\frac{\partial(\bar{y}_i - y_i)}{\partial(c-c_0)} = 2\Sigma(\bar{y}_i - y_i)y_c$$

$$0 = \Sigma y_0 y_c + \Sigma y_a y_c(a-a_0) + \Sigma y_b y_c(b-b_0) + \Sigma y_c^2(c-c_0) +$$

$$\Sigma y_c y_d(d-d_0) - \Sigma y_i y_c \tag{2.22}$$

4. $\frac{\partial E}{\partial(d-d_o)} = 0 = 2\Sigma(\bar{y}_i-y_i)\frac{\partial(\bar{y}_i-y_i)}{\partial(d-d_o)} = 2\Sigma(\bar{y}_i-y_i)y_d$

$$0 = \Sigma y_o y_d + \Sigma y_a y_d(a-a_o) + \Sigma y_b y_d(b-b_o) + \Sigma y_c y_d(c-c_o) +$$

$$\Sigma y_d^2(d-d_o) - \Sigma y_i y_d \quad (2.23)$$

These four equations can be expressed in matrix form as

$$\begin{bmatrix} \Sigma y_a^2 & \Sigma y_a y_b & \Sigma y_a y_c & \Sigma y_a y_d \\ \Sigma y_a y_b & \Sigma y_b^2 & \Sigma y_b y_c & \Sigma y_b y_d \\ \Sigma y_a y_c & \Sigma y_b y_c & \Sigma y_c^2 & \Sigma y_c y_d \\ \Sigma y_a y_d & \Sigma y_b y_d & \Sigma y_c y_d & \Sigma y_d^2 \end{bmatrix} \begin{bmatrix} a-a_o \\ b-b_o \\ c-c_o \\ d-d_o \end{bmatrix} = \begin{bmatrix} \Sigma y_a(y_i-y_o) \\ \Sigma y_b(y_i-y_o) \\ \Sigma y_c(y_i-y_o) \\ \Sigma y_d(y_i-y_o) \end{bmatrix} \quad (2.24)$$

Note that in order to solve for a, b, c, and d, a 4 x 4 symetric matrix must be inverted.

The convolution model for the mean return waveform assumes that the risetime parameter, c, is a composite of two Gaussian distributions: the calm sea pulsewidth, σ_c, and the rough sea rms, σ_s, both expressed in nanoseconds. Since the convolution of two Gaussian distributions is itself a Gaussian distribution,

$$c^2 = \sigma_s^2 + \sigma_c^2 \quad (2.25)$$

The significant wave height is defined as four times the rms sea height relative to mean sea level. Conversion to units of meters by multiplying by the two-way speed of light yields

$$SWH = 4\sigma_s = 0.6\sqrt{c^2 - \sigma_c^2} \quad (2.26)$$

The implementation of the estimation algorithm proceeds as follows:

1. Provide initial guesses for a_0, b_0, c_0, and d_0

2. Estimate a, b, c, and d using Equation (2.24)

3. Compute the relative errors $\frac{a-a_0}{a_0}$, $\frac{b-b_0}{b_0}$, $\frac{c-c_0}{c_0}$, and $\frac{d-d_0}{d_0}$

4. If the relative errors have converged, go to Step #6

5. Replace a_0, b_0, c_0, and d_0 with the new estimates of a, b, c, and d and return to Step #2

6. Compute significant wave height using Equation (2.26).

2.5 Convergence Considerations

Significant wave height has been computed on thousands of passes of GEOS-3 data and it has been found that the algorithm typically converges within 2 or 3 iterations. In addition, it has been determined that the final converged estimate of significant wave height is not particularly sensitive to the initial guesses of a_0, b_0, c_0, and d_0. In practice, the same initial guesses are used for all passes. For each significant wave height estimate after the first frame of data, the converged values of a, b, c, and d for the previous frame of data are used as the initial guesses for a_0, b_0, c_0, and d_0.

As was discussed in Section 2.2, it is necessary to have an accurate estimate of the calm sea pulse width in order to calculate significant wave height using Equation (2.26). Early in the GEOS-3 mission, many arcs of the satellite which passed over areas where ship measurements indicated calm seas were analyzed in order to determine that value of σ_c which would yield an estimate of SWH = 0 for those passes. The value arrived at was

$$\sigma_c = 7.49 \text{ nanoseconds} \tag{2.27}$$

This value has been examined in the McMillan/Roy investigation and found to be accurate.

Due to the electronic characteristics of the altimeter, the mean return waveform represented by the ARS's contains noise. Waveforms from two adjacent data frames can differ substantially, even though the altimeter is receiving data from ocean areas only a few kilometers apart. This fact, combined with the inherent errors introduced in the estimation process, can produce an estimate of c which causes the term under the radical in Equation (2.26) to become negative. This is especially true when the sea state is very calm.

Figure 2.5 illustrates the algebraic relationship between significant wave height and the estimated value of c. It should be noted that for moderate values of significant wave height, small errors in the estimate of c do not cause large errors in the calculated value of significant wave height. However, the estimate of significant wave height is very sensitive to even small errors in c for calm seas.

When the noise characteristics of the altimeter, the estimation errors, and the algebraic sensitivity of the estimate to c are combined, it is obvious that smoothing the estimate should provide more confidence in its accuracy, especially when the sea state is calm. Empirical studies indicated that the longest segment over which the return pulse can be assumed to be correlated is approximately 140 kilometers (or 21 seconds), a sliding 21-second rectangular filter has been employed by the significant wave height estimation software. Either the estimate of c or the calculated value of significant wave height can be smoothed and the results were shown by McMillan and Roy (1977) to be nearly identical. For computational ease, the estimate of c is smoothed in this investigation. Even when the estimate is smoothed, the term under the radical in Equation (2.26) can still occasionally become negative. Such cases have no physical meaning and a value of SWH = 0 is assumed.

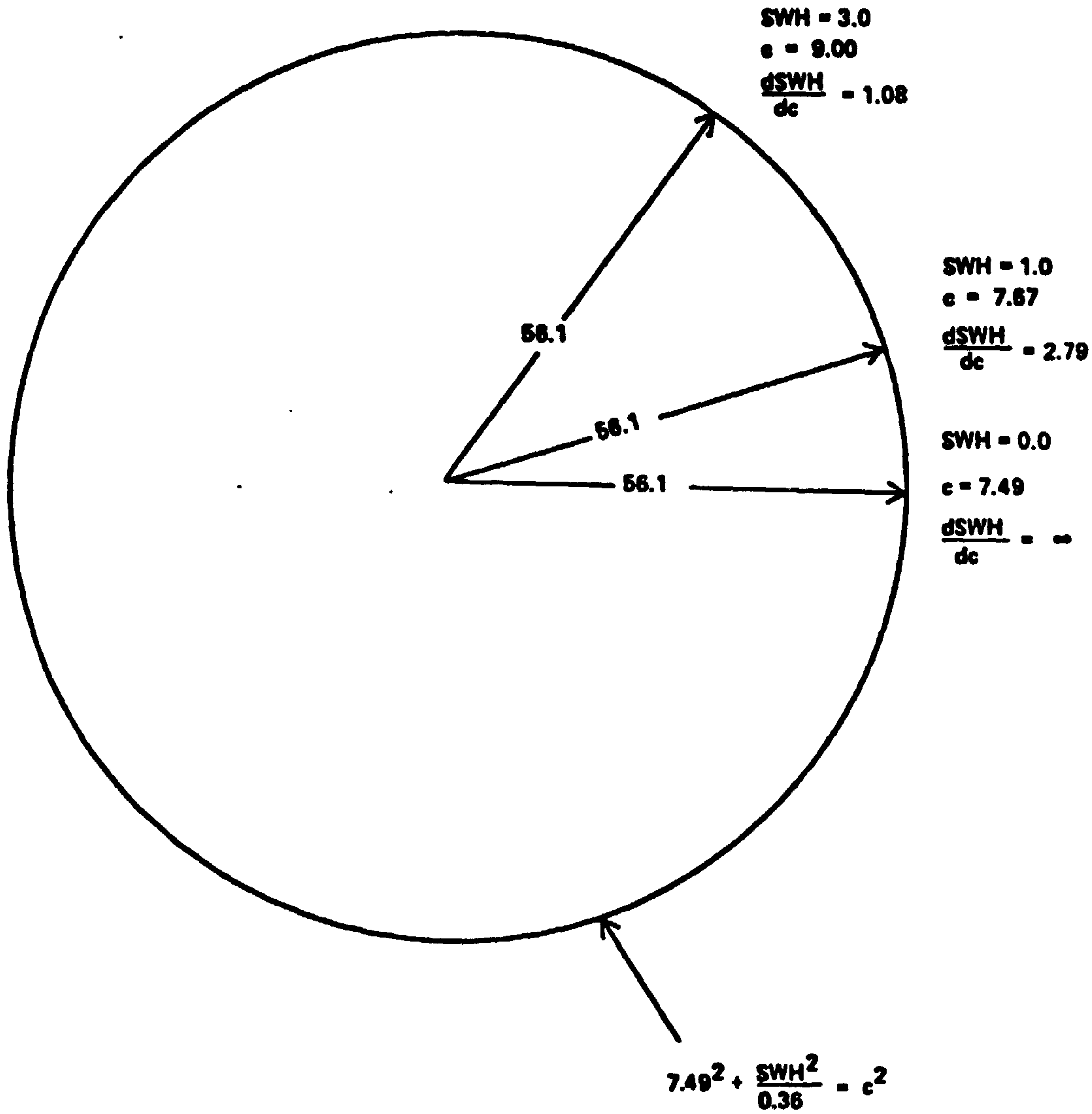


FIGURE 2.5. GEOMETRIC RELATIONSHIP BETWEEN SWH AND ESTIMATED VALUE OF c

The first few weeks after the launch of GEOS-3 were designated as the calibration phase of the mission and were designed to eliminate known errors and inconsistencies in the preprocessing of the altimeter data. During this phase, it was determined that two important corrections needed to be made to the ARS's. First, the 16 sample and hold gates should not have been assumed to be equally spaced in time. Accordingly, General Electric supplied WFC with the timing corrections necessary to properly time tag the ARS's. Second, it became evident that amplitude biases needed to be determined for the gates. In subsequent weeks, several sets of ARS amplitude biases were determined by Hayne and by E. J. Walsh at WFC. McMillan and Roy (1977) determined that the most consistent agreement between the estimated value of significant wave height and ship measurements of significant wave height was produced when the Walsh amplitude biases were employed.

The algorithm drived in this section, together with the smoothing technique and ARS timing and amplitude bias corrections detailed above, has been in use at the Wallops Island facility in preprocessing the GEOS-3 altimeter data since July of 1975. The same techniques were used by the Goddard Space Flight Center in establishing the near-real-time data network in March of 1978.

3.0 Wind Speed Estimation Algorithm

A widely used parameter in the analysis of radar returns is σ_0, which is the radar backscattering per unit scattering area and is a measure of how good a radar reflector the surface is. It has been shown (NASA, 1978) that $\sigma_0(0°)$, which is the value of σ_0 for no off-nadir pointing angle, may be written as

$$\sigma_0(0°) = \alpha \frac{R(0°)^2}{\overline{\zeta^2_{\ell r}}} \quad (3.1)$$

where α is a constant of proportionality which depends upon the density of the slopes of the filtered surface, $R(0°)^2$ is the Fresnel power reflection coefficient for the sea at normal incidence and 13.9 GHz, and $\overline{\zeta^2_{\ell r}}$ is the mean square slope of the filtered surface, which can be logarithmically related to the wind speed, W, by

$$\overline{\zeta^2_{\ell r}} = a \ln W + b \quad (3.2)$$

Assuming that α remains essentially unchanged with variations in wind speed,

$$\sigma_0(0°) = \frac{R_0(0°)^2}{A \ln W + B} \quad (3.3)$$

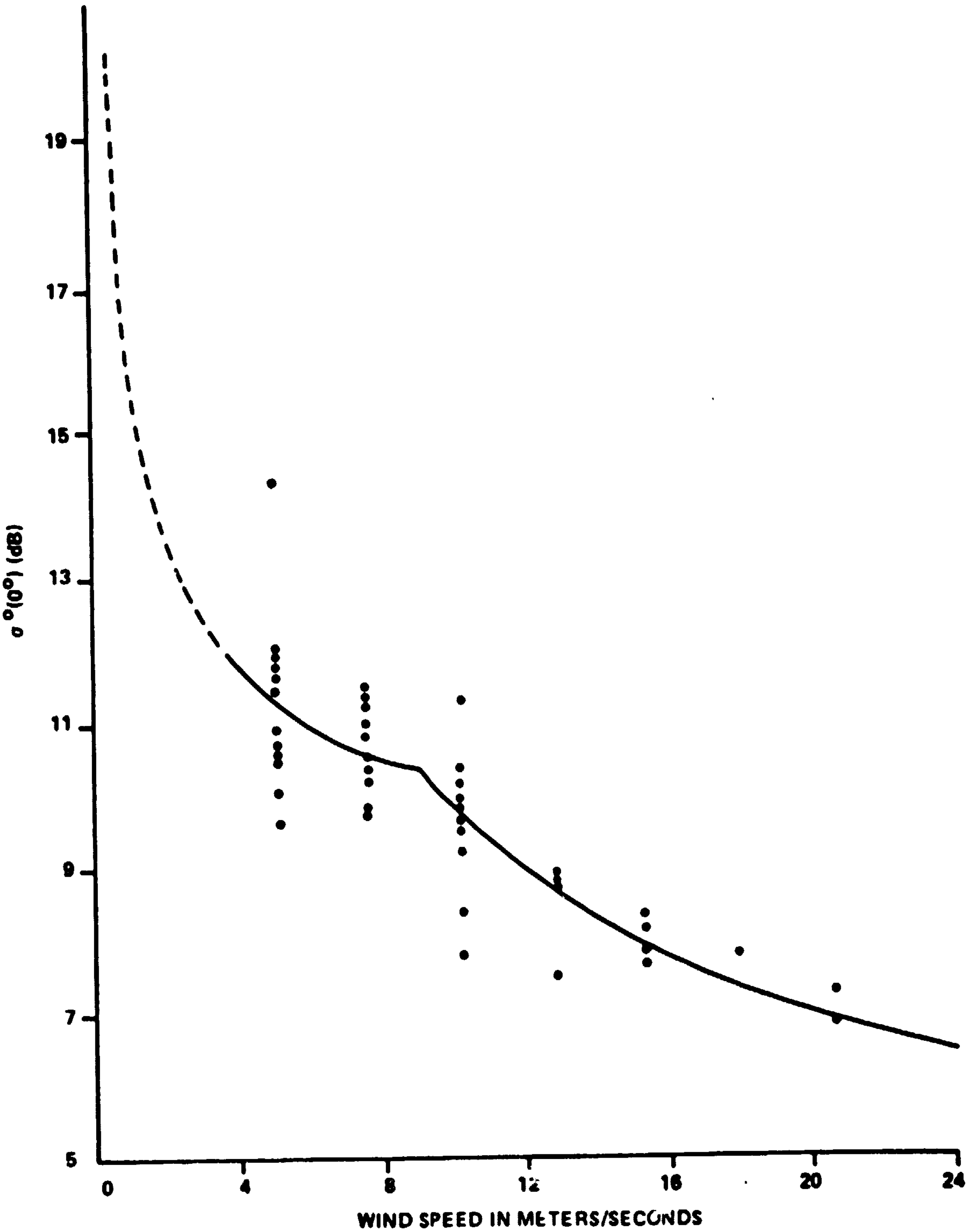
Rearranging terms and using -2.1 dB for $R_0(0°)^2$

$$W = \exp\left(\frac{10^{-x} - B}{A}\right) \quad (3.4)$$

where $x = \frac{\sigma_0(0°) + 2.1}{10}$ and $\sigma_0(0°)$ is given in dB. The linear coefficients A and B were determined by fitting a curve to the GEOS-3 $\sigma_0(0°)$ estimates where ground truth knowledge of wind speed was available. This data, shown in Figure 3.1, suggests the use of a cusped curve. The least squares determination of these constants yielded (Brown, 1978):

	W < 9.2 m/sec	W > 9.2 m/sec
A	0.02098	0.08289
B	0.01075	-0.12664

Figure 3.1. σ_o (0°) vs. Wind Speed



Thus, using Equation (3.4), wind speed can be determined solely as a function of $\sigma_0(0°)$. It should be noted, however, that the received power drops in a predictable manner as the satellite pointing angle varies from nadir. Since the GEOS-3 pointing angle varies by as much as 0.8°, this effect must be accounted for in the calculation of σ_0. Brown and Curry (1977) developed a scheme for correcting σ_0 for pointing angle variations and that scheme has been implemented in the wind estimation algorithm.

3.1 Wind Development Factor

The wave development factor, γ, a function of the computed significant wave height and wind speed, is given by

$$\gamma = 138.44 \sqrt[3]{\frac{\text{significant wave height}}{(\text{windspeed})^2}} \tag{3.5}$$

Although the wave development factor is useful in determining if the wave height is primarily wind-driven or swell, it is not calculated separately here since it can be computed directly as a function of the wind speed and significant wave height estimates given in the report. Generally, if the wave development factor is less than 50, the waves are considered to be wind-driven. For additional information, see Parsons, 1979.

4.0 Altimeter Data Set

For the purpose of this investigation, it has been necessary to select passes of GEOS-3 altimeter passes whose ground tracks enter the BLM coverage area (see Figure 4.1), which comprises the area from latitude 27° to 35°N and longitude from the U. S. coastline to 76°W. In addition, for significant wave height estimation, the altimeter must be operating in a mode which allows significant wave height to be computed.

After the altimeter passes, which enter one or more of the BLM search areas, are identified, it is necessary to ascertain the altimeter status and telemetry mode of the data. The telemetry mode can be

BLM INVESTIGATION AREAS

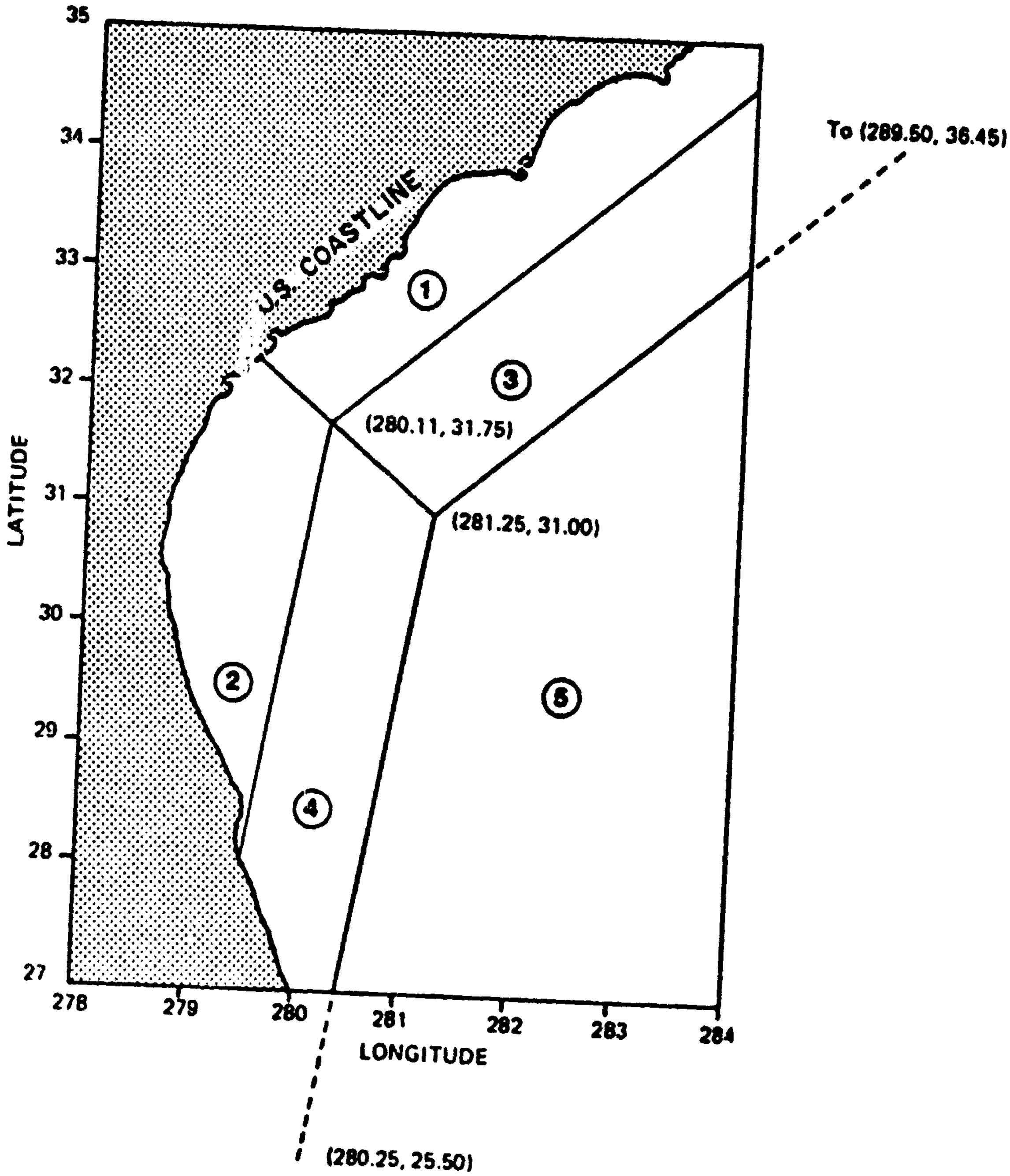


Figure 4.1

1. Global
2. Intensive (no waveforms)
3. Intensive (8 waveforms)
4. Intensive (16 waveforms)

If the altimeter is operating in global mode, no waveform information is reported so that significant wave height cannot be estimated. If the altimeter is operating in intensive mode, waveform information may or may not be reported. Since all 16 ARS's are required in order to estimate significant wave height, only intensive mode with 16 waveforms can be accepted for the computation of significant wave height. All telemetry modes can be used to calculate wind speed. Additionally, any passes whose altimeter status word indicates that the altimeter is not locked in the tracking mode (this usually occurs during and shortly after the time when the satellite passes over land) cannot be included in the altimeter data set.

5.0 Significant Wave Height Histograms

The histograms for significant wave height are presented in the following section. In each figure, the axis of abscissa is graduated in units of meters and the axis of ordinate is graduated in percent. In addition, each element of the histogram is labeled with the actual number of samples included in the element and each figure contains the number of points in the distribution as well as the mean and standard deviation of the distribution.

The histograms for each of the five BLM areas and a composite histogram of all five areas are given for

1) each month (composite of all years),
2) each season (composite of all years), and
3) the entire mission

For the seasonal histograms, winter is defined as December, January, and February; spring is defined as March, April, and May; summer is defined as June, July, and August; and fall is defined as September, October, and November.

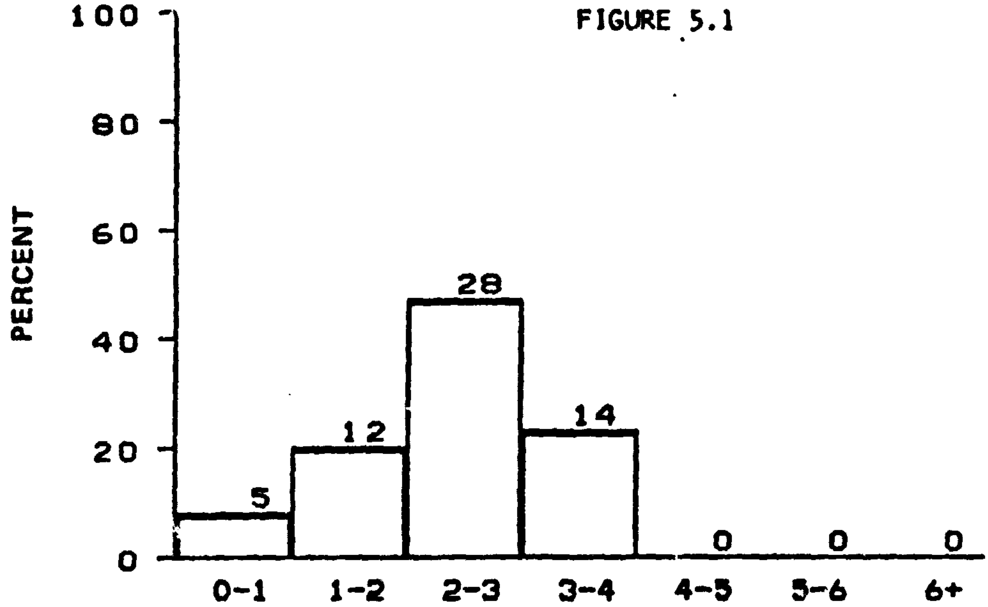
The monthly histograms for each of the five BLM areas have too few points to be considered as statistically valid distributions. In several cases, the number of points in the distribution for an entire month is only on the order of 50. Since each point could represent a time interval as small as 2.0 seconds, such a distribution is likely to have contained only four or five passes. This is obviously insufficient information from which to determine the significant wave height distribution for an entire month. It is therefore impossible to characterize any differences between the BLM areas that might be present by analyzing the monthly histograms.

The monthly composite histograms of all five BLM areas do contain some useful information. For example, it can be seen by looking at the monthly composite histograms that 70 to 80 percent of the significant wave height estimates lie between 1 and 3 meters and that this percentage stays fairly constant throughout the entire year. Furthermore, the 1 to 2 meter range contains slightly more points than the 2 to 3 meter range except for the months roughly corresponding to the winter season. This conclusion can be verified by looking at the seasonal histograms.

The seasonal histograms for the individual BLM investigation areas contain sufficient points to be considered statistically valid distributions. The seasonal histograms for the composite of all the BLM areas are of particular interest. These figures indicate that the mean significant wave height for the entire BLM investigation area oscillates around 2 meters, dropping to 1.8 meters in the summer and peaking at 2.2 meters in the winter.

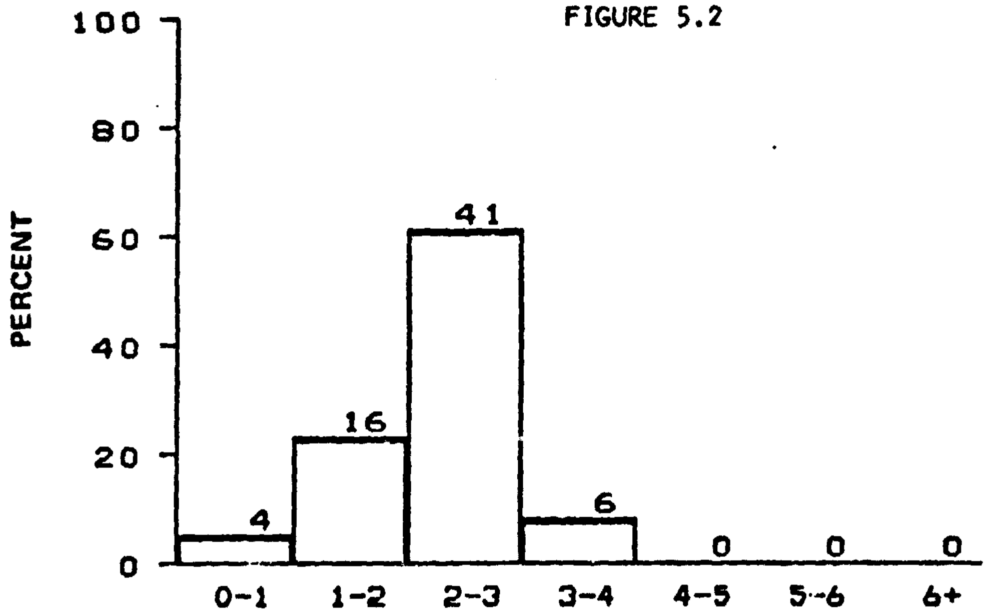
The histograms for the entire mission are presented at the end of this section. Examination of these histograms yields some subtle differences between the histograms of different areas. Nevertheless, the distributions are so similar that any conclusions to be drawn from their differences would appear to be strictly speculation.

FIGURE 5.1



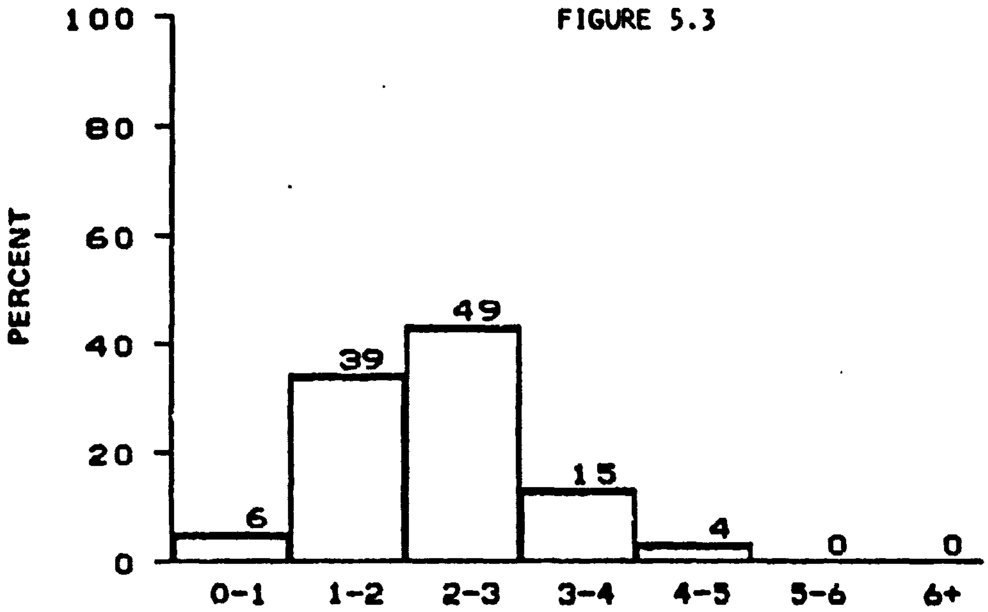
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF JANUARY
BLM AREA #1
N = 59, MEAN = 2.4, SIGMA = 0.87

FIGURE 5.2



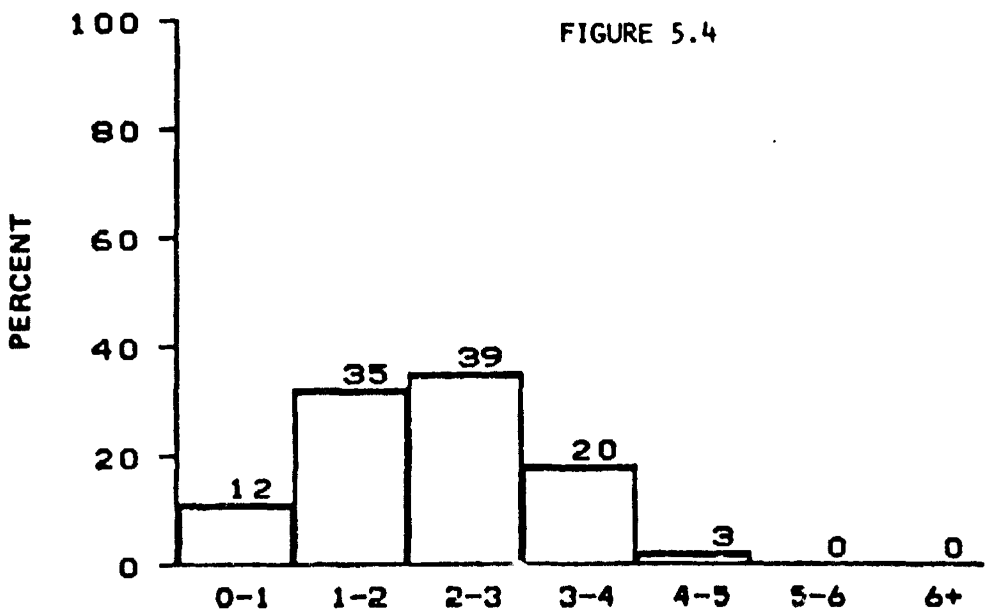
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF JANUARY
BLM AREA #2
N = 67, MEAN = 2.2, SIGMA = 0.70

FIGURE 5.3

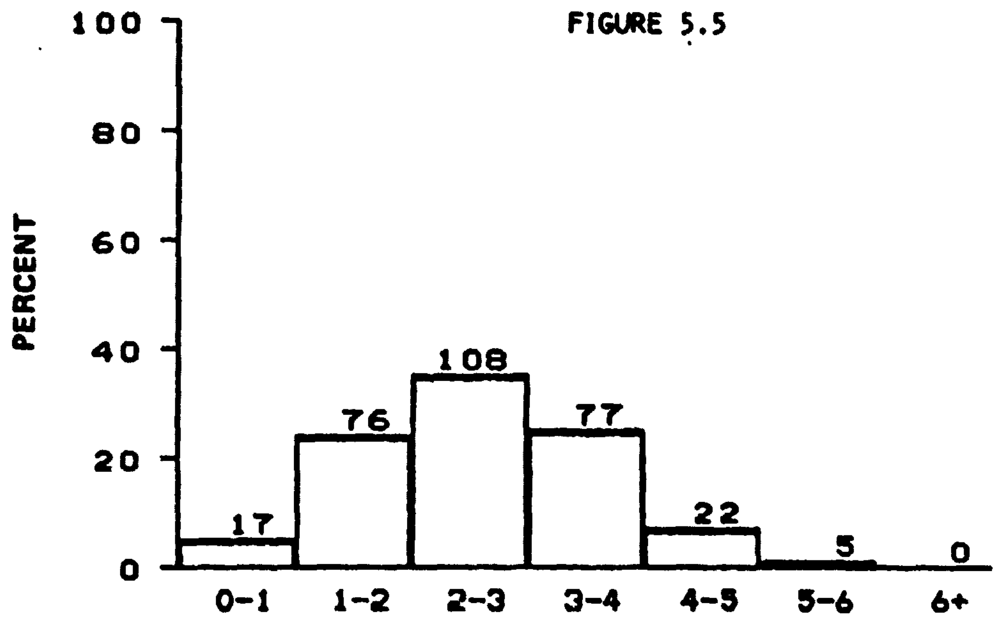


DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF JANUARY
BLM AREA #3
N = 113, MEAN = 2.3, SIGMA = 0.88

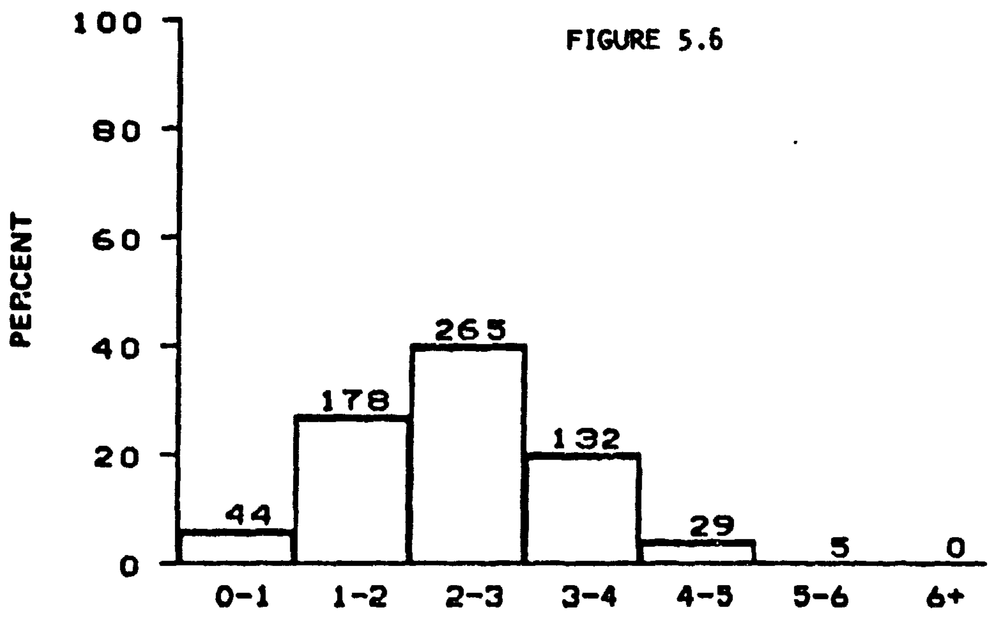
FIGURE 5.4



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF JANUARY
BLM AREA #4
N = 109, MEAN = 2.2, SIGMA = 0.98



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF JANUARY
BLM AREA #5
N = 305, MEAN = 2.6, SIGMA = 1.1



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF JANUARY
ALL BLM AREAS
N = 653, MEAN = 2.4, SIGMA = 0.99

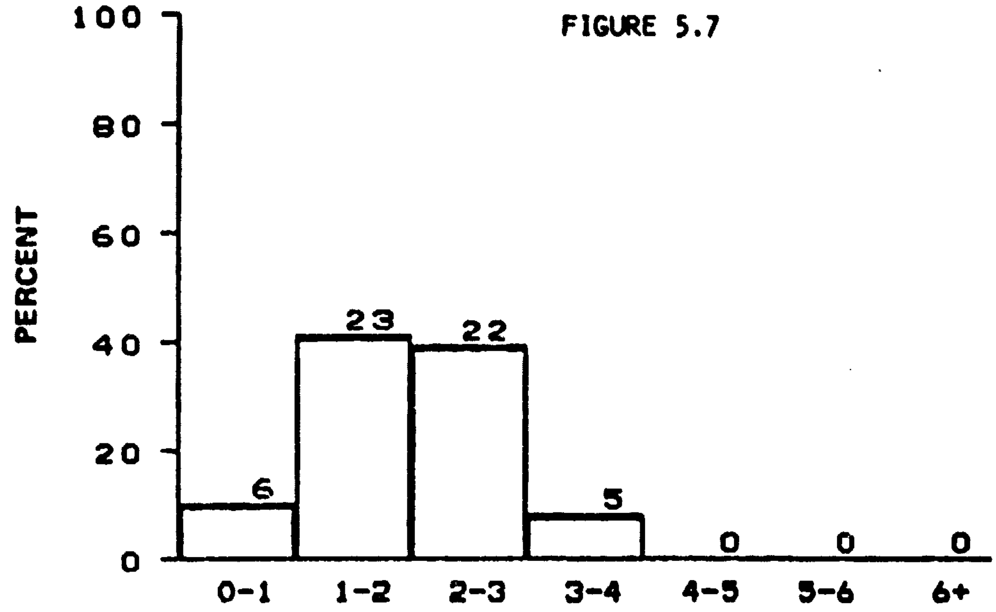


FIGURE 5.7

DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF FEBRUARY
BLM AREA #1
N = 56, MEAN = 2.0, SIGMA = 0.80

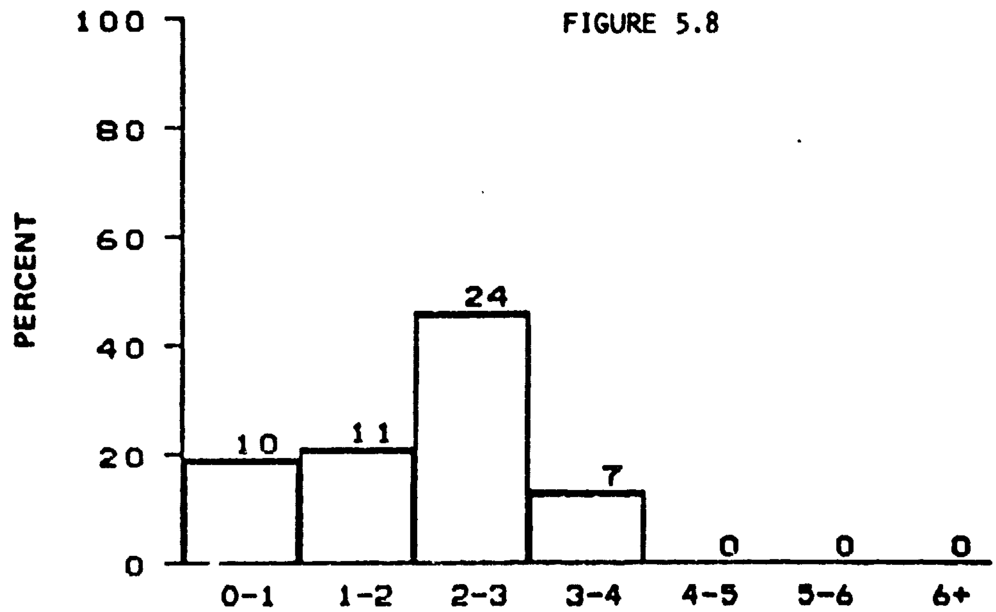
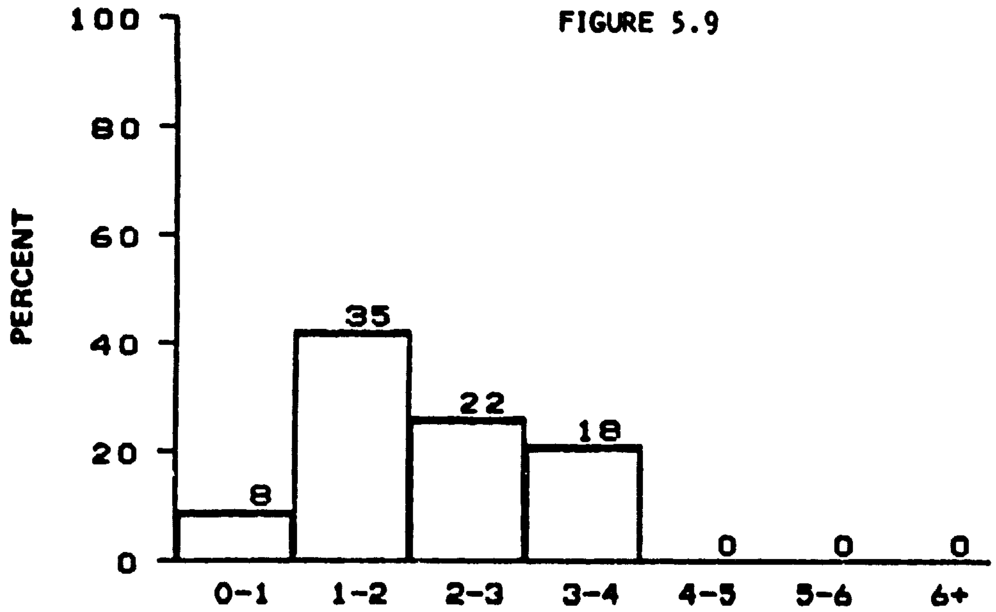


FIGURE 5.8

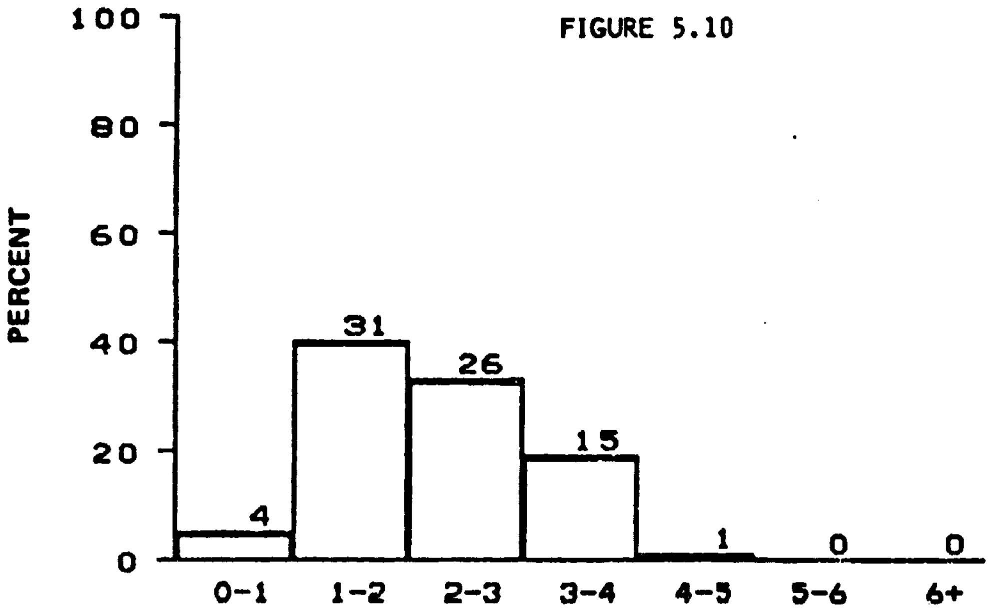
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF FEBRUARY
BLM AREA #2
N = 52, MEAN = 2.0, SIGMA = 0.95

FIGURE 5.9

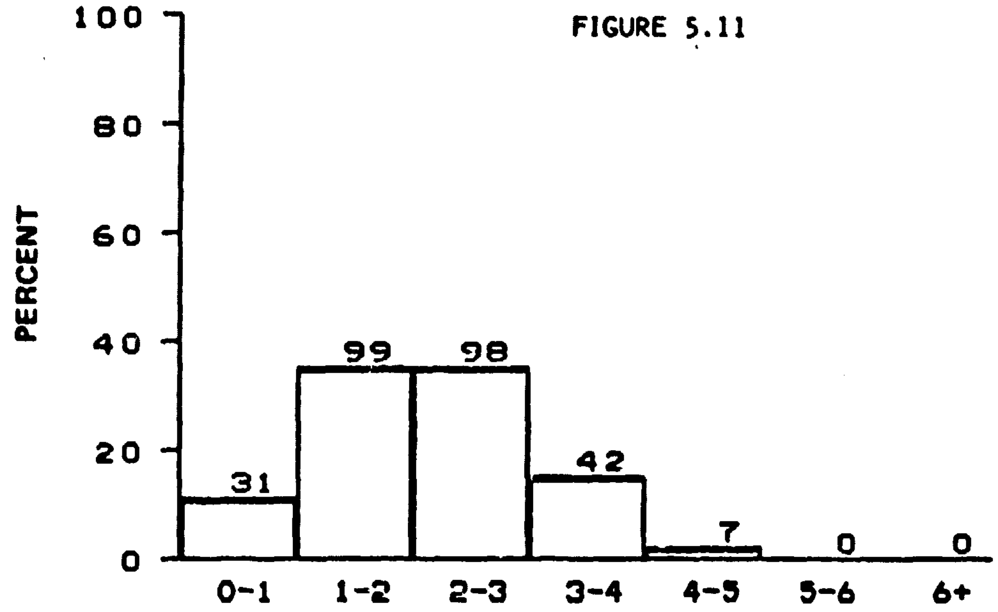


DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF FEBRUARY
BLM AREA #3
N = 83, MEAN = 2.1, SIGMA = 0.93

FIGURE 5.10



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF FEBRUARY
BLM AREA #4
N = 77, MEAN = 2.2, SIGMA = 0.88

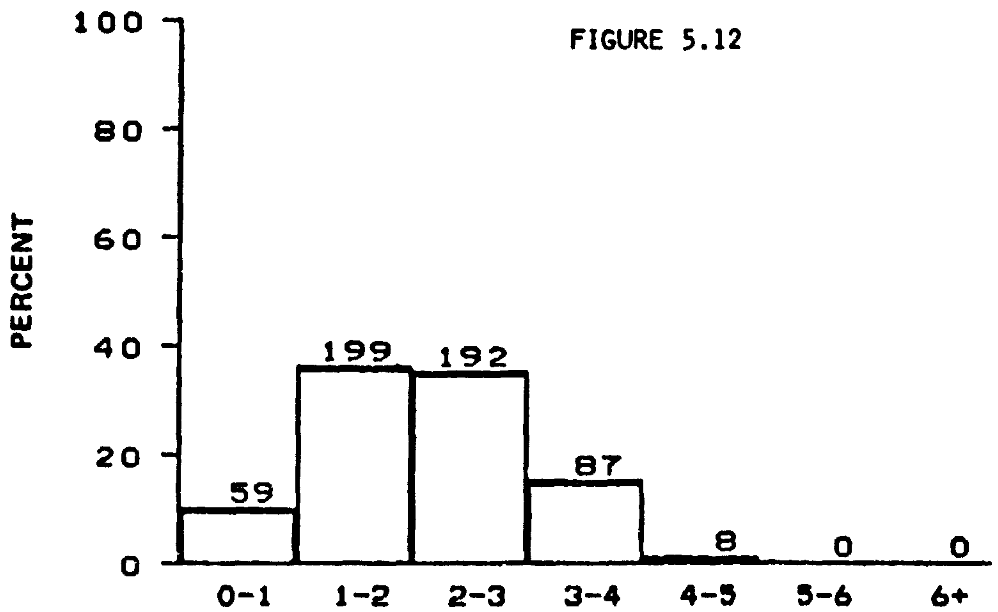


DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

MONTH OF FEBRUARY

BLM AREA #5

N = 277, MEAN = 2.1, SIGMA = 0.96

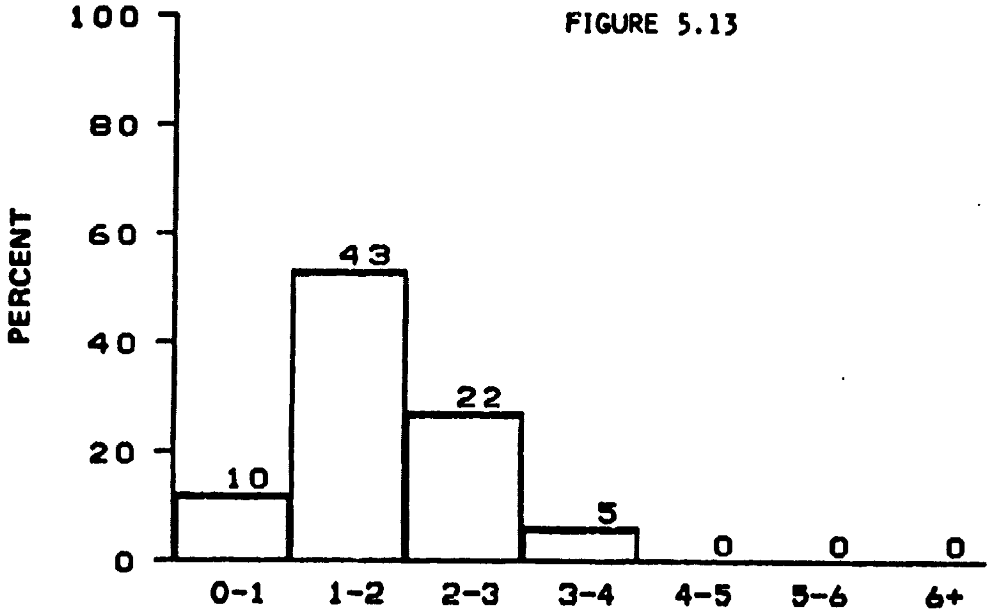


DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

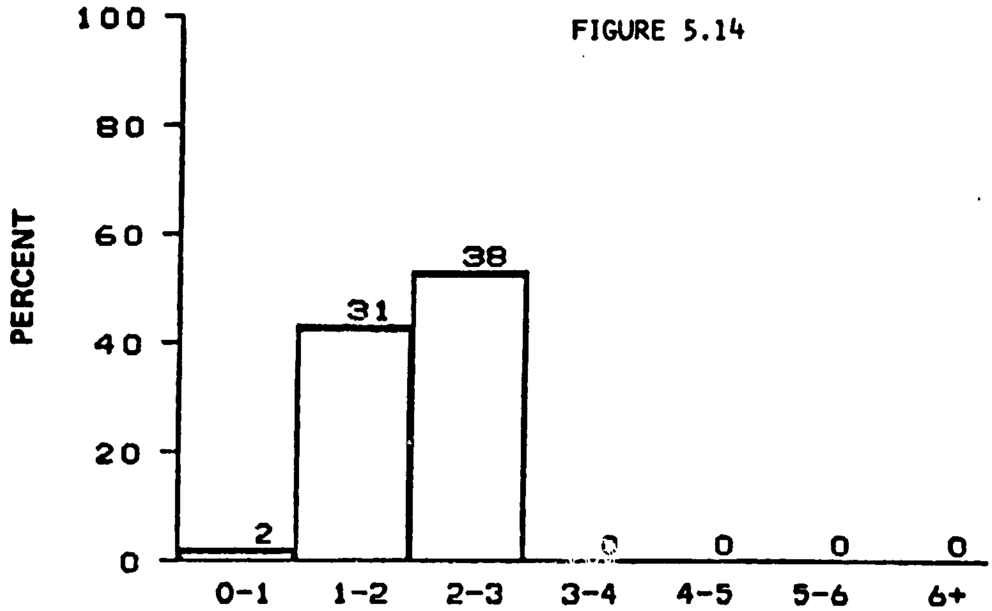
MONTH OF FEBRUARY

ALL BLM AREAS

N = 545, MEAN = 2.1, SIGMA = 0.93



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF MARCH
BLM AREA #1
N = 80, MEAN = 1.8, SIGMA = 0.76



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF MARCH
BLM AREA #2
N = 71, MEAN = 2.0, SIGMA = 0.55

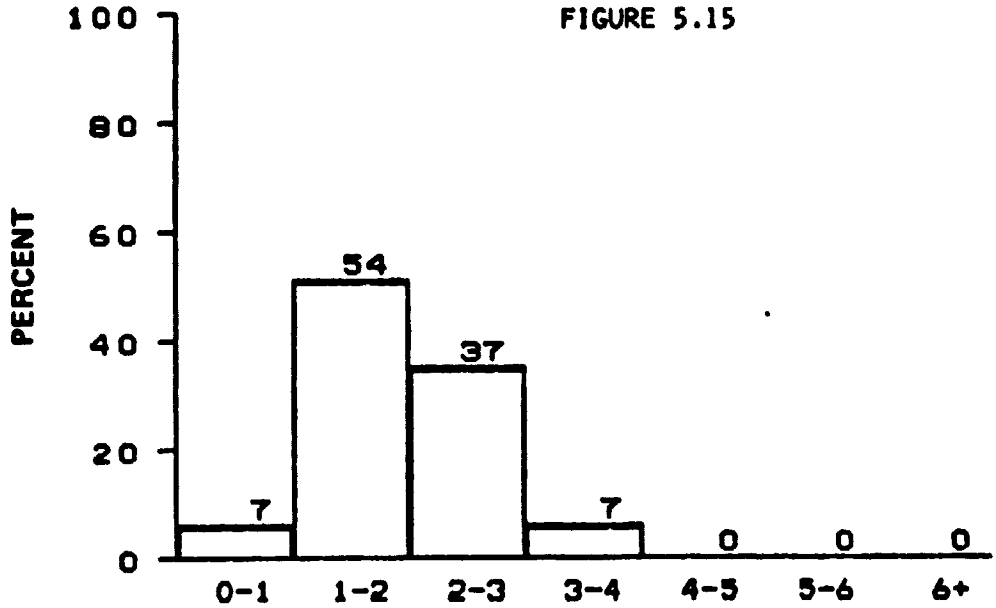


FIGURE 5.15

DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF MARCH
BLM AREA #3
N = 105, MEAN = 1.9, SIGMA = 0.71

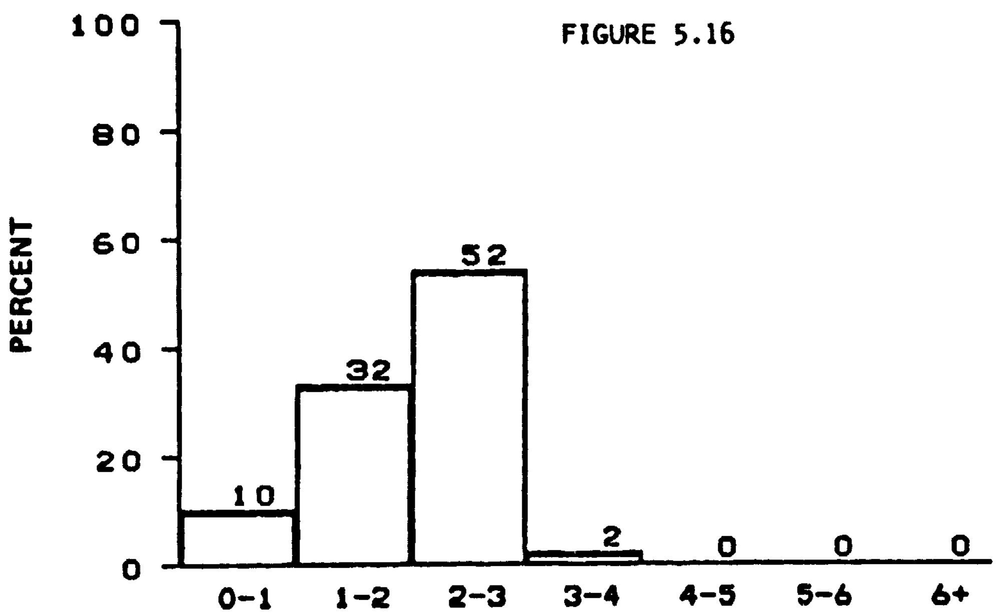
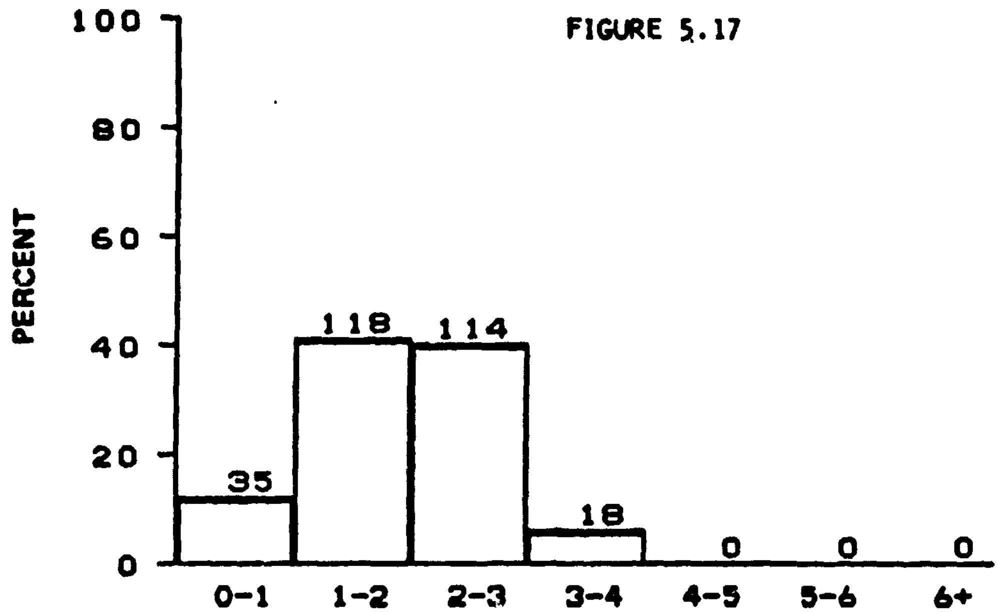
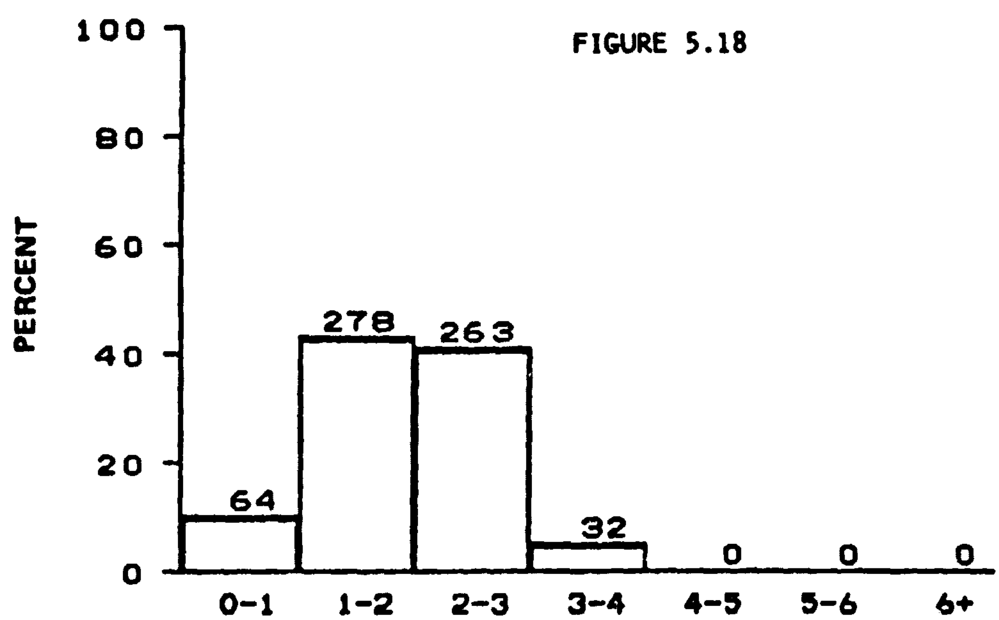


FIGURE 5.16

DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF MARCH
BLM AREA #4
N = 96, MEAN = 2.0, SIGMA = 0.71

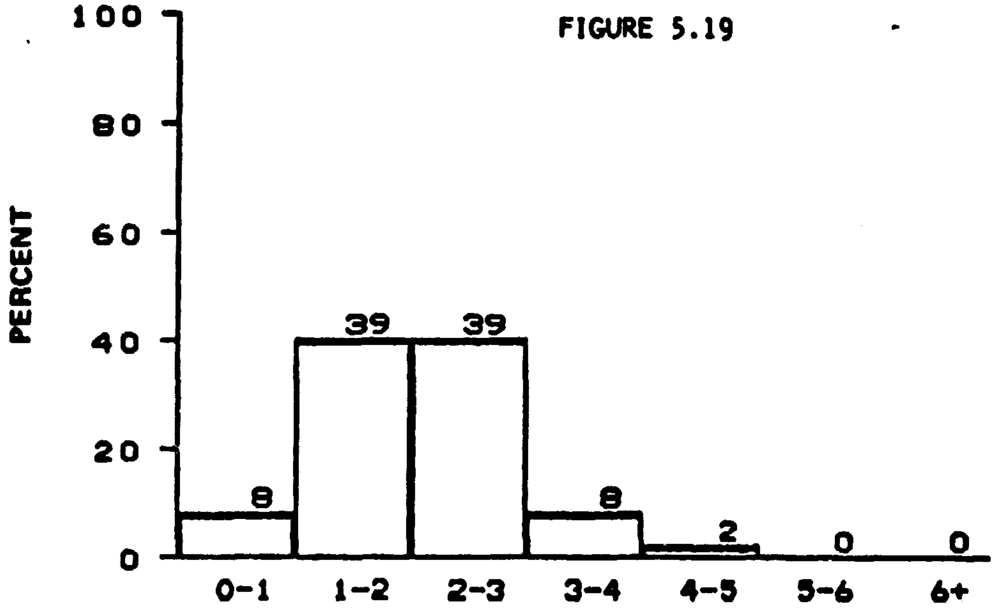


DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF MARCH
BLM AREA #5
N = 285, MEAN = 1.9, SIGMA = 0.78



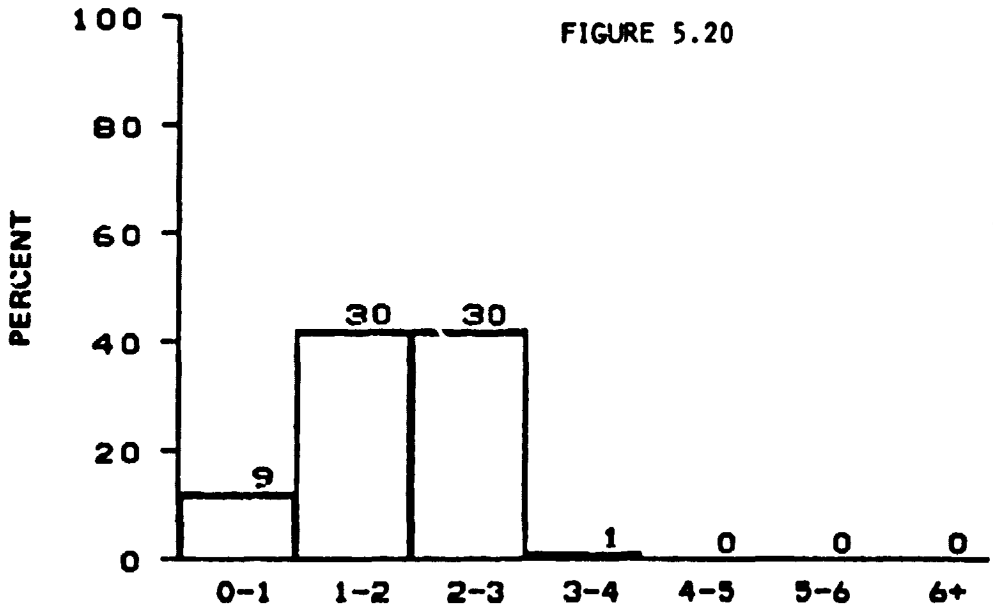
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF MARCH
ALL BLM AREAS
N = 637, MEAN = 1.9, SIGMA = 0.74

FIGURE 5.19



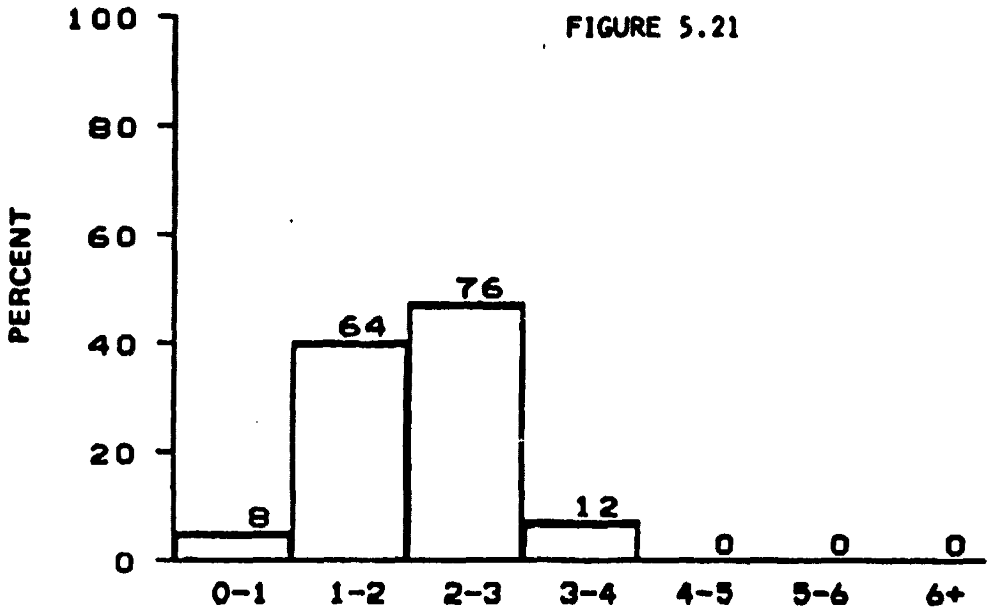
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF APRIL
BLM AREA #1
N = 96, MEAN = 2.1, SIGMA = 0.84

FIGURE 5.20



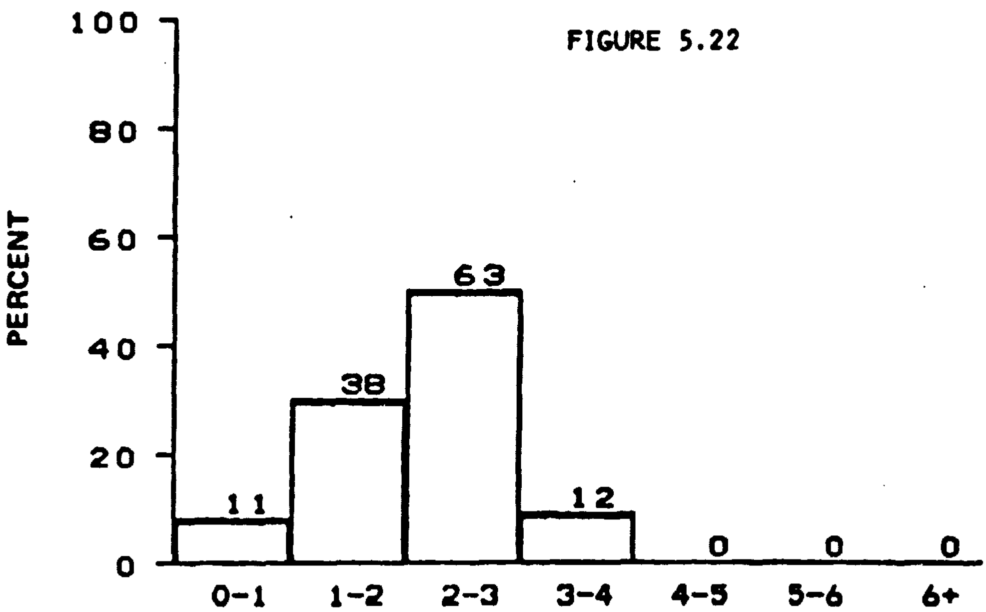
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF APRIL
BLM AREA #2
N = 70, MEAN = 1.8, SIGMA = 0.71

FIGURE 5.21

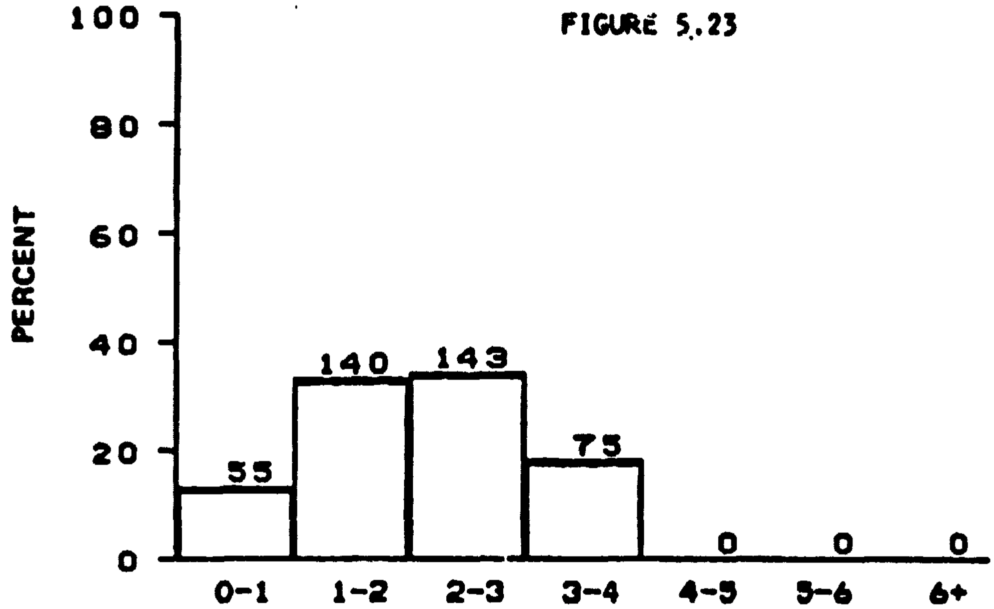


DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF APRIL
BLM AREA #3
N = 160, MEAN = 2.1, SIGMA = 0.70

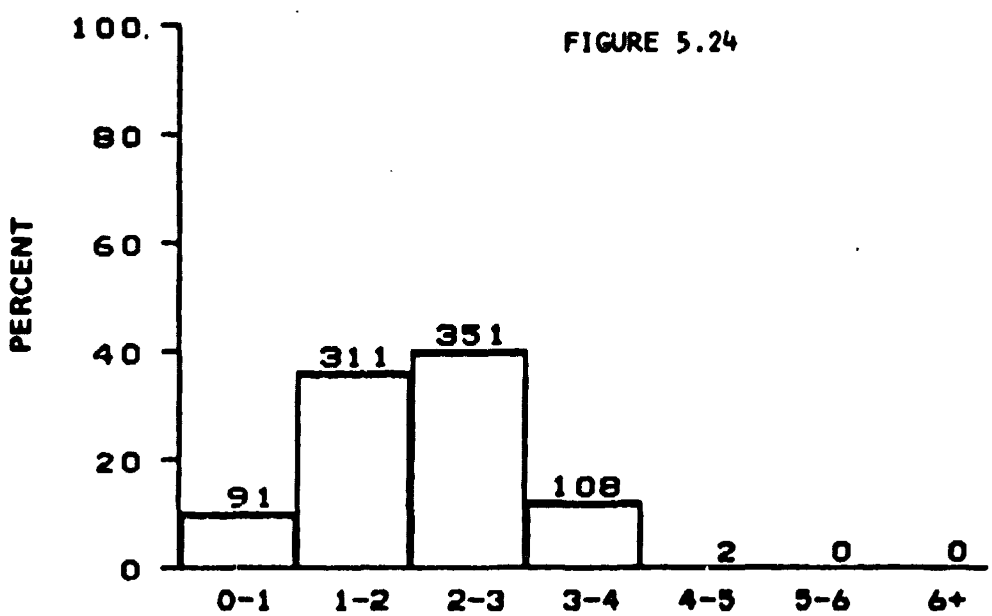
FIGURE 5.22



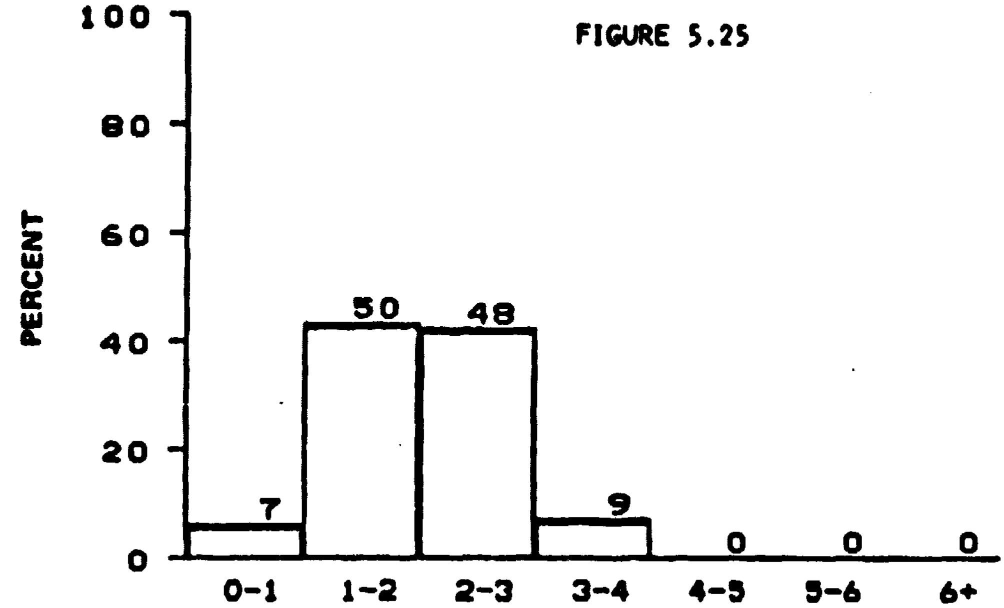
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF APRIL
BLM AREA #4
N = 124, MEAN = 2.1, SIGMA = 0.78



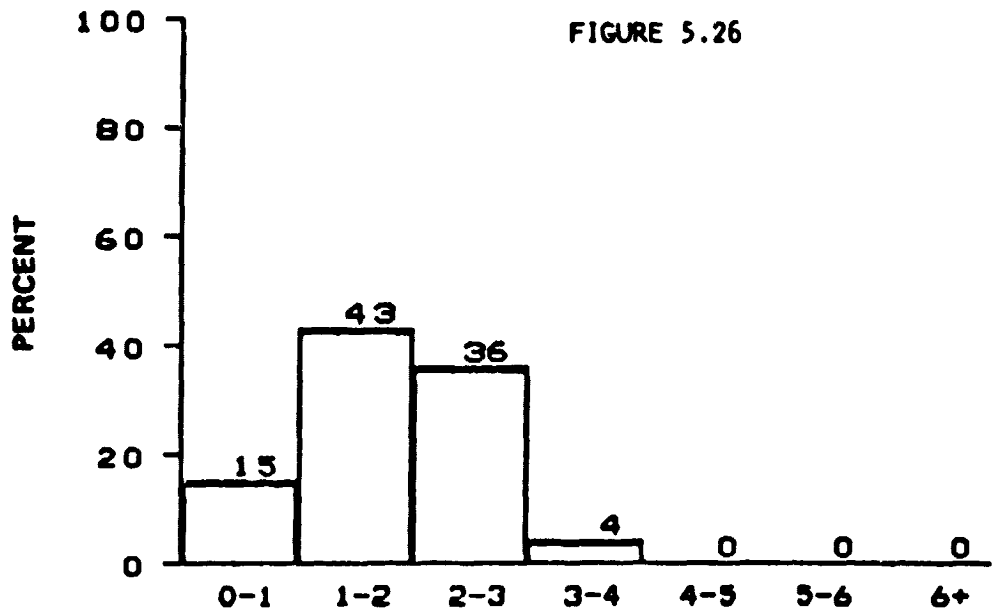
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF APRIL
BLM AREA #5
N = 413, MEAN = 2.1, SIGMA = 0.93



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF APRIL
ALL BLM AREAS
N = 863, MEAN = 2.1, SIGMA = 0.85

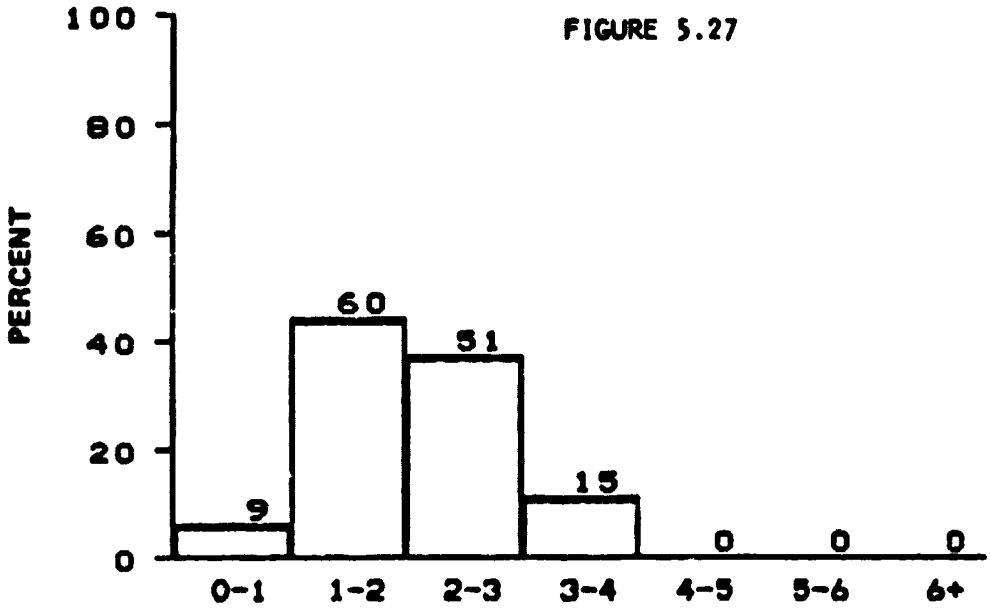


DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF MAY
BLM AREA #1
N = 114, MEAN = 2.0, SIGMA = 0.73



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF MAY
BLM AREA #2
N = 98, MEAN = 1.8, SIGMA = 0.77

FIGURE 5.27



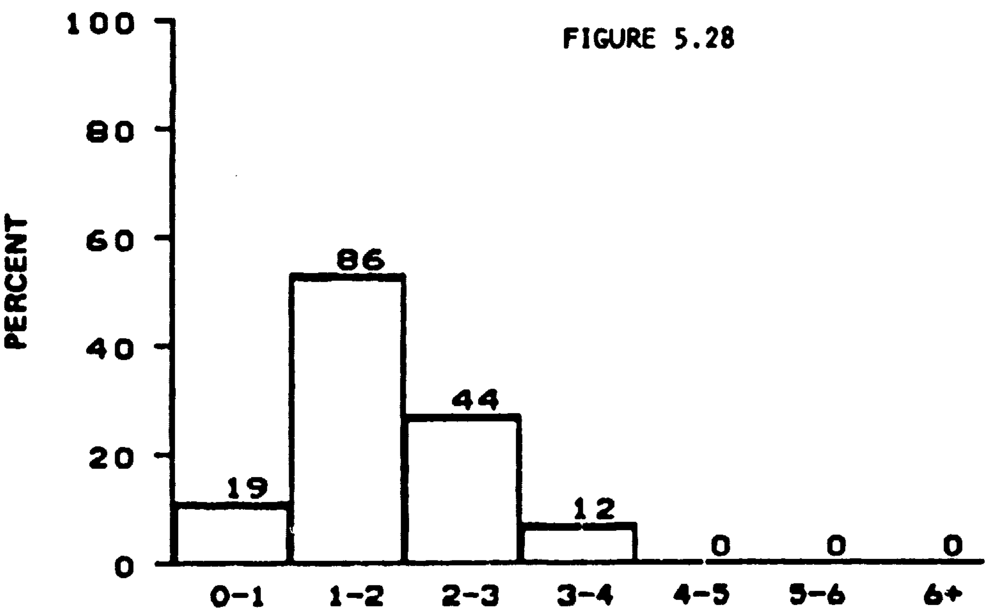
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

MONTH OF MAY

BLM AREA #3

N = 135, MEAN = 2.0, SIGMA = 0.78

FIGURE 5.28



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

MONTH OF MAY

BLM AREA #4

N = 161, MEAN = 1.8, SIGMA = 0.77

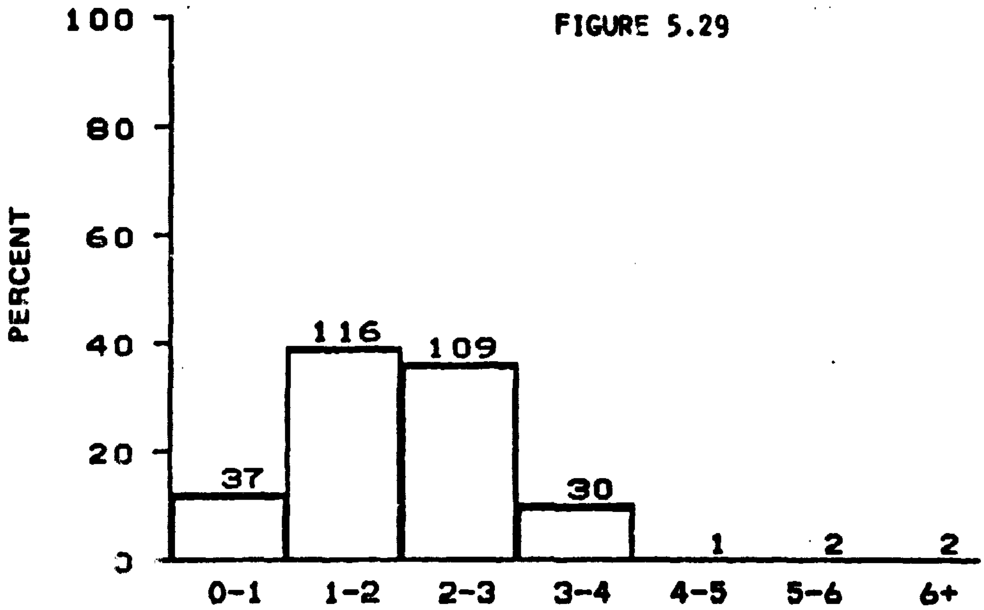


FIGURE 5.29

DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF MAY
BLM AREA #5
N = 297, MEAN = 2.0, SIGMA = 0.97

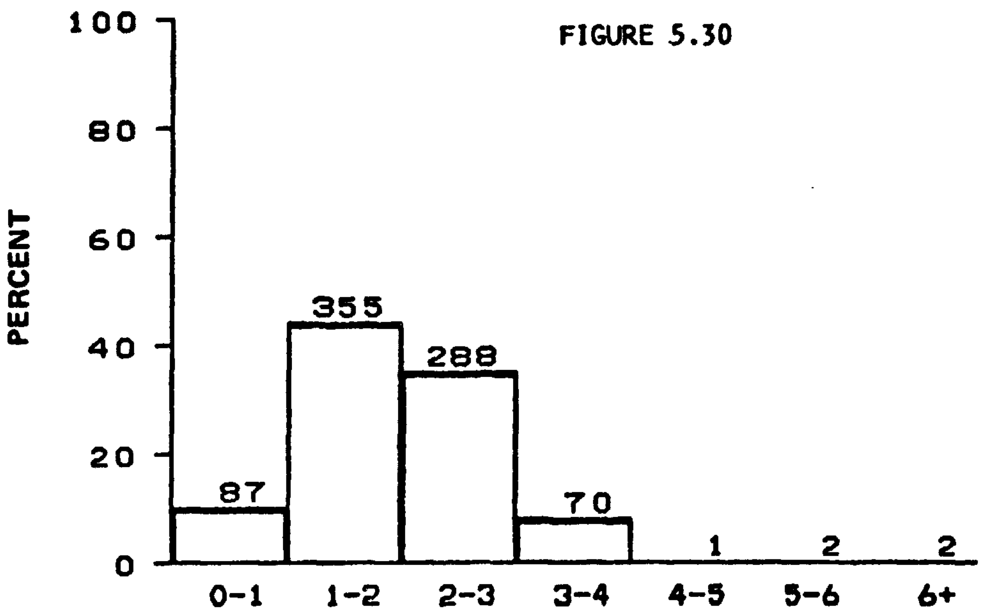
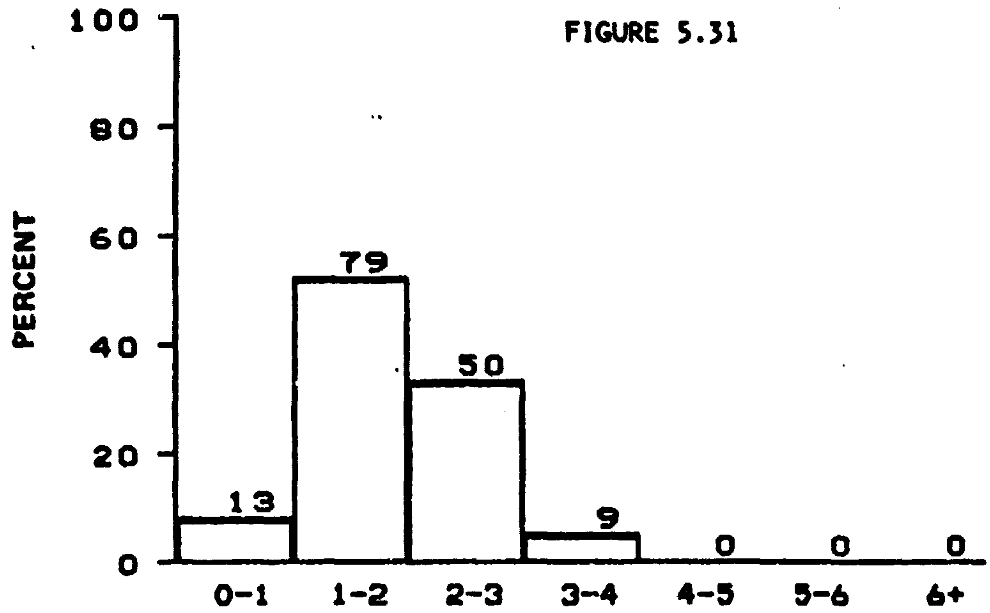


FIGURE 5.30

DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF MAY
ALL BLM AREAS
N = 805, MEAN = 1.9, SIGMA = 0.85

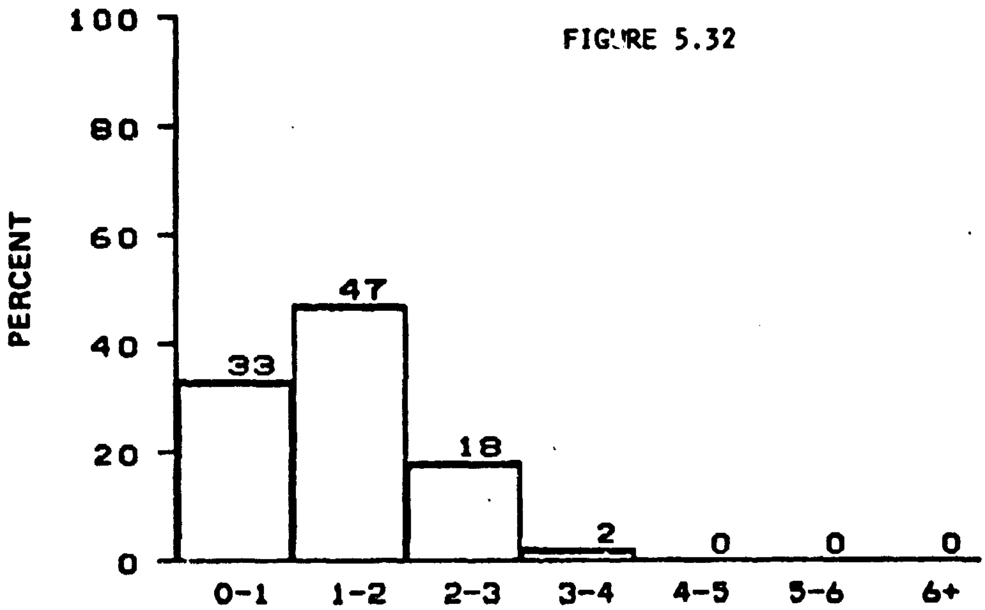


DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

MONTH OF JUNE

BLM AREA #1

N = 151, MEAN = 1.9, SIGMA = 0.72

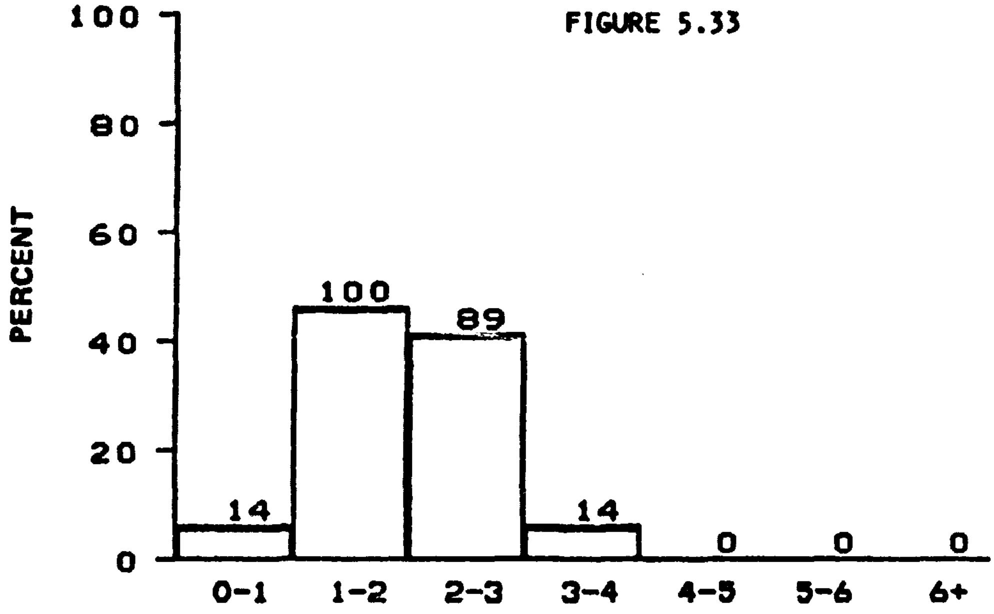


DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

MONTH OF JUNE

BLM AREA #2

N = 100, MEAN = 1.4, SIGMA = 0.76

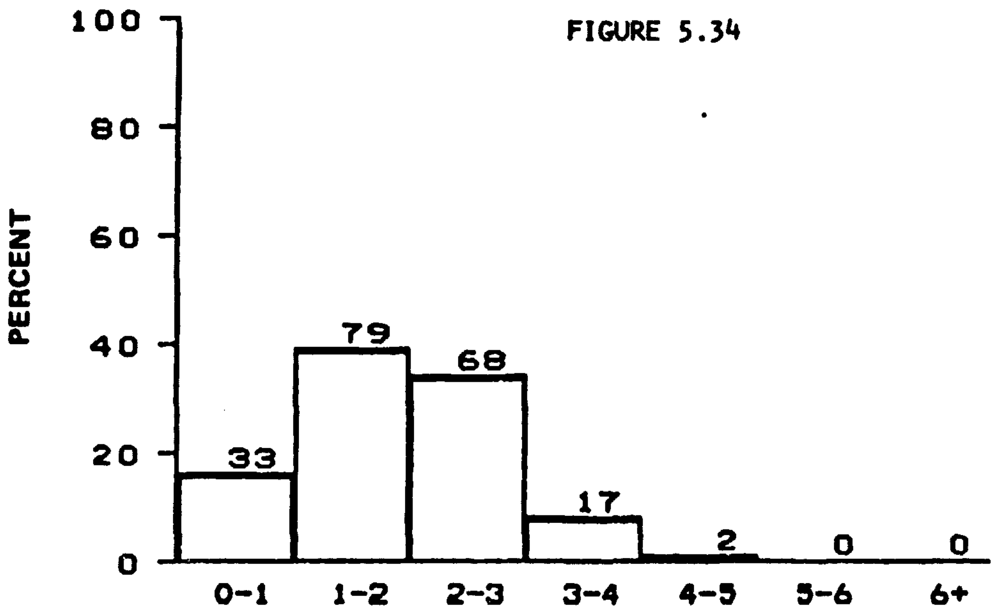


DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

MONTH OF JUNE

BLM AREA #3

N = 217, MEAN = 2.0, SIGMA = 0.71



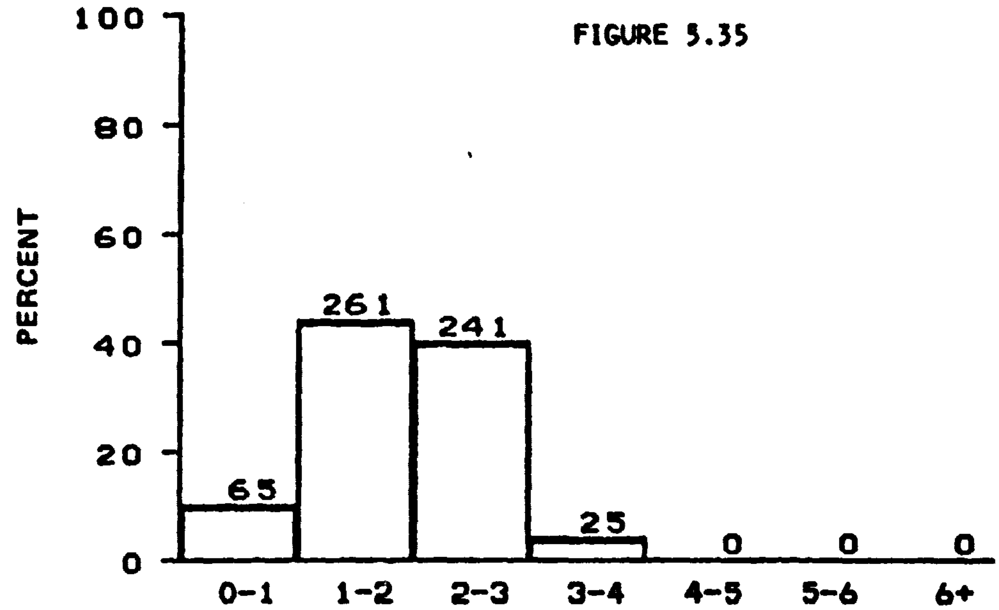
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

MONTH OF JUNE

BLM AREA #4

N = 199, MEAN = 1.9, SIGMA = 0.89

FIGURE 5.35



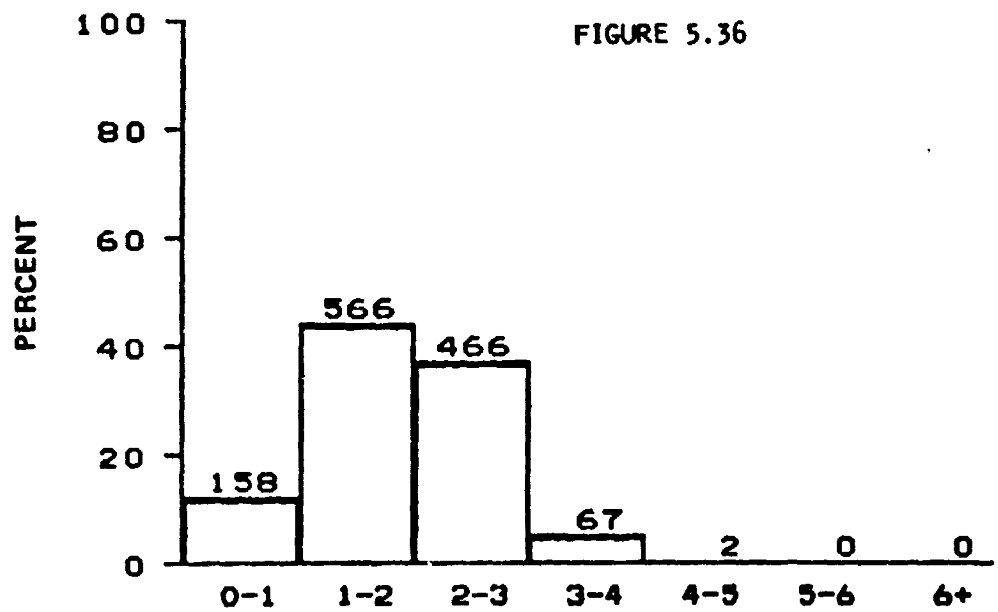
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

MONTH OF JUNE

BLM AREA #5

N = 592, MEAN = 1.9, SIGMA = 0.73

FIGURE 5.36



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

MONTH OF JUNE

ALL BLM AREAS

N = 1259, MEAN = 1.9, SIGMA = 0.77

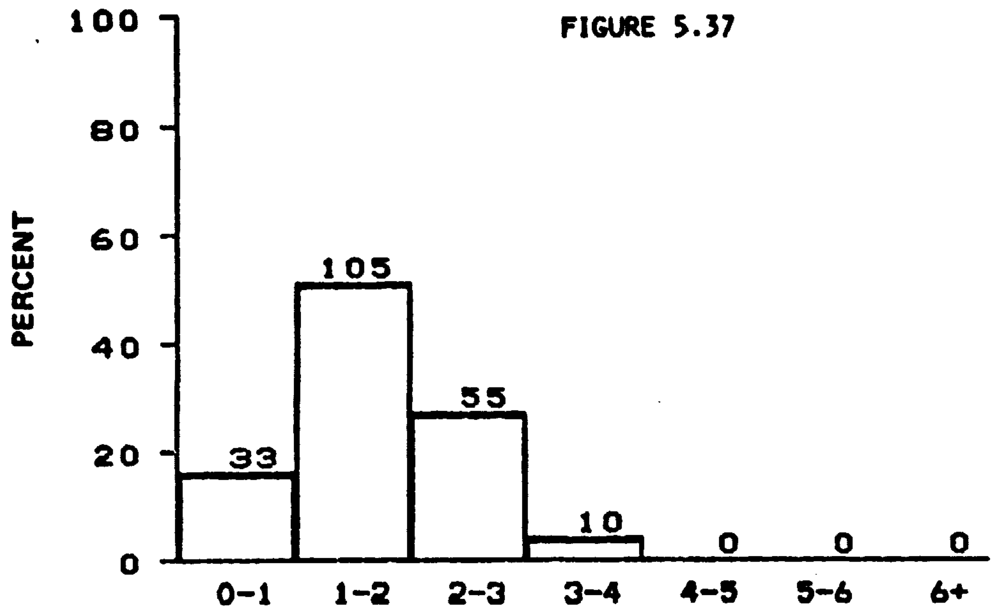


FIGURE 5.37

DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

MONTH OF JULY

BLM AREA #1

N = 203, MEAN = 1.7, SIGMA = 0.77

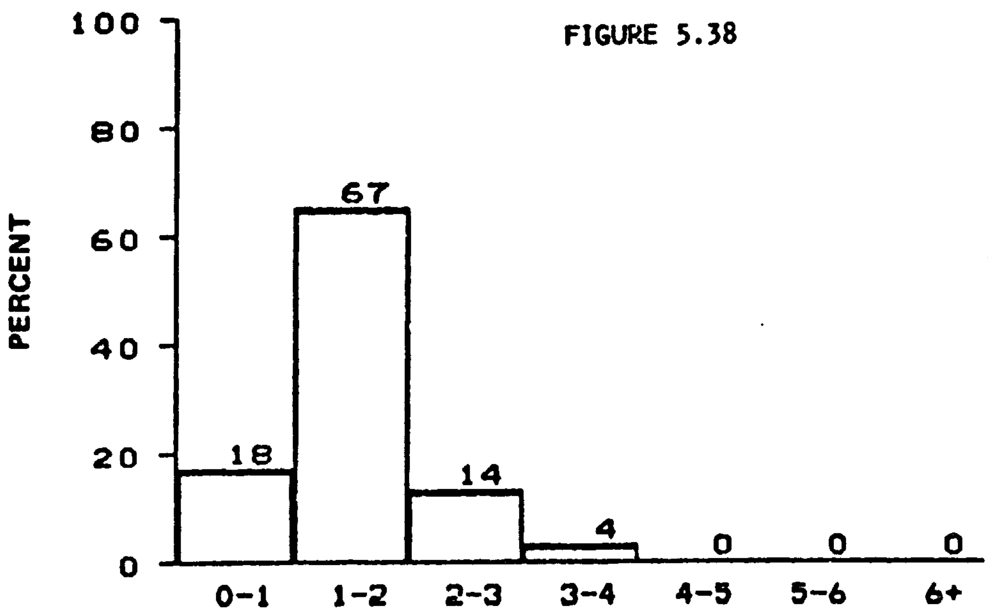


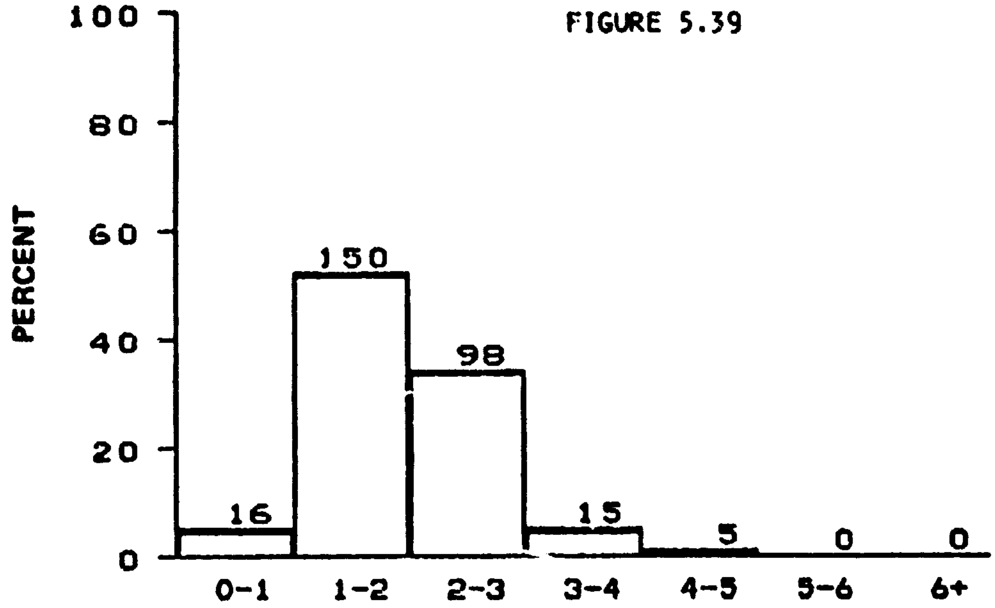
FIGURE 5.38

DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

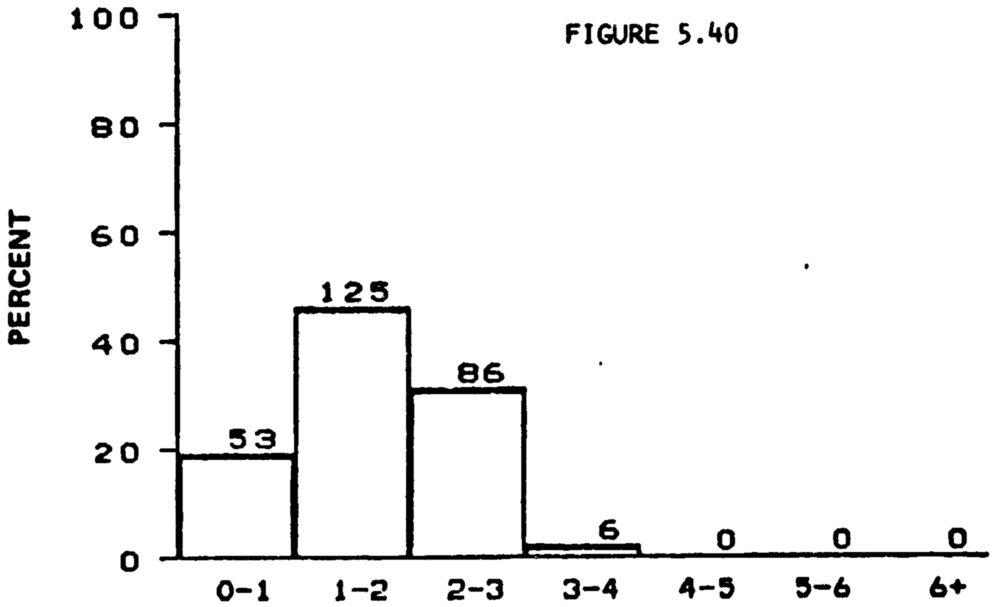
MONTH OF JULY

BLM AREA #2

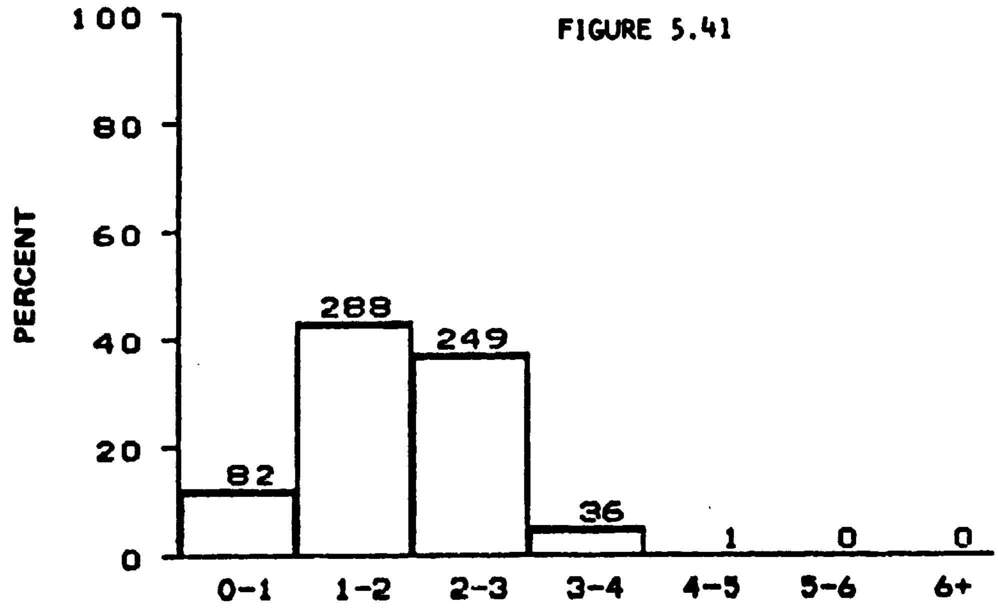
N = 103, MEAN = 1.5, SIGMA = 0.68



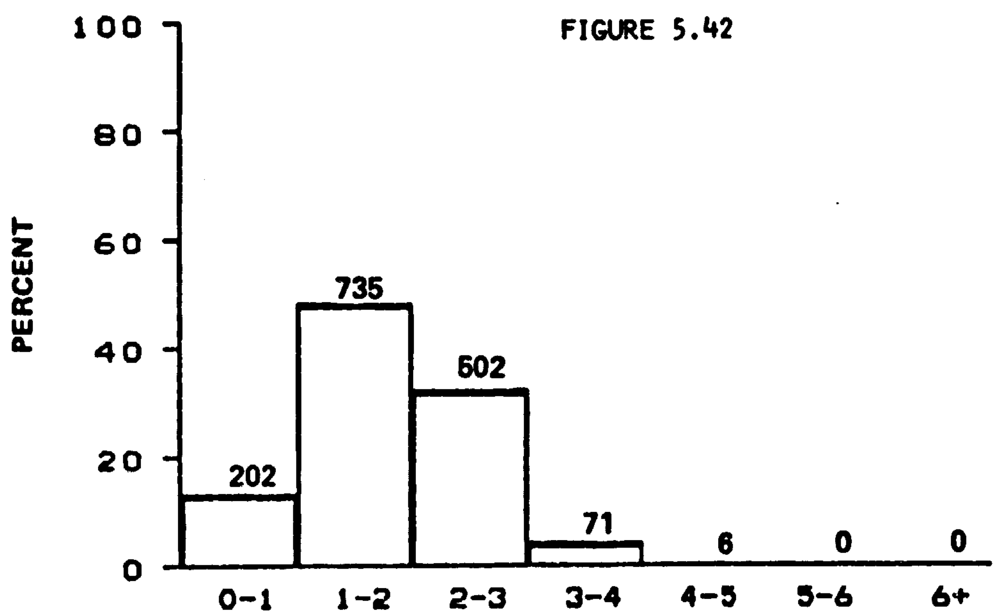
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF JULY
BLM AREA #3
N = 284, MEAN = 1.9, SIGMA = 0.76



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF JULY
BLM AREA #4
N = 270, MEAN = 1.7, SIGMA = 0.76

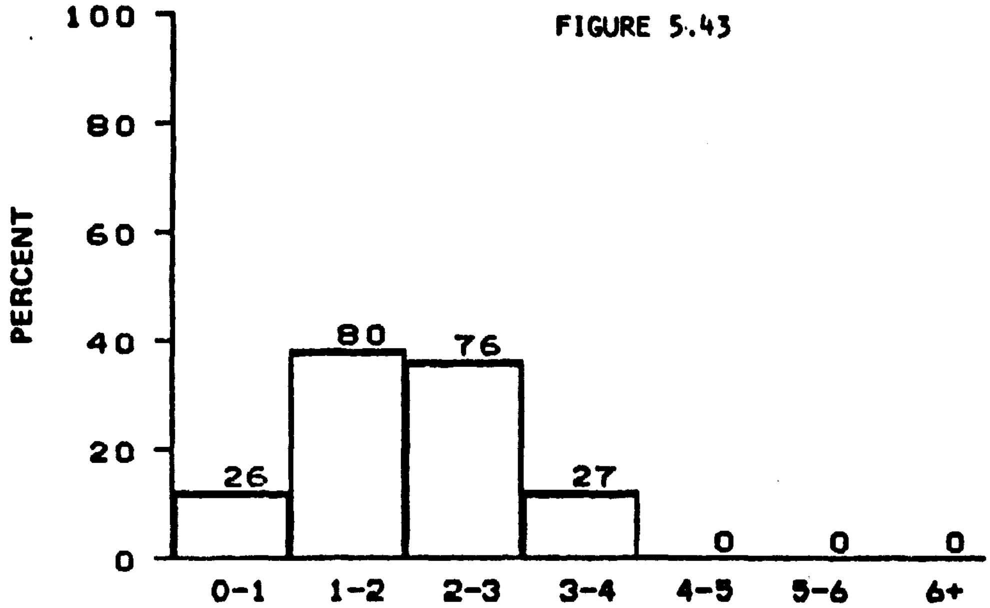


DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF JULY
BLM AREA #5
N = 656, MEAN = 1.9, SIGMA = 0.78



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF JULY
ALL BLM AREAS
N = 1516, MEAN = 1.8, SIGMA = 0.78

FIGURE 5.43



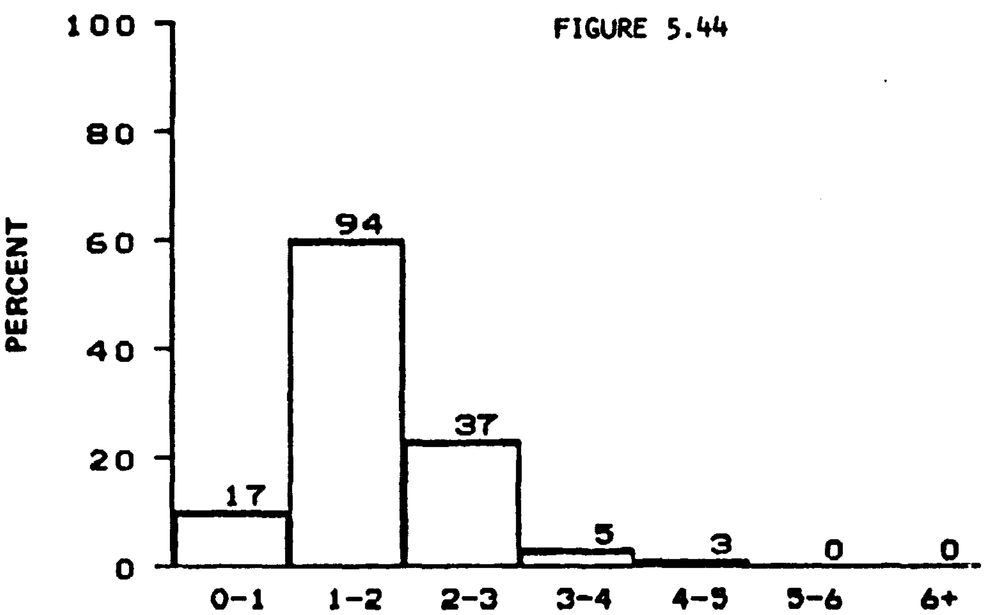
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

MONTH OF AUGUST

BLM AREA #1

N = 209, MEAN = 2.0, SIGMA = 0.87

FIGURE 5.44

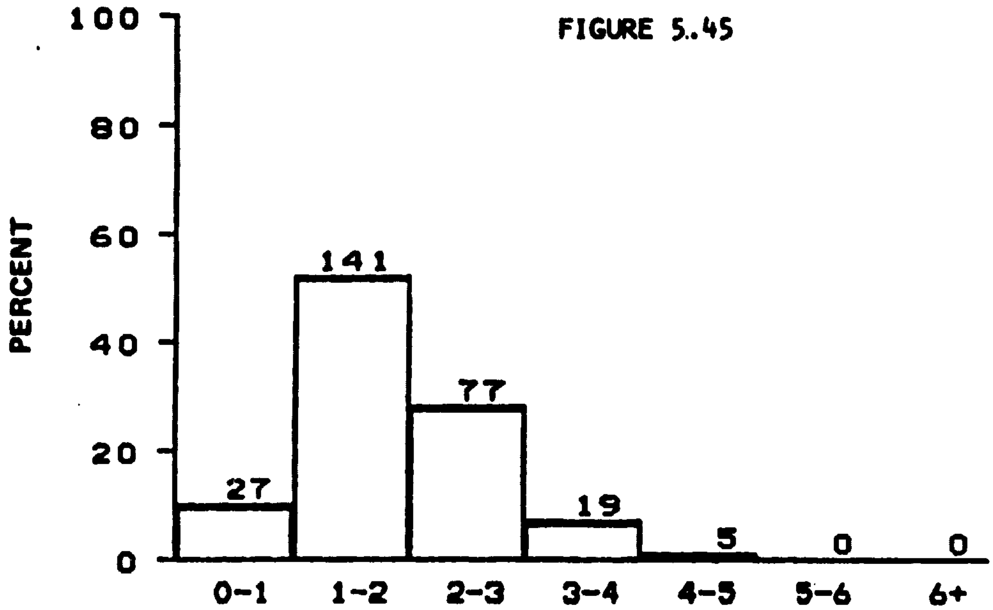


DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

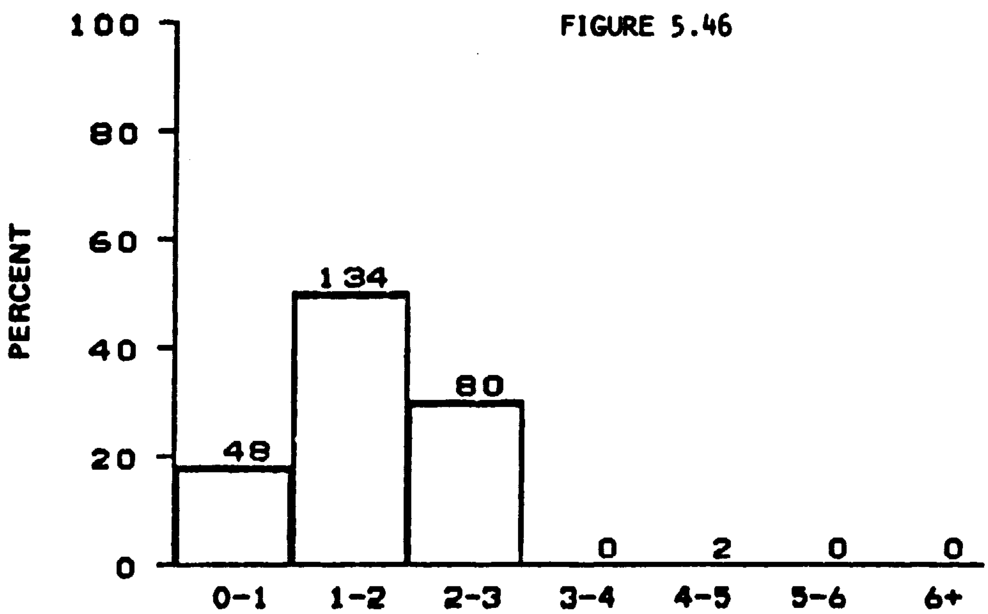
MONTH OF AUGUST

BLM AREA #2

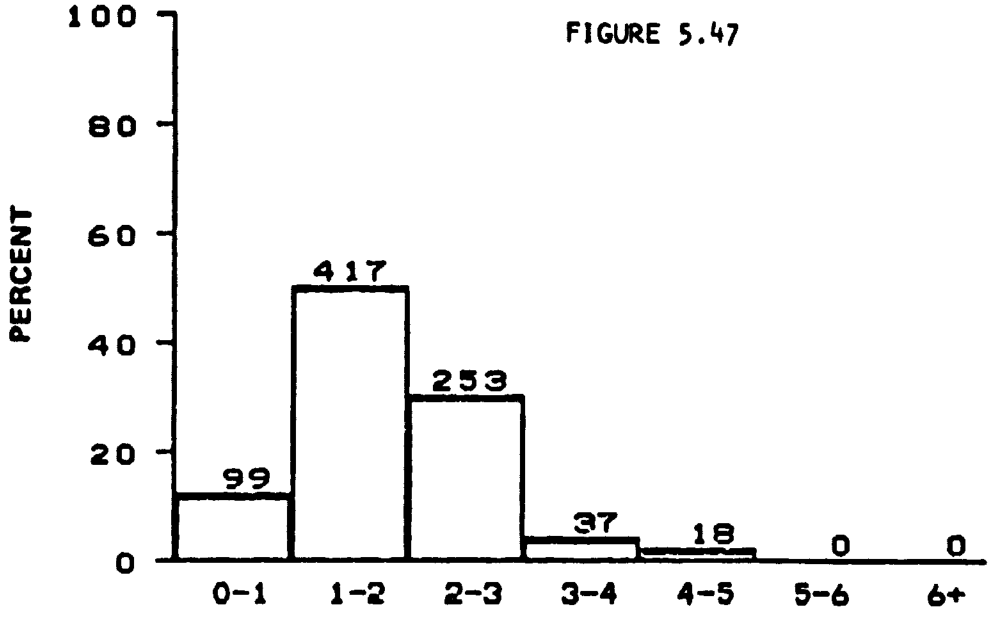
N = 156, MEAN = 1.8, SIGMA = 0.76



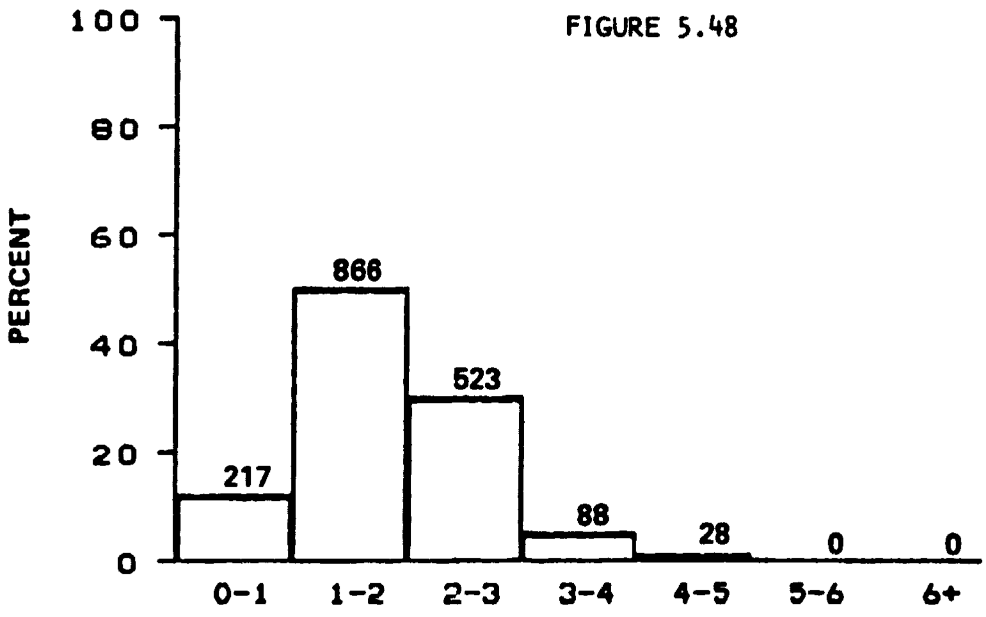
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF AUGUST
BLM AREA #3
N = 269, MEAN = 1.9, SIGMA = 0.83



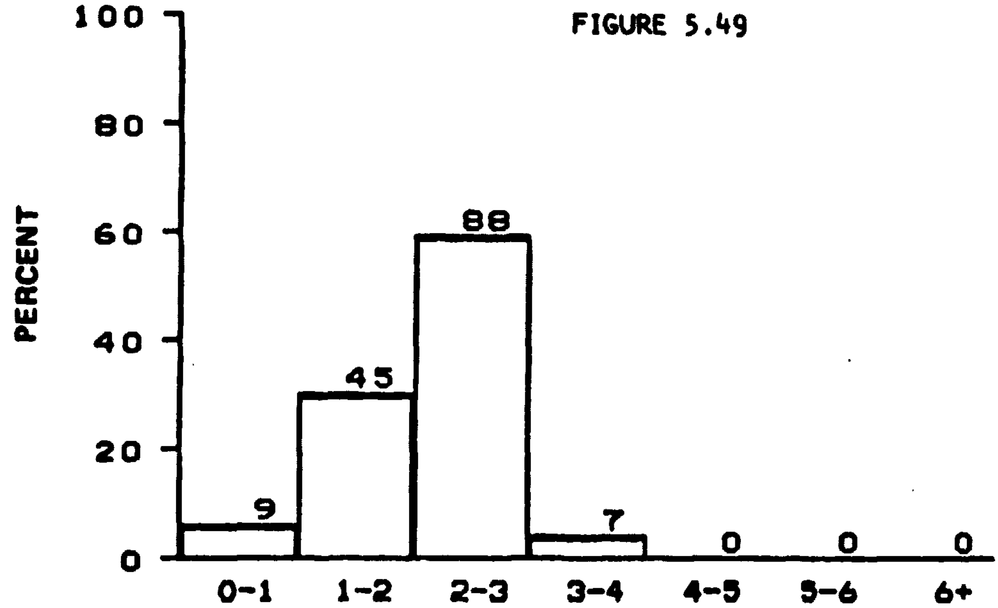
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF AUGUST
BLM AREA #4
N = 264, MEAN = 1.6, SIGMA = 0.73



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF AUGUST
BLM AREA #5
N = 824, MEAN = 1.8, SIGMA = 0.83



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF AUGUST
ALL BLM AREAS
N = 1722, MEAN = 1.8, SIGMA = 0.83

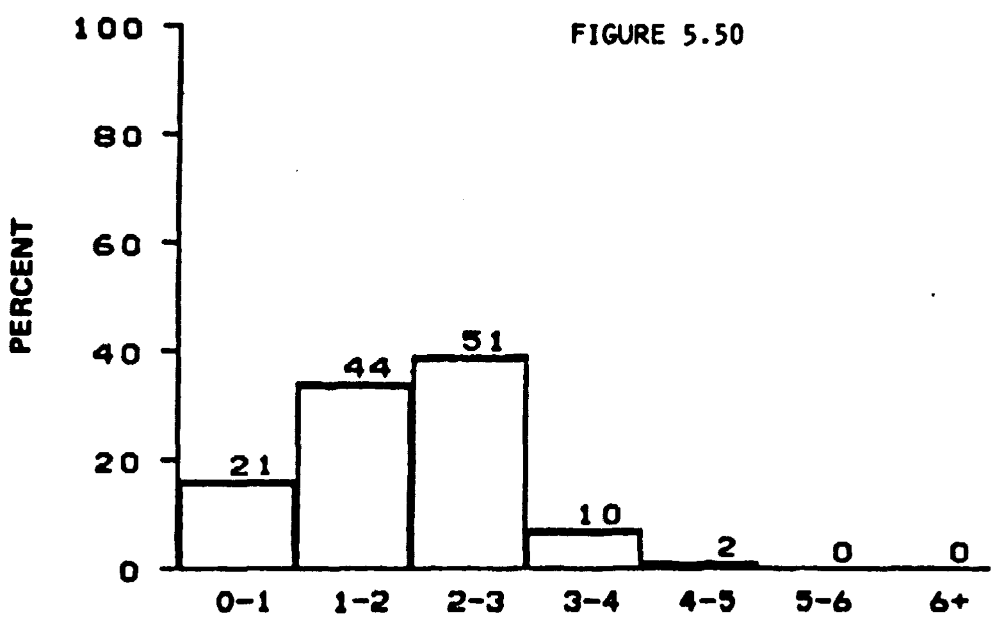


DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

MONTH OF SEPTEMBER

BLM AREA #1

N = 149, MEAN = 2.1, SIGMA = 0.67



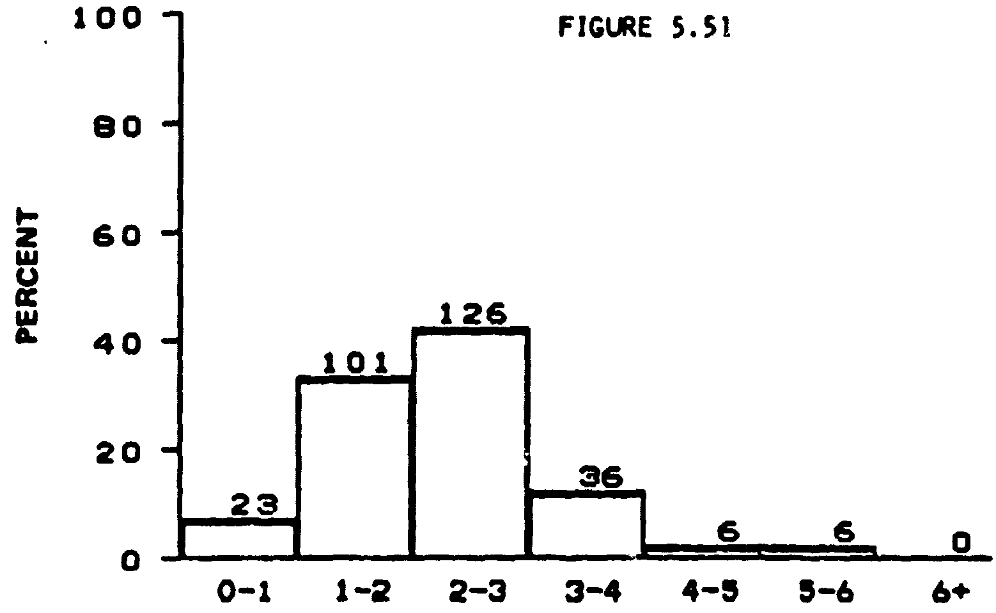
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

MONTH OF SEPTEMBER

BLM AREA #2

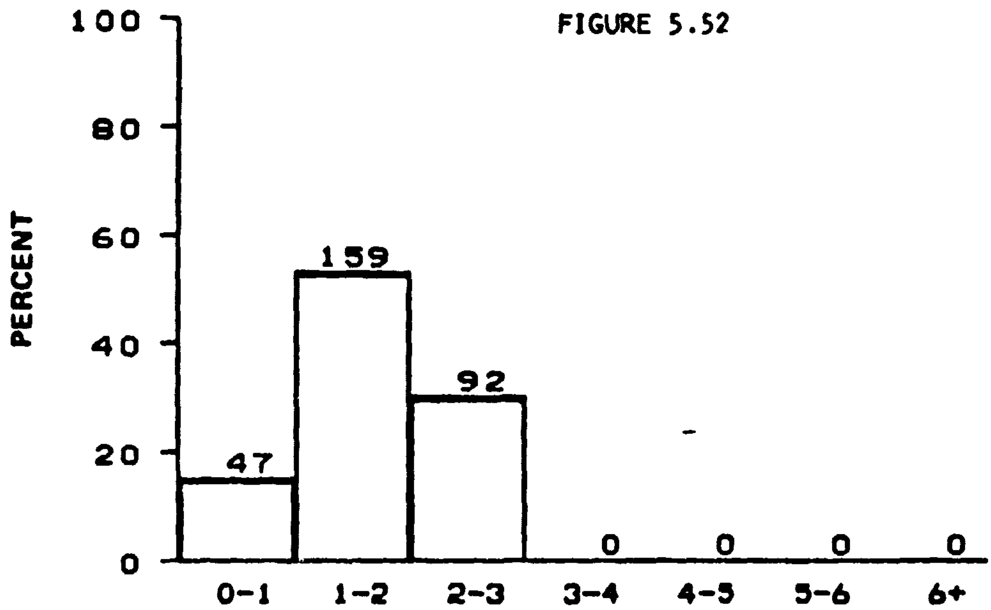
N = 128, MEAN = 1.9, SIGMA = 0.91

FIGURE 5.51



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF SEPTEMBER
BLM AREA #3
N = 298, MEAN = 2.2, SIGMA = 0.98

FIGURE 5.52



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF SEPTEMBER
BLM AREA #4
N = 298, MEAN = 1.7, SIGMA = 0.67

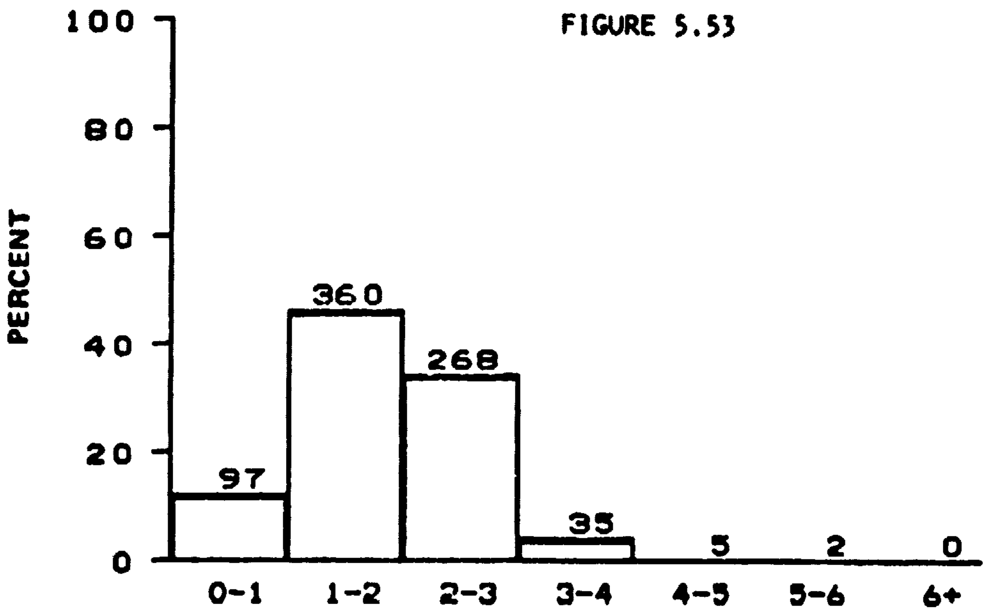


FIGURE 5.53

DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

MONTH OF SEPTEMBER

BLM AREA #5

N = 767, MEAN = 1.8, SIGMA = 0.80

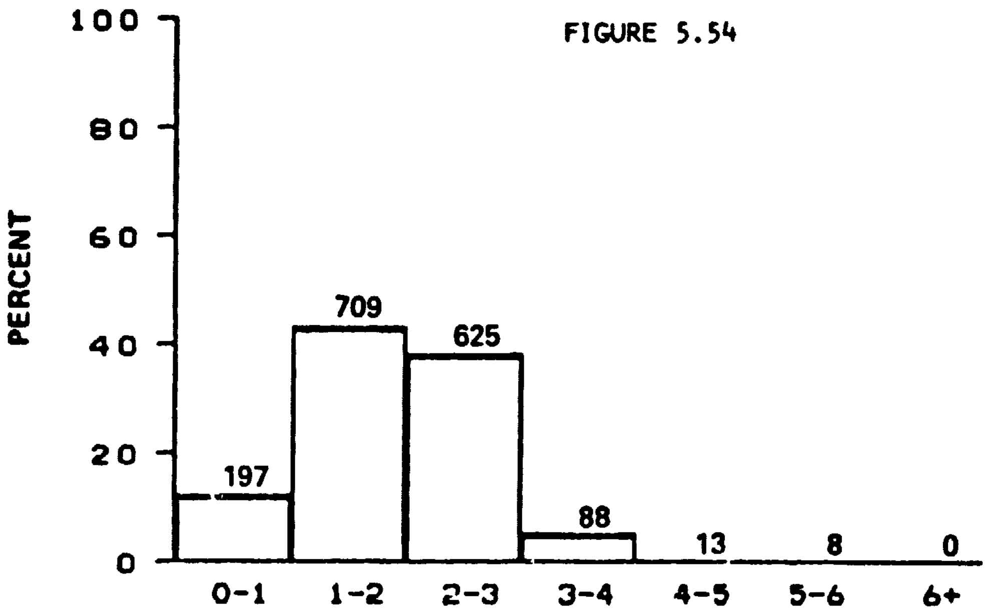


FIGURE 5.54

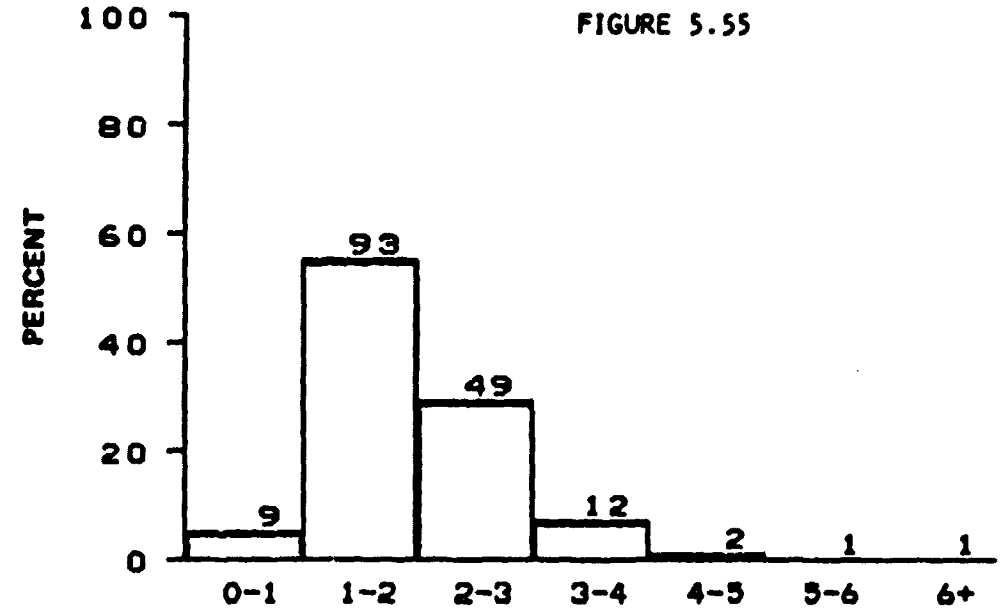
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

MONTH OF SEPTEMBER

ALL BLM AREAS

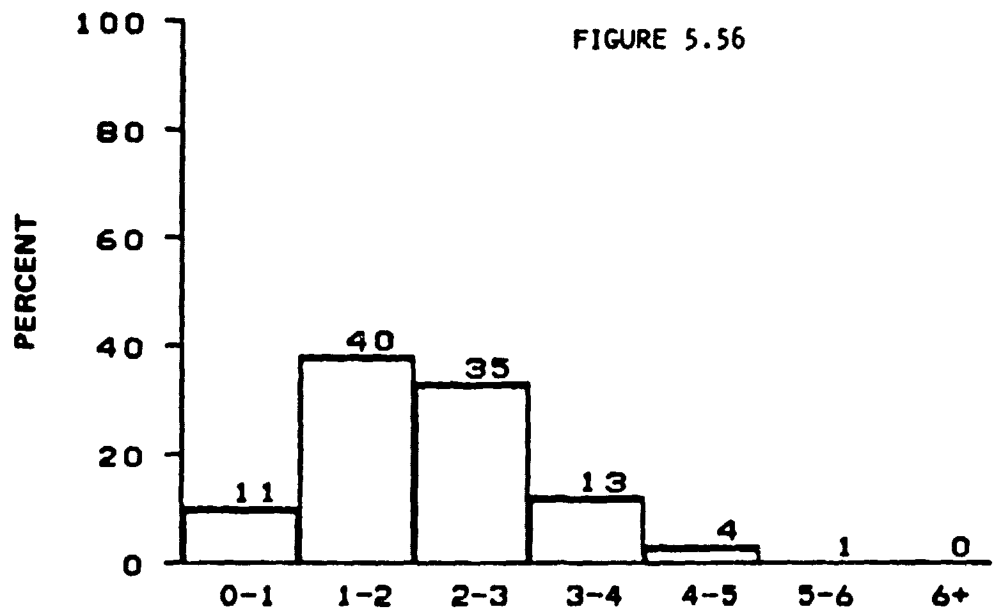
N = 1640, MEAN = 1.9, SIGMA = 0.84

FIGURE 5.55

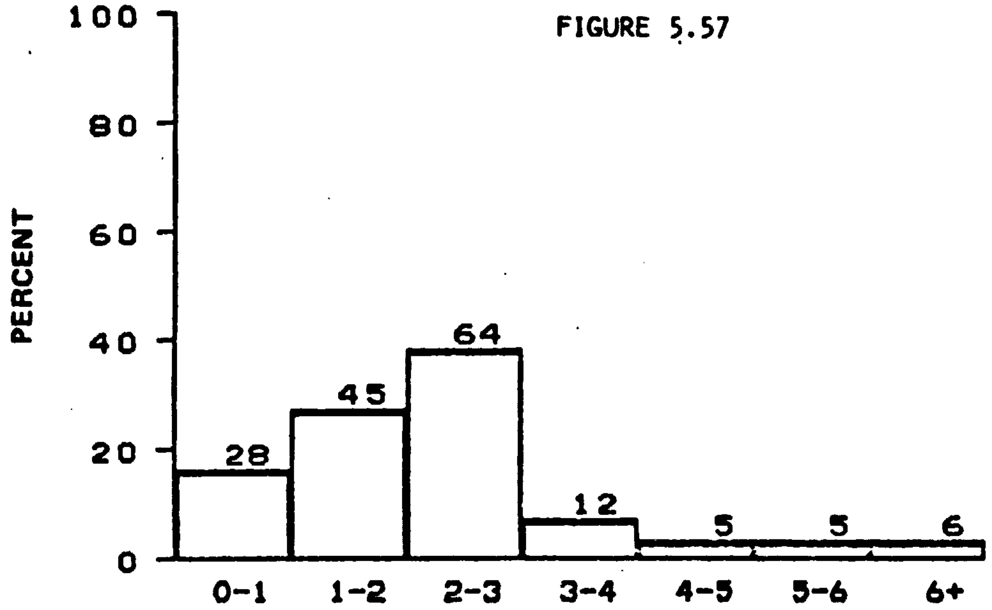


DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF OCTOBER
BLM AREA #1
N = 167, MEAN = 2.0, SIGMA = 0.87

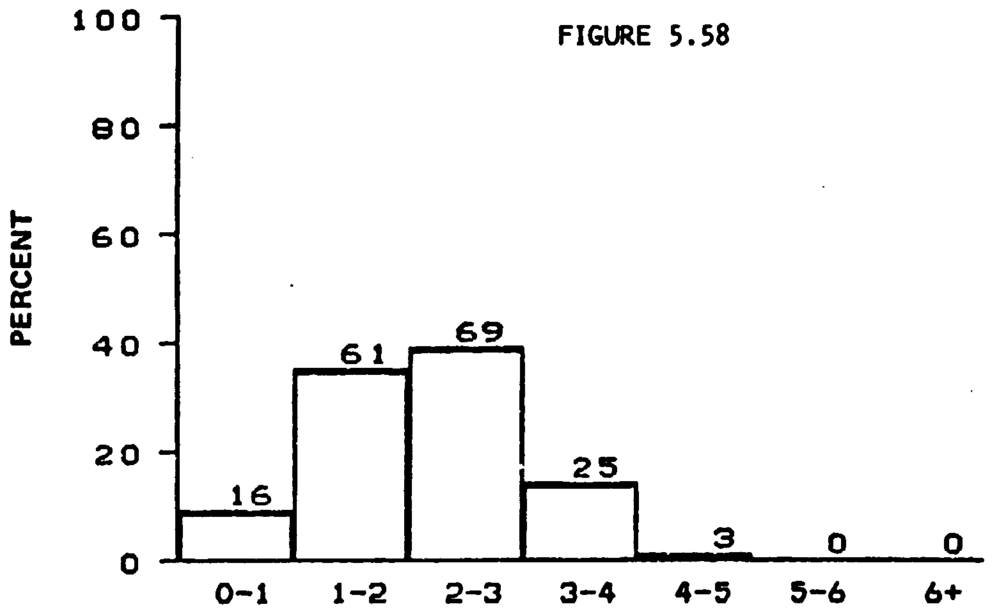
FIGURE 5.56



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF OCTOBER
BLM AREA #2
N = 104, MEAN = 2.1, SIGMA = 1.0

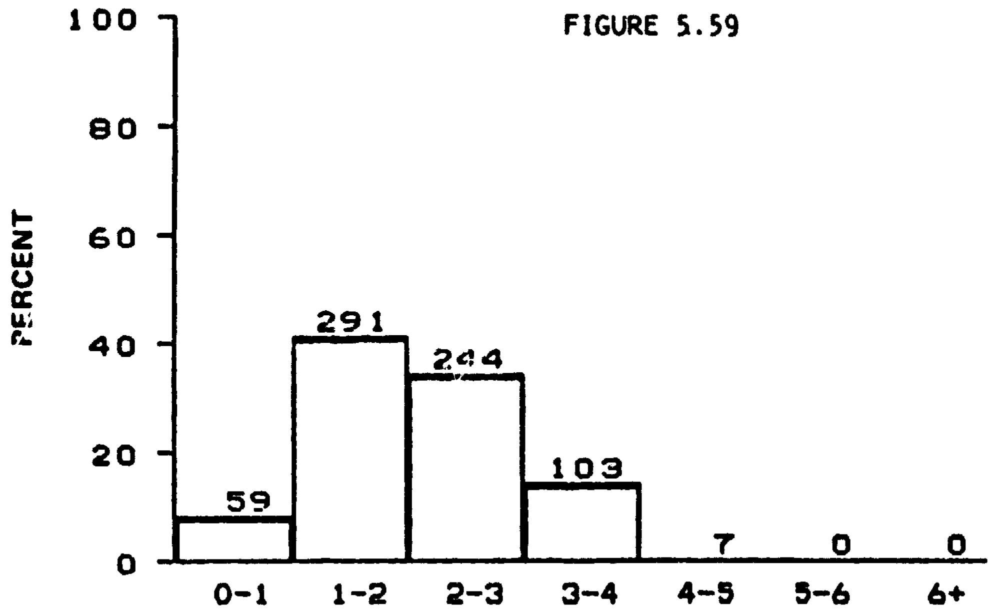


DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF OCTOBER
BLM AREA #3
N = 165, MEAN = 2.3, SIGMA = 1.4



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF OCTOBER
BLM AREA #4
N = 174, MEAN = 2.1, SIGMA = 0.90

FIGURE 5.59



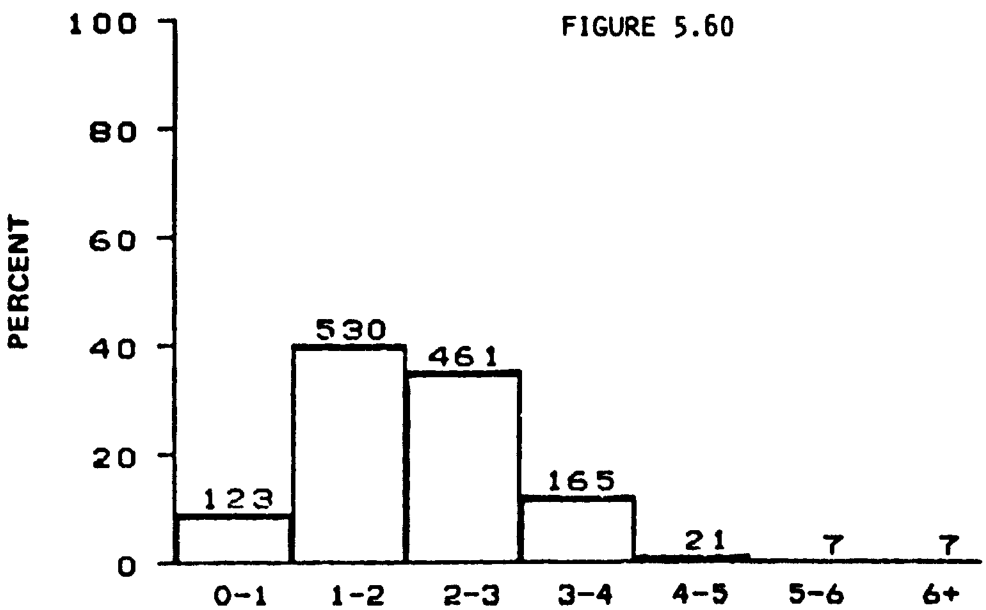
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

MONTH OF OCTOBER

BLM AREA #5

N = 704, MEAN = 2.1, SIGMA = 0.87

FIGURE 5.60



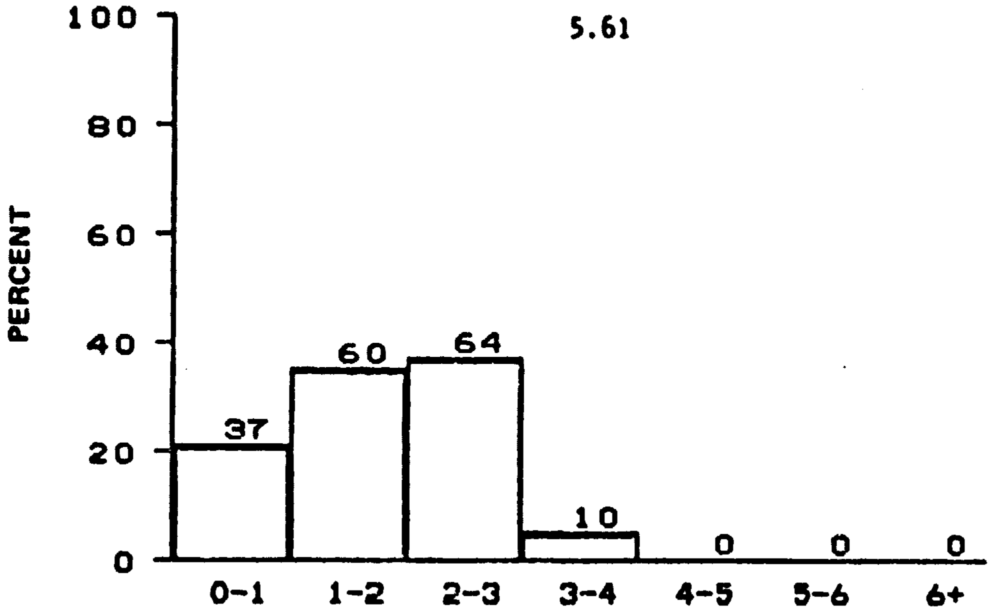
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

MONTH OF OCTOBER

ALL BLM AREAS

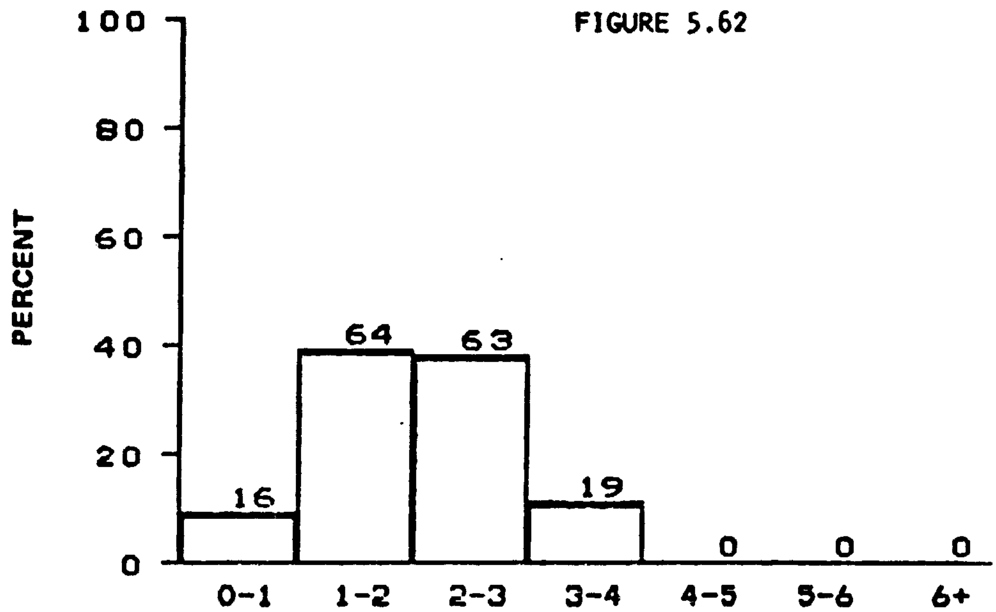
N = 1314, MEAN = 2.1, SIGMA = 0.97

5.61

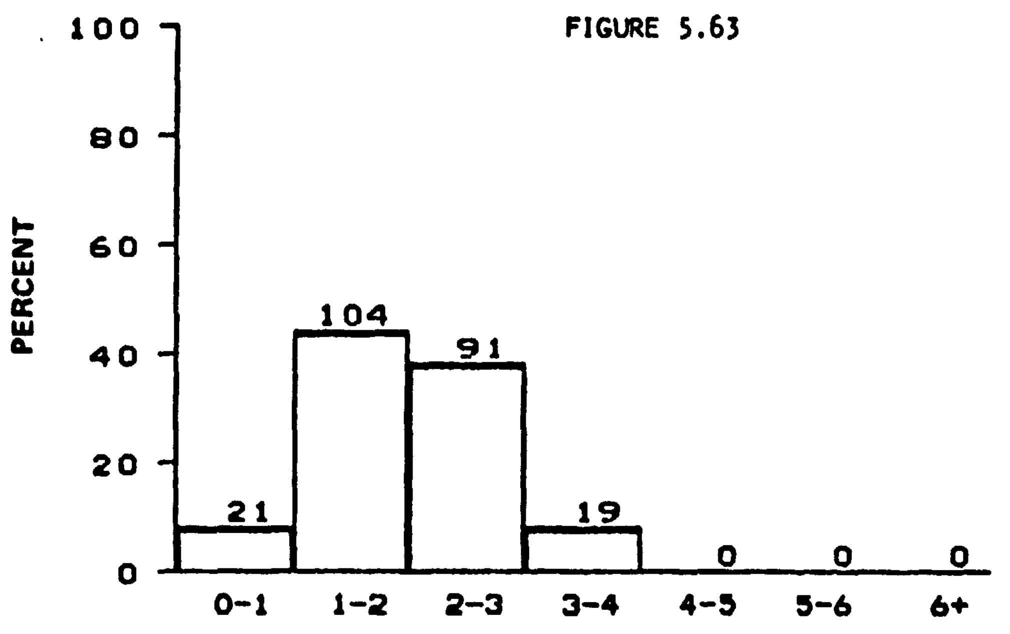


DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF NOVEMBER
BLM AREA #1
N = 171, MEAN = 1.8, SIGMA = 0.87

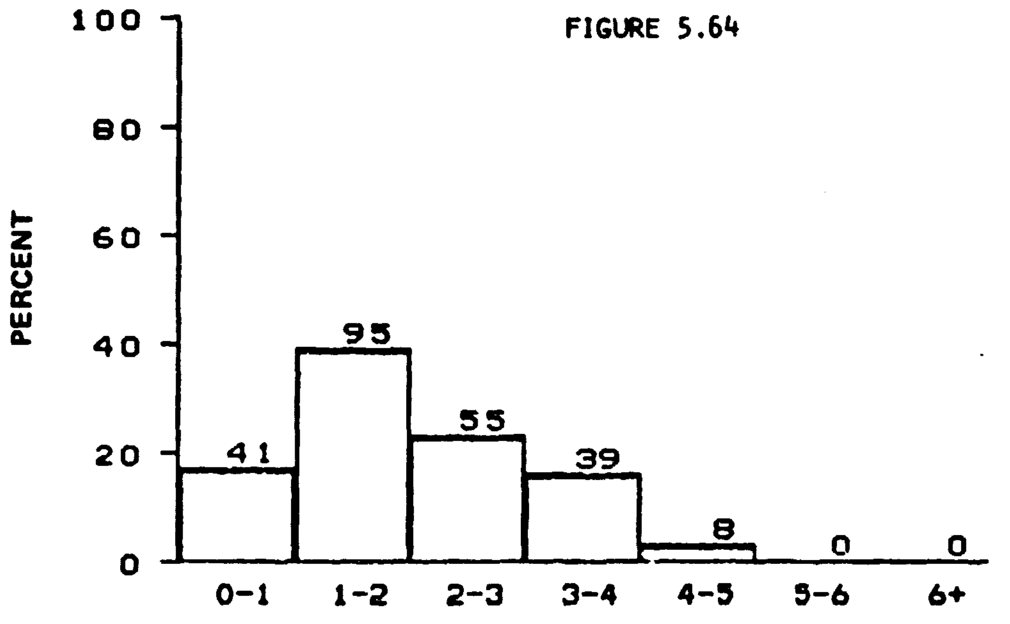
FIGURE 5.62



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF NOVEMBER
BLM AREA #2
N = 162, MEAN = 2.0, SIGMA = 0.83

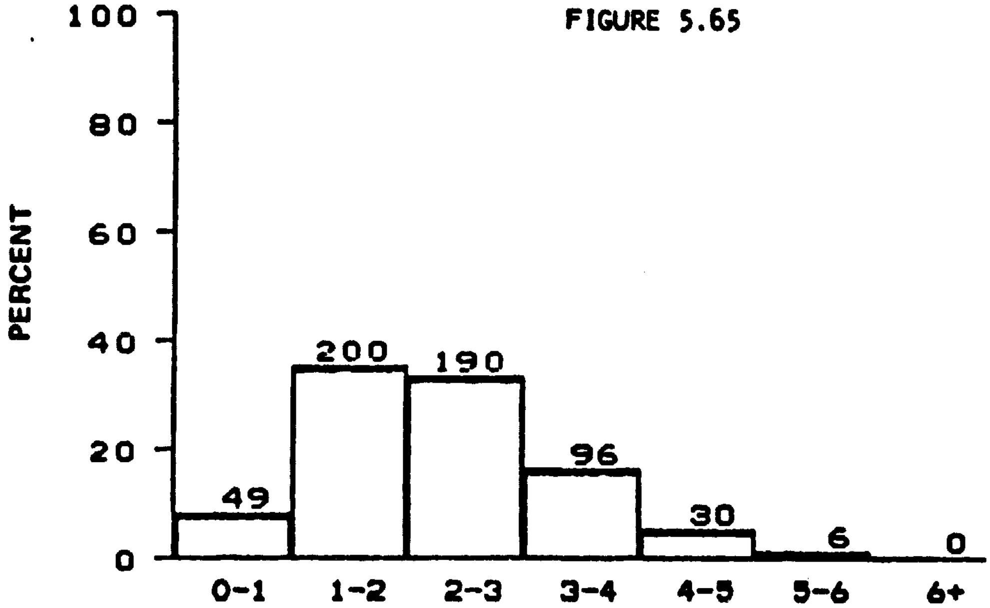


DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF NOVEMBER
BLM AREA #3
N = 235, MEAN = 2.0, SIGMA = 0.77



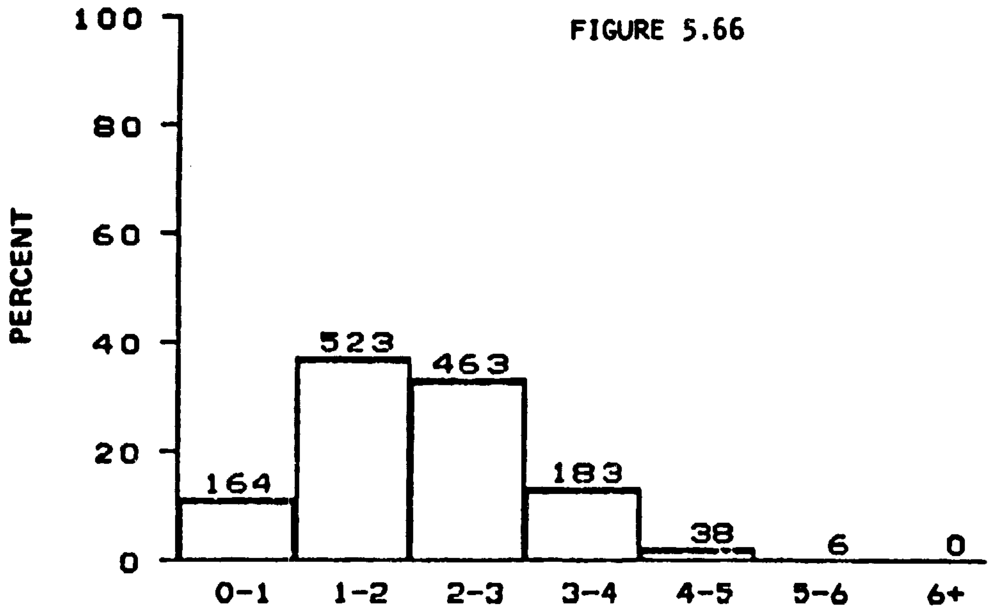
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF NOVEMBER
BLM AREA #4
N = 238, MEAN = 2.0, SIGMA = 1.1

FIGURE 5.65

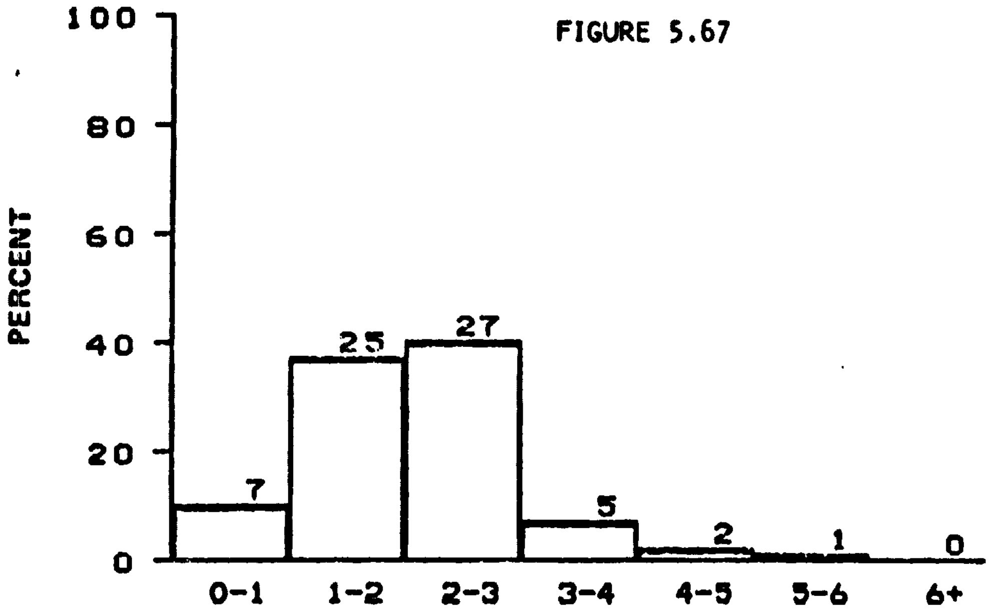


DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF NOVEMBER
BLM AREA #5
N = 571, MEAN = 2.3, SIGMA = 1.1

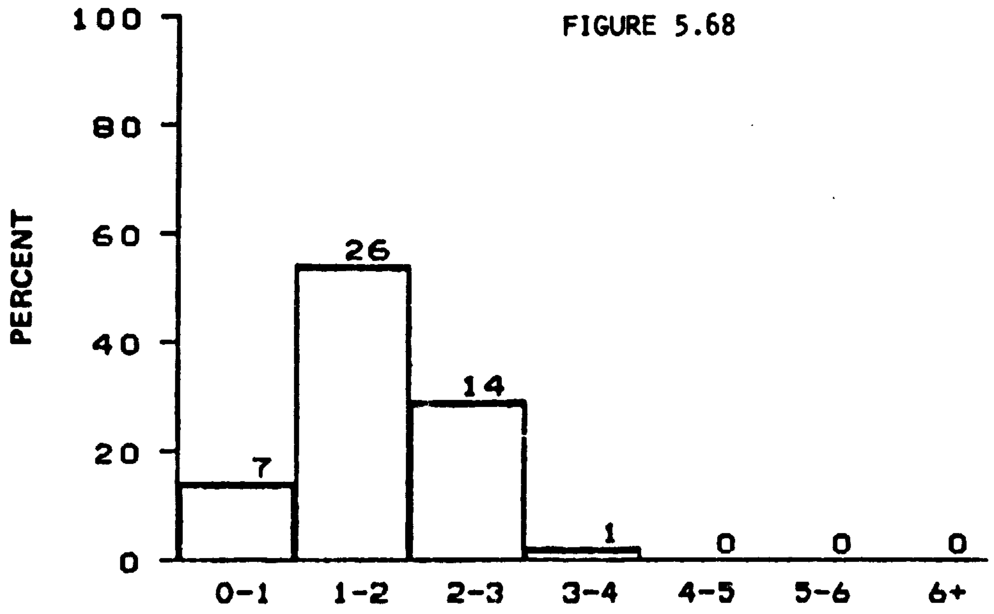
FIGURE 5.66



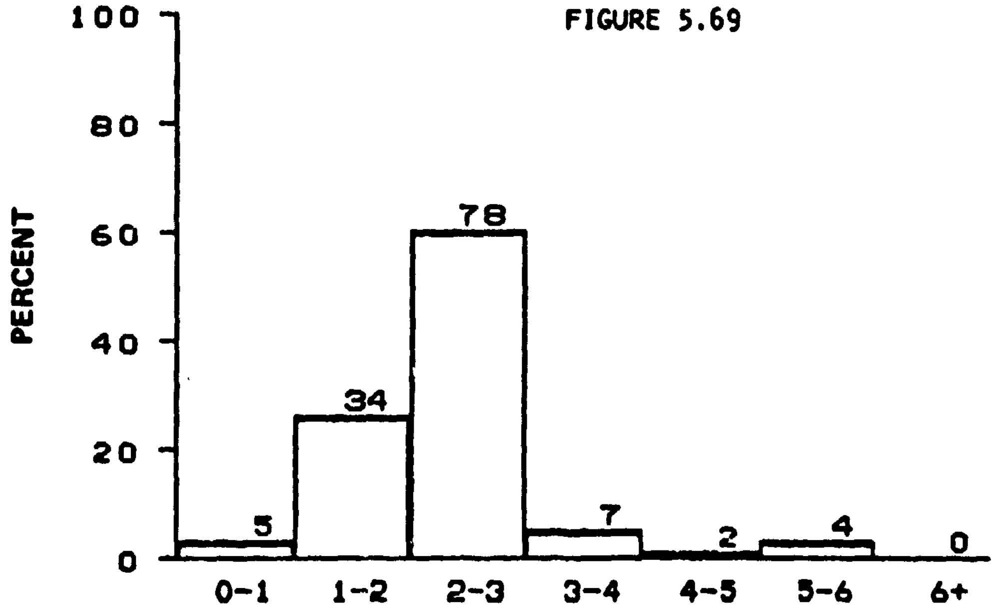
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF NOVEMBER
ALL BLM AREAS
N = 1377, MEAN = 2.1, SIGMA = 0.98



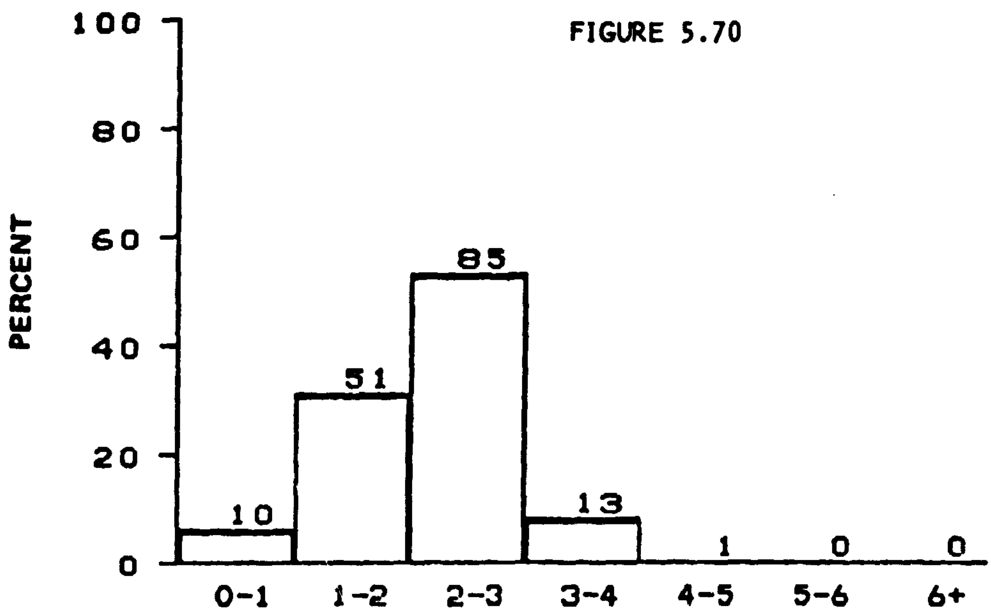
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF DECEMBER
BLM AREA #1
N = 67, MEAN = 2.1, SIGMA = 0.98



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF DECEMBER
BLM AREA #2
N = 48, MEAN = 1.7, SIGMA = 0.70



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF DECEMBER
BLM AREA #3
N = 130, MEAN = 2.3, SIGMA = 0.88



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF DECEMBER
BLM AREA #4
N = 160, MEAN = 2.2, SIGMA = 0.74

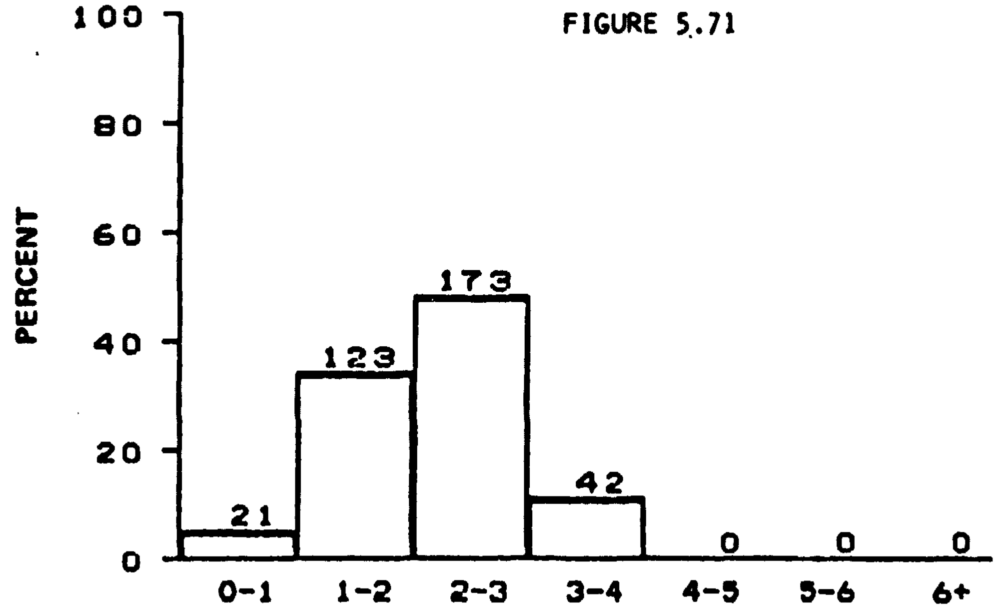


FIGURE 5.71

DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF DECEMBER
BLM AREA #5
N = 359, MEAN = 2.2, SIGMA = 0.76

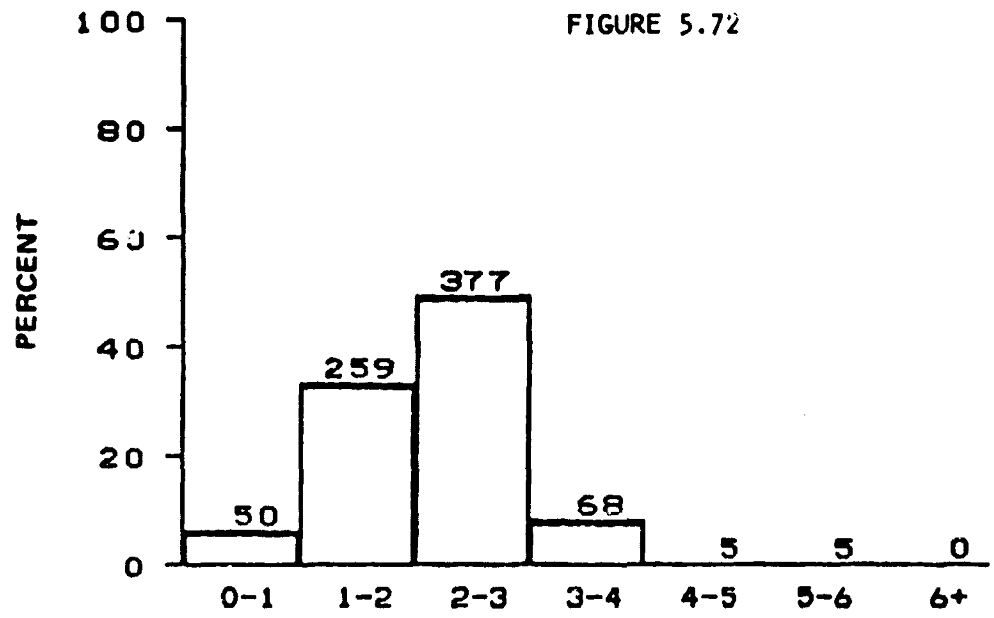
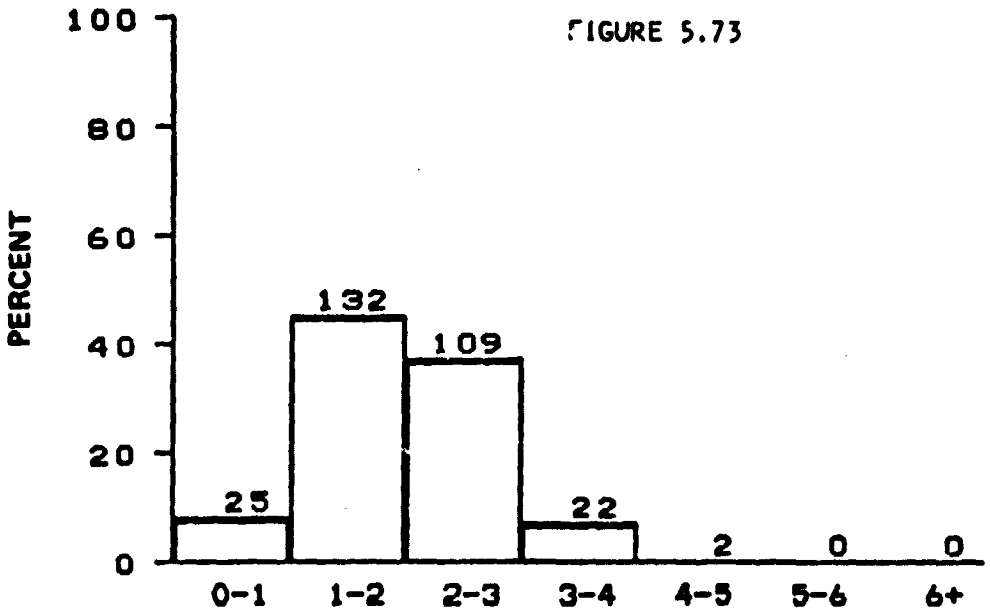
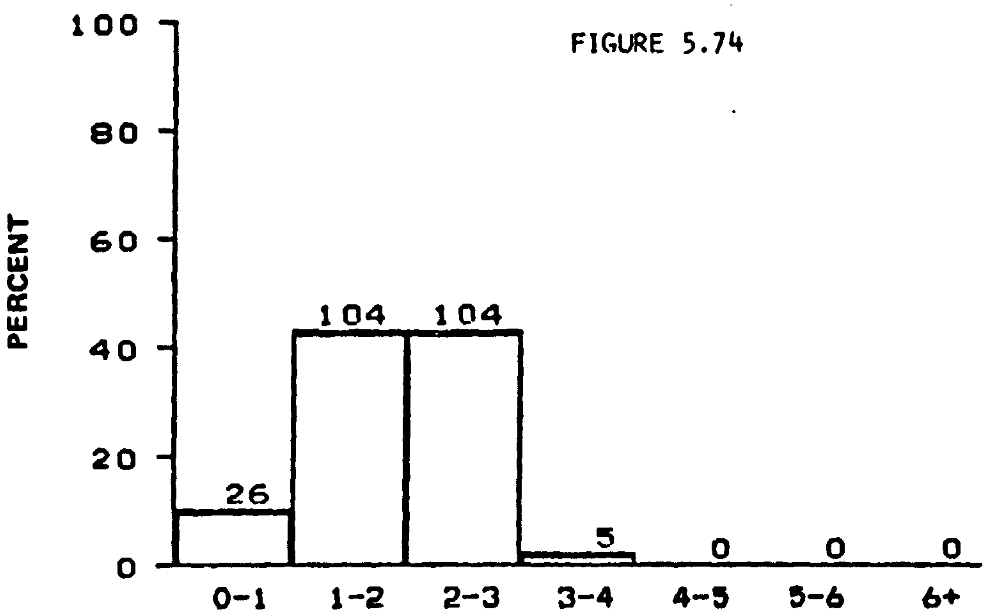


FIGURE 5.72

DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
MONTH OF DECEMBER
ALL BLM AREAS
N = 764, MEAN = 2.2, SIGMA = 0.81



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
SPRING SEASON
BLM AREA #1
N = 290, MEAN = 2.0, SIGMA = 0.78



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
SPRING SEASON
BLM AREA #2
N = 239, MEAN = 1.9, SIGMA = 0.70

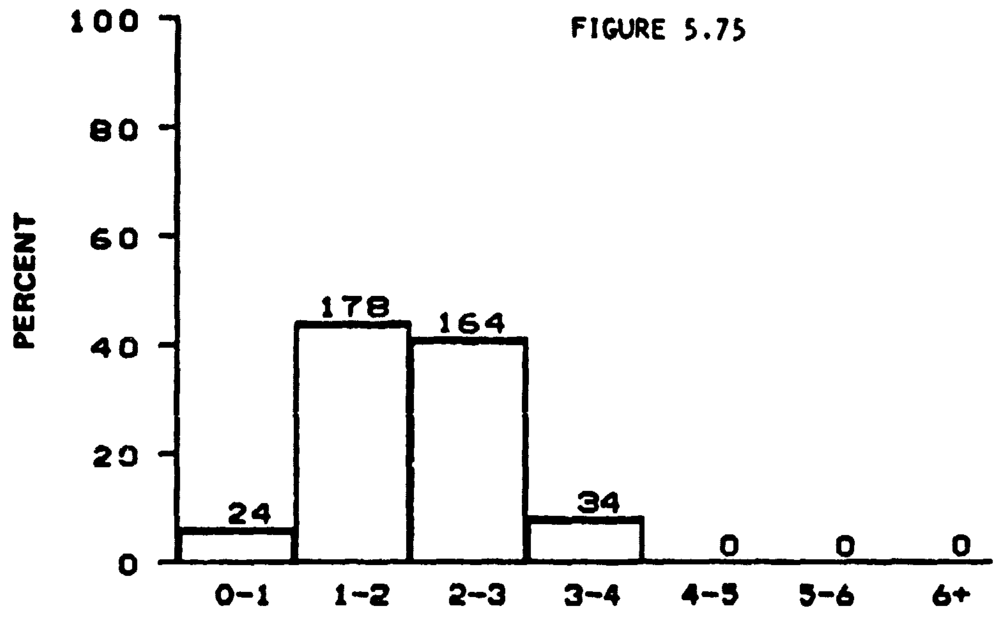


FIGURE 5.75

DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

SPRING SEASON

BLM AREA #3

N = 400, MEAN = 2.0, SIGMA = 0.73

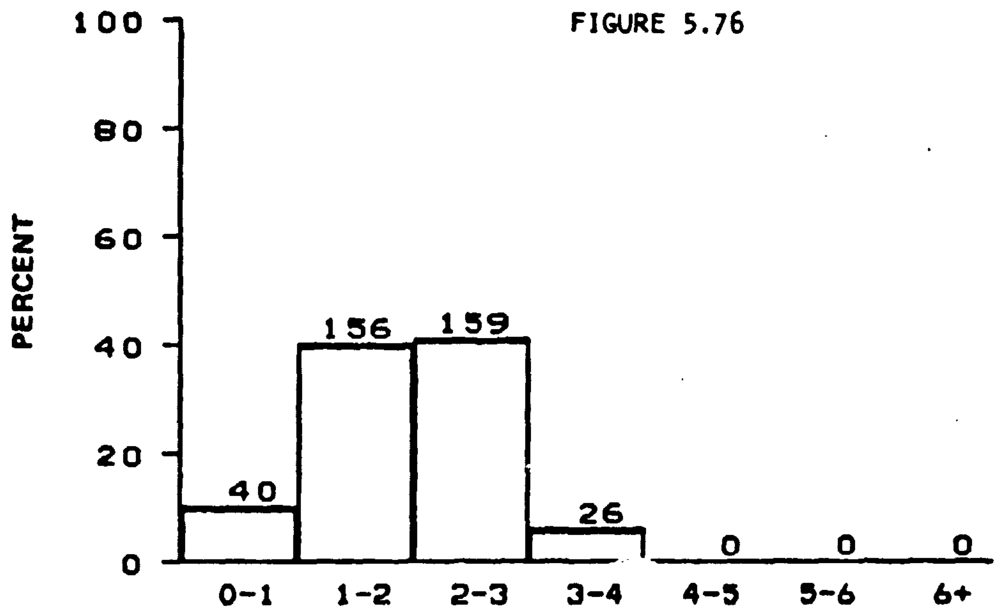


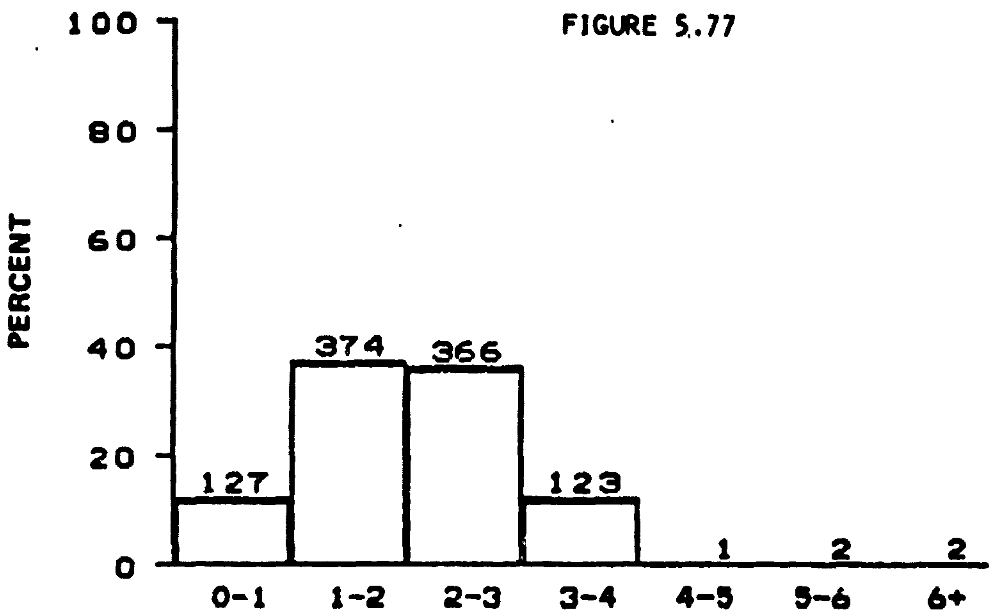
FIGURE 5.76

DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

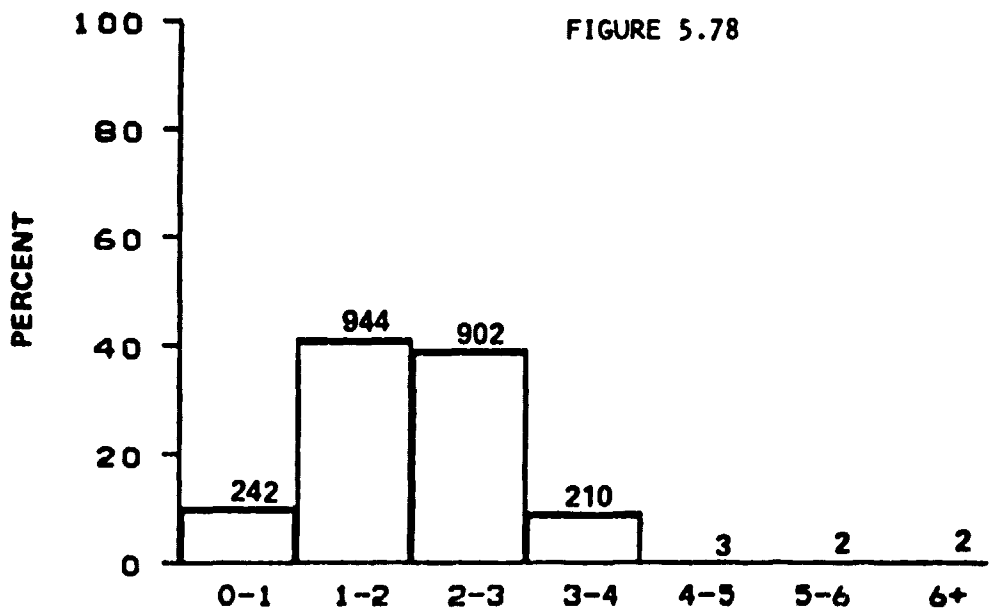
SPRING SEASON

BLM AREA #4

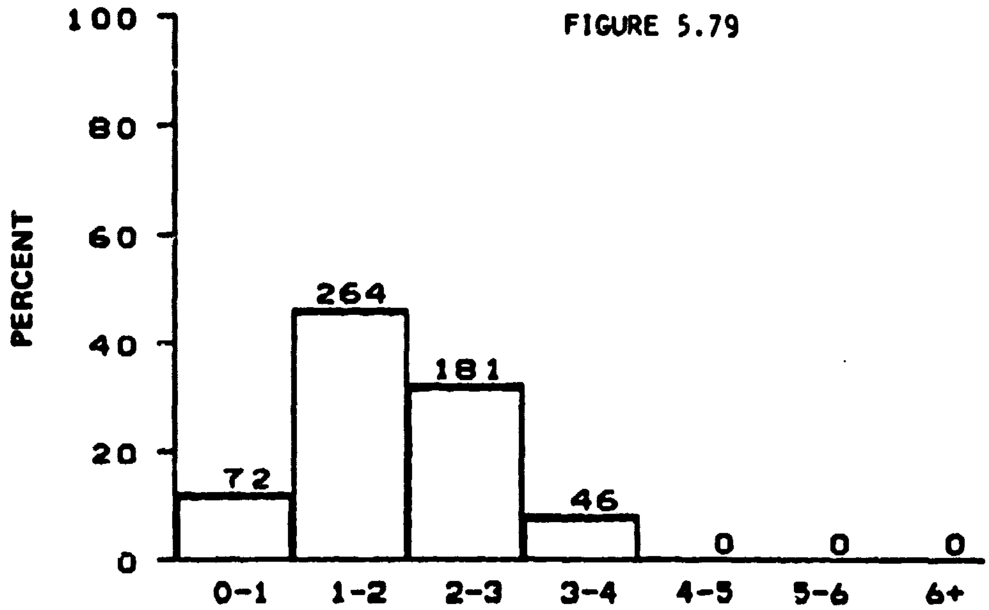
N = 381, MEAN = 1.9, SIGMA = 0.77



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
SPRING SEASON
BLM AREA #5
N = 995, MEAN = 2.0, SIGMA = 0.91



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
SPRING SEASON
ALL BLM AREAS
N = 2305, MEAN = 2.0, SIGMA = 0.80

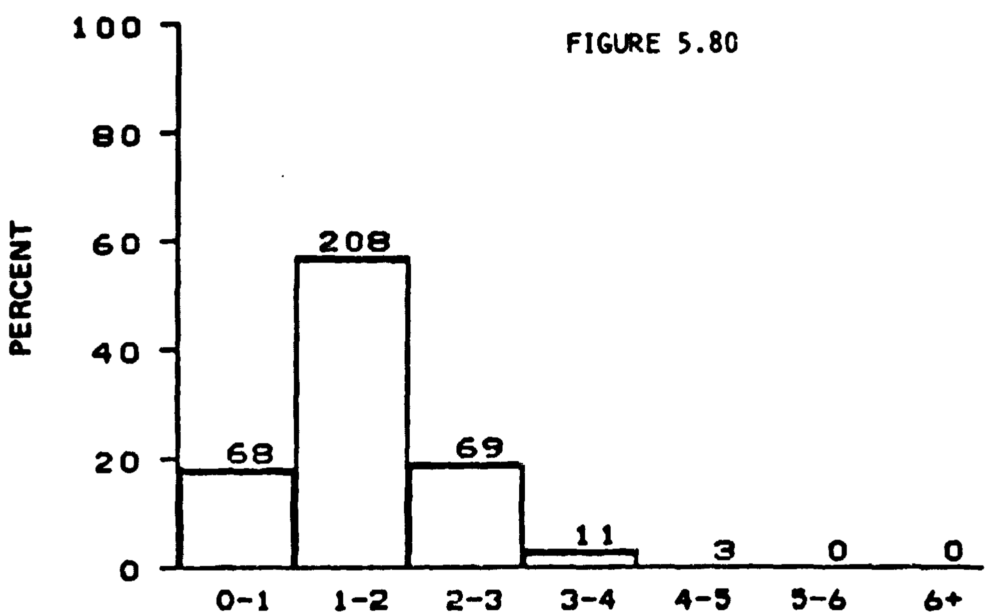


DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

SUMMER SEASON

BLM AREA #1

N = 563, MEAN = 1.9, SIGMA = 0.81



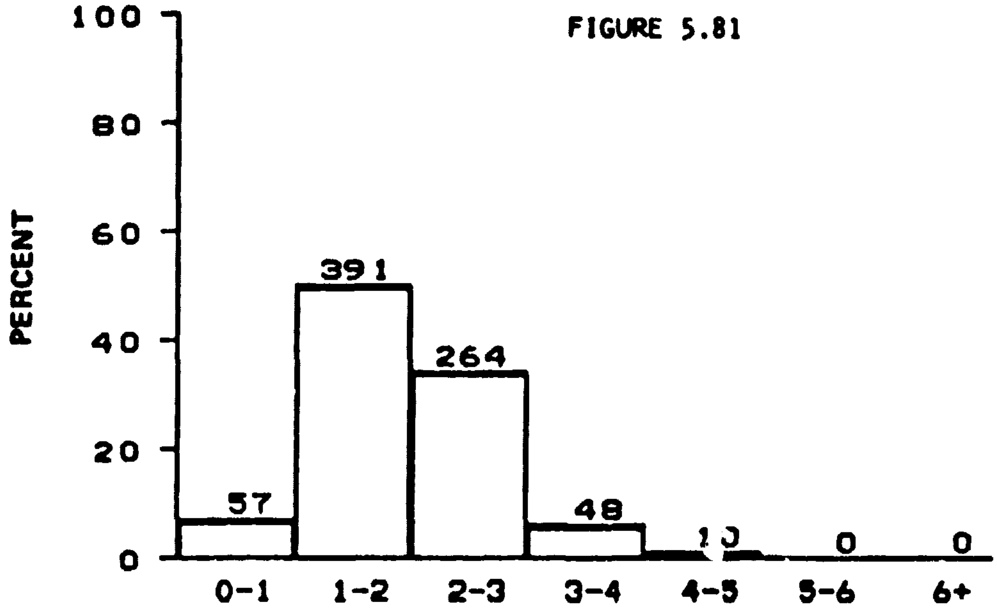
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

SUMMER SEASON

BLM AREA #2

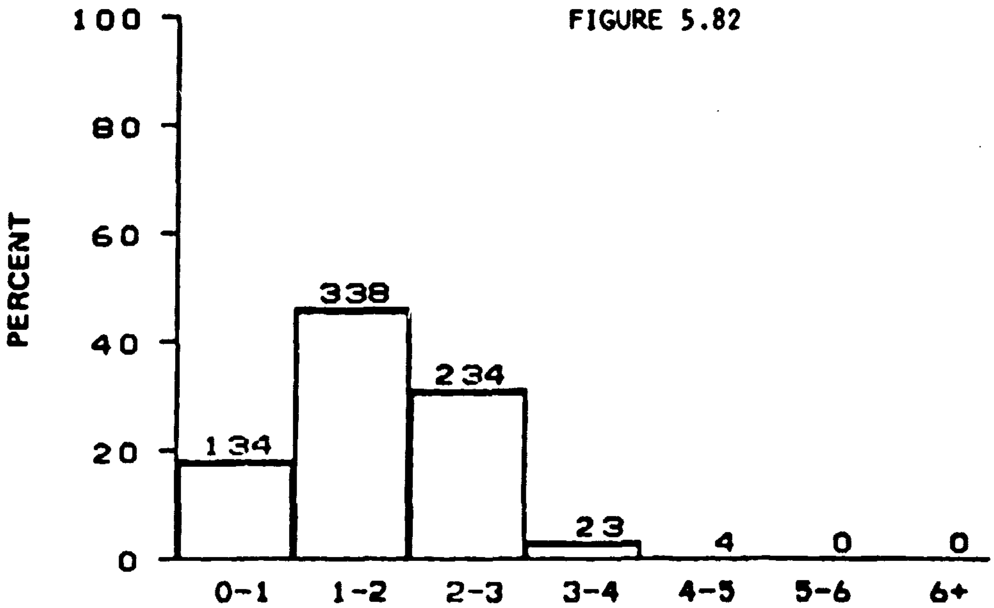
N = 359, MEAN = 1.6, SIGMA = 0.76

FIGURE 5.81



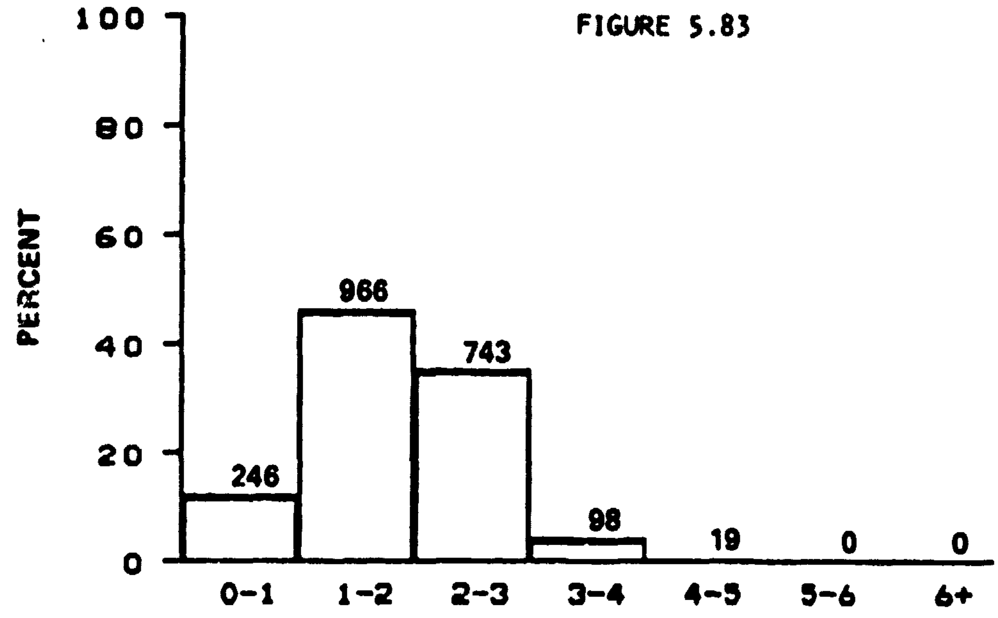
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
SUMMER SEASON
BLM AREA #3
N = 770, MEAN = 1.9, SIGMA = 0.77

FIGURE 5.82



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
SUMMER SEASON
BLM AREA #4
N = 733, MEAN = 1.7, SIGMA = 0.79

FIGURE 5.83



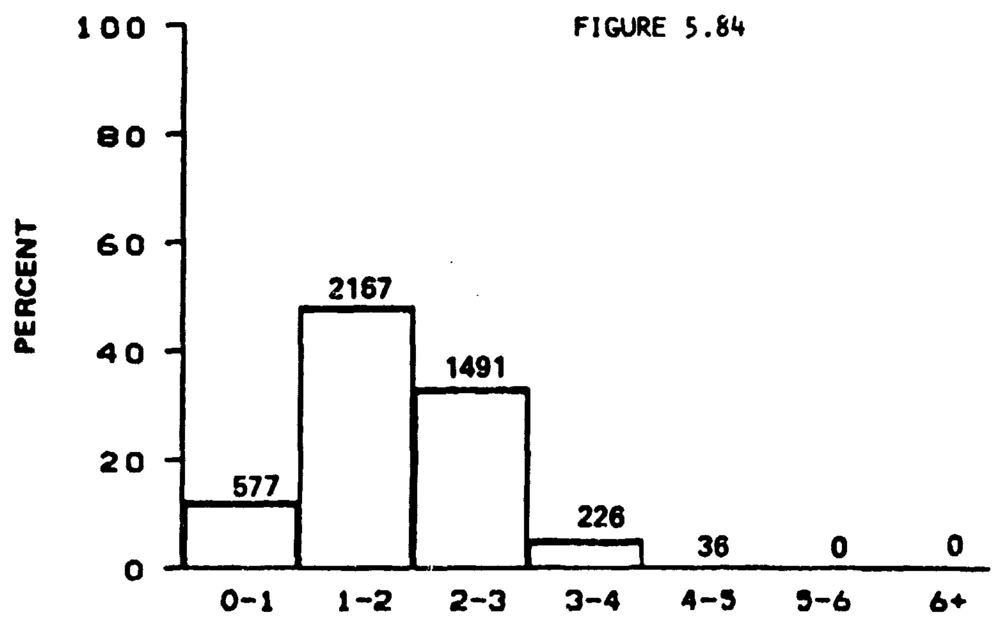
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

SUMMER SEASON

BLM AREA #5

N = 2072, MEAN = 1.9, SIGMA = 0.79

FIGURE 5.84

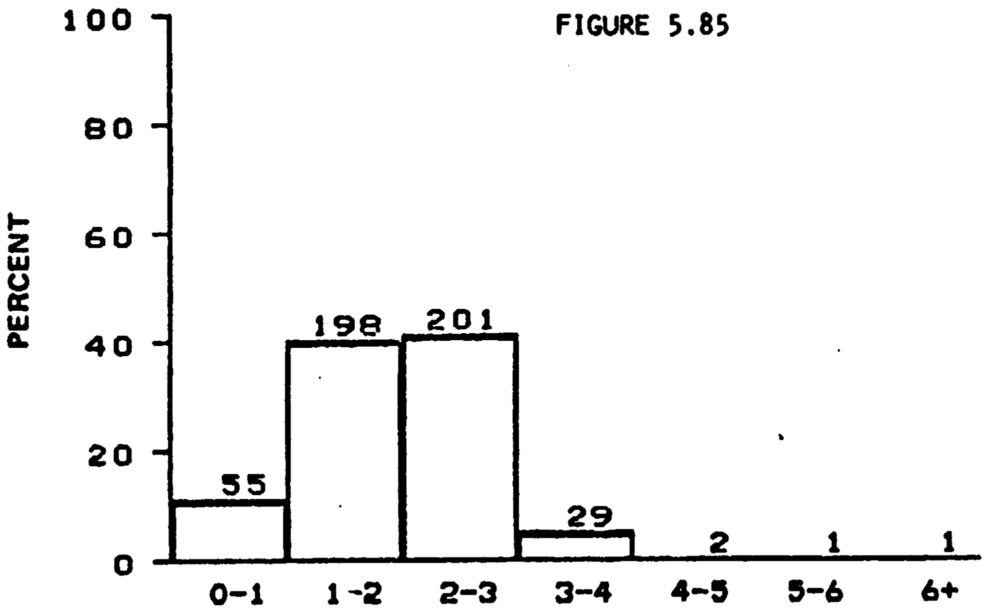


DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

SUMMER SEASON

ALL BLM AREAS

N = 4497, MEAN = 1.8, SIGMA = 0.80

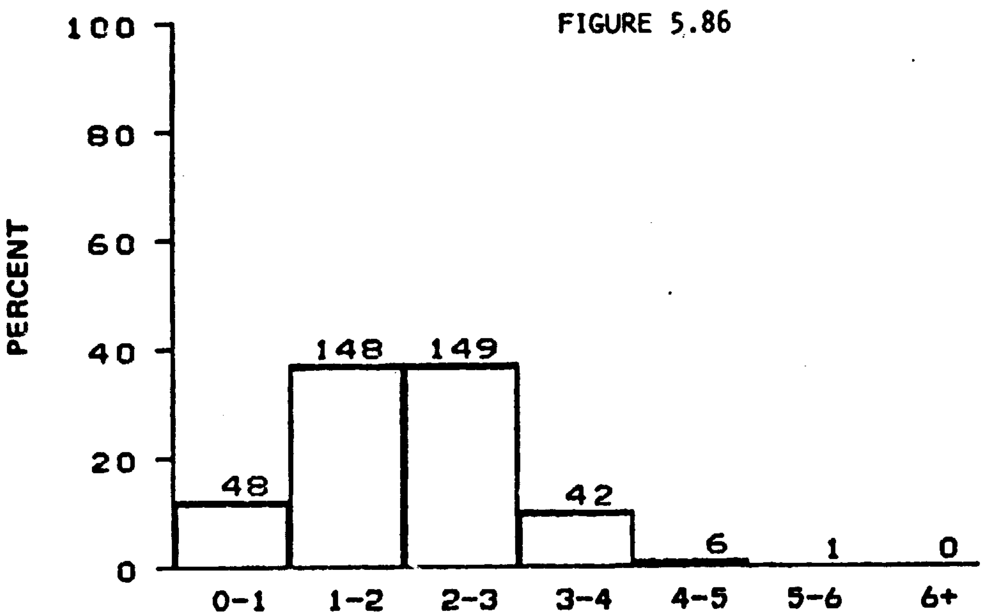


DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

FALL SEASON

BLM AREA #1

N = 487, MEAN = 1.9, SIGMA = 0.83



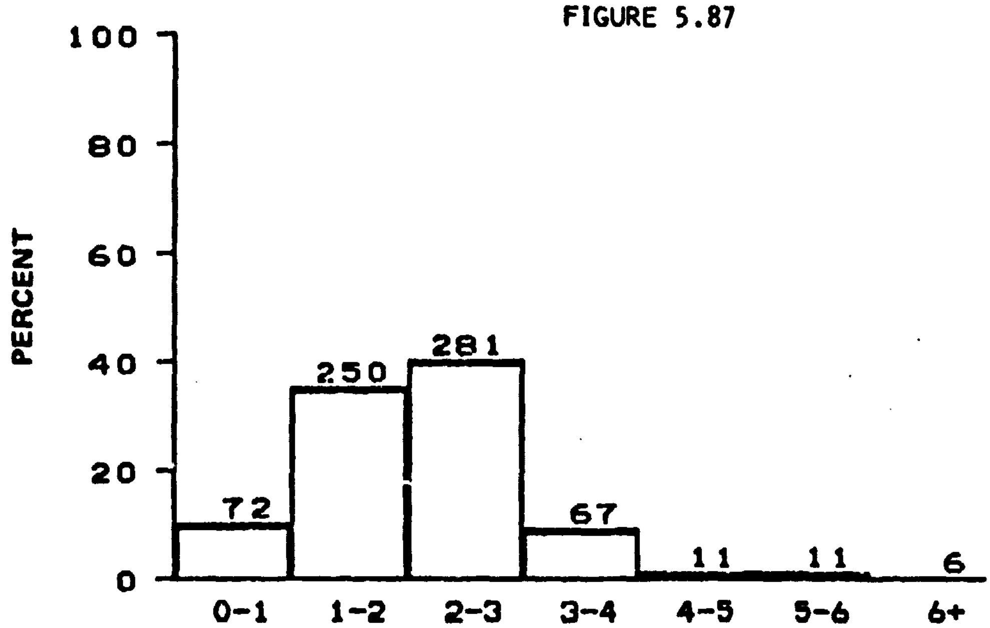
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

FALL SEASON

BLM AREA #2

N = 394, MEAN = 2.0, SIGMA = 0.91

FIGURE 5.87



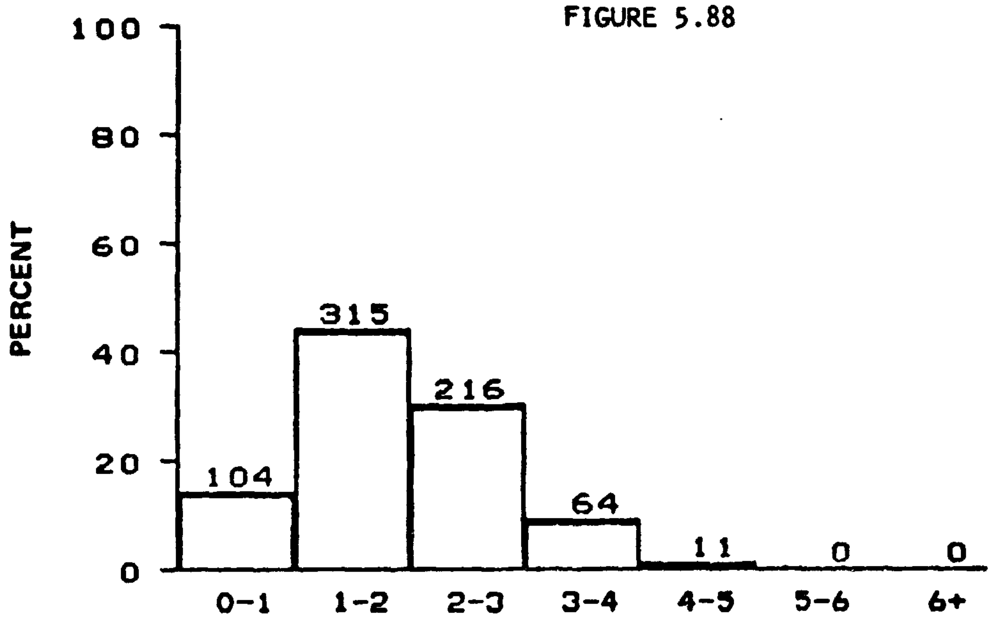
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

FALL SEASON

BLM AREA #3

N = 698, MEAN = 2.1, SIGMA = 1.0

FIGURE 5.88



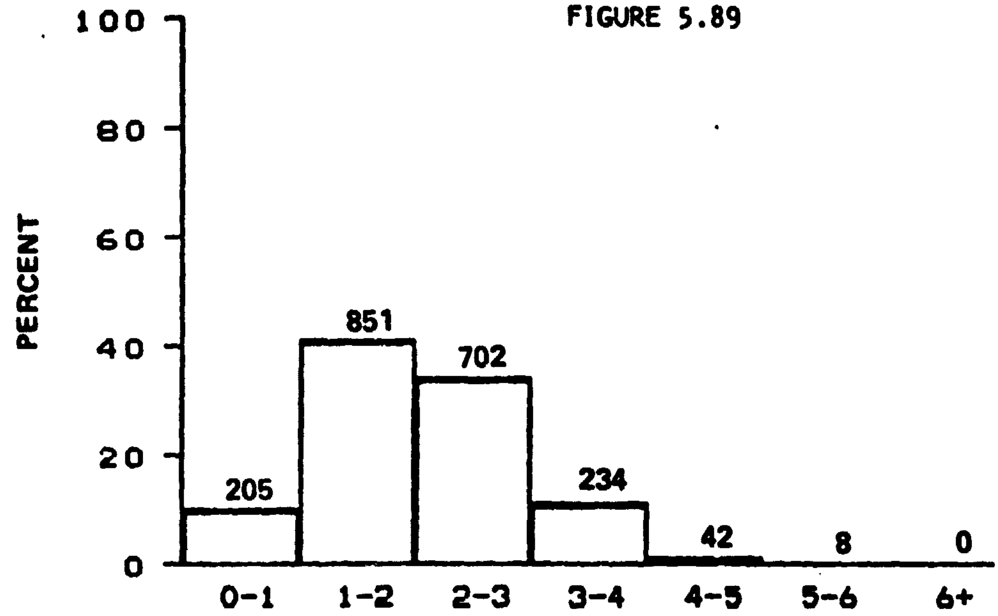
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

FALL SEASON

BLM AREA #4

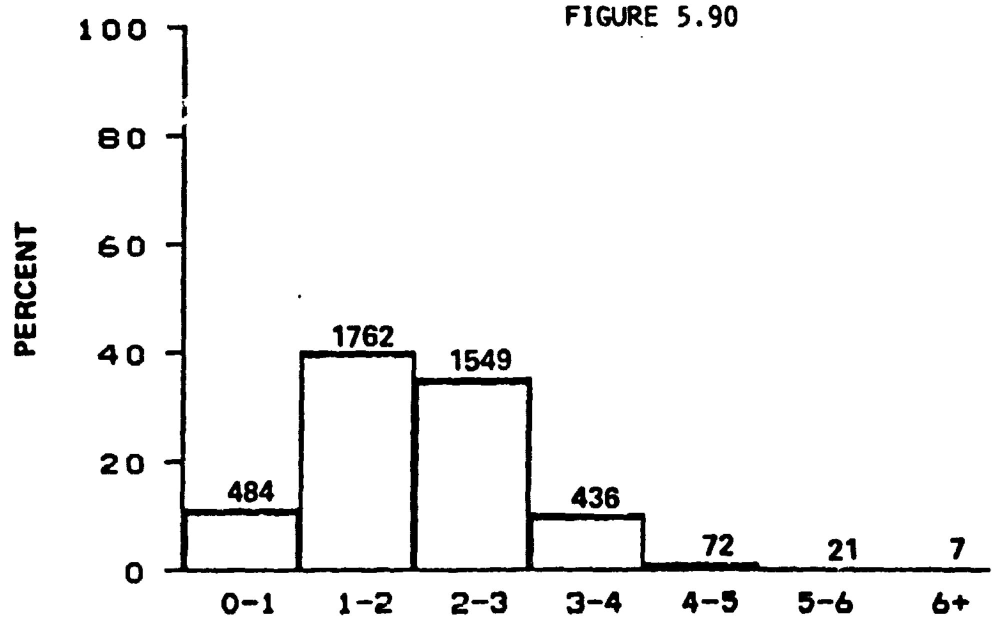
N = 710, MEAN = 1.9, SIGMA = 0.90

FIGURE 5.89



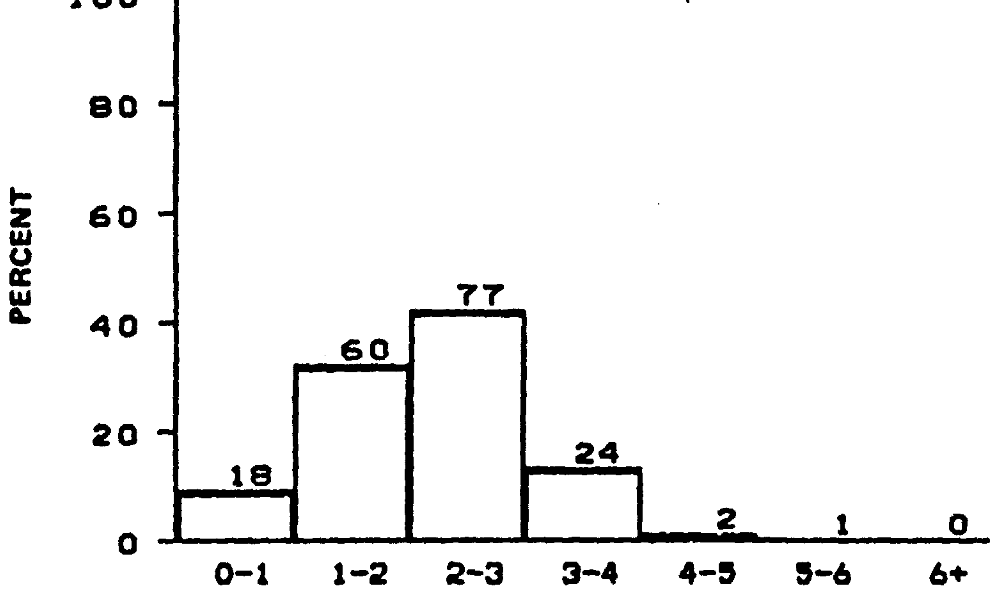
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
FALL SEASON
BLM AREA #5
N = 2042, MEAN = 2.0, SIGMA = 0.93

FIGURE 5.90



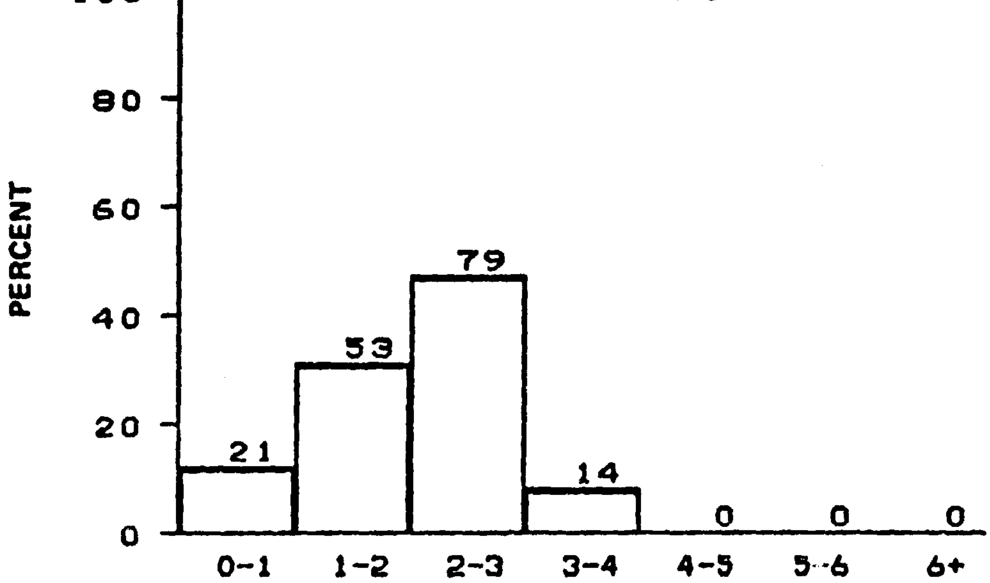
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
FALL SEASON
ALL BLM AREAS
N = 4331, MEAN = 2.0, SIGMA = 0.93

FIGURE 5.91



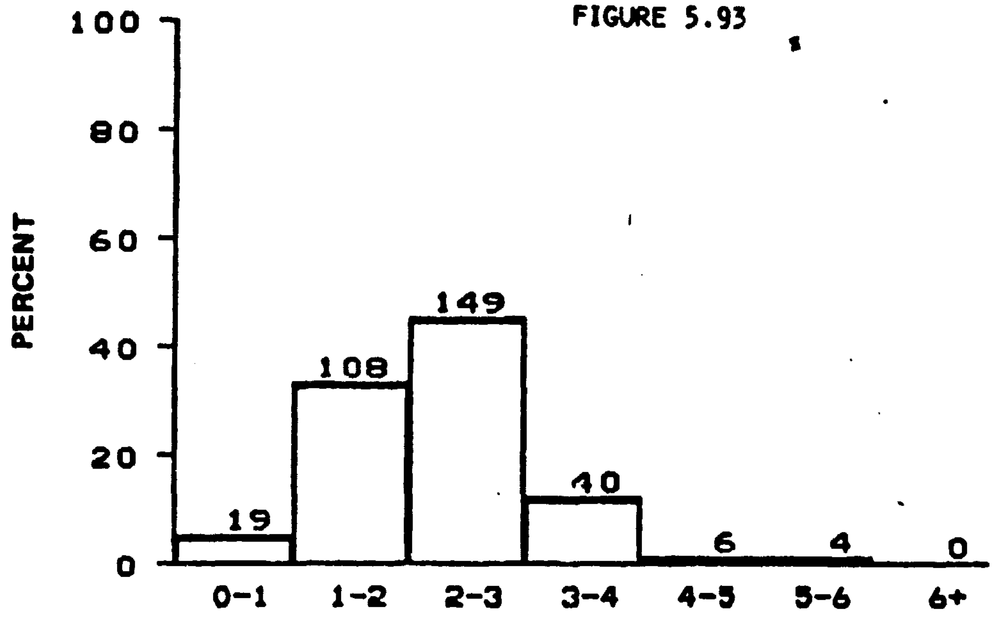
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
WINTER SEASON
BLM AREA #1
N = 182, MEAN = 2.1, SIGMA = 0.91

FIGURE 5.92



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
WINTER SEASON
BLM AREA #2
N = 167, MEAN = 2.0, SIGMA = 0.82

FIGURE 5.93



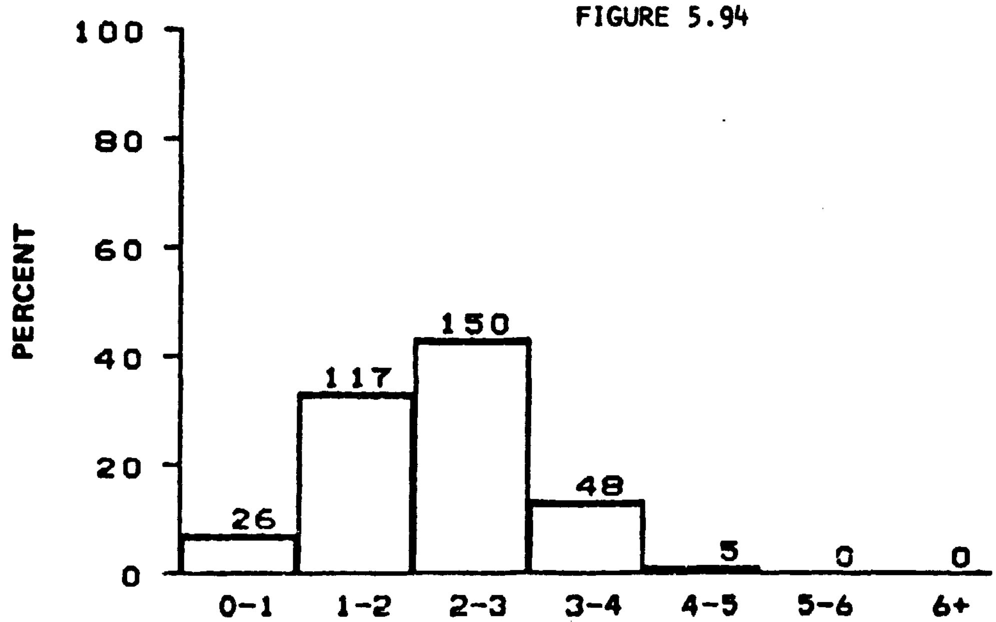
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

WINTER SEASON

BLM AREA #3

N = 326, MEAN = 2.2, SIGMA = 0.90

FIGURE 5.94



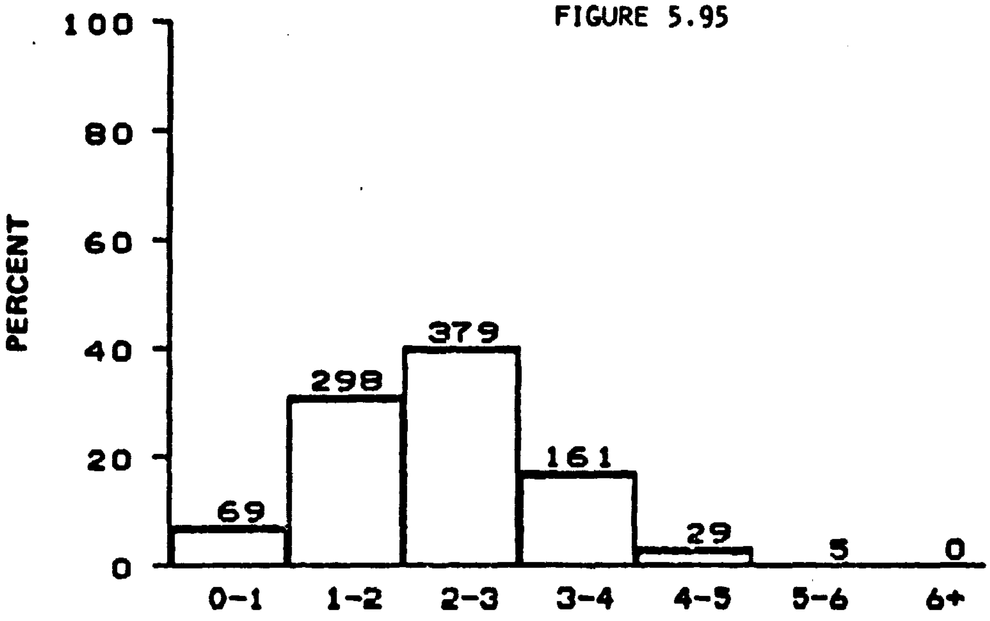
DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

WINTER SEASON

BLM AREA #4

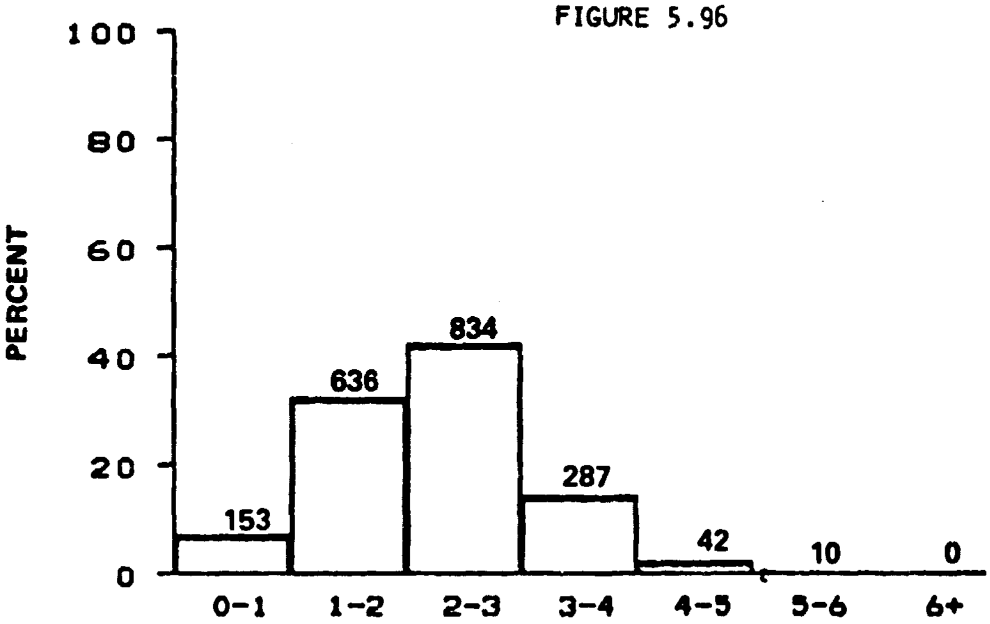
N = 346, MEAN = 2.2, SIGMA = 0.86

FIGURE 5.95



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
WINTER SEASON
BLM AREA #5
N = 941, MEAN = 2.3, SIGMA = 0.95

FIGURE 5.96



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
WINTER SEASON
ALL BLM AREAS
N = 1962, MEAN = 2.2, SIGMA = 0.91

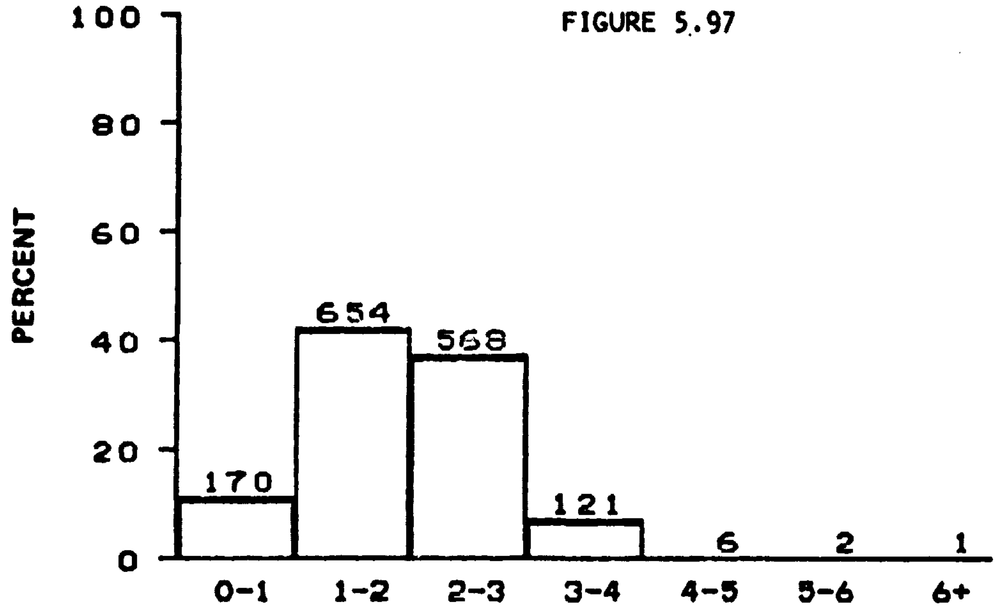


FIGURE 5.97

DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

ENTIRE MISSION

BLM AREA #1

N = 1522, MEAN = 1.9, SIGMA = 0.83

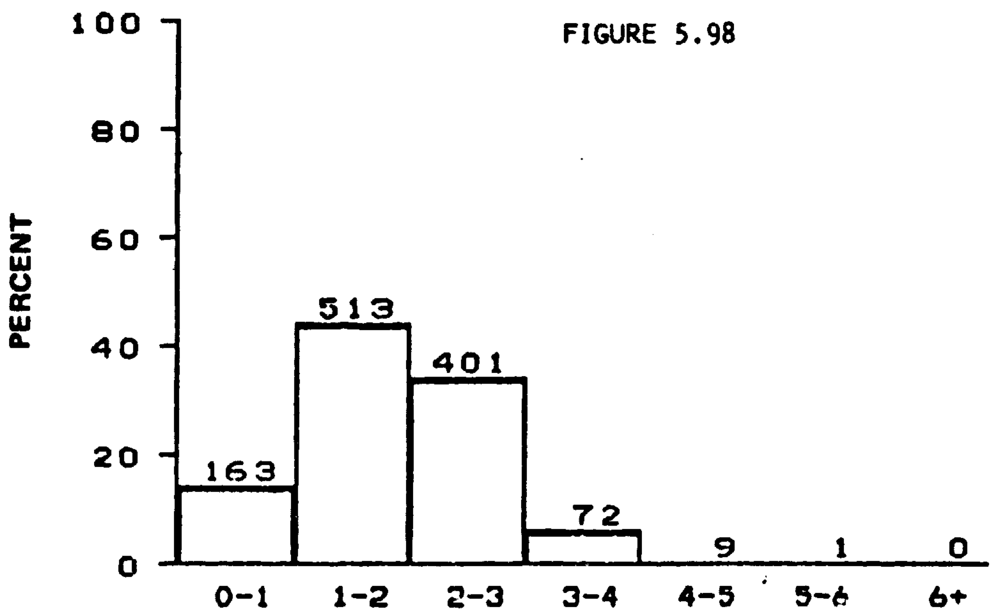


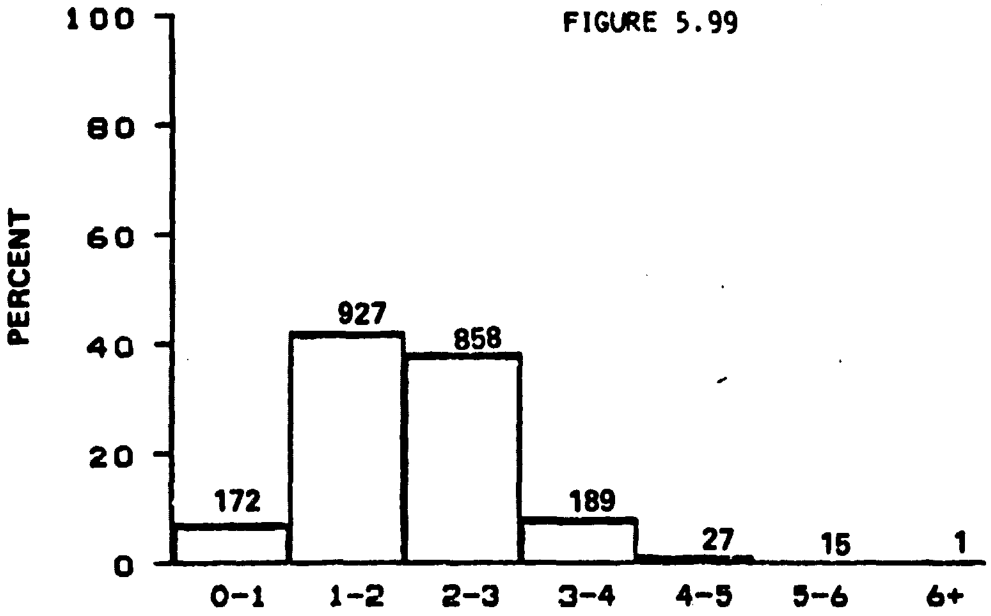
FIGURE 5.98

DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS

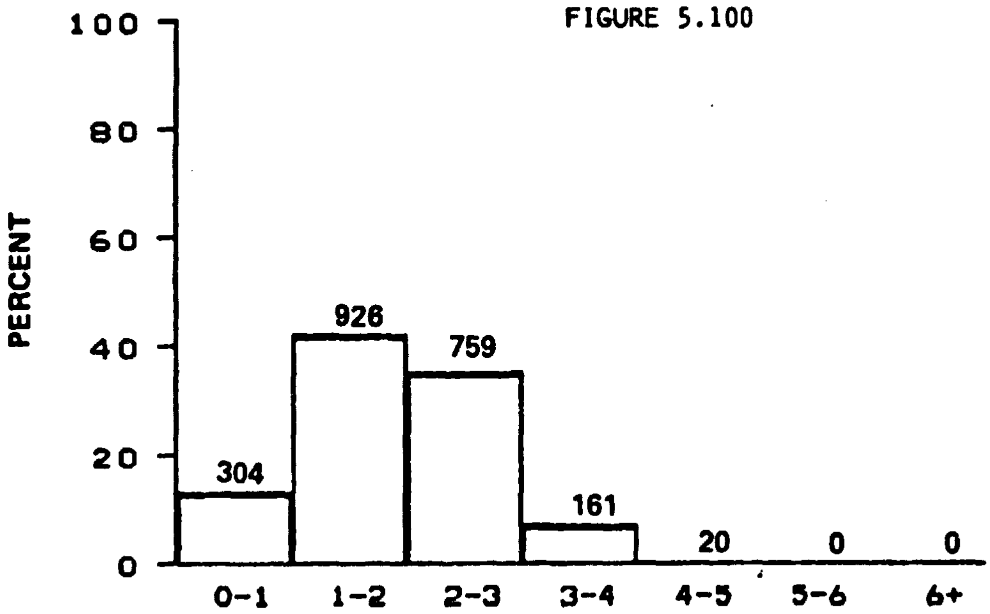
ENTIRE MISSION

BLM AREA #2

N = 1159, MEAN = 1.9, SIGMA = 0.83

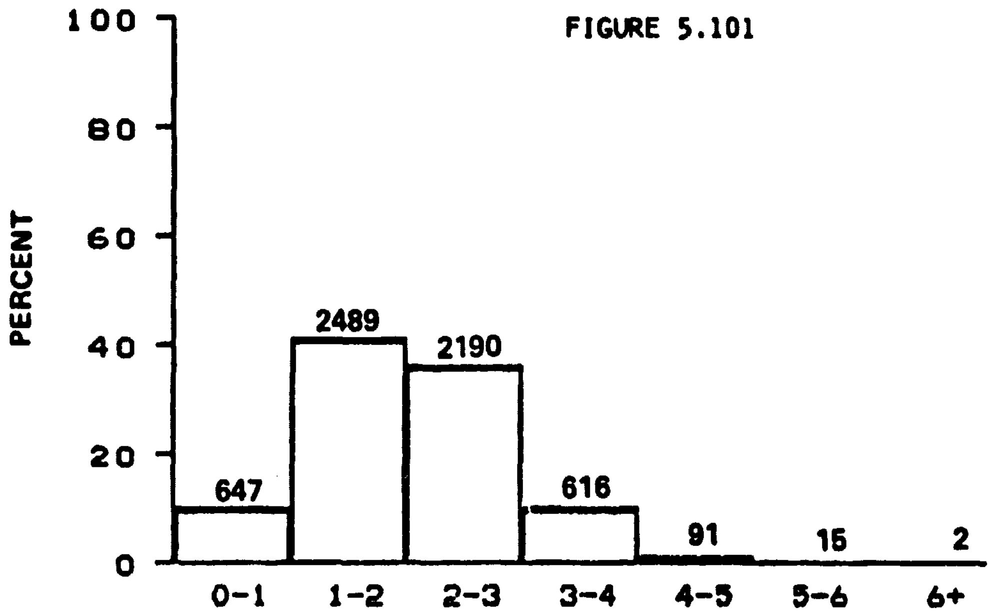


DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
ENTIRE MISSION
BLM AREA #3
N = 2194, MEAN = 2.1, SIGMA = 0.92



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
ENTIRE MISSION
BLM AREA #4
N = 2170, MEAN = 1.9, SIGMA = 0.85

FIGURE 5.101



DISTRIBUTION OF SIGNIFICANT WAVE HEIGHT IN METERS
ENTIRE MISSION
BLM AREA #5
N = 6050, MEAN = 2.0, SIGMA = 0.89

6.0 Wind Speed Histograms

The histograms for wind speed are presented in the following section. In each figure, the axis of abscissa is graduated in units of meters per second and the axis of ordinate is graduated in percent. In addition, each element of the histogram is labeled with the actual number of samples included in the element and each figure contains the number of points in the distribution as well as the mean and standard deviation of the distribution.

The histograms for each of the five BLM areas and a composite histogram of all five areas are given for

1) each month (composite of all years)
2) each season (composite of all years), and
3) the entire mission

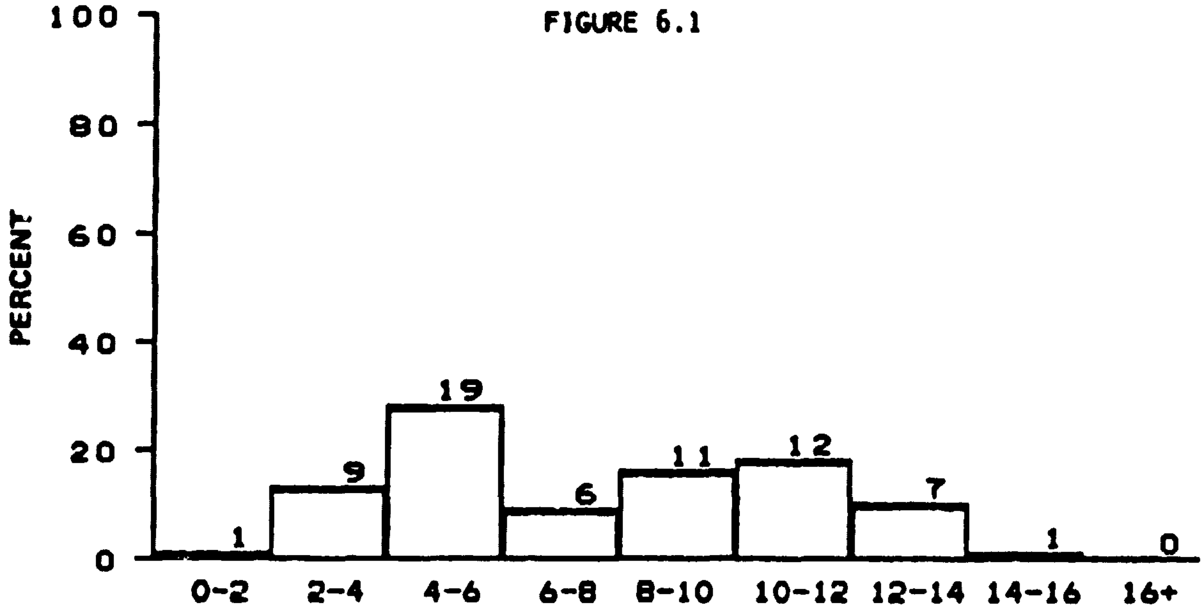
For the seasonal histograms, winter is defined as December, January, and February; spring is defined as March, April, and May; summer is defined as June, July, and August; and fall is defined as September, October, and November.

The monthly histograms for each of the five BLM areas have too few points to be considered as statistically valid distributions. This fact can be verified by observing the randomness of the distributions as compared to the monthly composite distributions. It is therefore impossible to characterize any differences between the BLM areas that might be present by analyzing the monthly histograms.

The monthly composite histograms of all five BLM areas do contain some useful information. For example, the composite histograms for the winter months indicate a mean wind speed in excess of 8 meters per second while the mean wind speed for late summer and early fall is about 5 meters per second.

The seasonal histograms for the composite of the five BLM areas verify this observation. Additionally, although the seasonal histograms for the individual BLM investigation areas contain sufficient points to be considered statistically valid distributions, the seasonal histograms for the composite of all the BLM areas are of particular interest. These figures indicate that the mean wind speed for the entire BLM investigation area oscillates around 6 meters per second, dropping to 5 meters per second in the summer and peaking at 8.5 meters per second in the winter.

The histograms for the entire mission are presented at the end of this section. Examination of these histograms yields some subtle differences between the histograms of different areas. Nevertheless, the distributions are so similar that any conclusions to be drawn from their differences would appear to be strictly speculation.

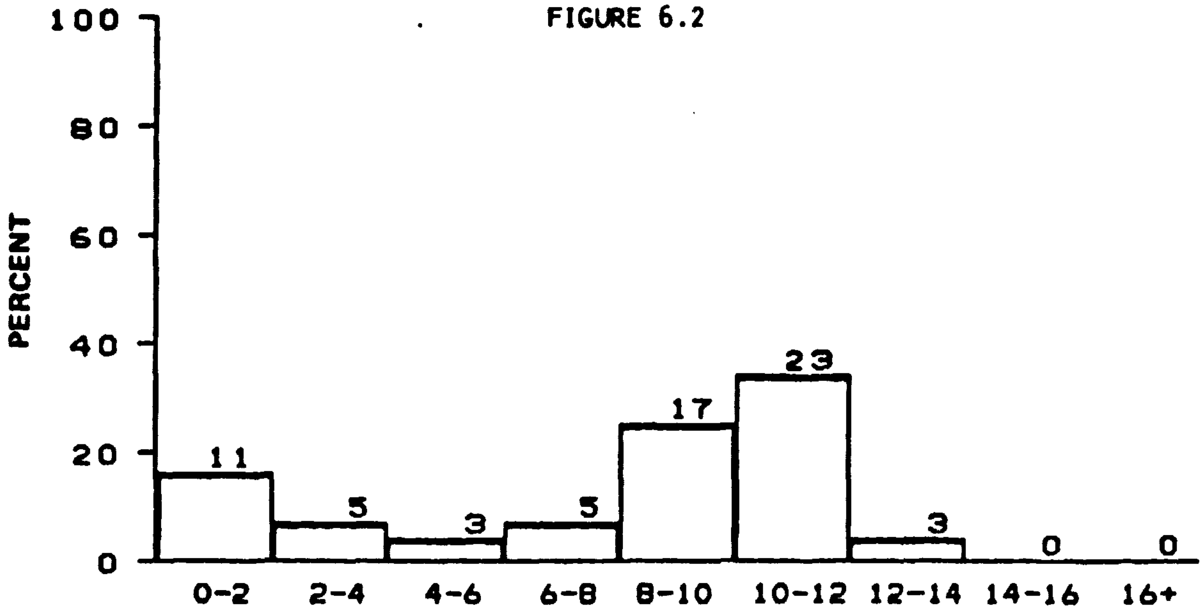


DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF JANUARY

BLM AREA #1

N = 66, MEAN = 7.6, SIGMA = 3.4



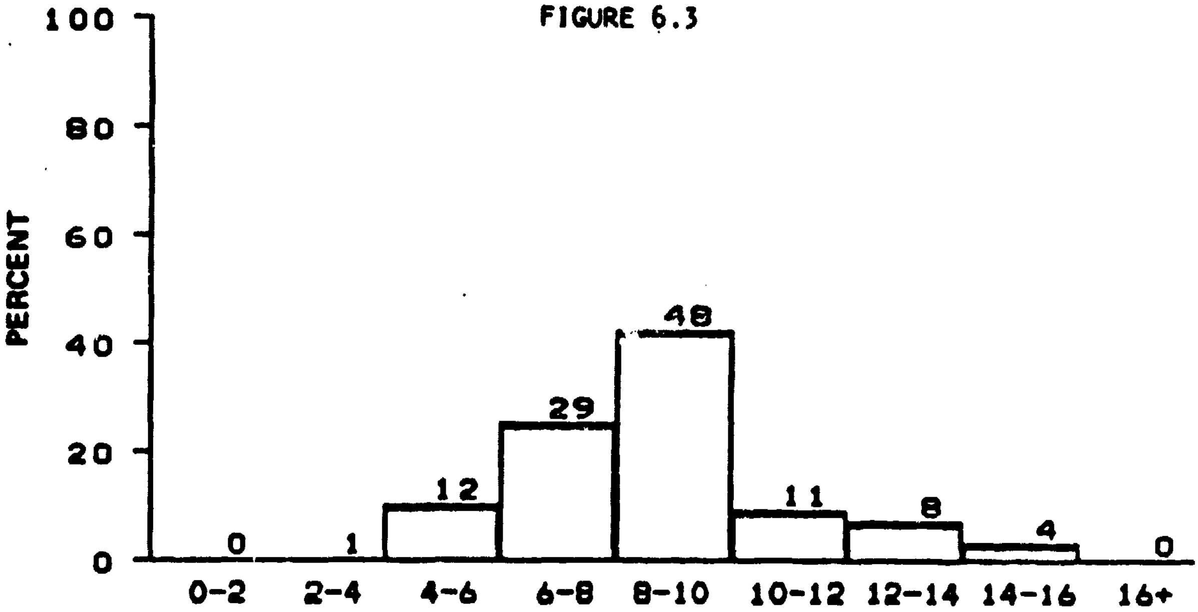
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF JANUARY

BLM AREA #2

N = 67, MEAN = 7.8, SIGMA = 3.8

FIGURE 6.3



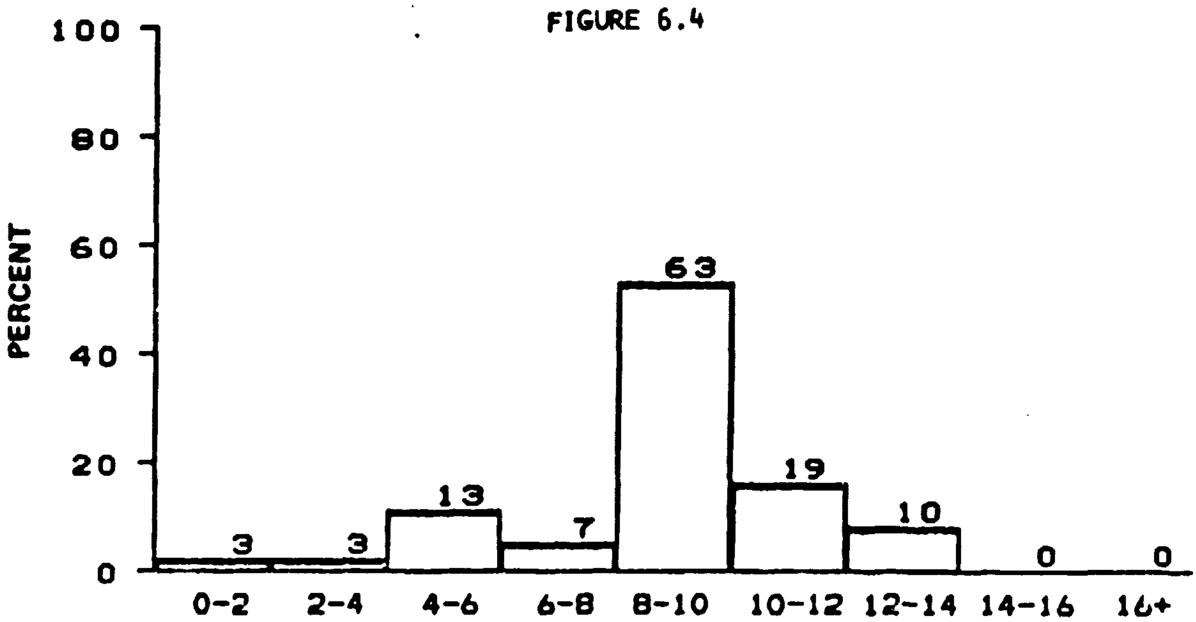
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF JANUARY

BLM AREA #3

N = 113, MEAN = 8.7, SIGMA = 2.4

FIGURE 6.4



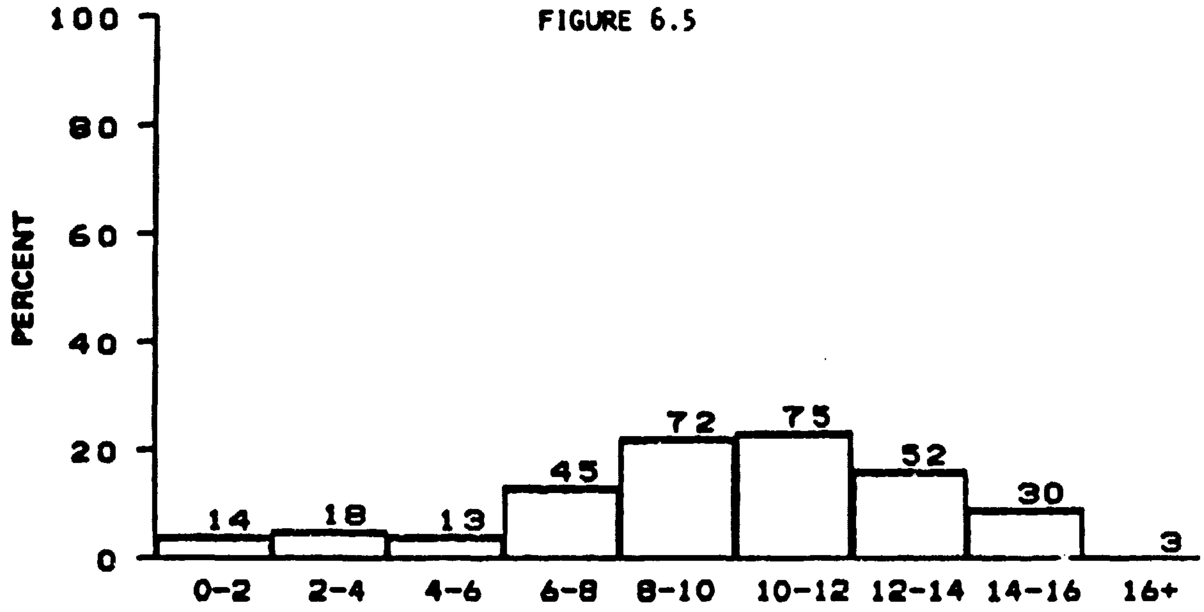
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF JANUARY

BLM AREA #4

N = 118, MEAN = 8.7, SIGMA = 2.5

FIGURE 6.5



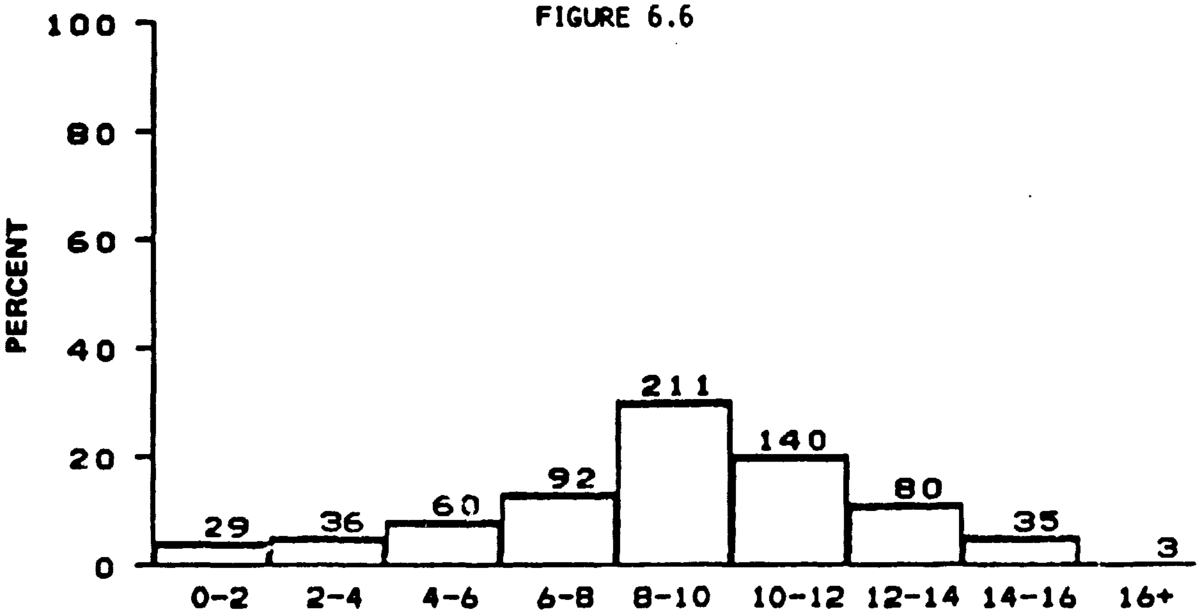
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF JANUARY

BLM AREA #5

N = 322, MEAN = 9.6, SIGMA = 3.6

FIGURE 6.6

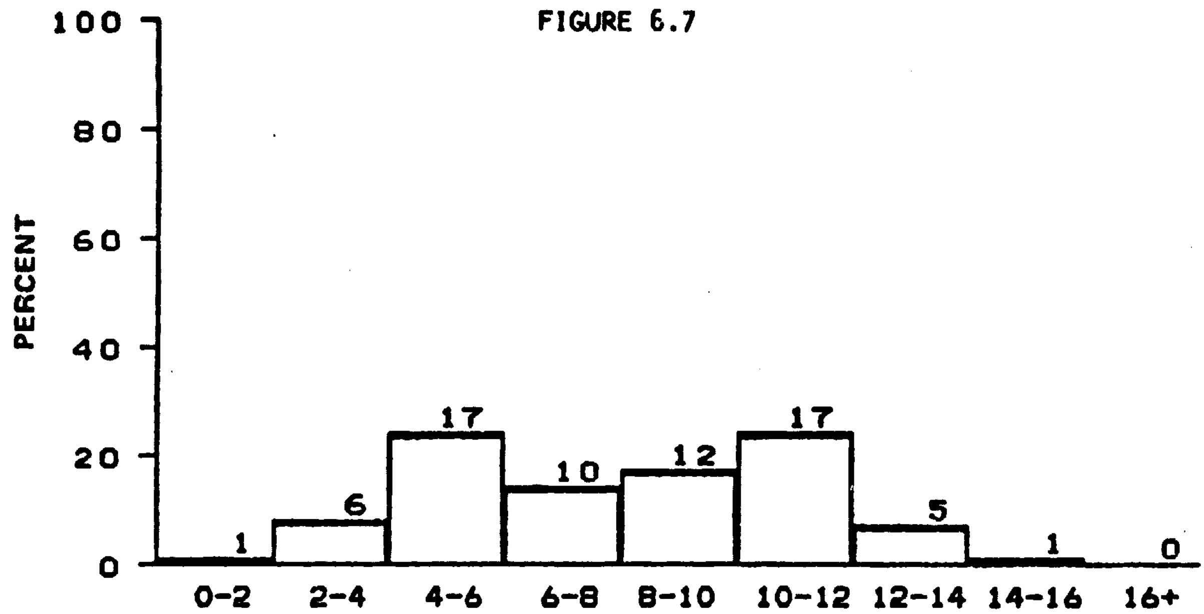


DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

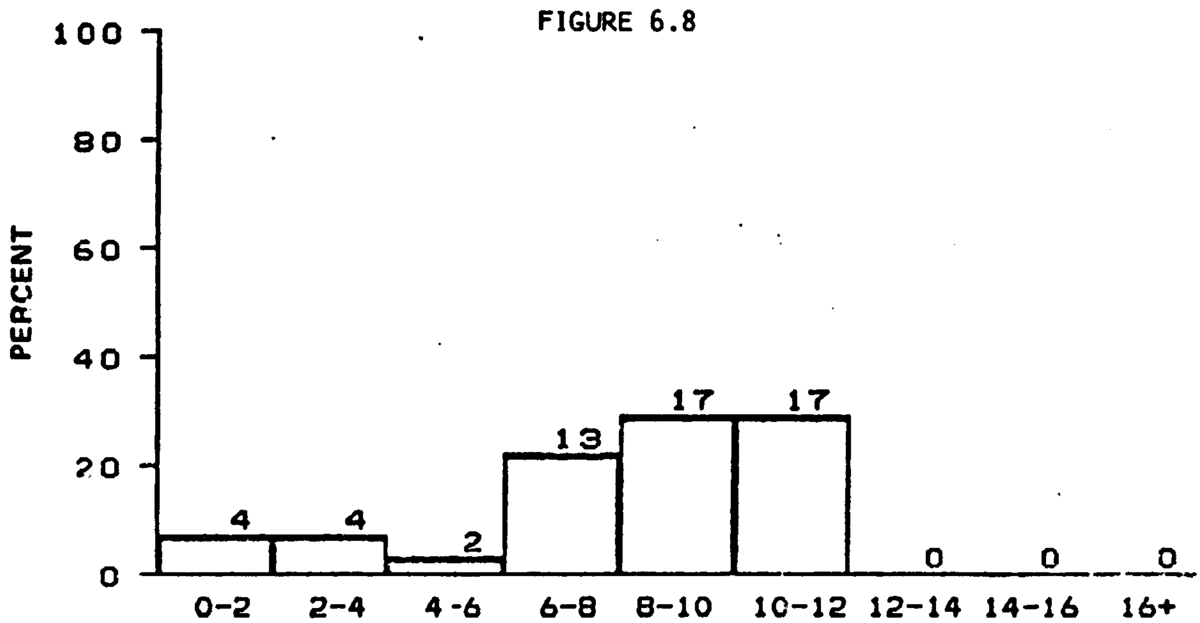
MONTH OF JANUARY

ALL BLM AREAS

N = 686, MEAN = 8.9, SIGMA = 3.4

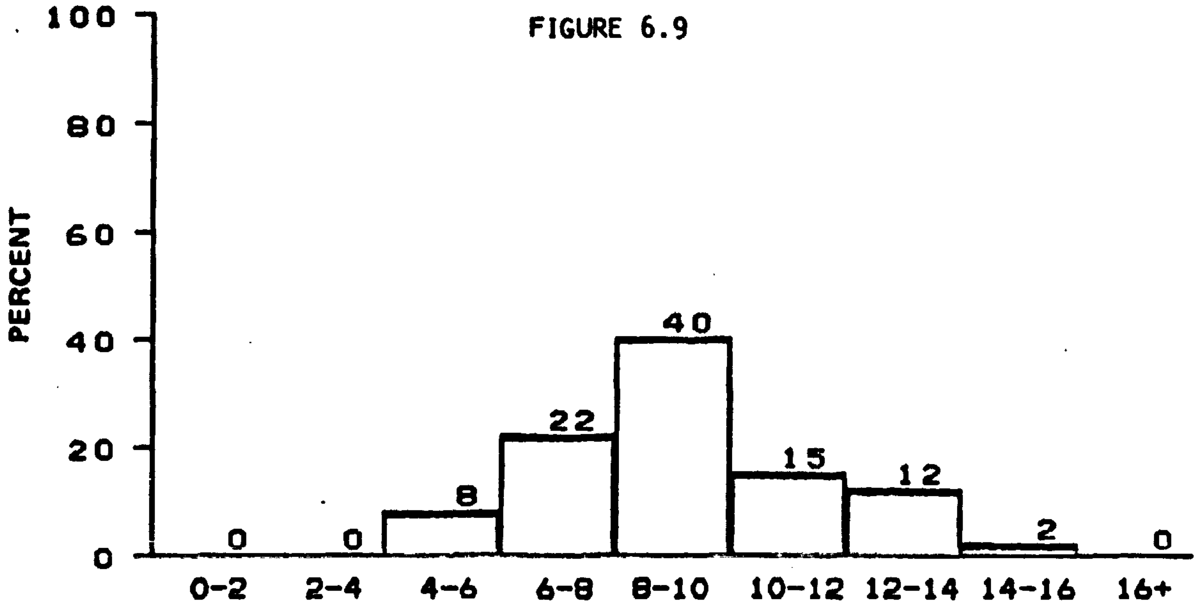


DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
MONTH OF FEBRUARY
BLM AREA #1
N = 69, MEAN = 8.0, SIGMA = 3.2



DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
MONTH OF FEBRUARY
BLM AREA #2
N = 57, MEAN = 8.0, SIGMA = 3.0

FIGURE 6.9



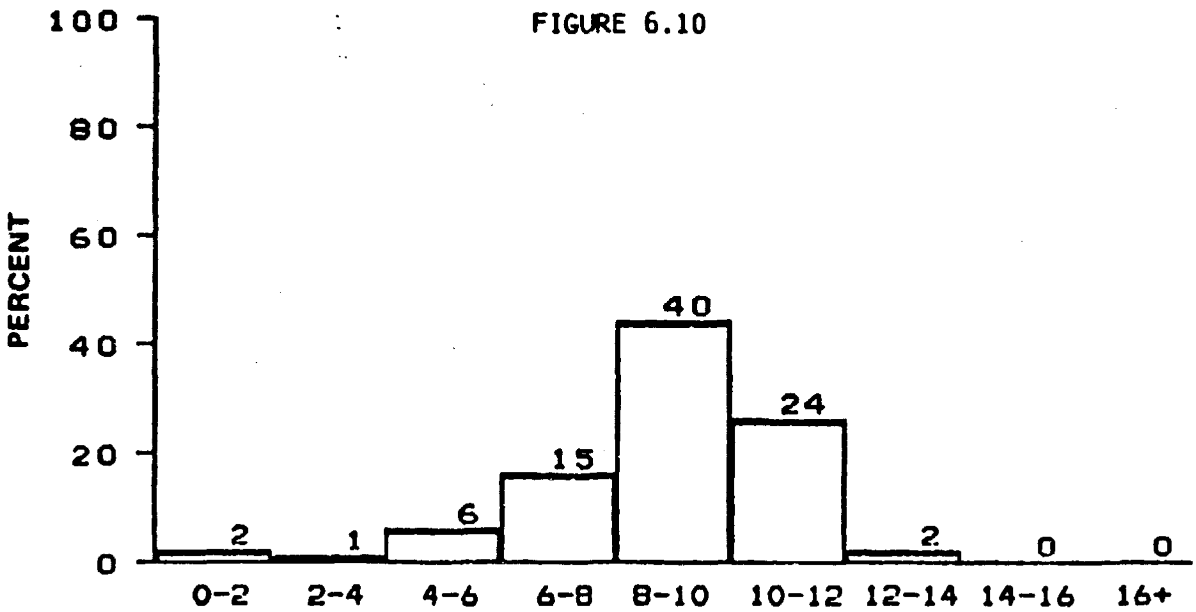
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF FEBRUARY

BLM AREA #3

N = 99, MEAN = 9.1, SIGMA = 2.3

FIGURE 6.10

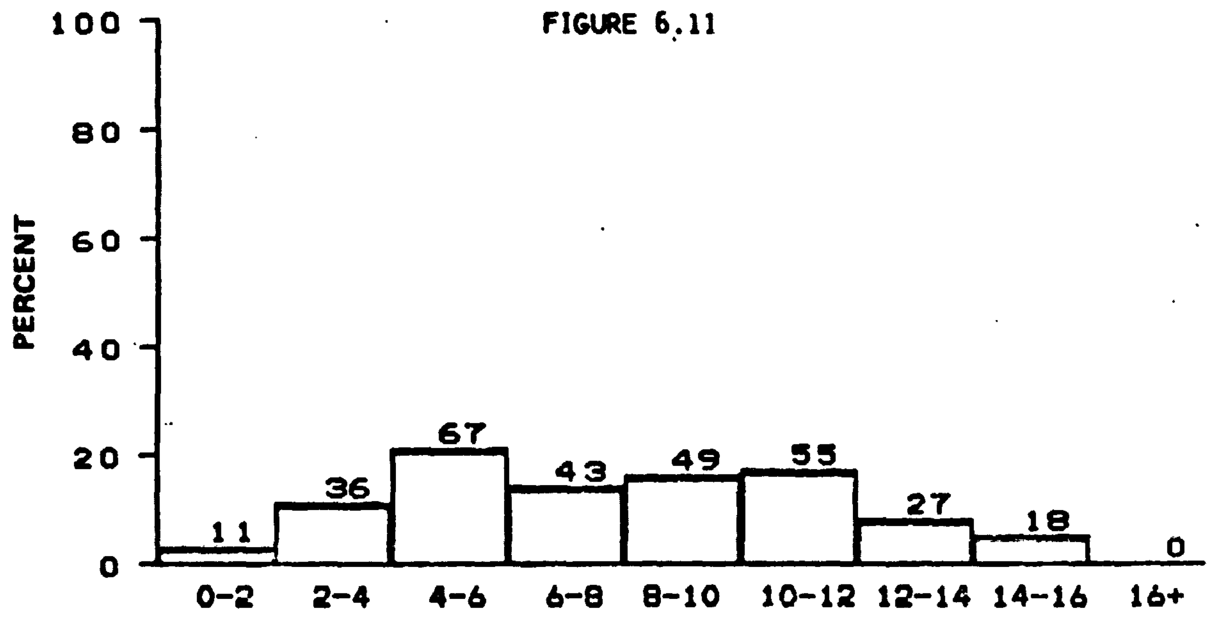


DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

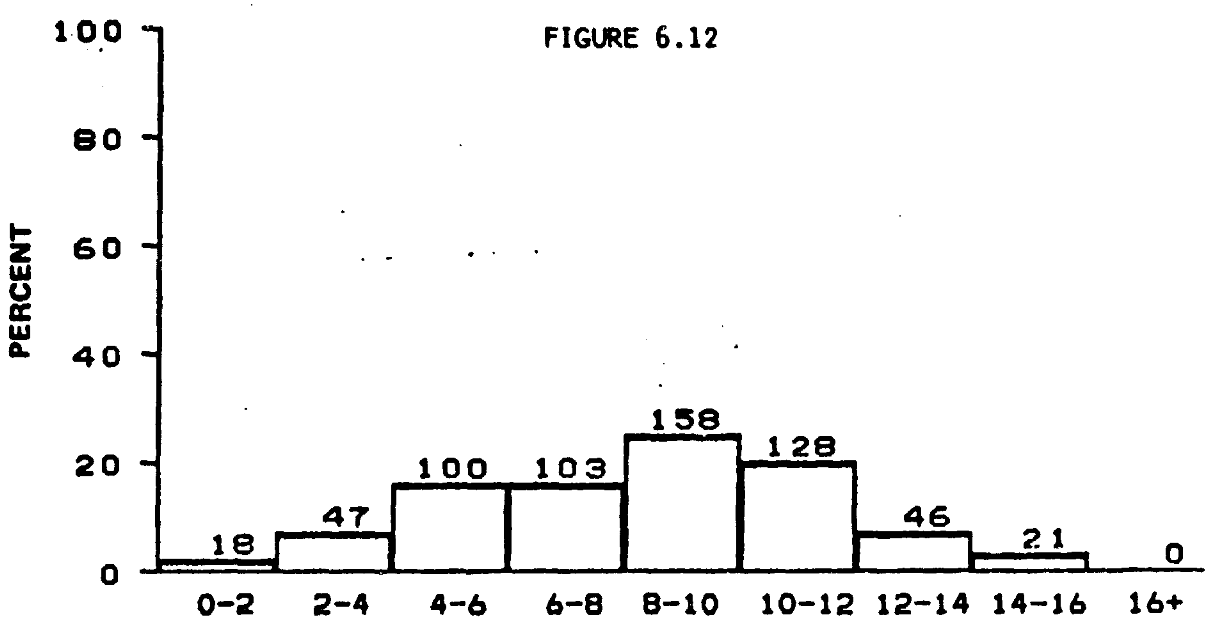
MONTH OF FEBRUARY

BLM AREA #4

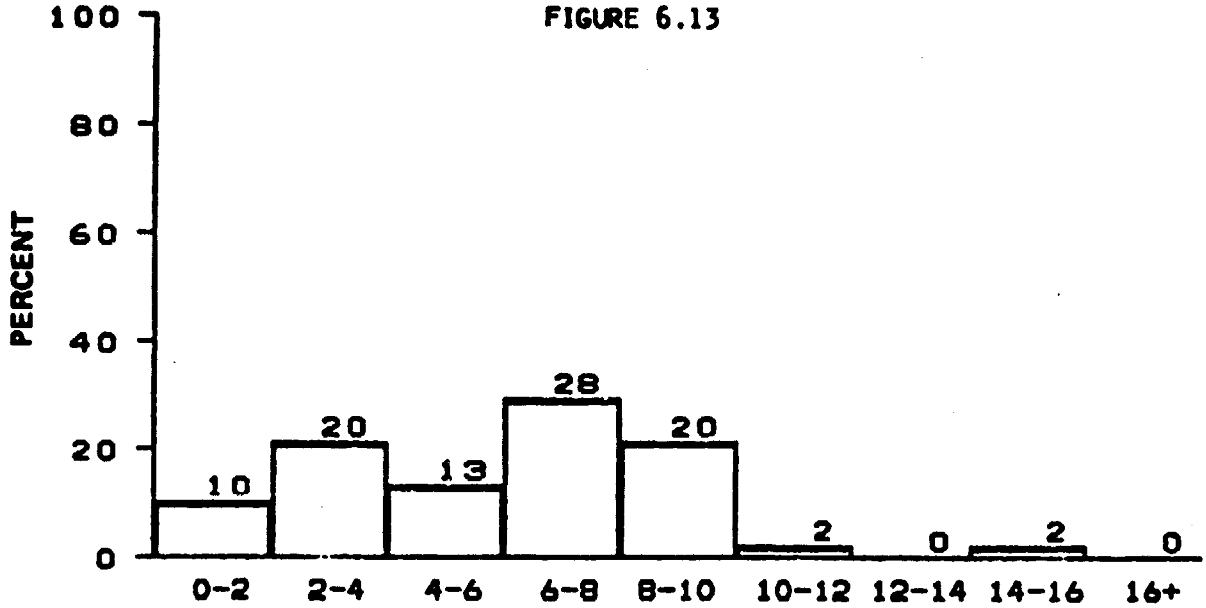
N = 90, MEAN = 8.8, SIGMA = 2.2



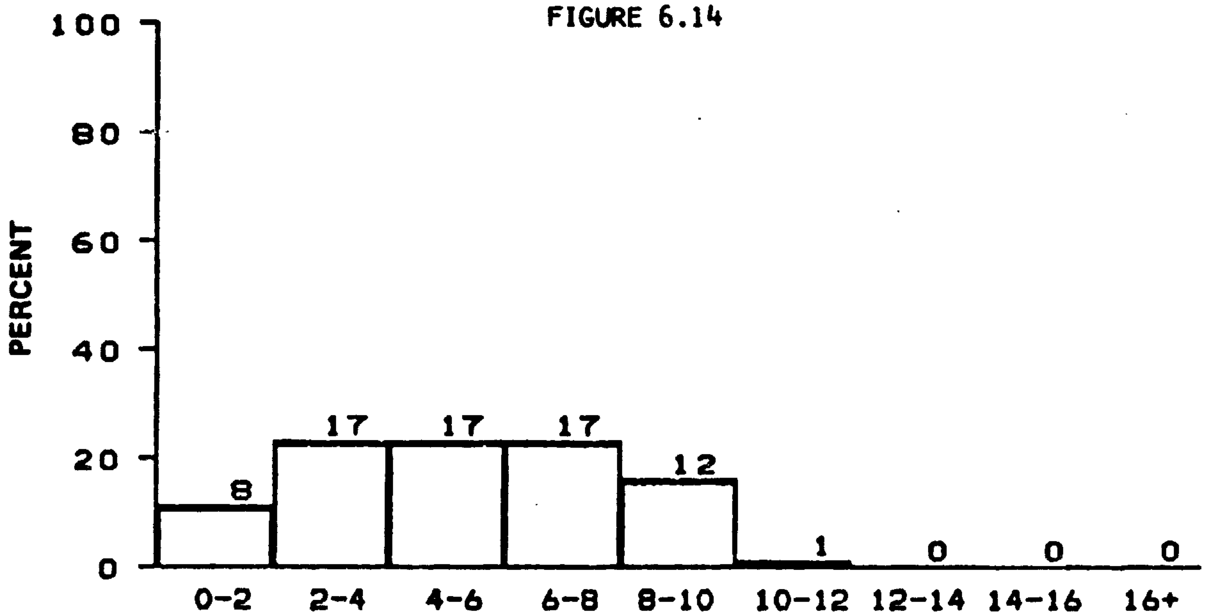
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
MONTH OF FEBRUARY
BLM AREA #5
N = 306, MEAN = 7.9, SIGMA = 3.7



DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
MONTH OF FEBRUARY
ALL BLM AREAS
N = 621, MEAN = 8.2, SIGMA = 3.2

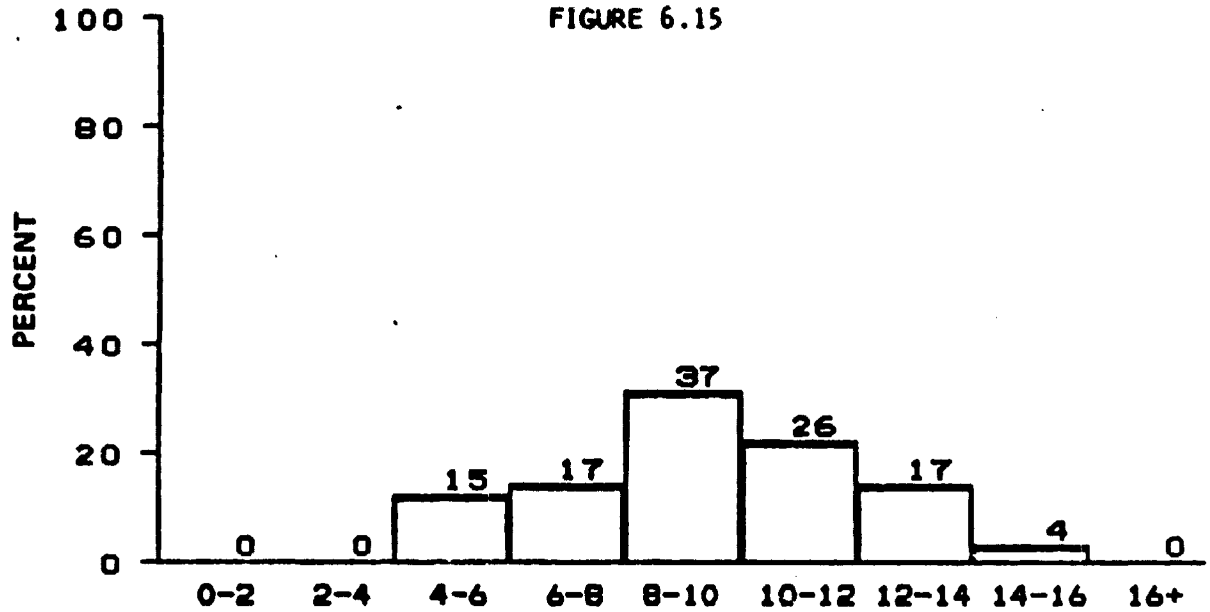


DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
MONTH OF MARCH
BLM AREA #1
N = 95, MEAN = 5.9, SIGMA = 3.0



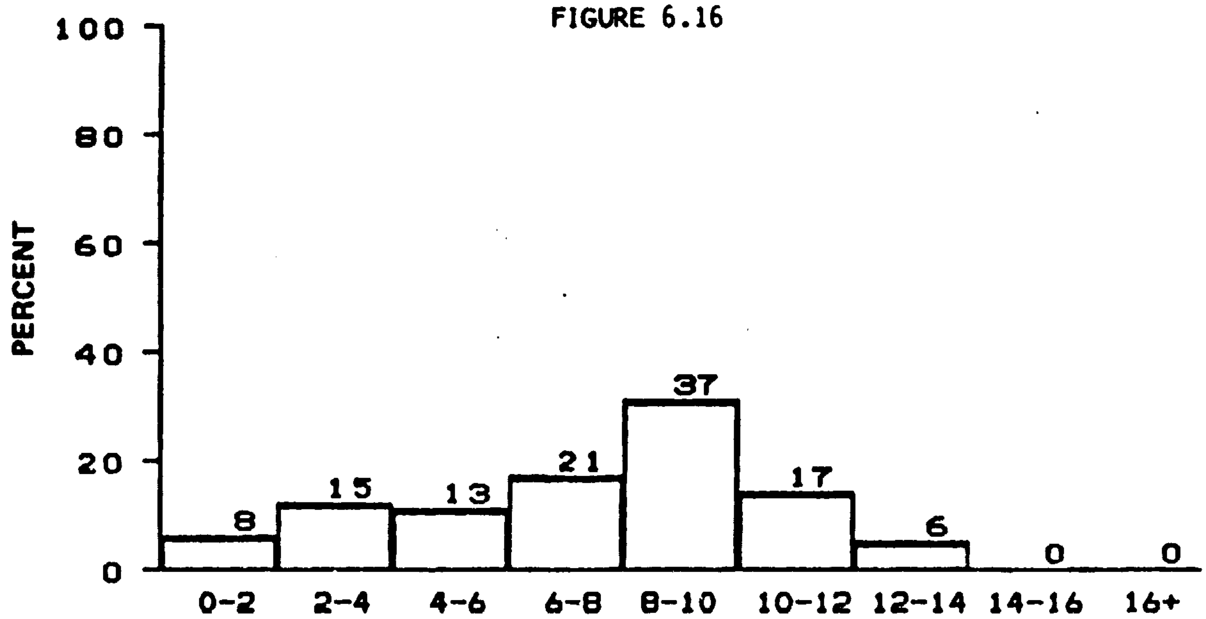
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
MONTH OF MARCH
BLM AREA #2
N = 72, MEAN = 5.3, SIGMA = 2.6

FIGURE 6.15



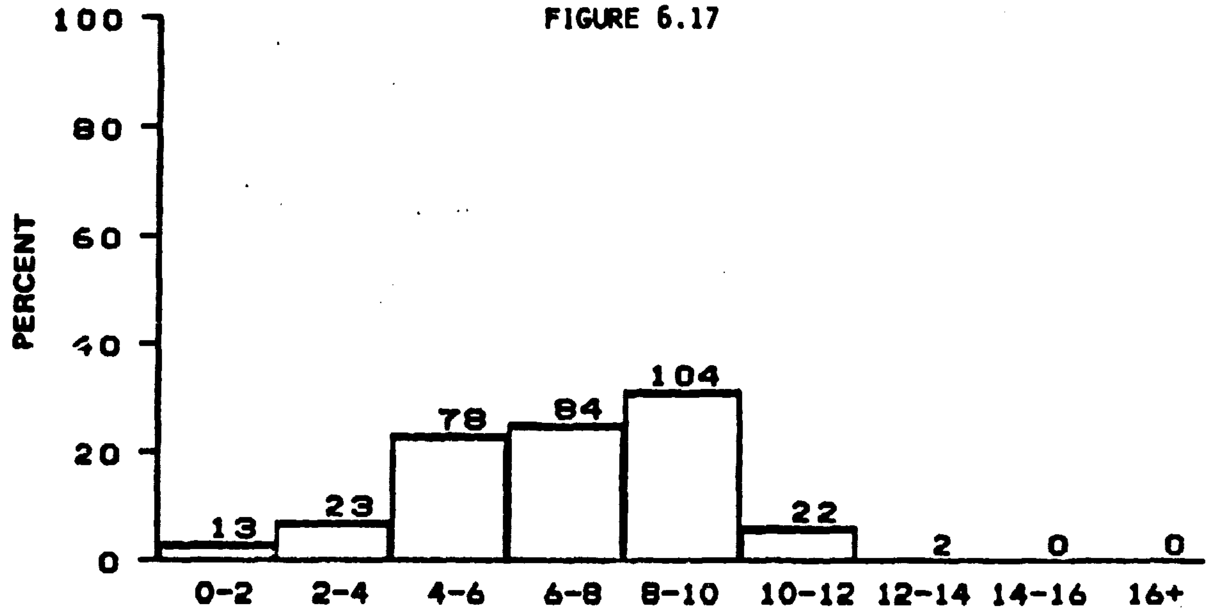
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
MONTH OF MARCH
BLM AREA #3
N = 116, MEAN = 9.4, SIGMA = 2.6

FIGURE 6.16



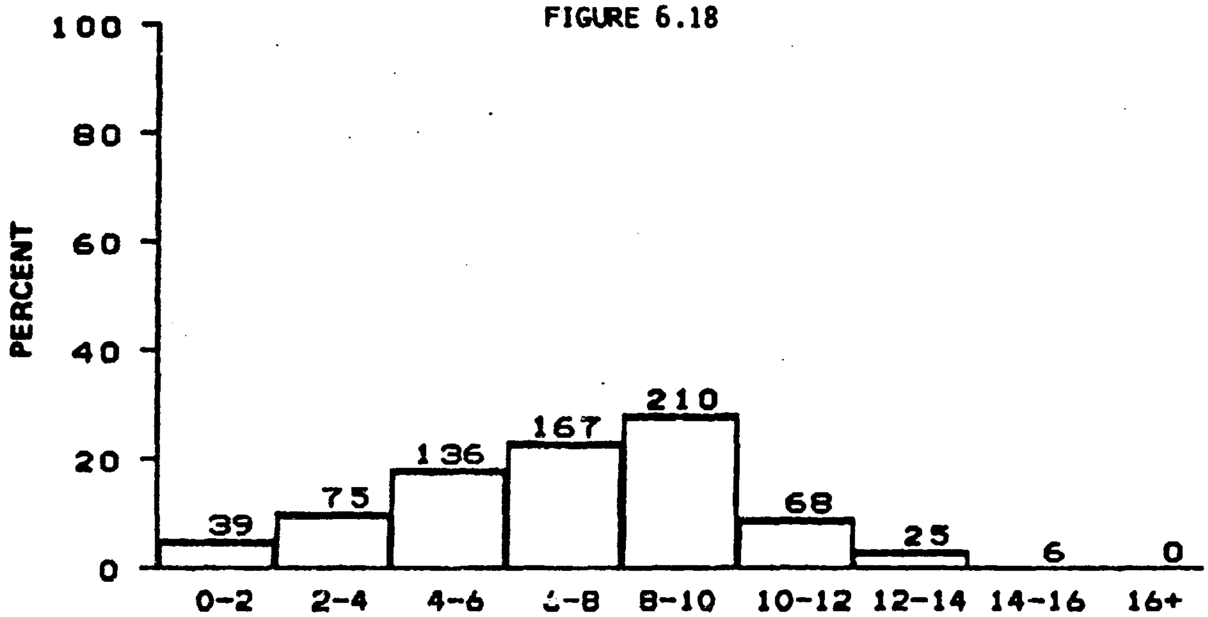
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
MONTH OF MARCH
BLM AREA #4
N = 117, MEAN = 7.4, SIGMA = 3.2

FIGURE 6.17



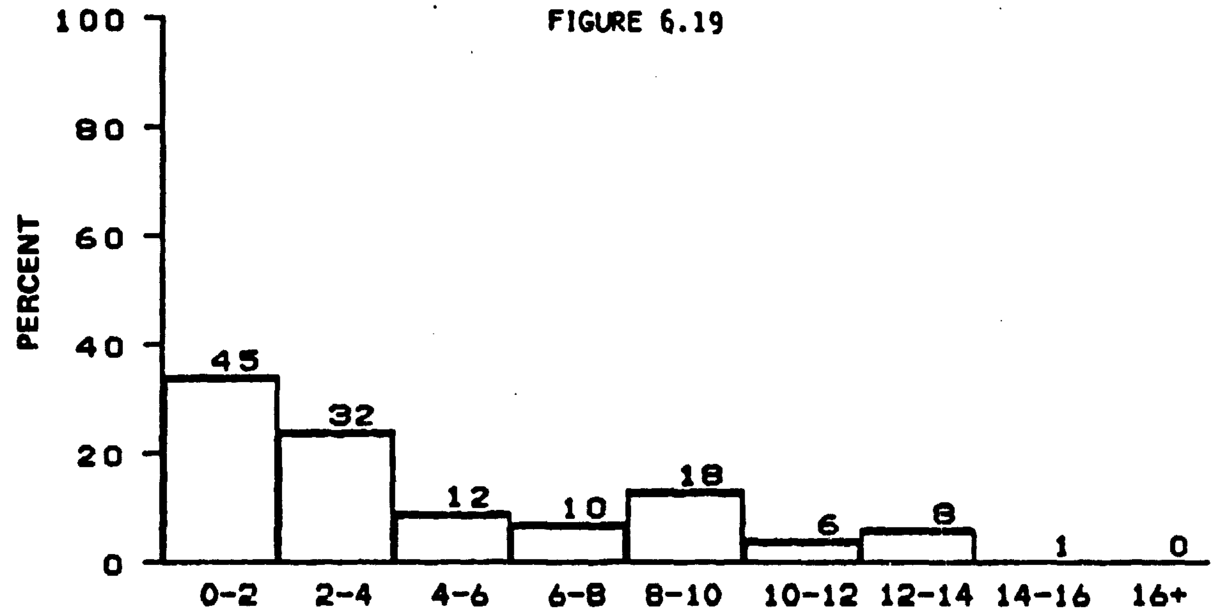
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
MONTH OF MARCH
BLM AREA #5
N = 326, MEAN = 6.9, SIGMA = 2.5

FIGURE 6.18



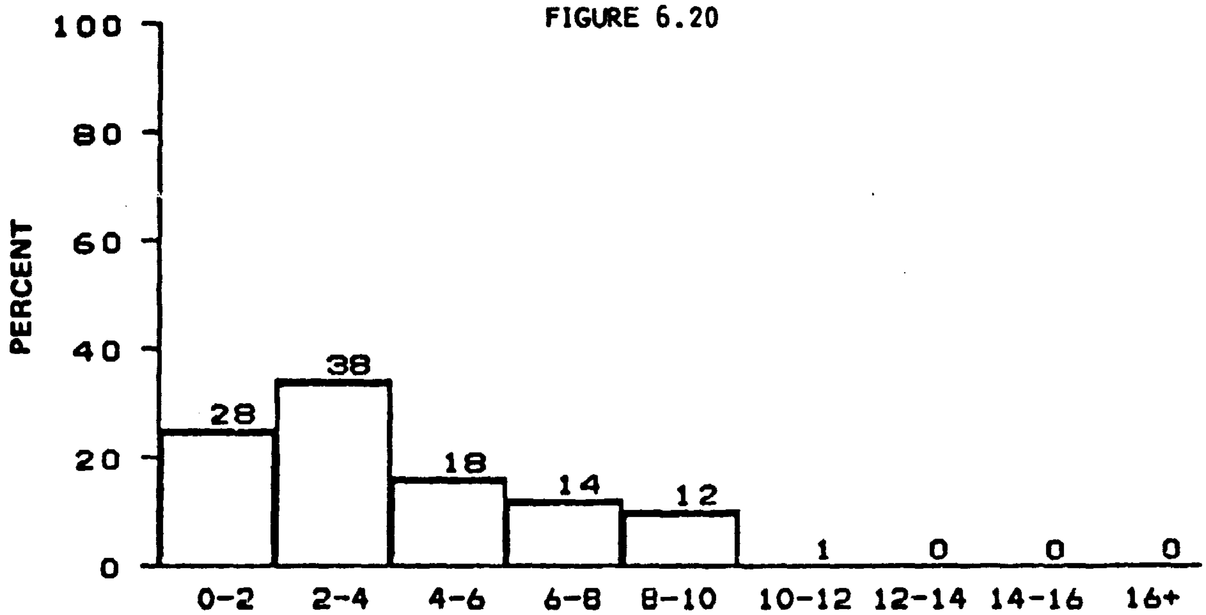
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
MONTH OF MARCH
ALL BLM AREAS
N = 726, MEAN = 7.1, SIGMA = 3.0

FIGURE 6.19



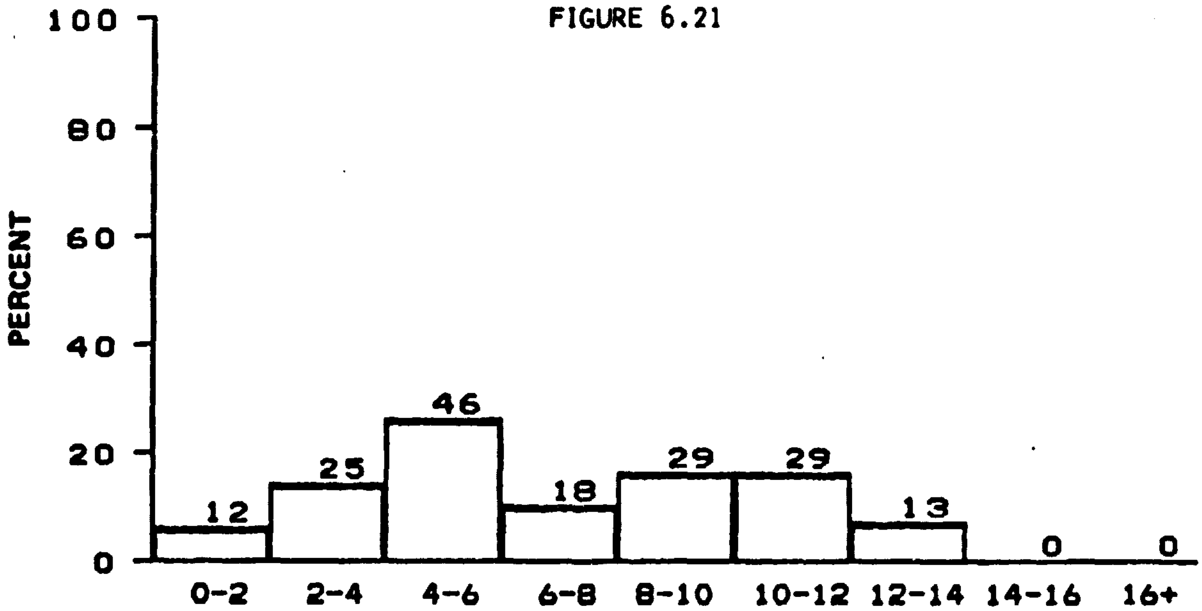
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
MONTH OF APRIL
BLM AREA #1
N = 132, MEAN = 4.7, SIGMA = 3.9

FIGURE 6.20



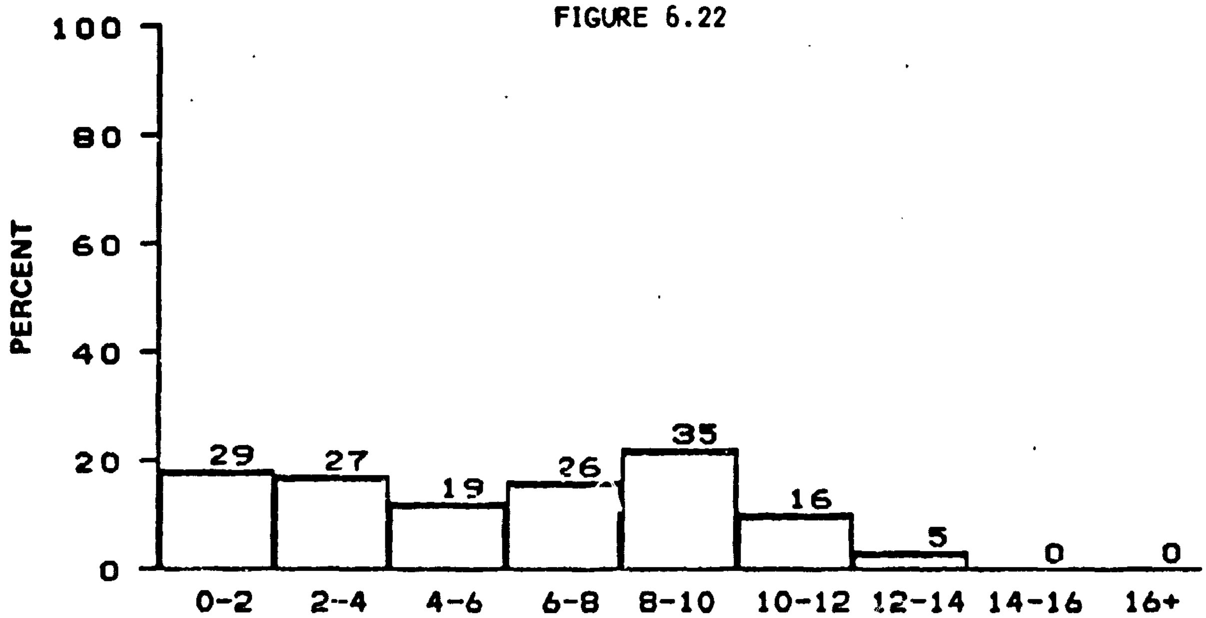
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
MONTH OF APRIL
BLM AREA #2
N = 111, MEAN = 4.0, SIGMA = 2.7

FIGURE 6.21



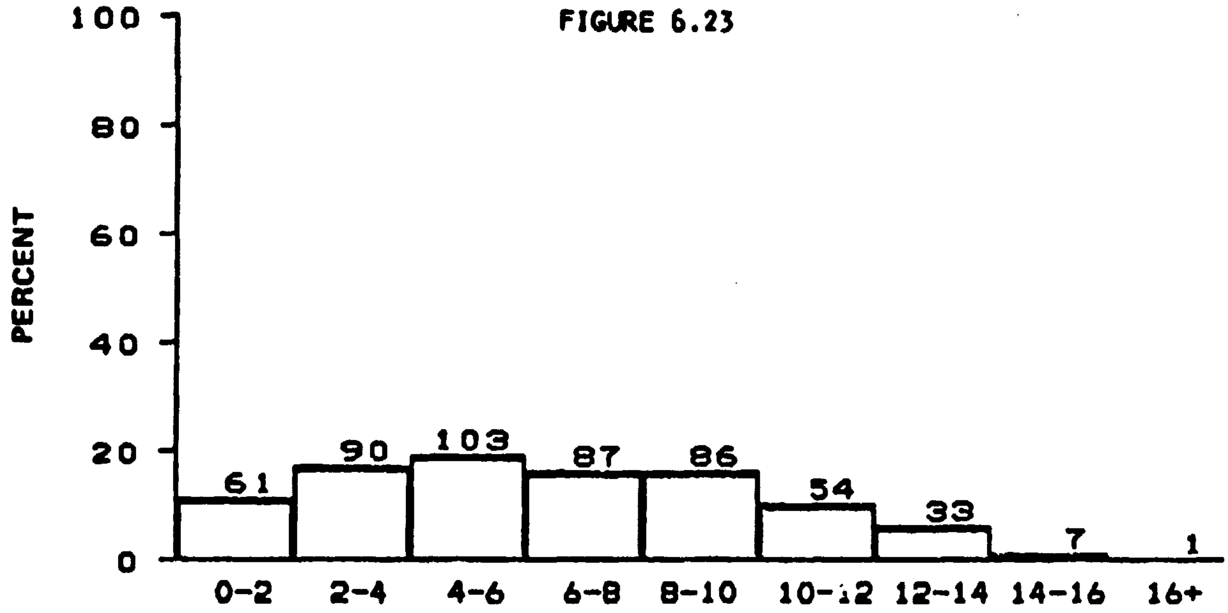
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
MONTH OF APRIL
BLM AREA #3
N = 172, MEAN = 6.9, SIGMA = 3.5

FIGURE 6.22



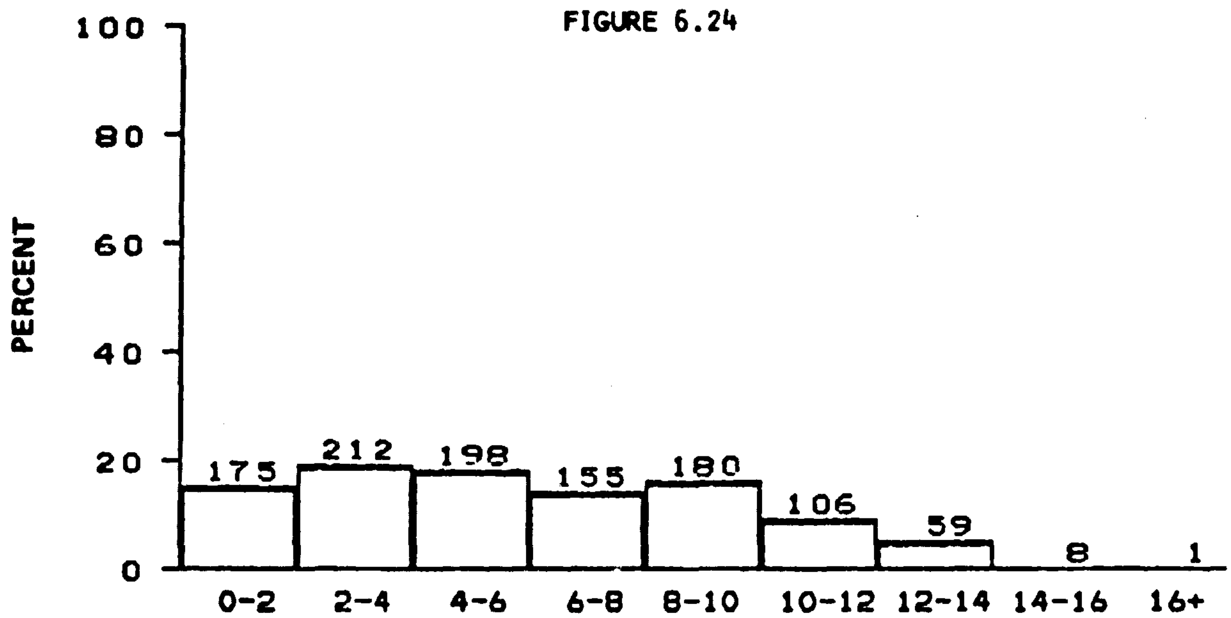
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
MONTH OF APRIL
BLM AREA #4
N = 157, MEAN = 6.0, SIGMA = 3.5

FIGURE 6.23



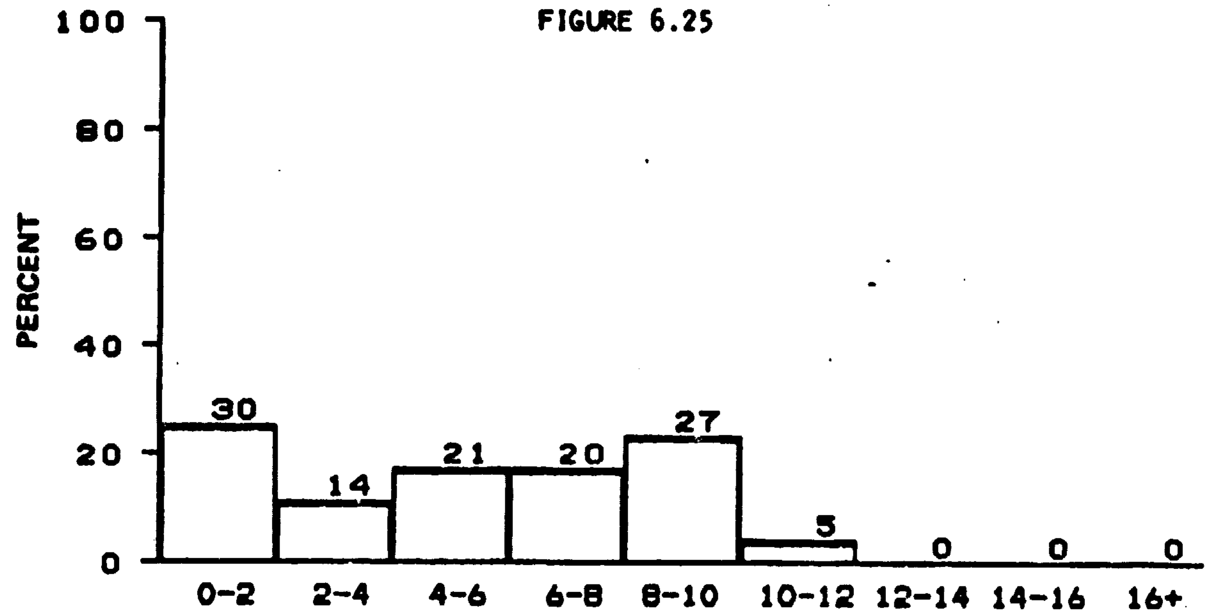
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
MONTH OF APRIL
BLM AREA #5
N = 522, MEAN = 6.5, SIGMA = 3.6

FIGURE 6.24



DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
MONTH OF APRIL
ALL BLM AREAS
N = 1094, MEAN = 6.0, SIGMA = 3.6

FIGURE 6.25



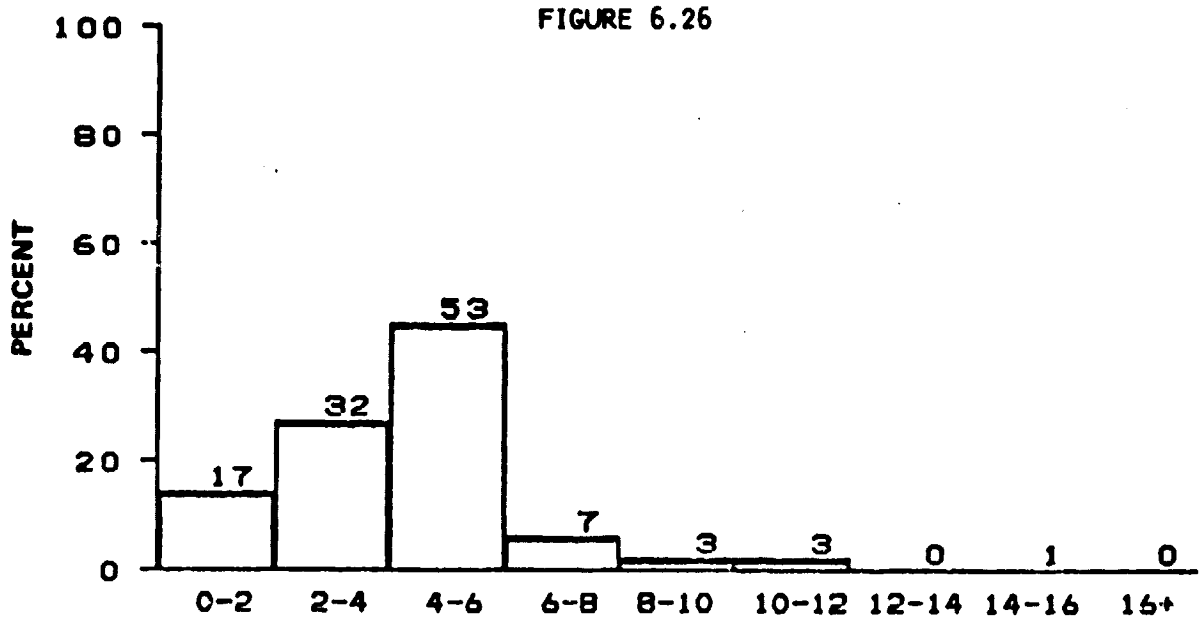
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF MAY

BLM AREA #1

N = 117, MEAN = 5.3, SIGMA = 3.2

FIGURE 6.26



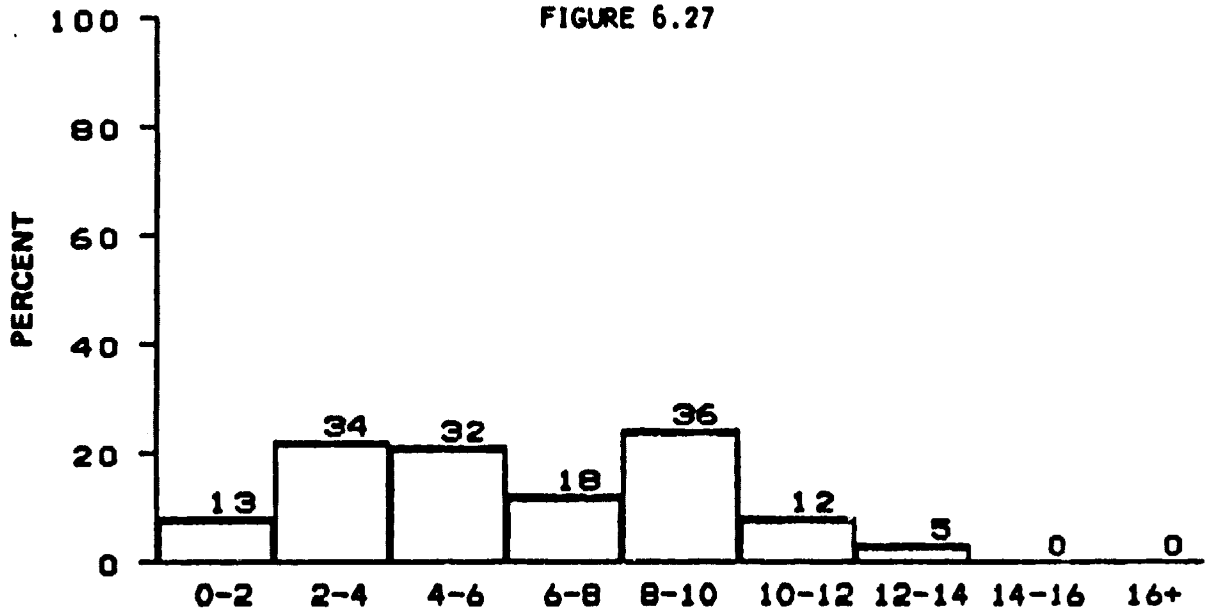
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF MAY

BLM AREA #2

N = 116, MEAN = 4.3, SIGMA = 2.3

FIGURE 6.27



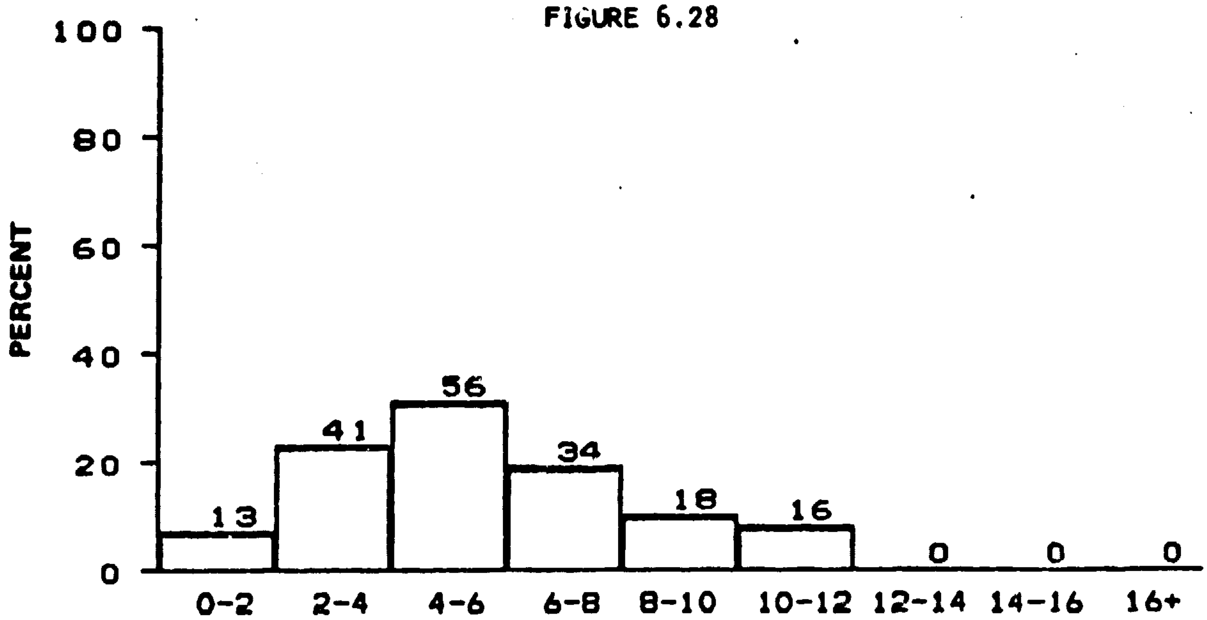
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF MAY

BLM AREA #3

N = 150, MEAN = 6.1, SIGMA = 3.2

FIGURE 6.28

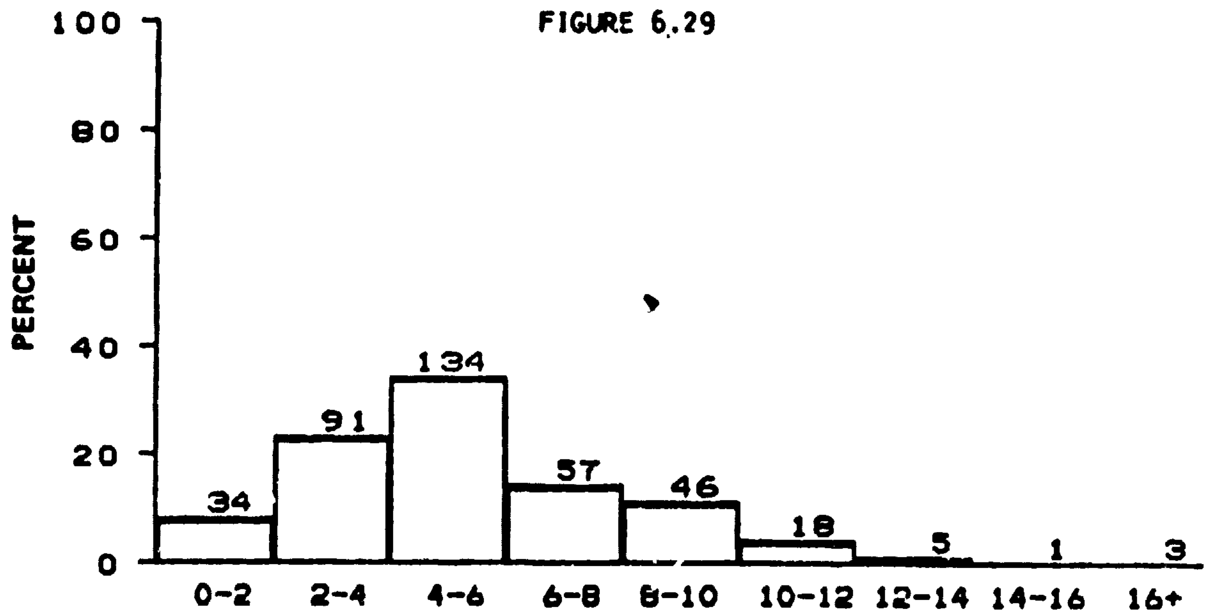


DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF MAY

BLM AREA #4

N = 178, MEAN = 5.6, SIGMA = 2.7

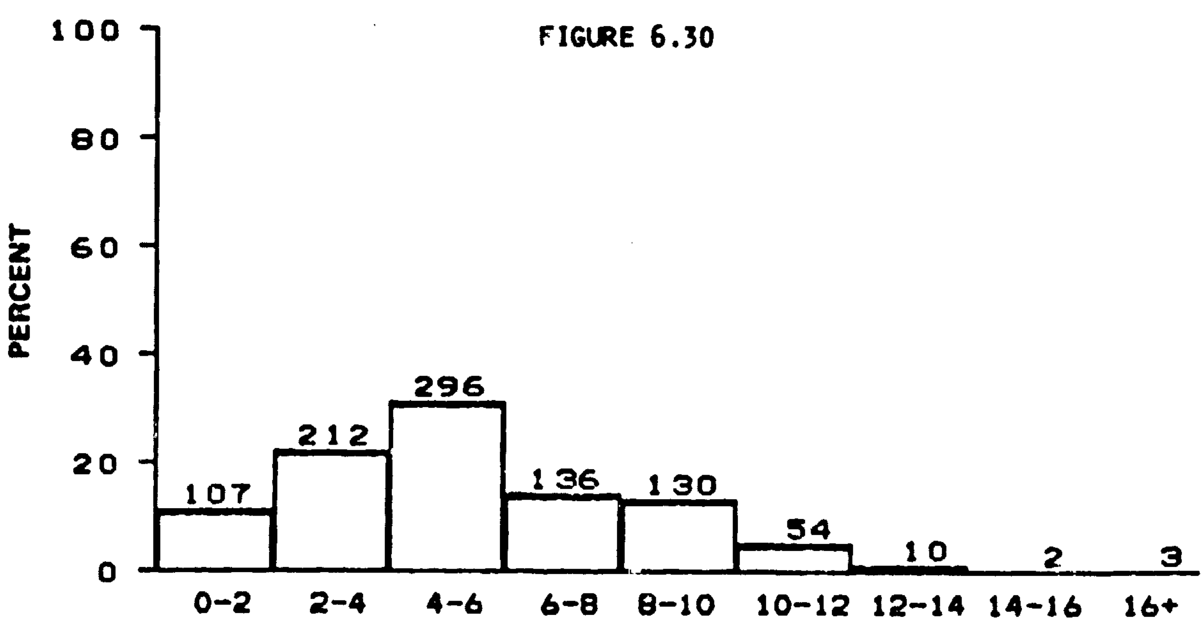


DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF MAY

BLM AREA #5

N = 389, MEAN = 5.4, SIGMA = 2.9



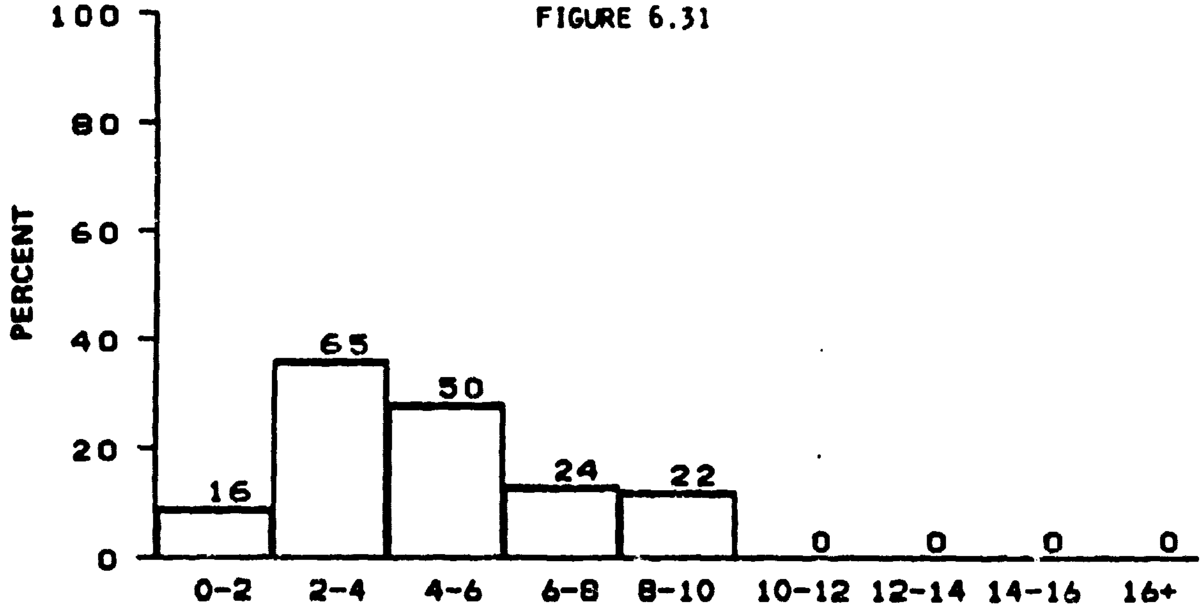
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF MAY

ALL BLM AREAS

N = 950, MEAN = 5.4, SIGMA = 2.9

FIGURE 6.31



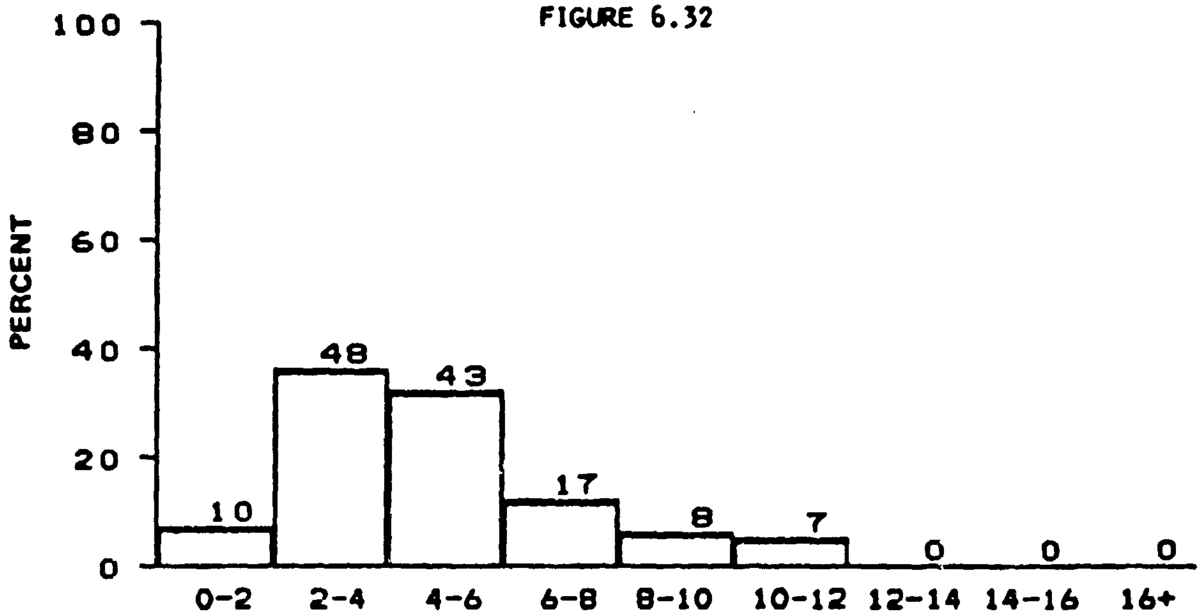
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF JUNE

BLM AREA #1

N = 177, MEAN = 4.7, SIGMA = 2.3

FIGURE 6.32



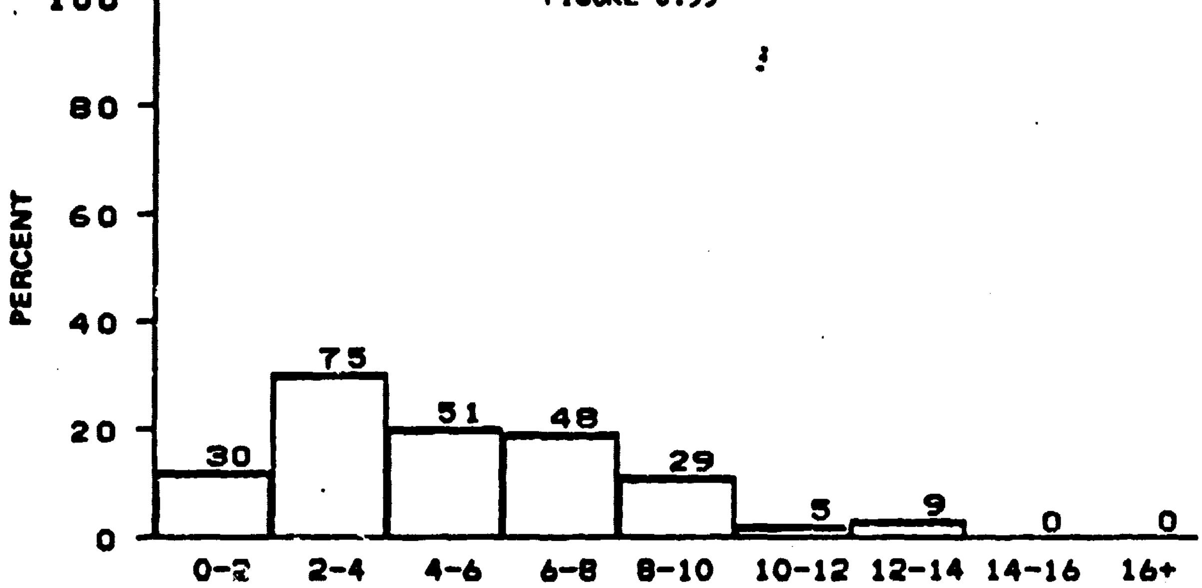
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF JUNE

BLM AREA #2

N = 133, MEAN = 4.8, SIGMA = 2.4

FIGURE 6.33



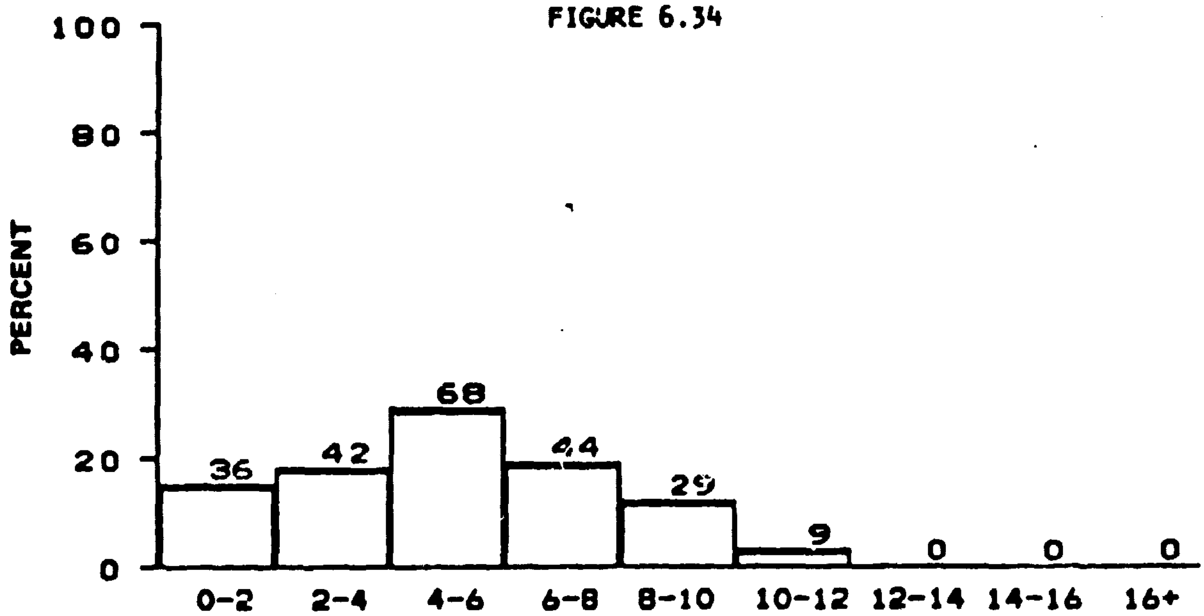
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF JUNE

BLM AREA #3

N = 247, MEAN = 5.2, SIGMA = 3.0

FIGURE 6.34



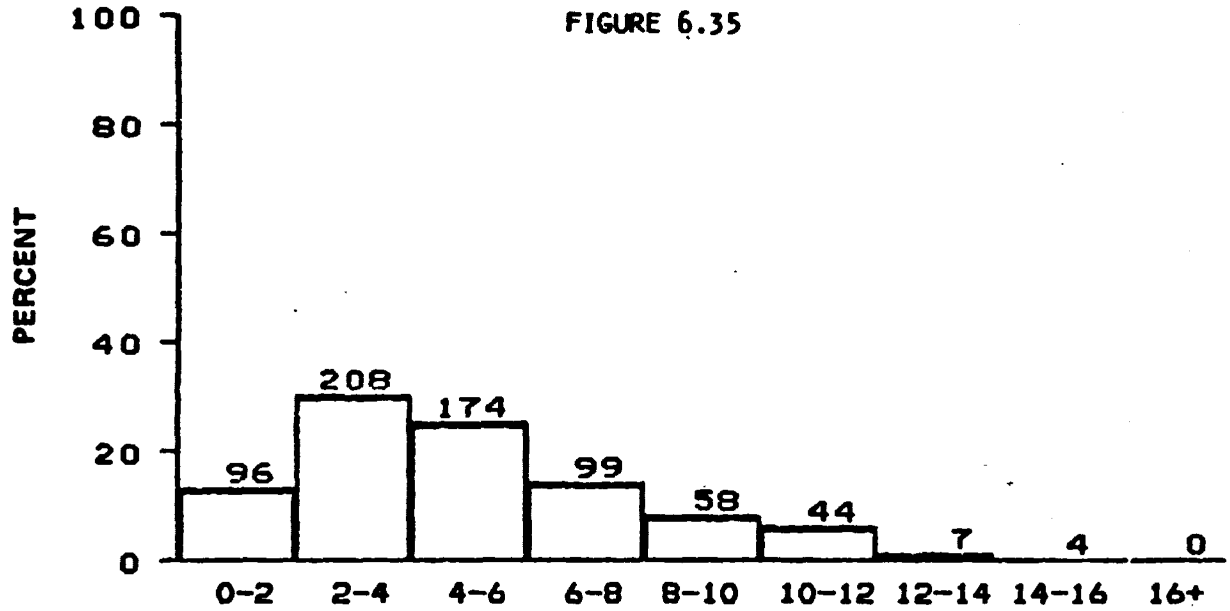
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF JUNE

BLM AREA #4

N = 228, MEAN = 5.1, SIGMA = 2.7

FIGURE 6.35



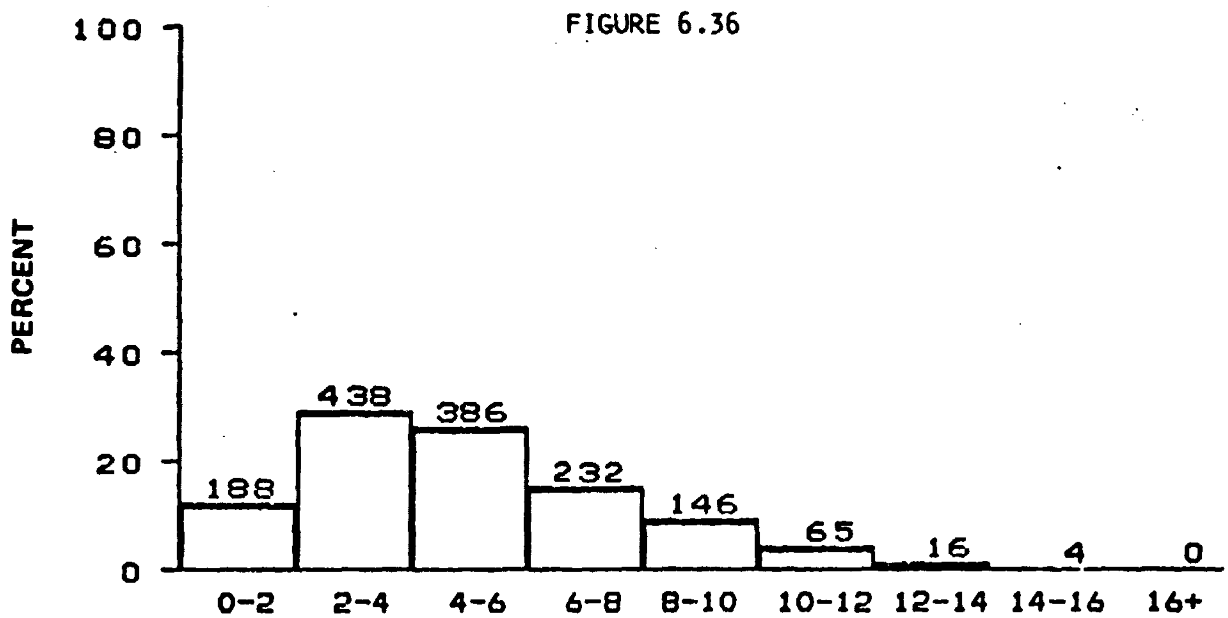
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF JUNE

BLM AREA #5

N = 690, MEAN = 5.0, SIGMA = 3.0

FIGURE 6.36



DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

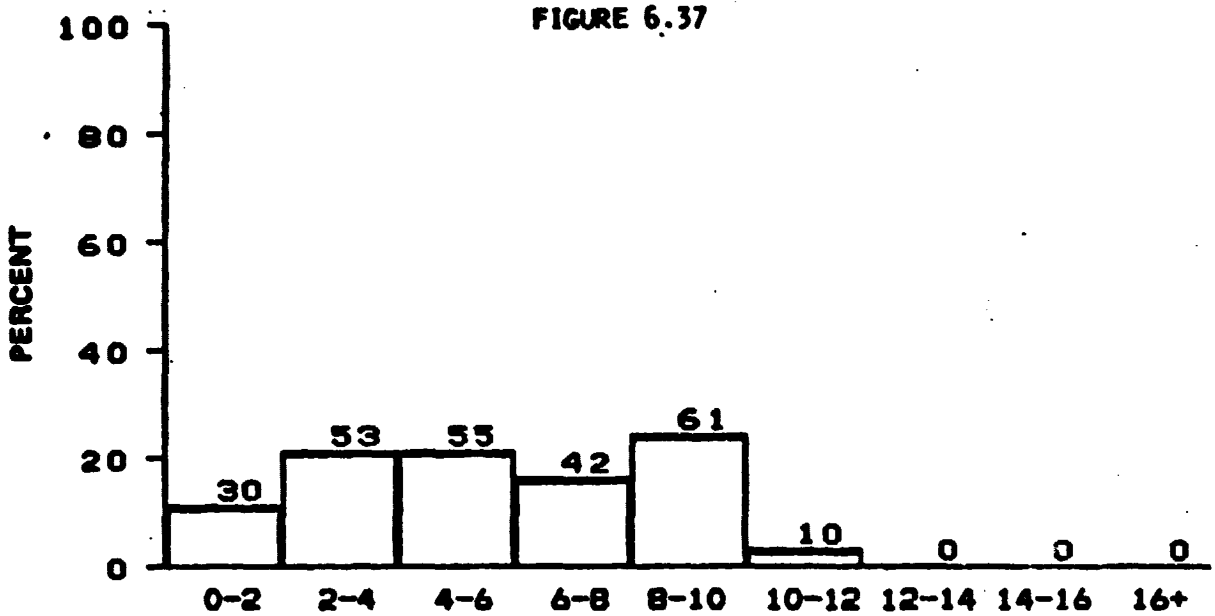
MONTH OF JUNE

ALL BLM AREAS

N = 1475, MEAN = 5.0, SIGMA = 2.8

C-2

FIGURE 6.37



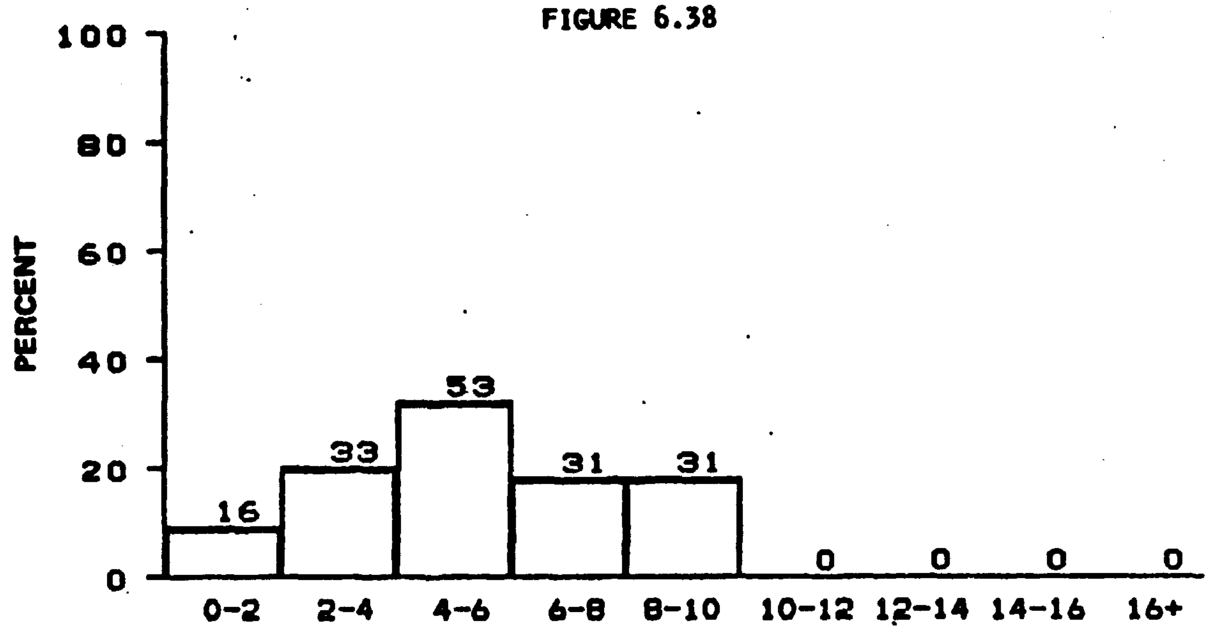
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF JULY

BLM AREA #1

N = 251, MEAN = 5.6, SIGMA = 2.9

FIGURE 6.38



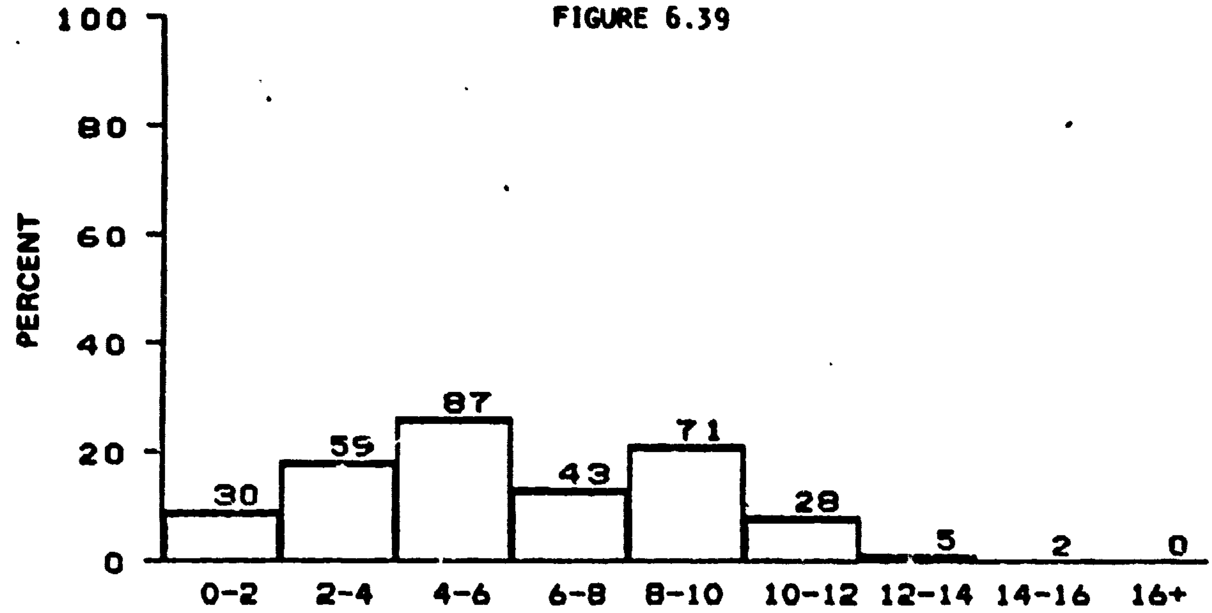
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF JULY

BLM AREA #2

N = 164, MEAN = 5.3, SIGMA = 2.5

FIGURE 6.39



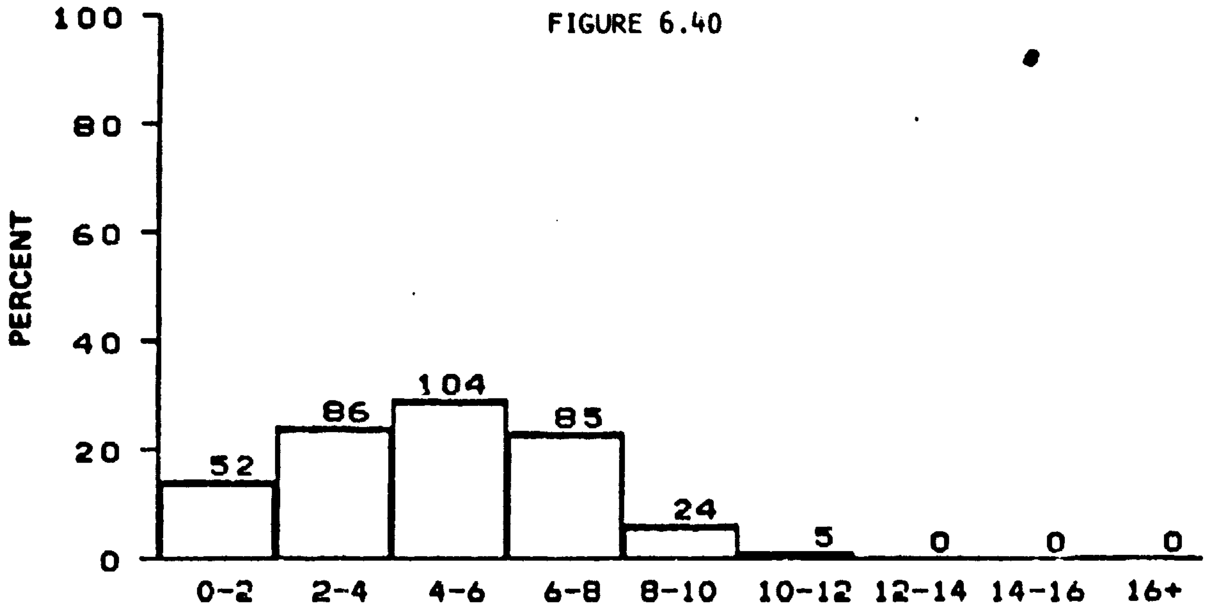
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF JULY

BLM AREA #3

N = 325, MEAN = 6.1, SIGMA = 3.1

FIGURE 6.40

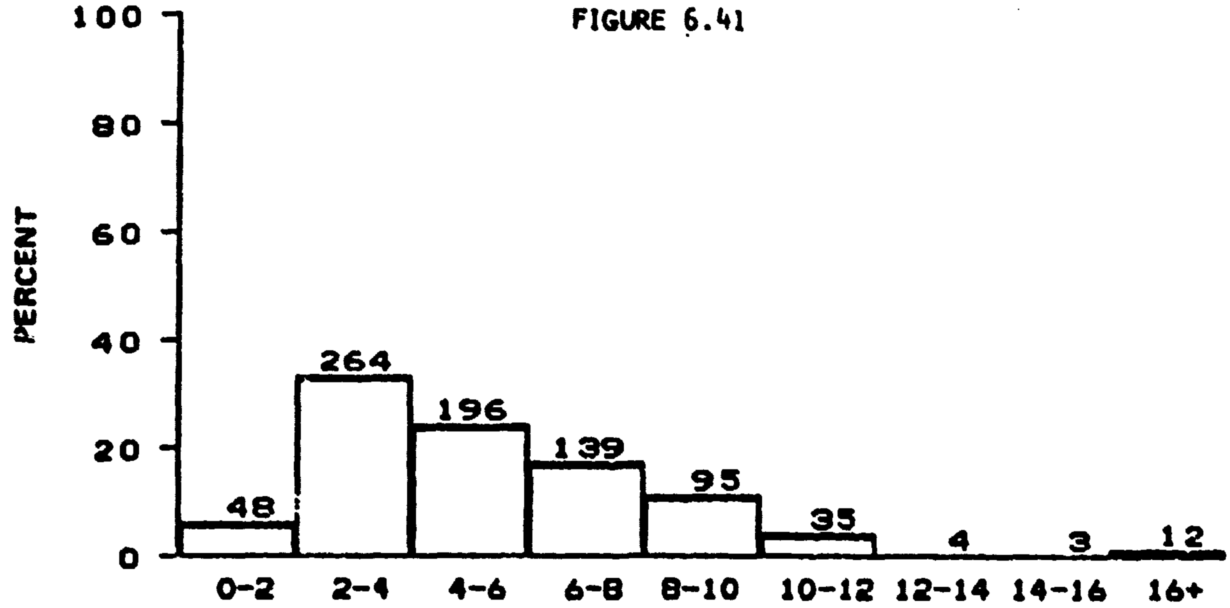


DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

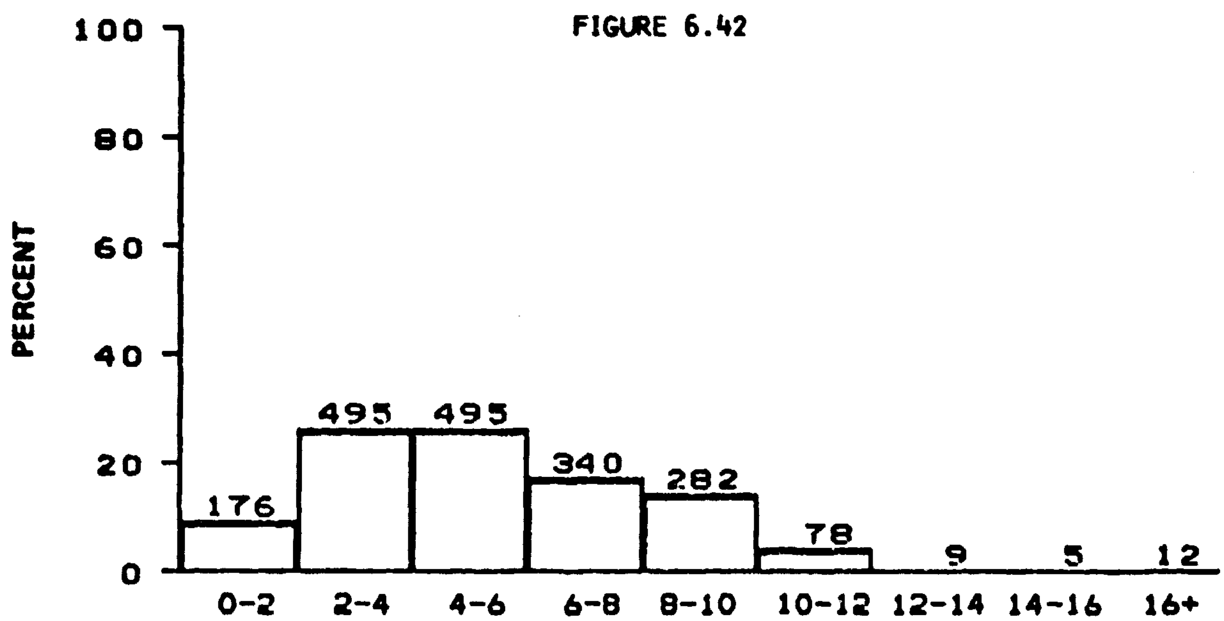
MONTH OF JULY

BLM AREA #4

N = 356, MEAN = 4.8, SIGMA = 2.4

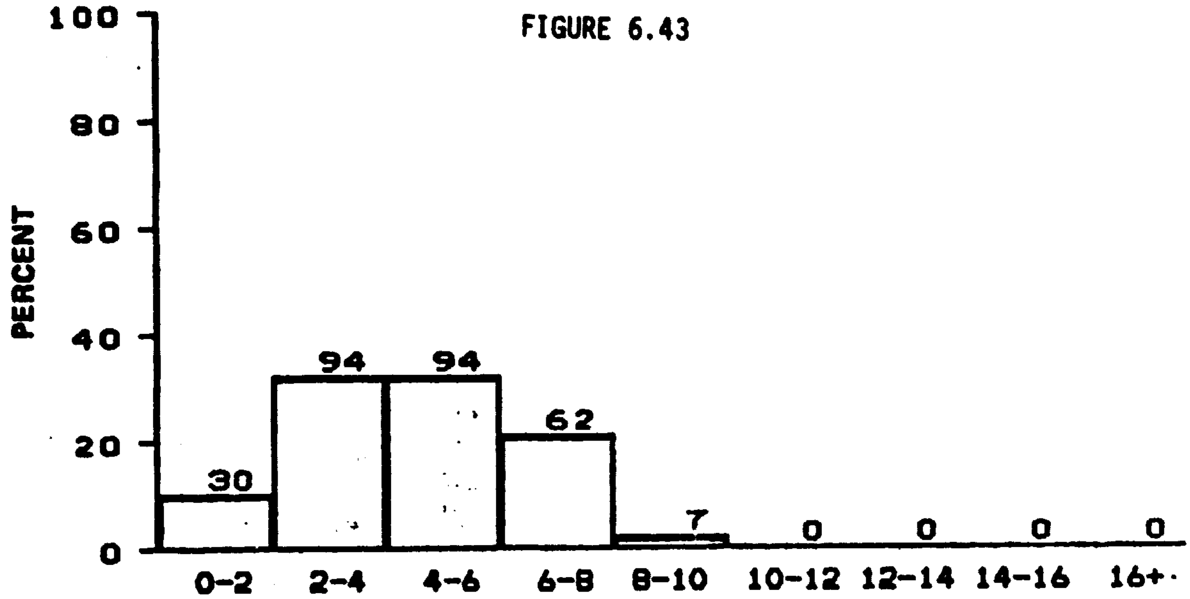


DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
MONTH OF JULY
BLM AREA #5
N = 796, MEAN = 5.4, SIGMA = 3.0



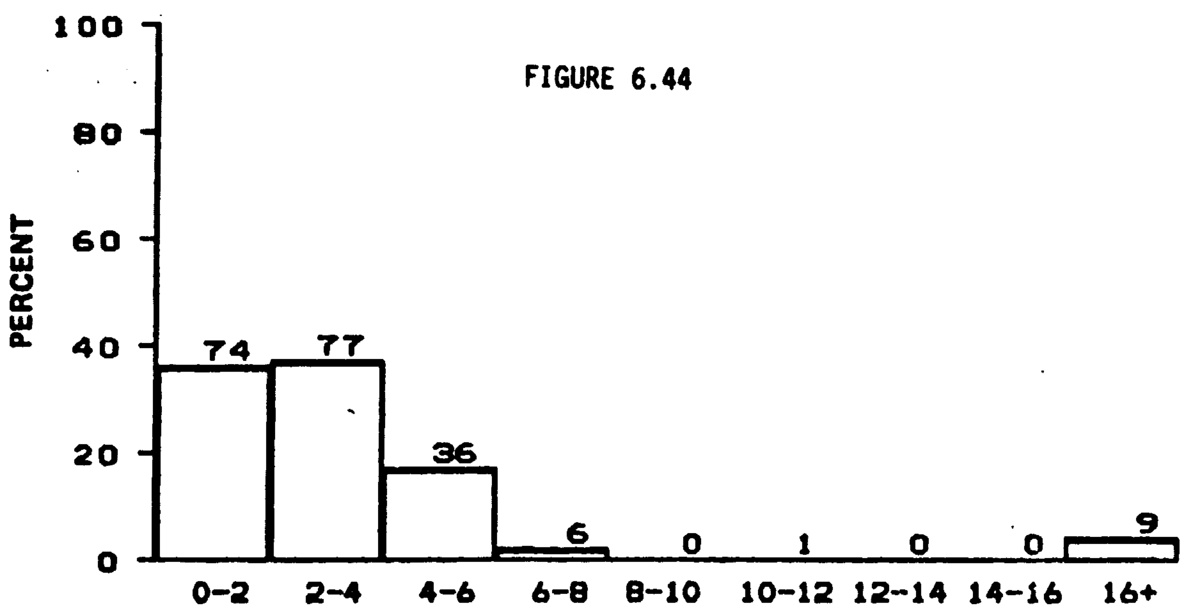
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
MONTH OF JULY
ALL BLM AREAS
N = 1892, MEAN = 5.4, SIGMA = 2.9

FIGURE 6.43



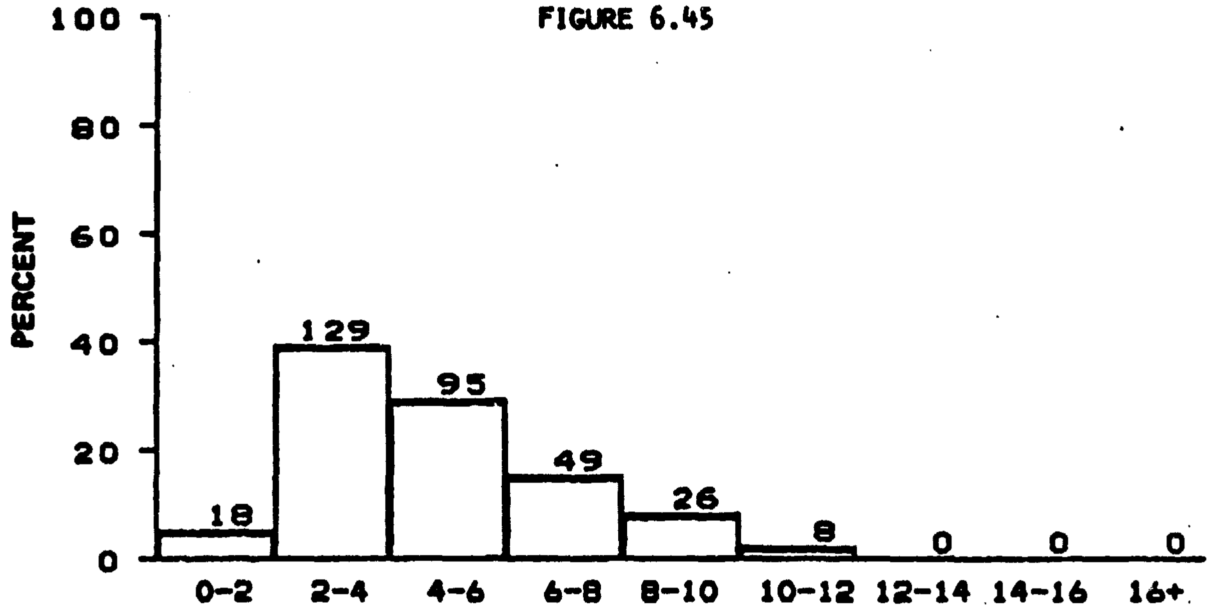
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
MONTH OF AUGUST
BLM AREA #1
N = 287, MEAN = 4.5, SIGMA = 2.0

FIGURE 6.44



DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
MONTH OF AUGUST
BLM AREA #2
N = 203, MEAN = 3.4, SIGMA = 3.4

FIGURE 6.45



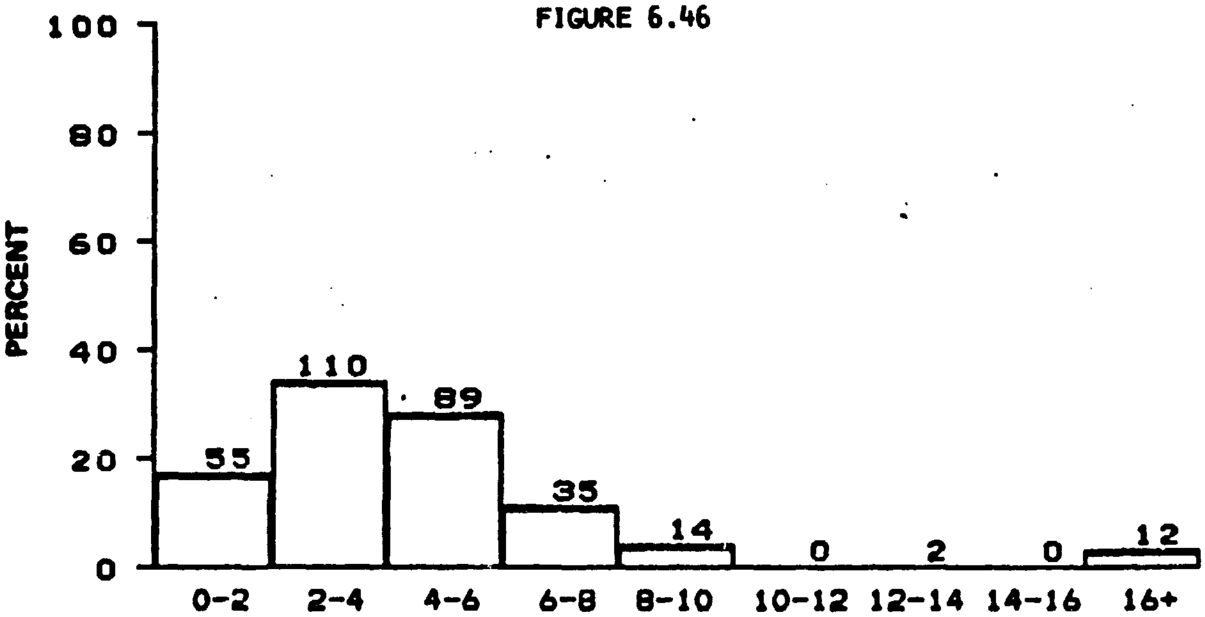
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF AUGUST

BLM AREA #3

N = 325, MEAN = 4.8, SIGMA = 2.3

FIGURE 6.46



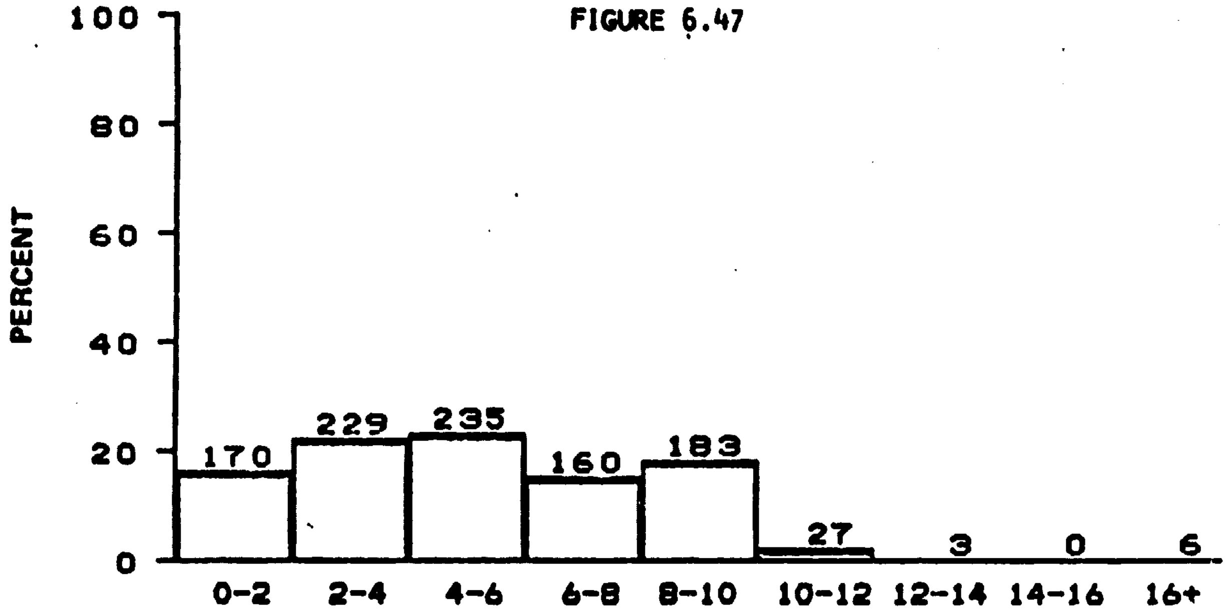
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF AUGUST

BLM AREA #4

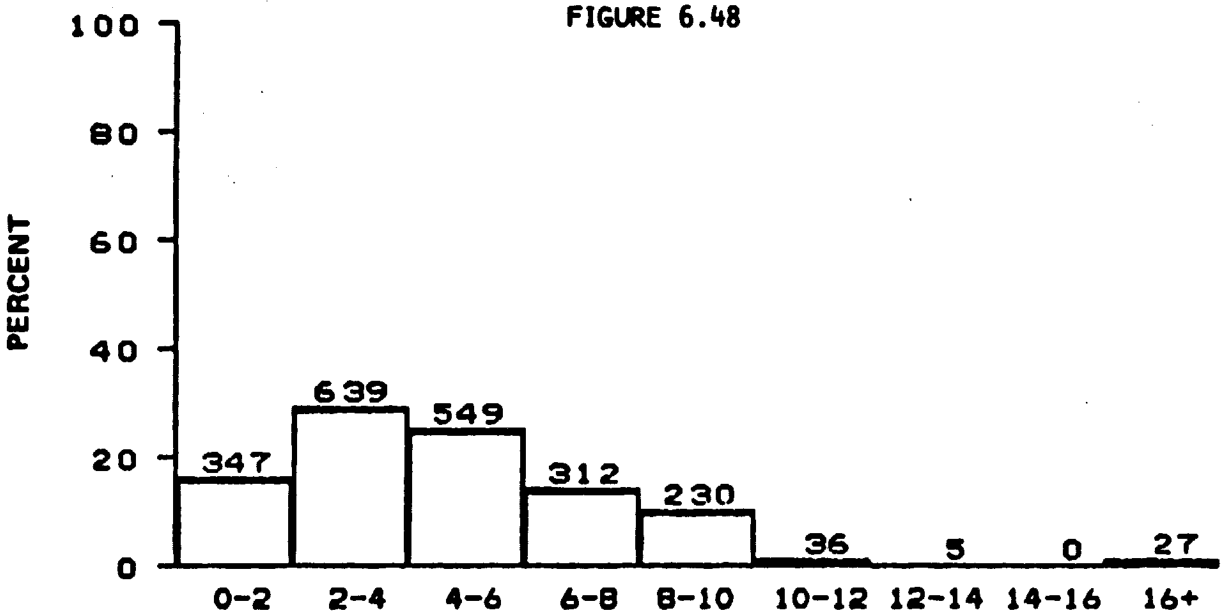
N = 317, MEAN = 4.5, SIGMA = 3.3

FIGURE 6.47



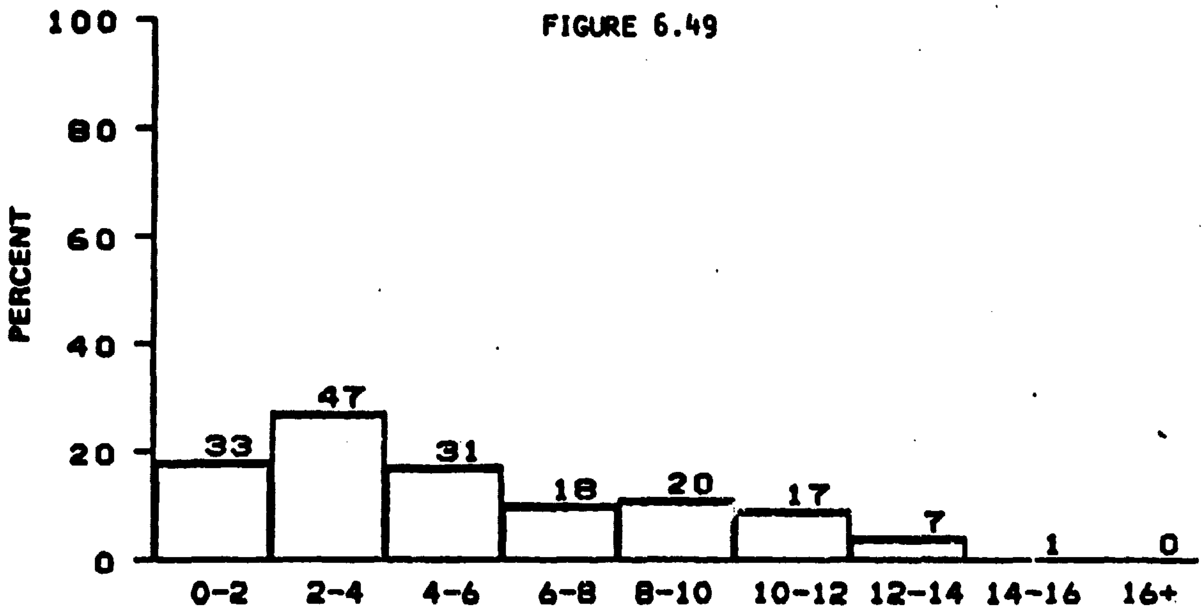
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
MONTH OF AUGUST
BLM AREA #5
N = 1013, MEAN = 5.2, SIGMA = 3.0

FIGURE 6.48



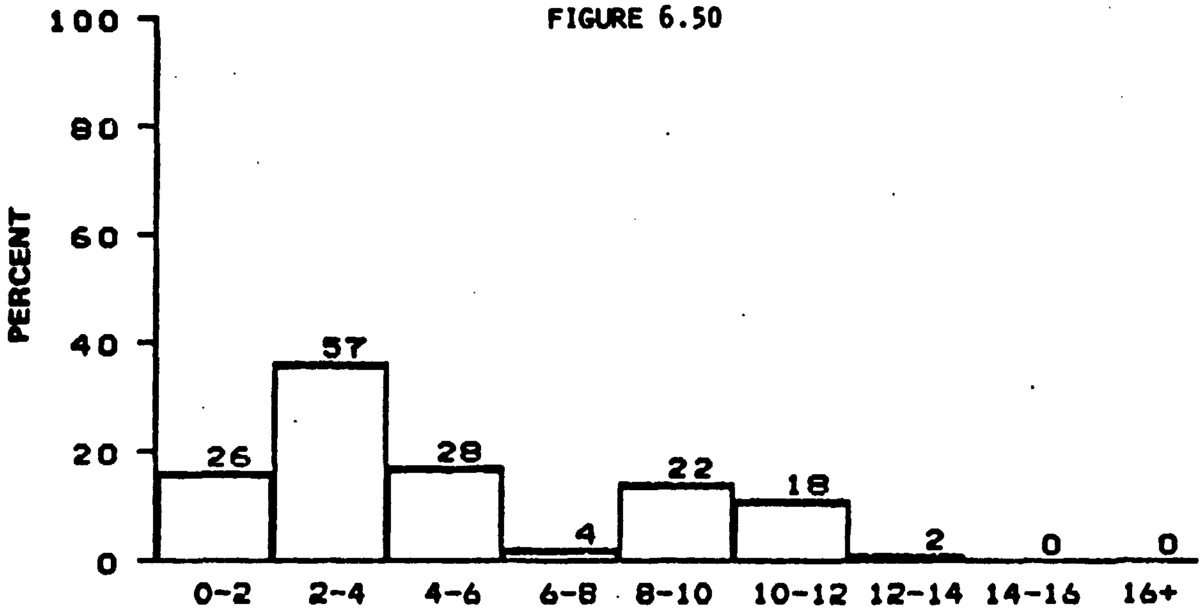
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
MONTH OF AUGUST
ALL BLM AREAS
N = 2145, MEAN = 4.7, SIGMA = 2.9

FIGURE 6.49



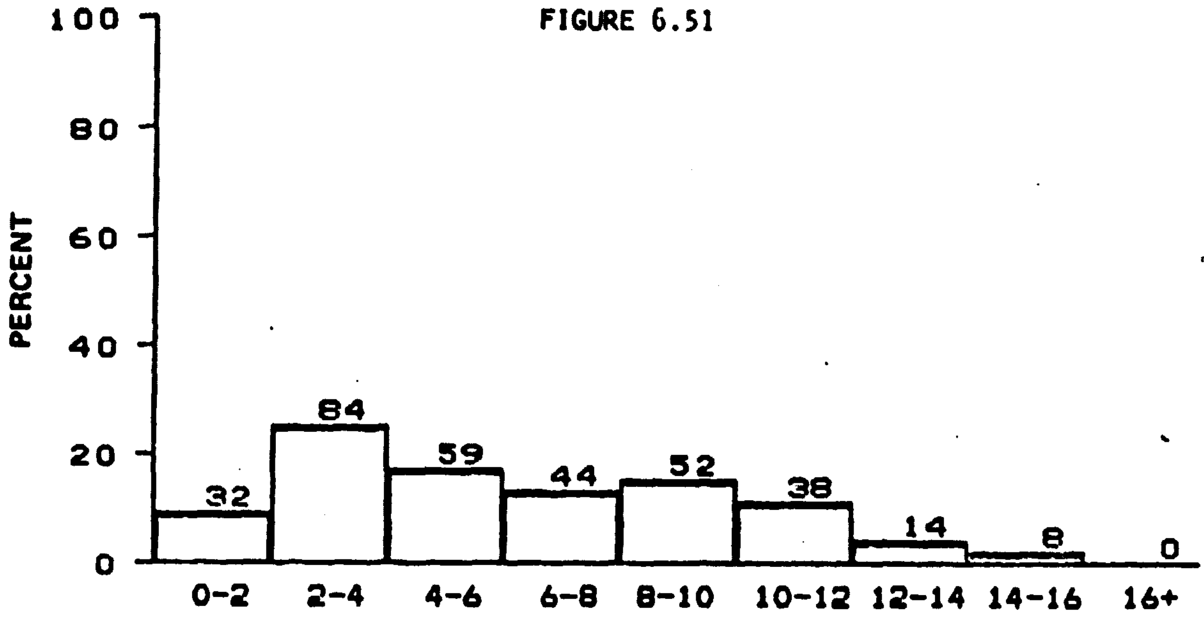
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
MONTH OF SEPTEMBER
BLM AREA #1
N = 174, MEAN = 5.3, SIGMA = 3.6

FIGURE 6.50



DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
MONTH OF SEPTEMBER
BLM AREA #2
N = 157, MEAN = 5.0, SIGMA = 3.4

FIGURE 6.51



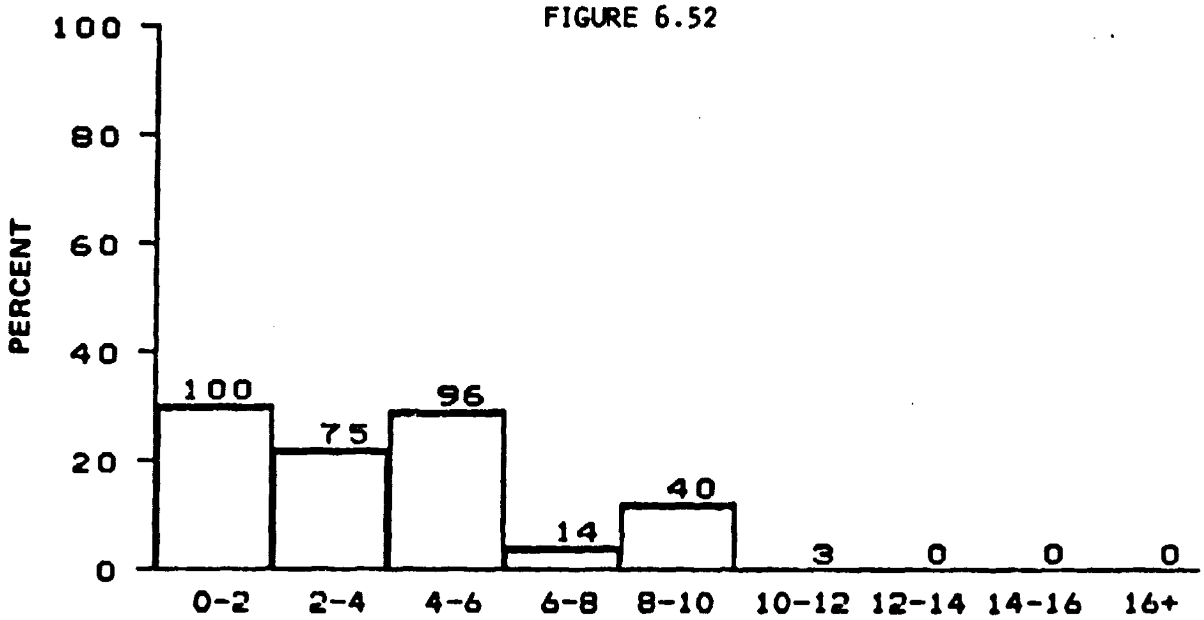
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF SEPTEMBER

BLM AREA #3

N = 331, MEAN = 6.3, SIGMA = 3.6

FIGURE 6.52

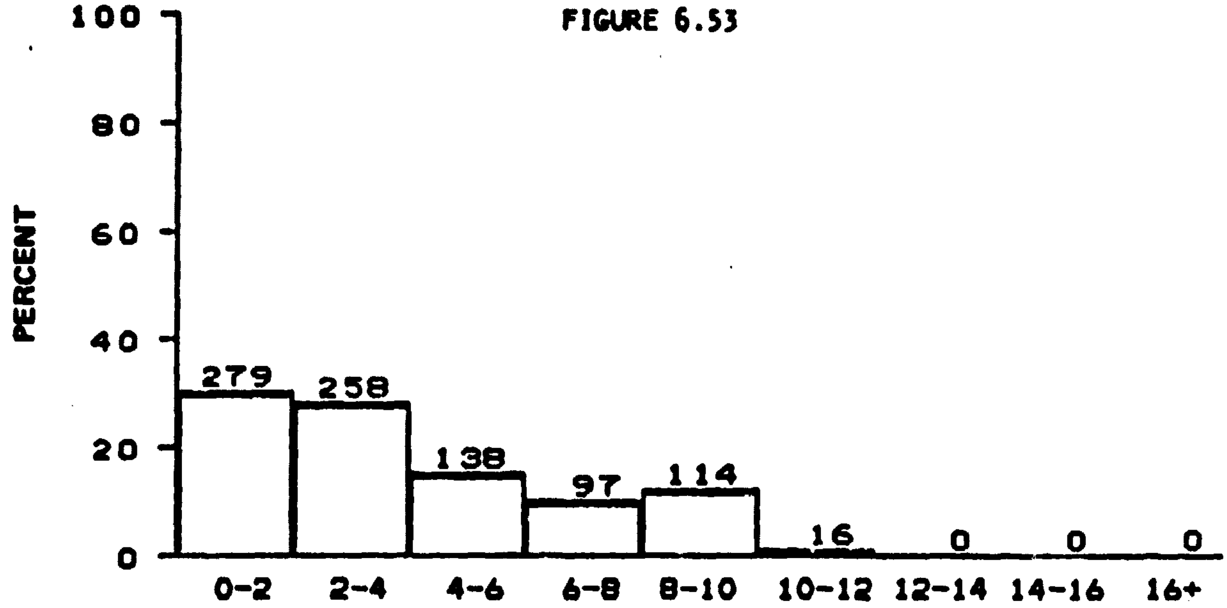


DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF SEPTEMBER

BLM AREA #4

N = 328, MEAN = 4.0, SIGMA = 2.7

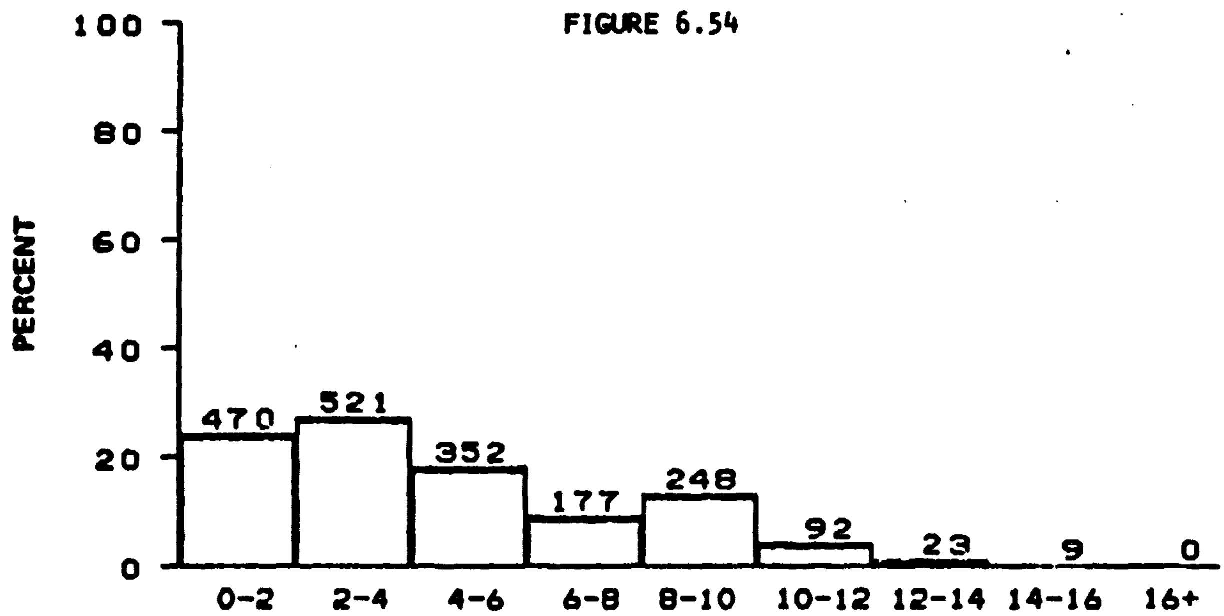


DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF SEPTEMBER

BLM AREA #5

N = 902, MEAN = 4.0, SIGMA = 2.9

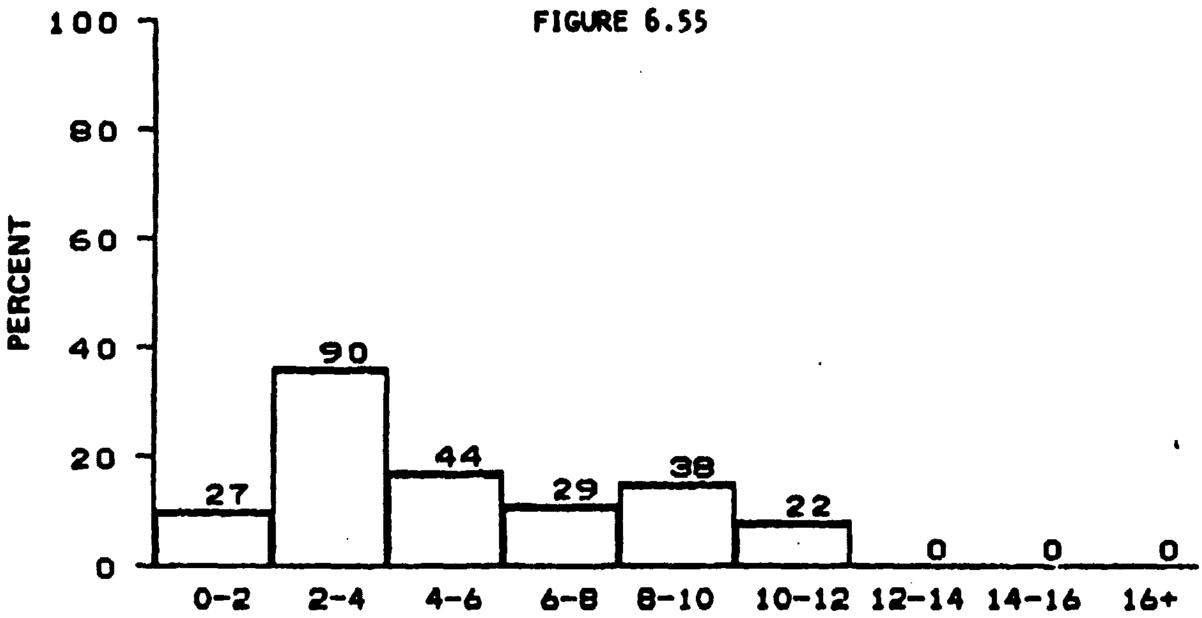


DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF SEPTEMBER

ALL BLM AREAS

N = 1892, MEAN = 4.6, SIGMA = 3.2

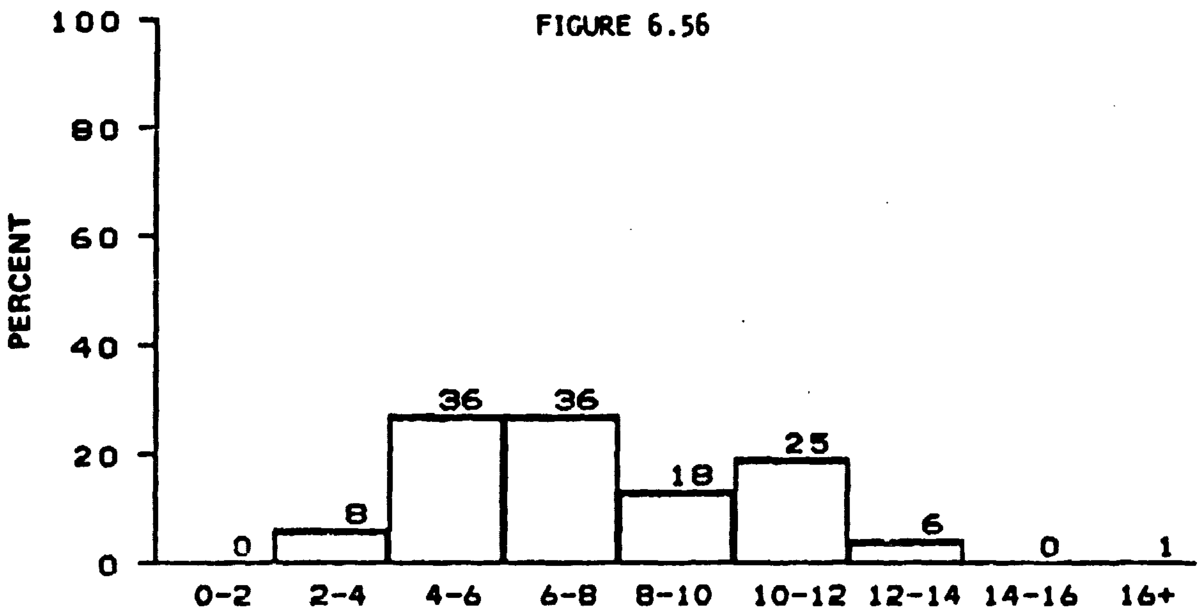


DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF OCTOBER

BLM AREA #1

N = 250, MEAN = 5.2, SIGMA = 3.0



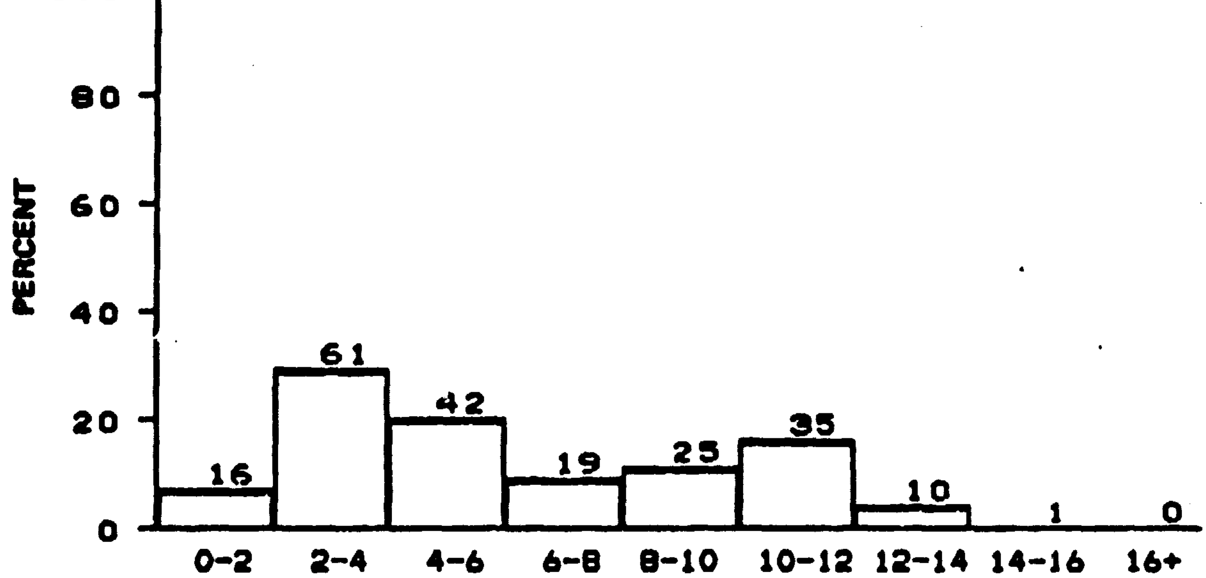
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF OCTOBER

BLM AREA #2

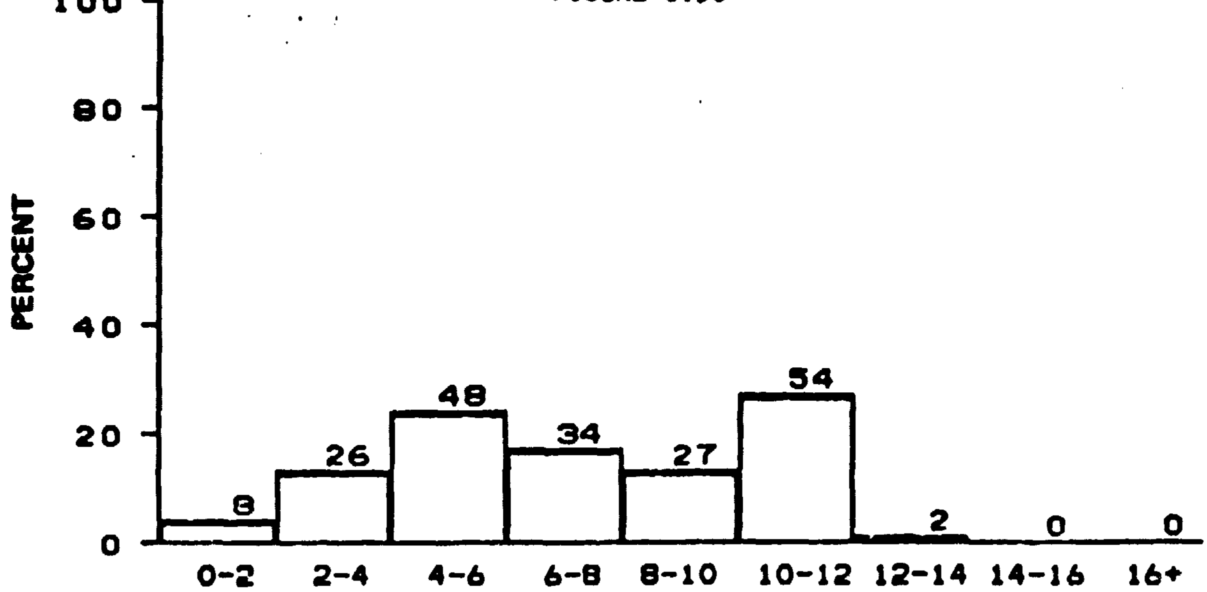
N = 130, MEAN = 7.6, SIGMA = 2.8

FIGURE 6.57

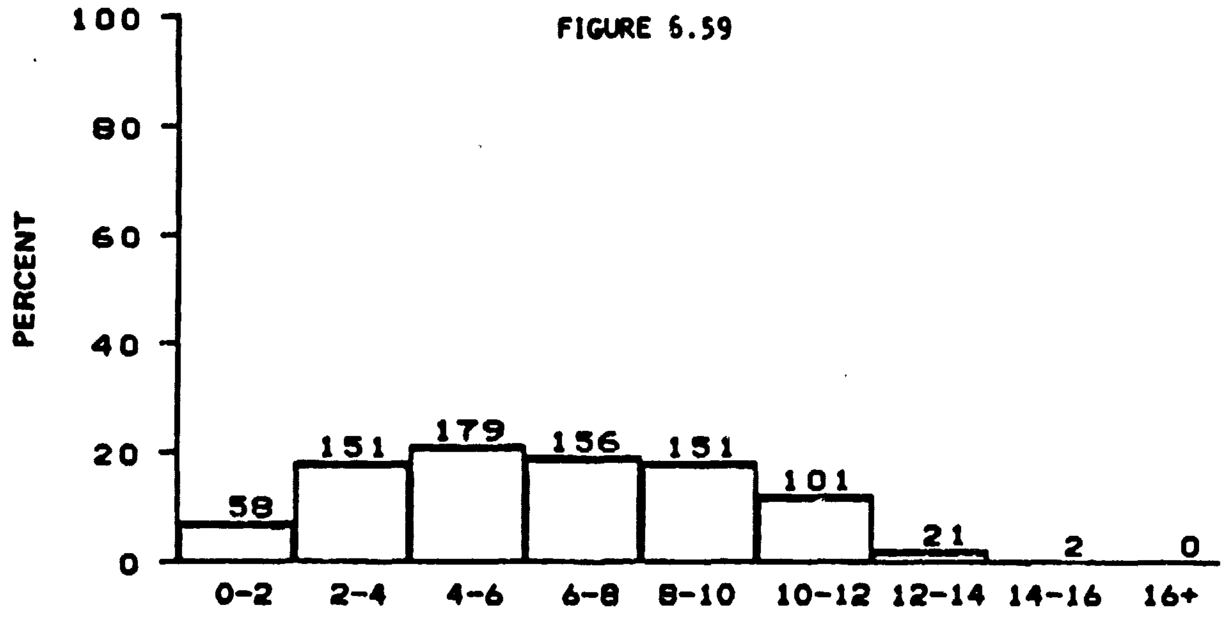


DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
MONTH OF OCTOBER
BLM AREA #3
N = 209, MEAN = 6.2, SIGMA = 3.6

FIGURE 6.58



DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
MONTH OF OCTOBER
BLM AREA #4
N = 199, MEAN = 7.2, SIGMA = 3.1

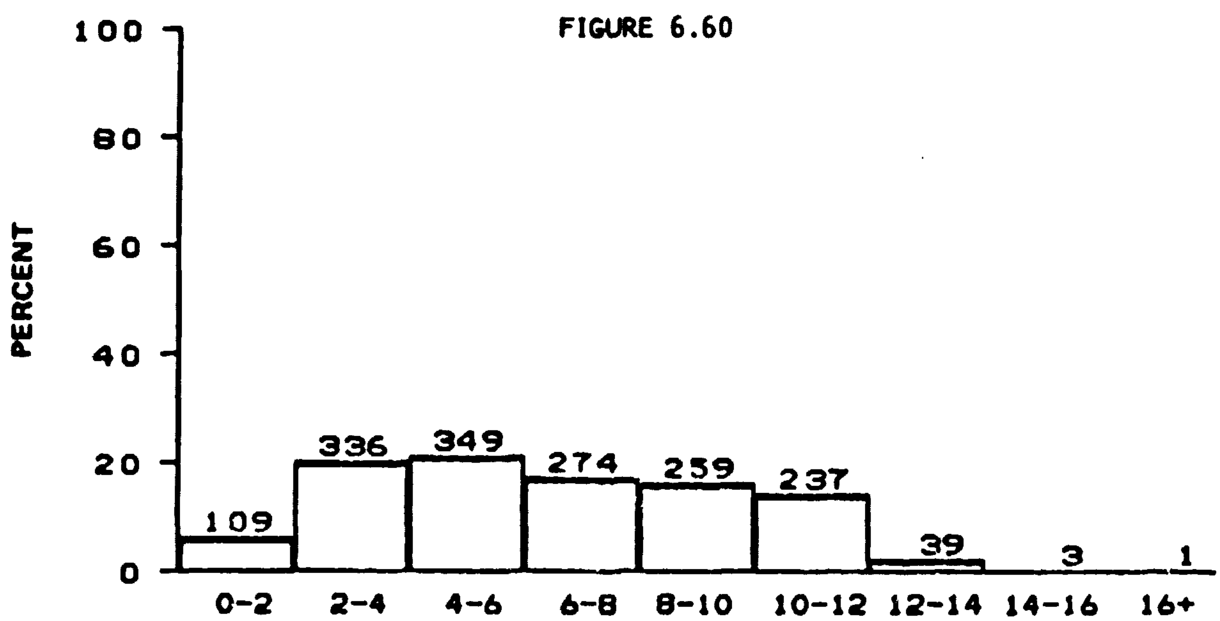


DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF OCTOBER

BLM AREA #5

N = 819, MEAN = 6.4, SIGMA = 3.1

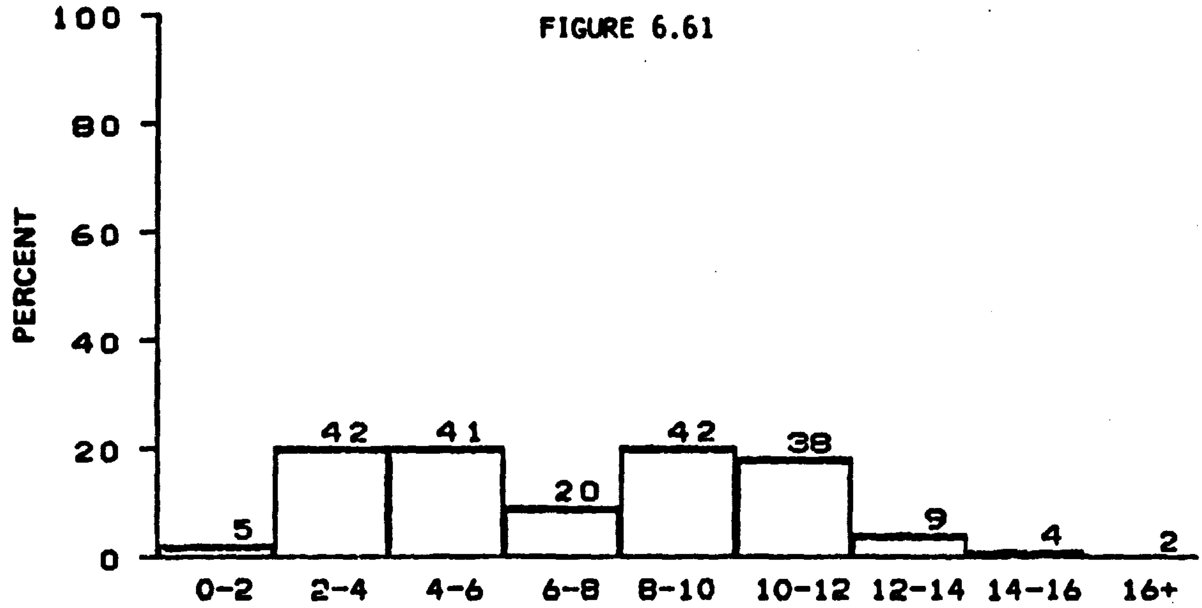


DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF OCTOBER

ALL BLM AREAS

N = 1607, MEAN = 6.4, SIGMA = 3.2

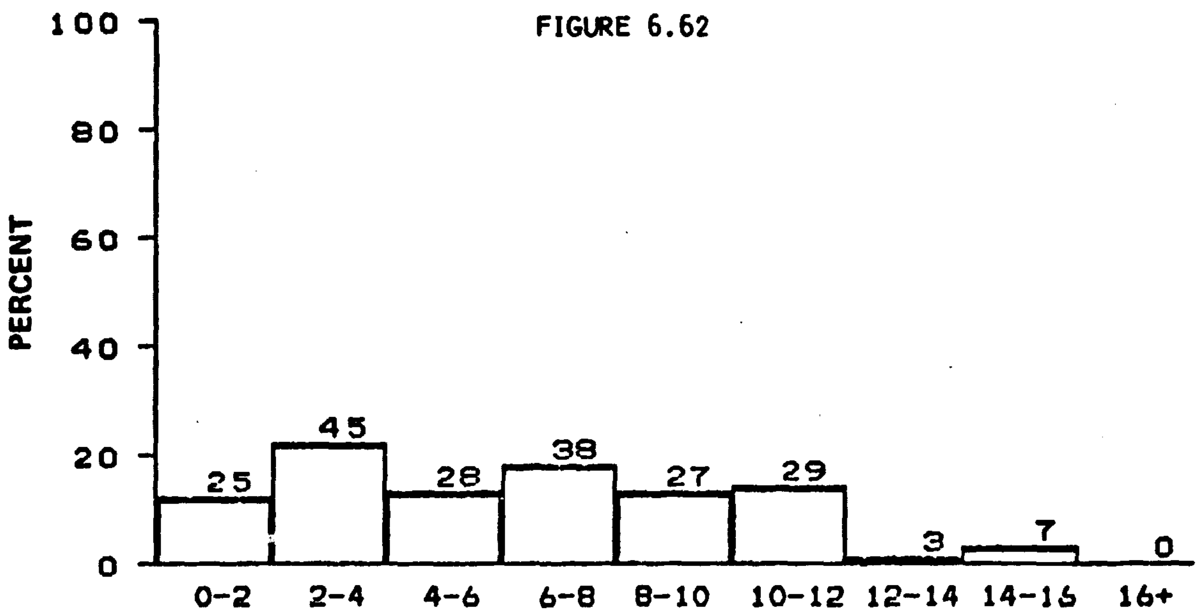


DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF NOVEMBER

BLM AREA #1

N = 203, MEAN = 7.3, SIGMA = 3.5



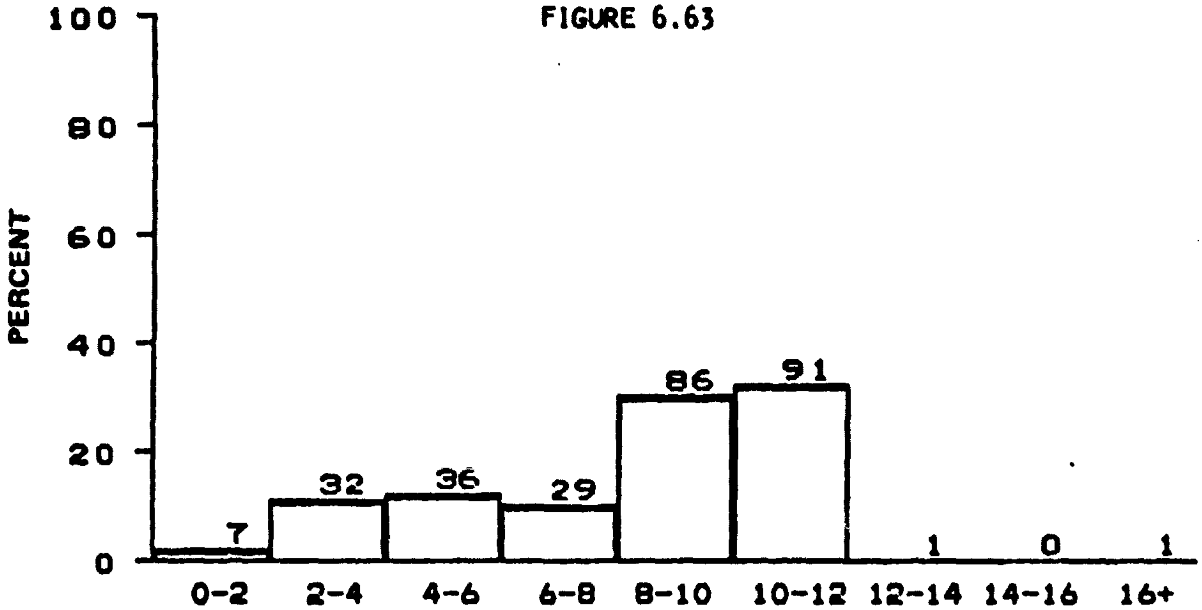
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF NOVEMBER

BLM AREA #2

N = 202, MEAN = 6.3, SIGMA = 3.7

FIGURE 6.63



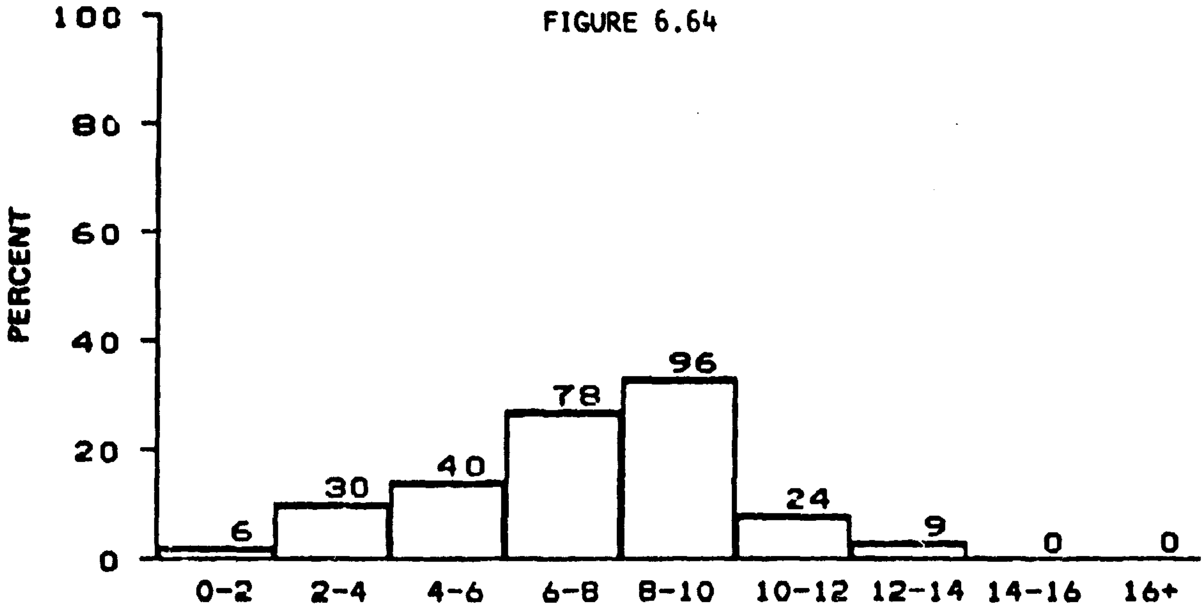
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF NOVEMBER

BLM AREA #3

N = 283, MEAN = 8.1, SIGMA = 3.0

FIGURE 6.64



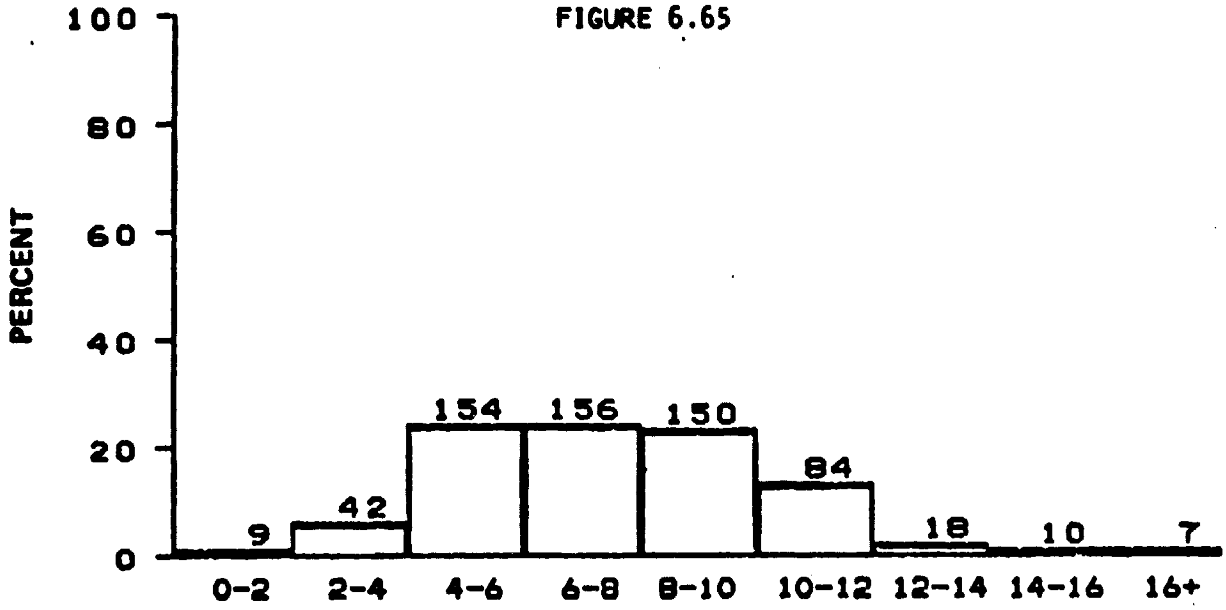
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF NOVEMBER

BLM AREA #4

N = 283, MEAN = 7.4, SIGMA = 2.6

FIGURE 6.65



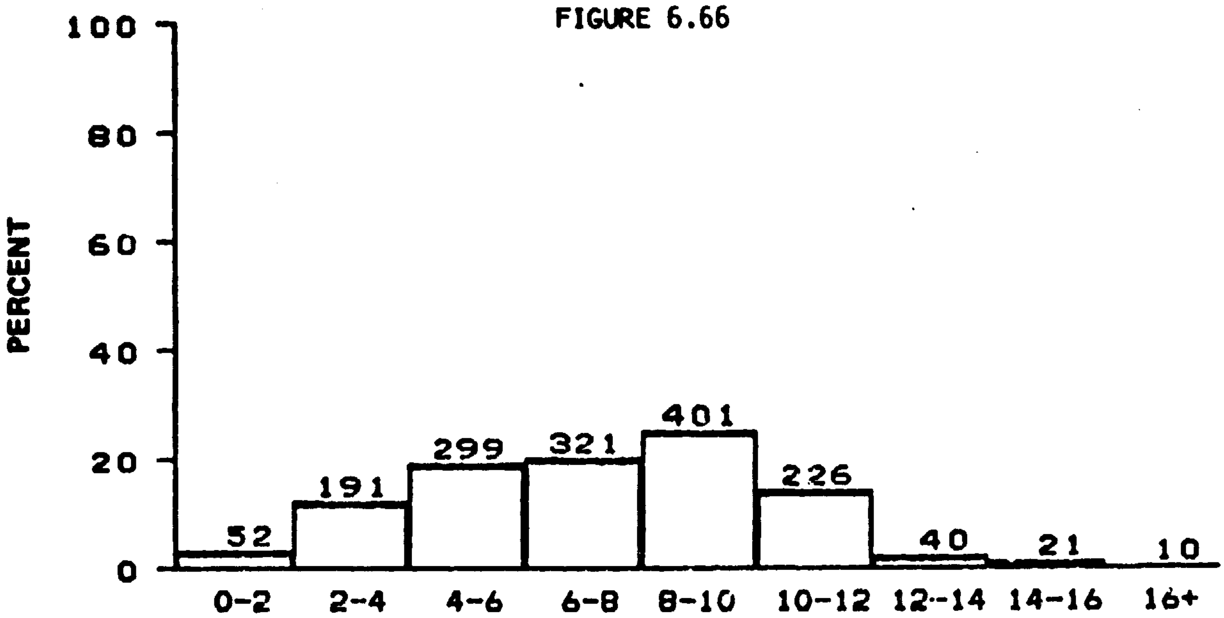
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF NOVEMBER

BLM AREA #5

N = 630, MEAN = 7.6, SIGMA = 2.9

FIGURE 6.66



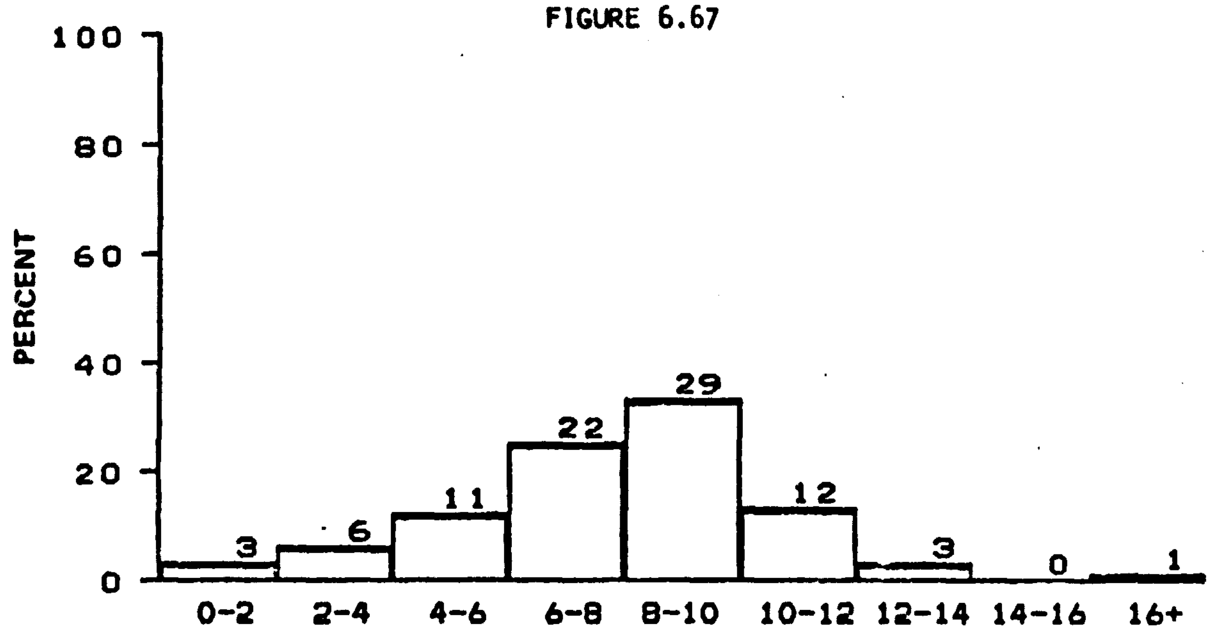
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF NOVEMBER

ALL BLM AREAS

N = 1561, MEAN = 7.3, SIGMA = 3.1

FIGURE 6.67



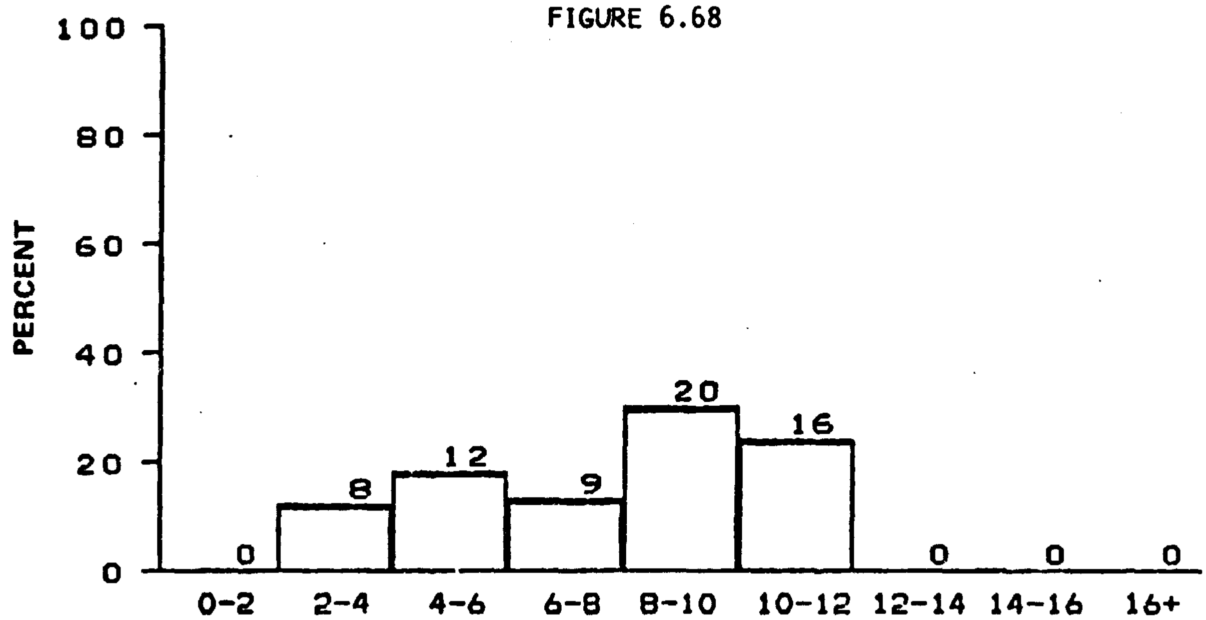
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF DECEMBER

BLM AREA #1

N = 87, MEAN = 7.8, SIGMA = 2.9

FIGURE 6.68



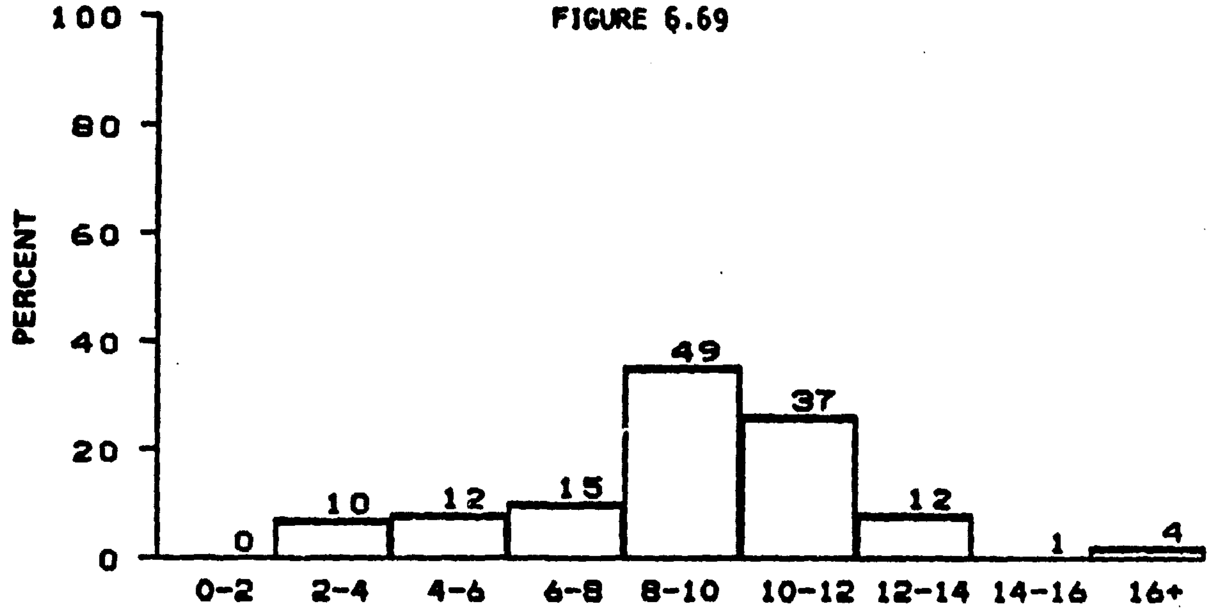
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF DECEMBER

BLM AREA #2

N = 65, MEAN = 7.7, SIGMA = 2.7

FIGURE 6.69



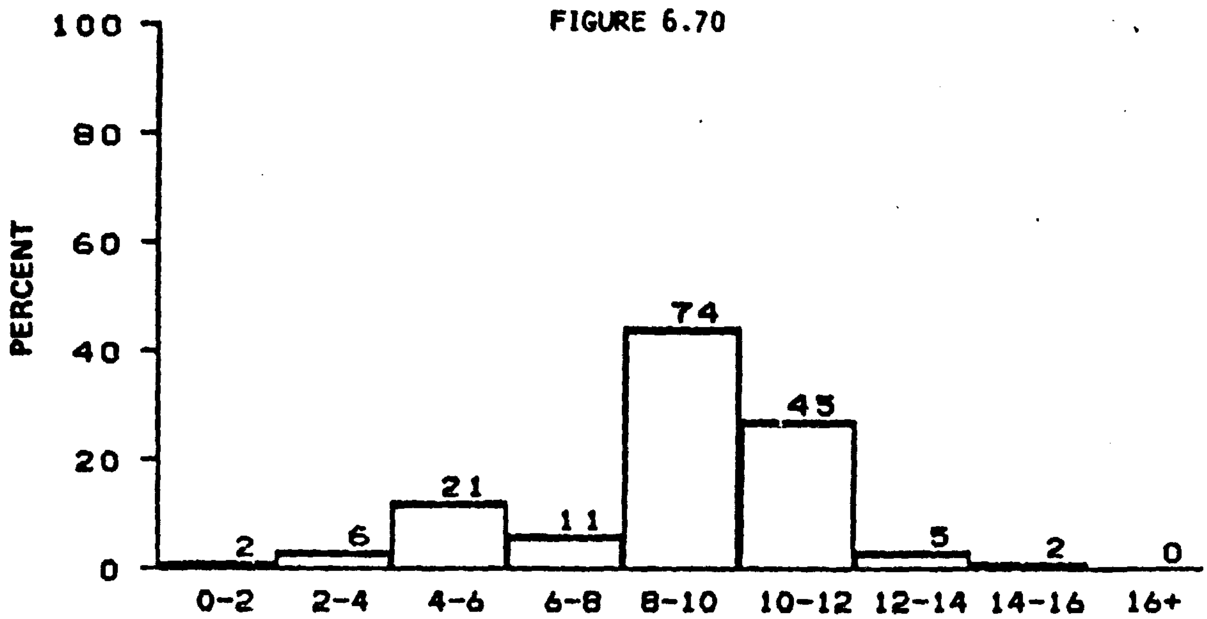
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF DECEMBER

BLM AREA #3

N = 140, MEAN = 9.2, SIGMA = 3.0

FIGURE 6.70



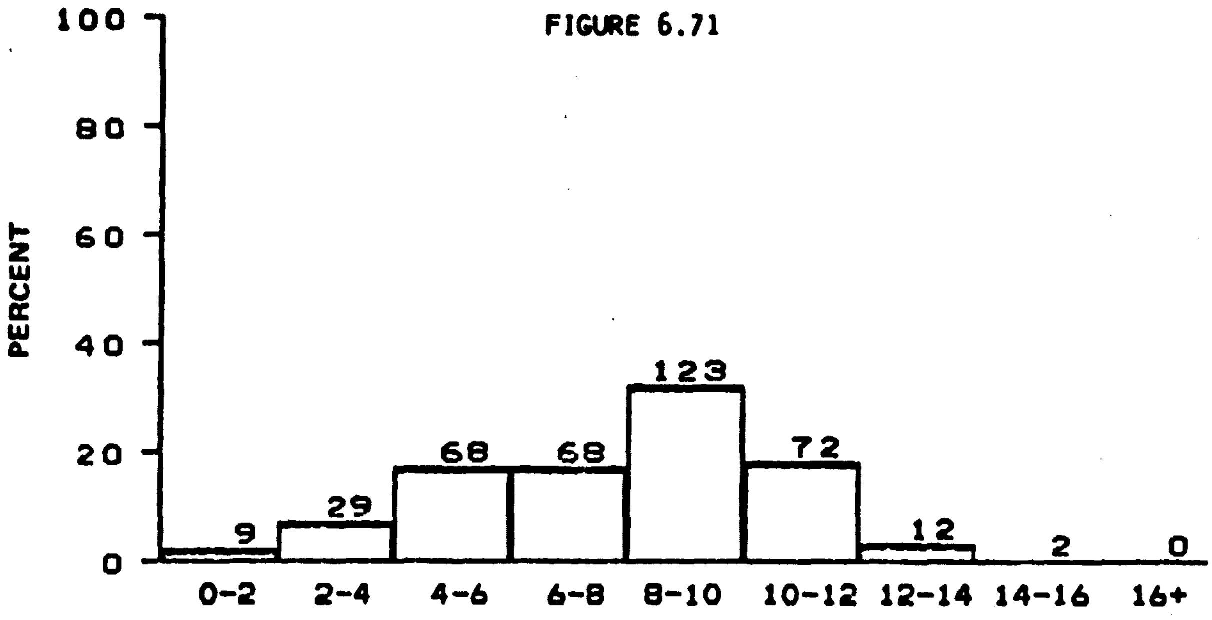
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF DECEMBER

BLM AREA #4

N = 166, MEAN = 8.8, SIGMA = 2.5

FIGURE 6.71



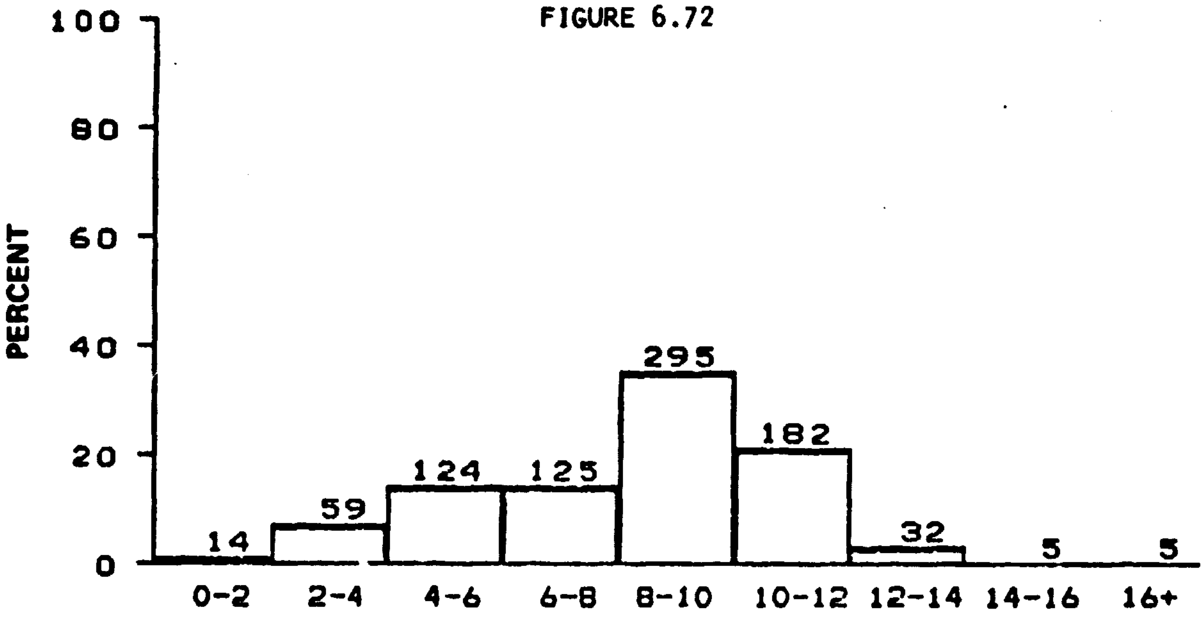
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF DECEMBER

BLM AREA #5

N = 383, MEAN = 7.8, SIGMA = 2.8

FIGURE 6.72



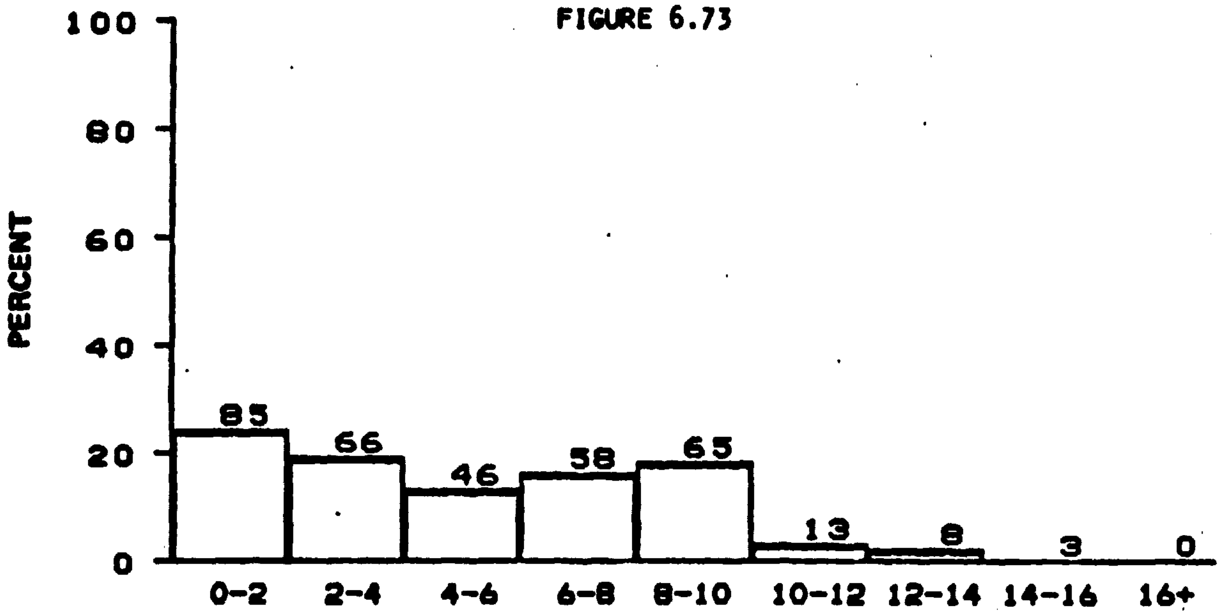
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

MONTH OF DECEMBER

ALL BLM AREAS

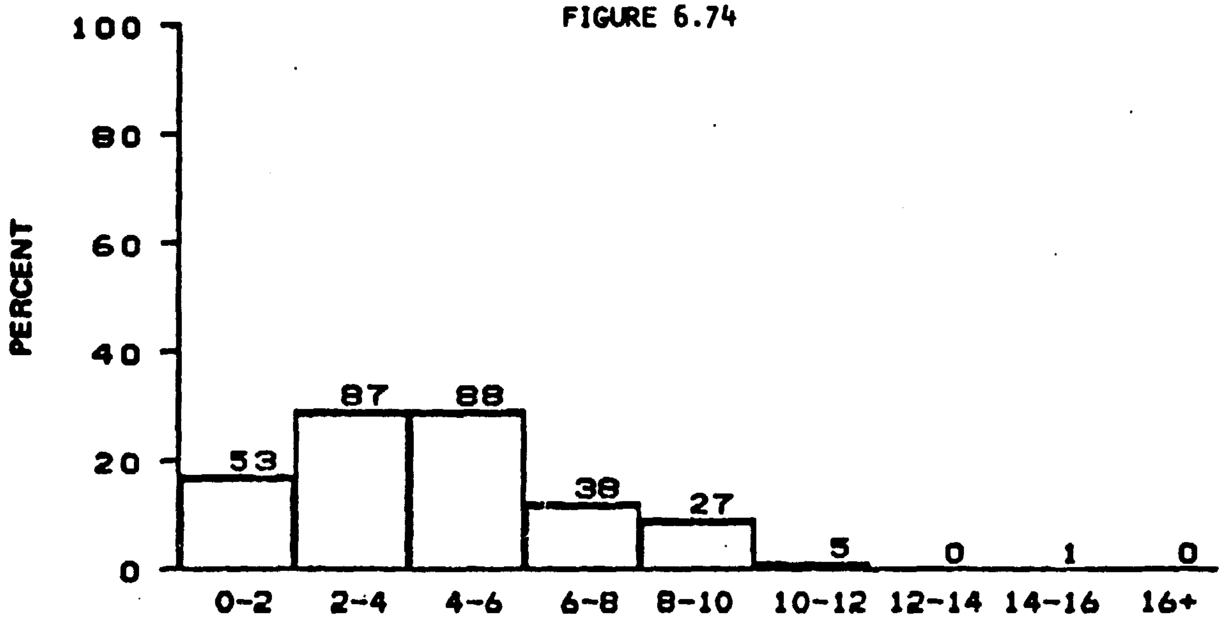
N = 841, MEAN = 8.2, SIGMA = 2.8

FIGURE 6.73

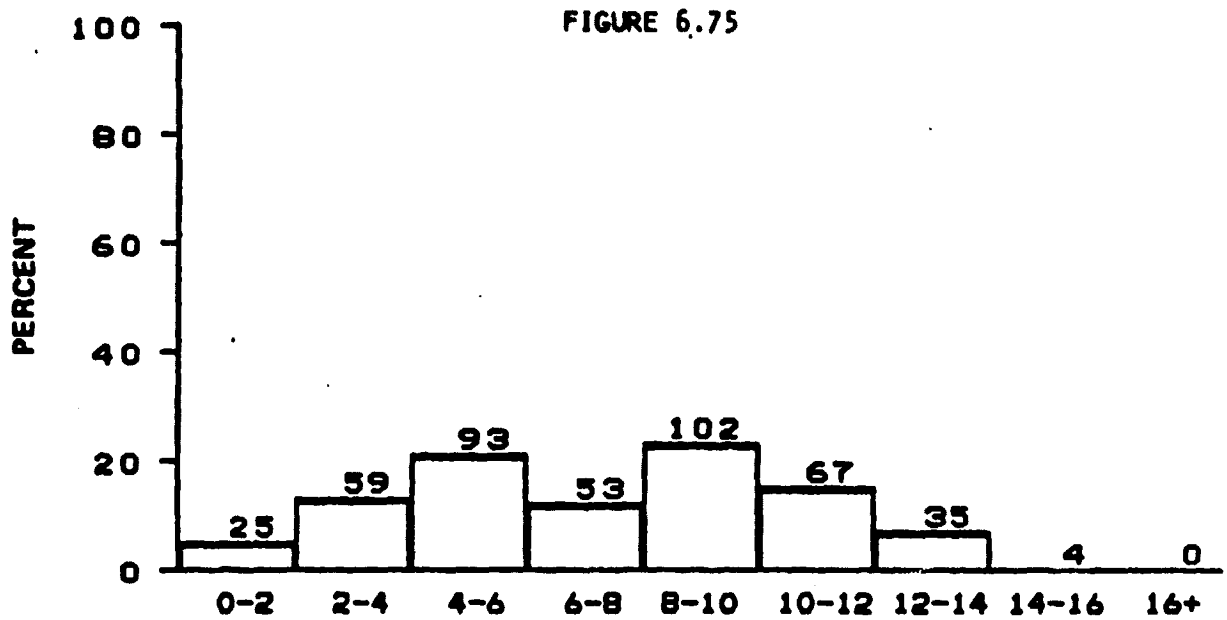


DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
SPRING SEASON
BLM AREA #1
N = 344, MEAN = 5.2, SIGMA = 3.5

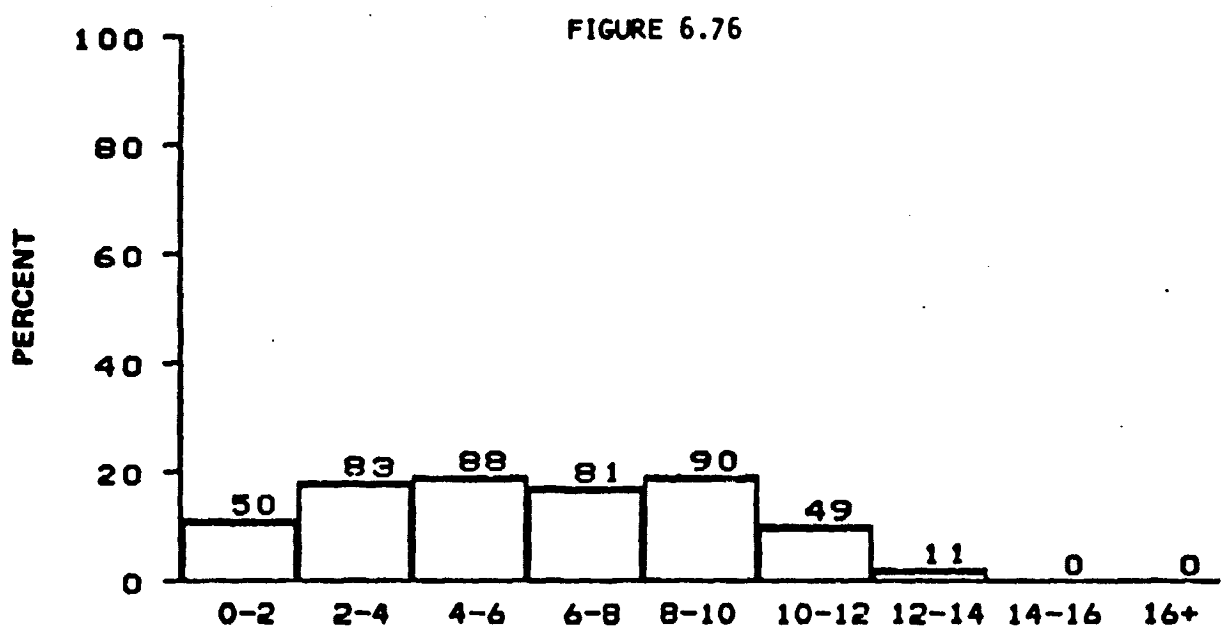
FIGURE 6.74



DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
SPRING SEASON
BLM AREA #2
N = 299, MEAN = 4.5, SIGMA = 2.6

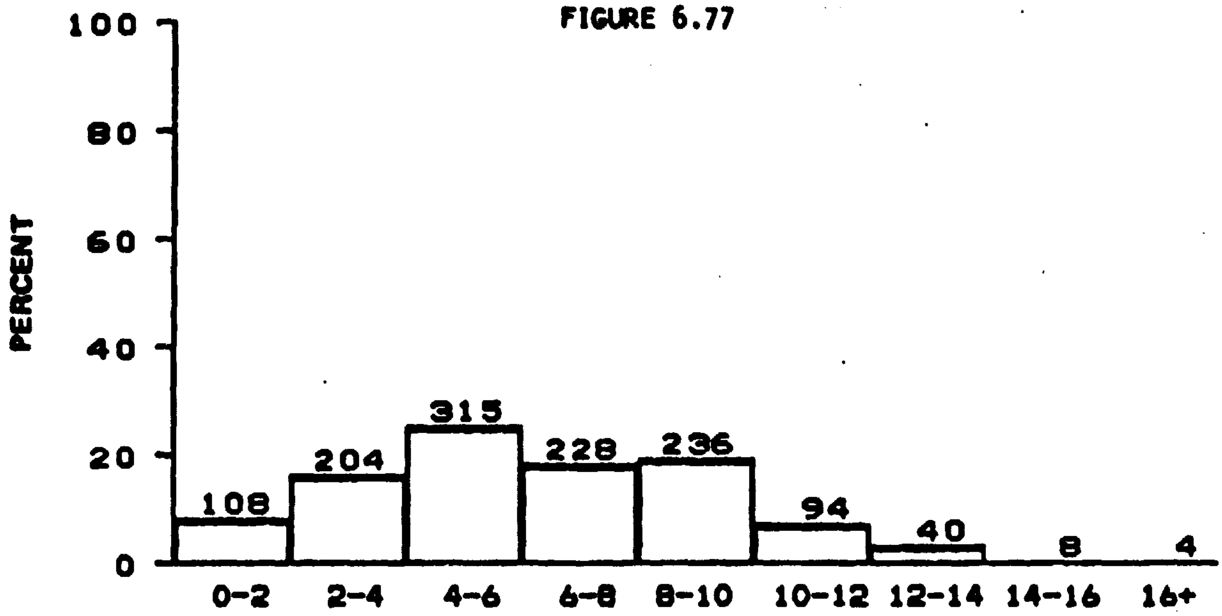


DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
SPRING SEASON
BLM AREA #3
N = 438, MEAN = 7.3, SIGMA = 3.4



DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
SPRING SEASON
BLM AREA #4
N = 452, MEAN = 6.2, SIGMA = 3.2

FIGURE 6.77



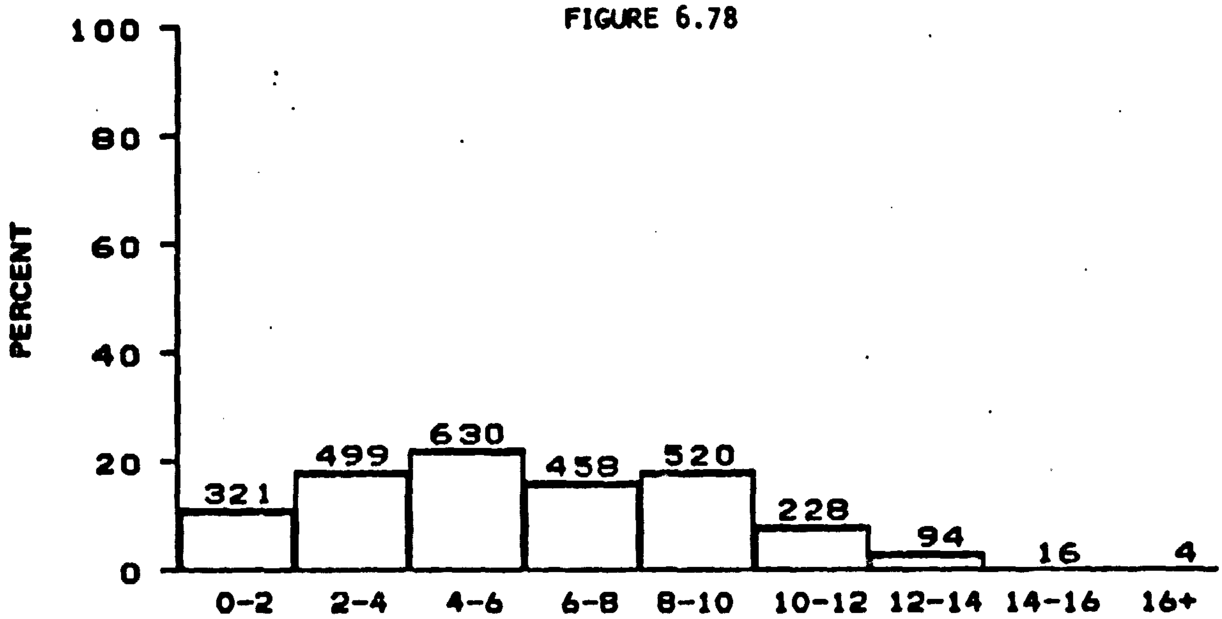
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

SPRING SEASON

BLM AREA #5

N = 1237, MEAN = 6.3, SIGMA = 3.2

FIGURE 6.78



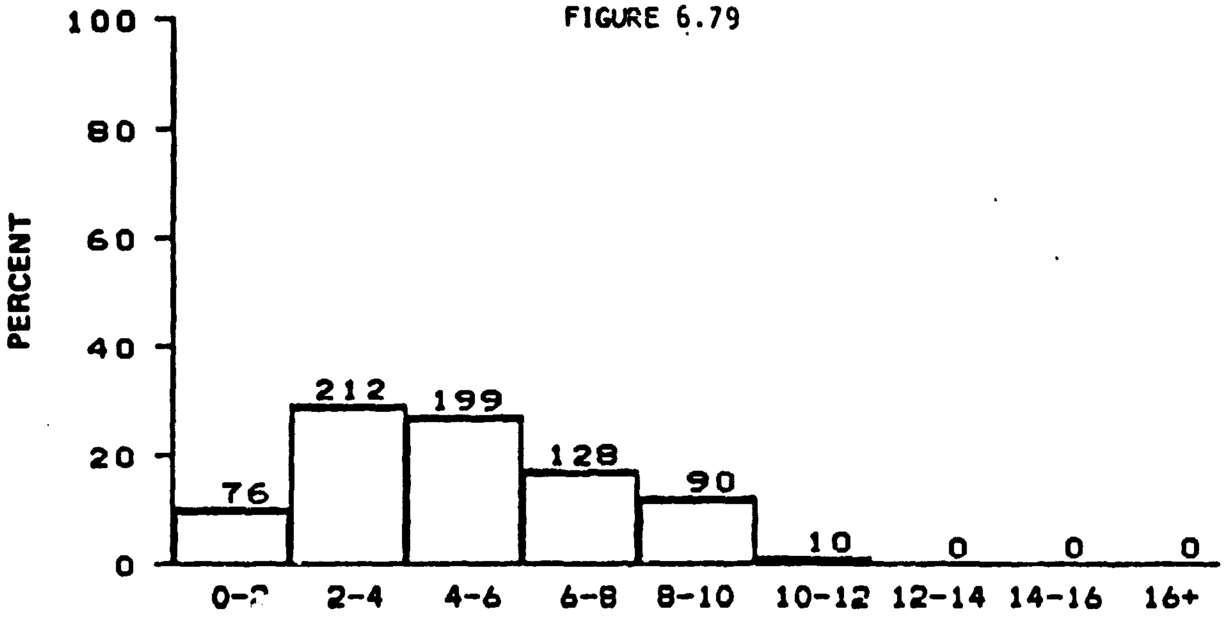
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

SPRING SEASON

ALL BLM AREAS

N = 2770, MEAN = 6.1, SIGMA = 3.3

FIGURE 6.79



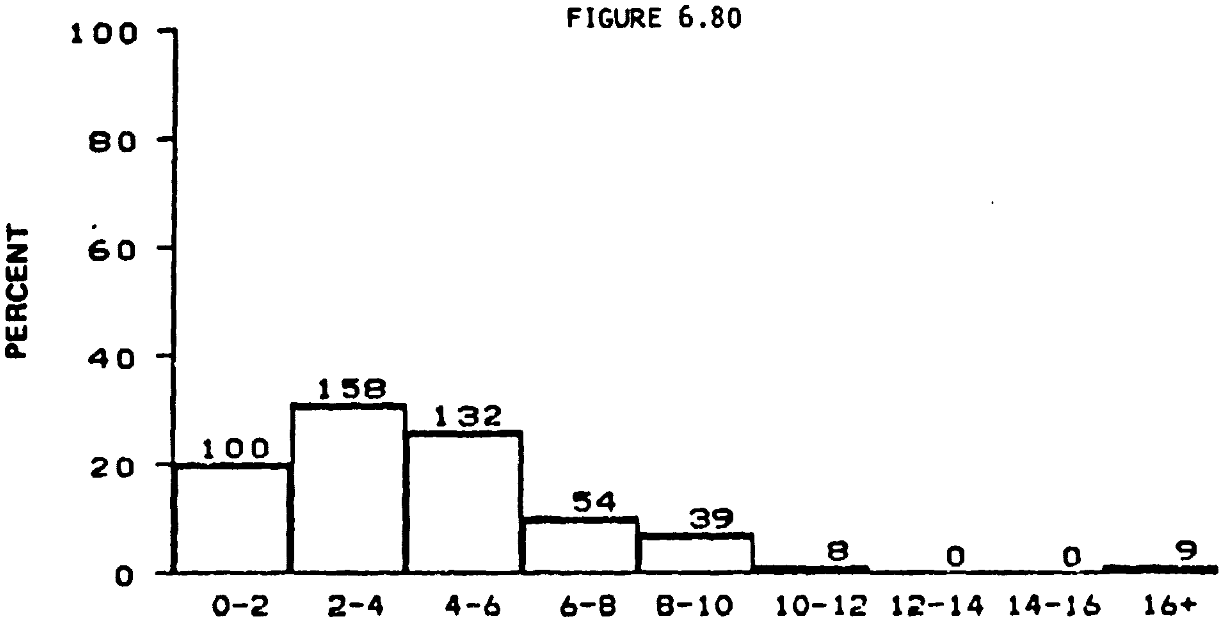
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

SUMMER SEASON

BLM AREA #1

N = 715, MEAN = 4.9, SIGMA = 2.5

FIGURE 6.80



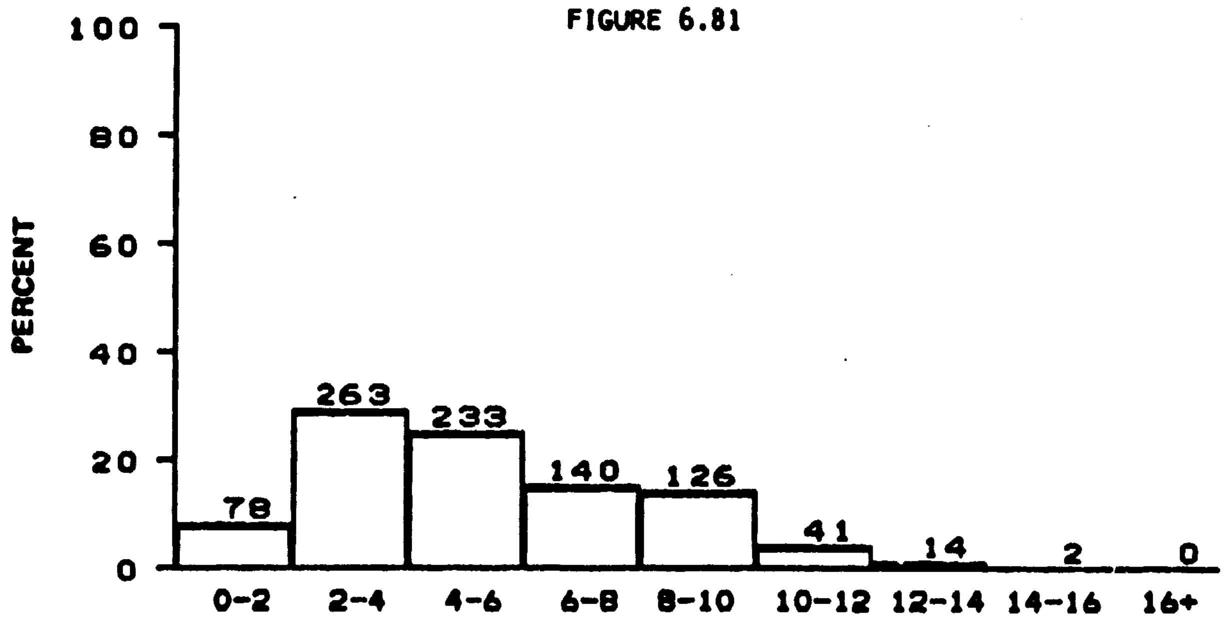
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

SUMMER SEASON

BLM AREA #2

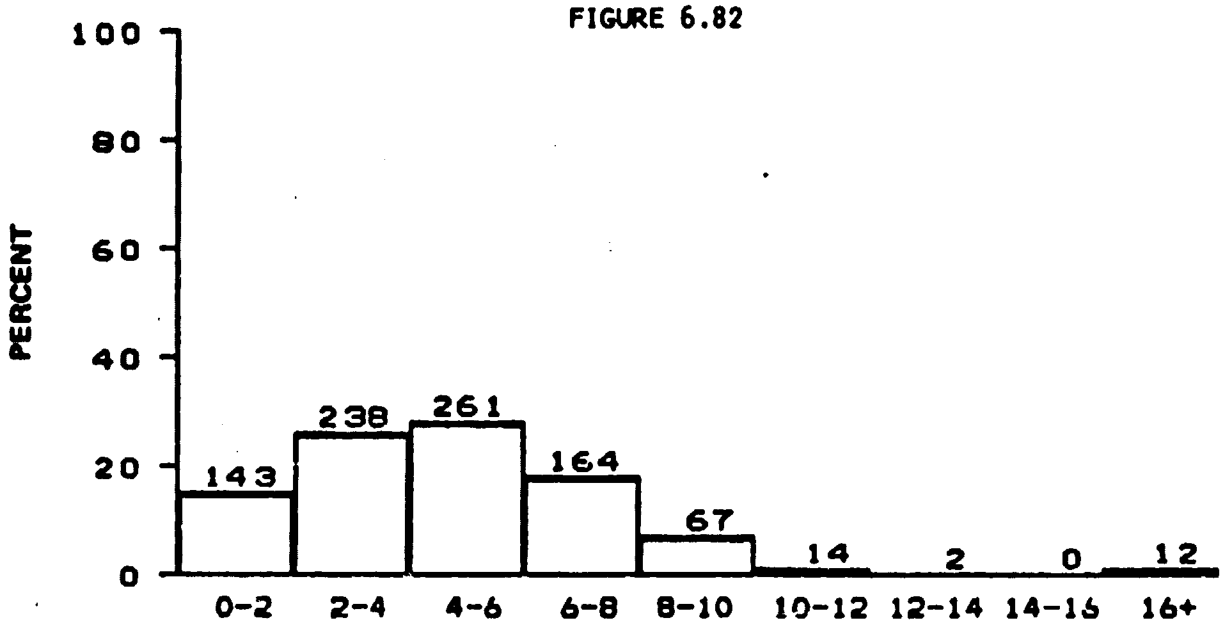
N = 500, MEAN = 4.4, SIGMA = 3.0

FIGURE 6.81

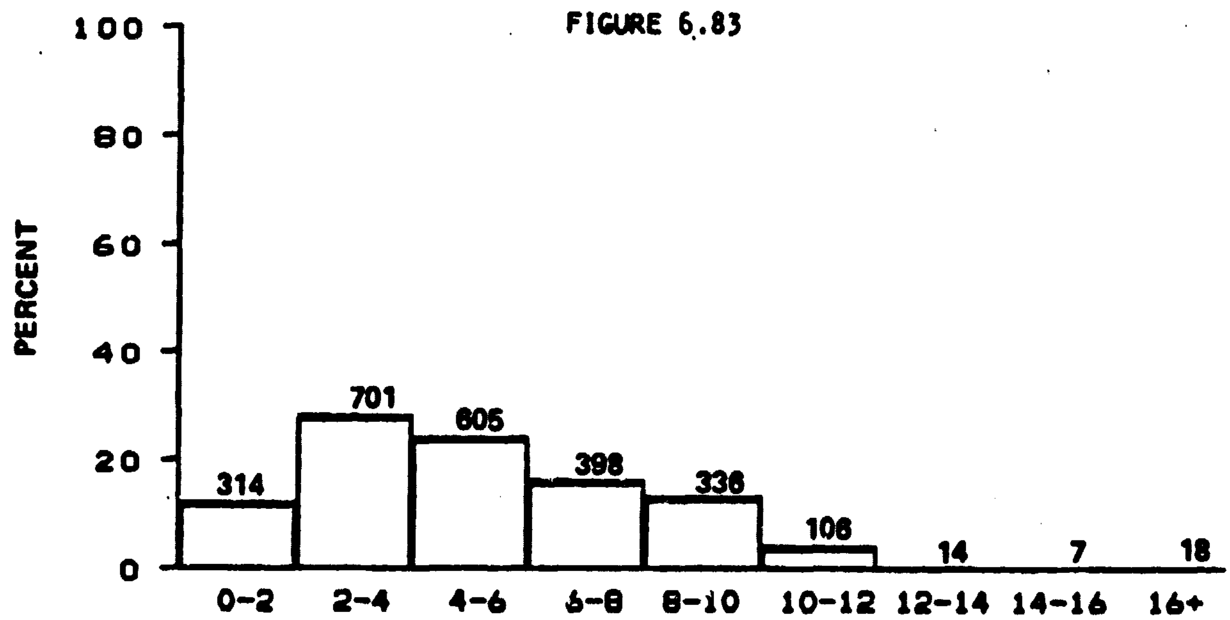


DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
SUMMER SEASON
BLM AREA #3
N = 897, MEAN = 5.4, SIGMA = 2.9

FIGURE 6.82



DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
SUMMER SEASON
BLM AREA #4
N = 901, MEAN = 4.8, SIGMA = 2.8

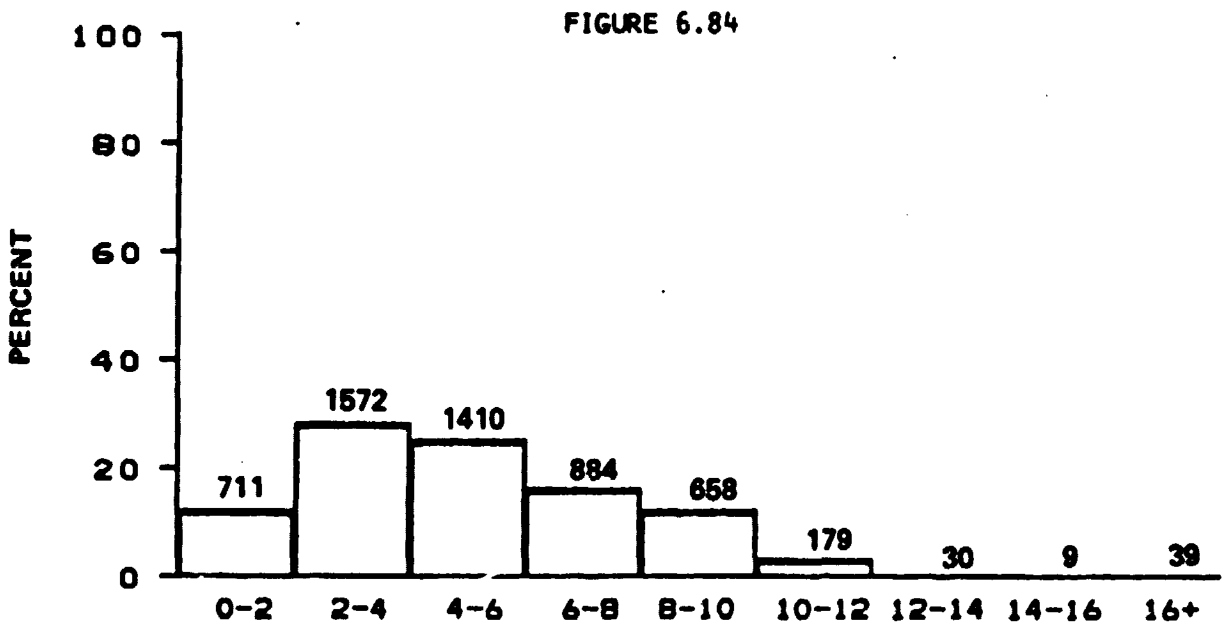


DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

SUMMER SEASON

BLM AREA #5

N = 2499, MEAN = 5.2, SIGMA = 3.0



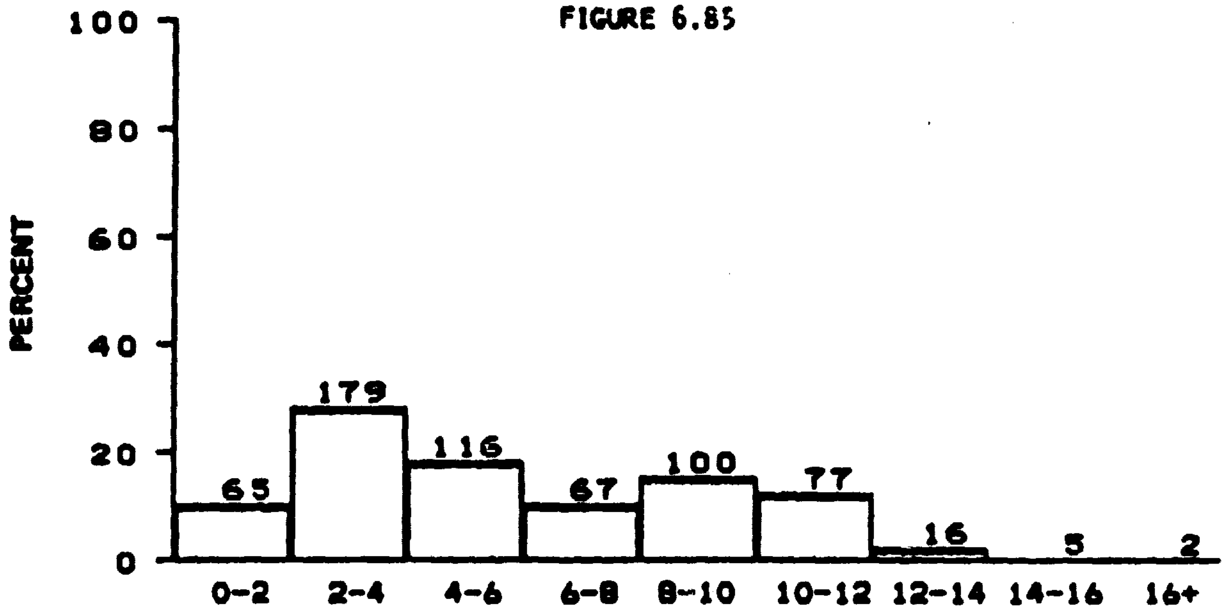
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

SUMMER SEASON

ALL BLM AREAS

N = 5492, MEAN = 5.1, SIGMA = 2.9

FIGURE 6.85



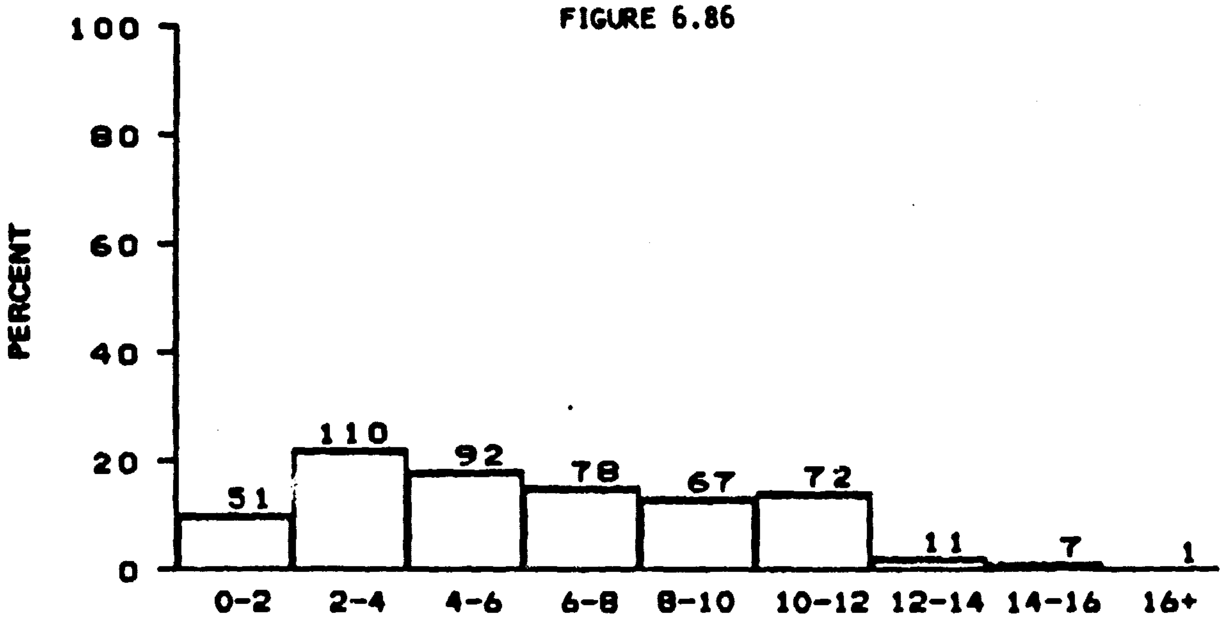
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

FALL SEASON

BLM AREA #1

N = 627, MEAN = 5.9, SIGMA = 3.5

FIGURE 6.86



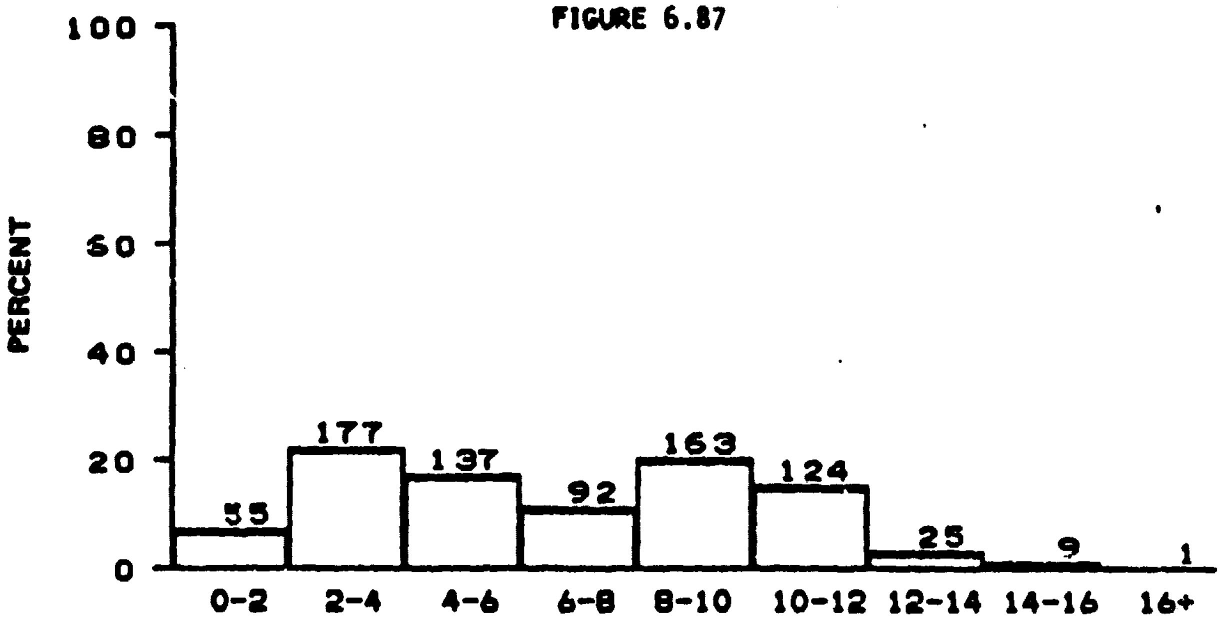
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

FALL SEASON

BLM AREA #2

N = 489, MEAN = 6.2, SIGMA = 3.5

FIGURE 6.87



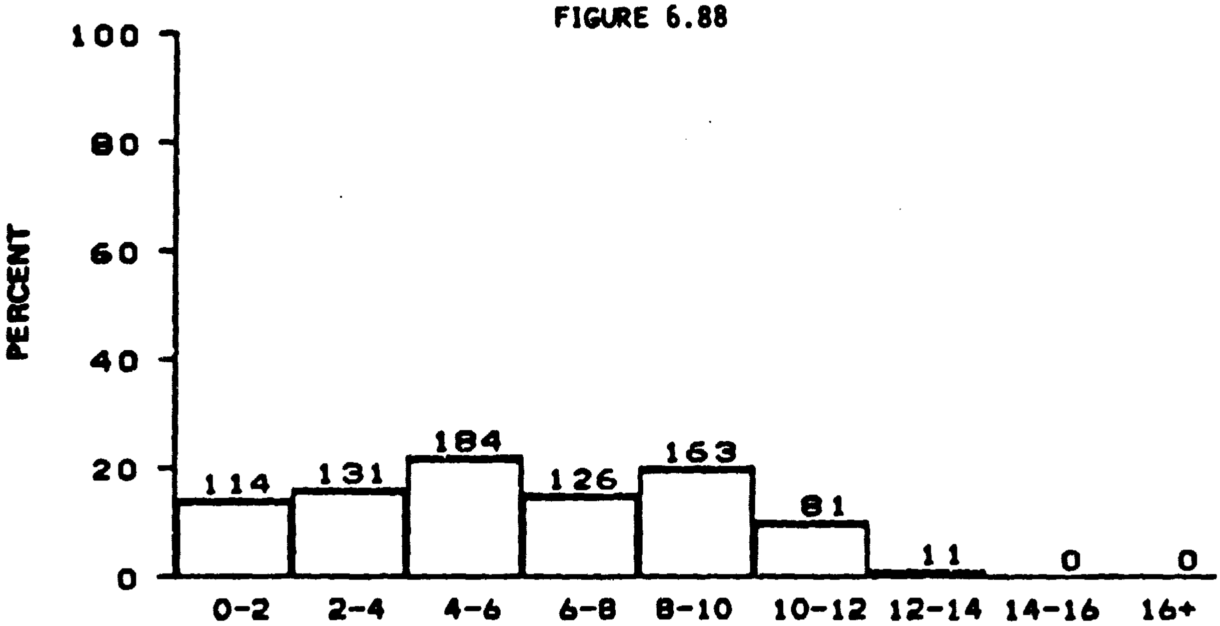
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

FALL SEASON

BLM AREA #3

N = 783, MEAN = 6.7, SIGMA = 3.5

FIGURE 6.88



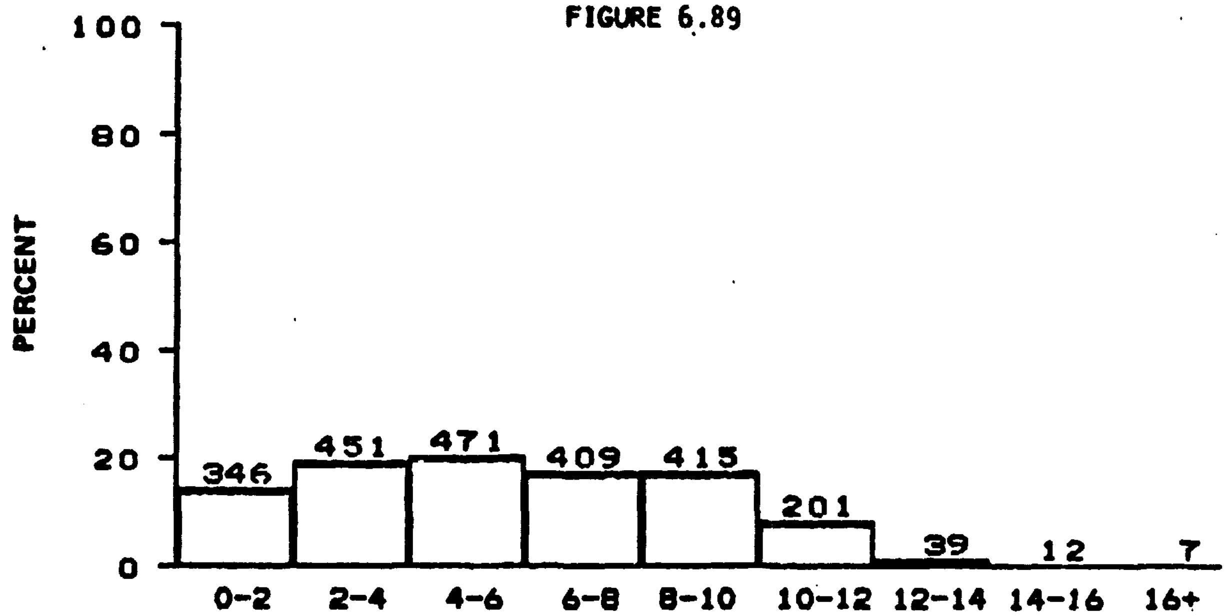
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

FALL SEASON

BLM AREA #4

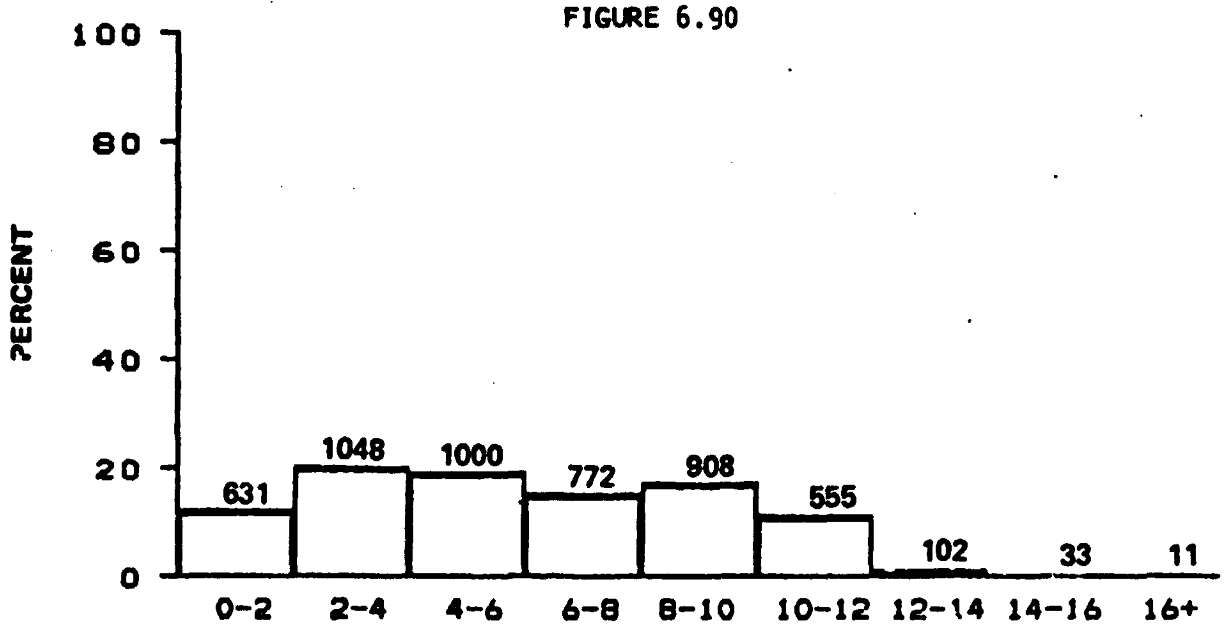
N = 810, MEAN = 5.9, SIGMA = 3.2

FIGURE 6.89



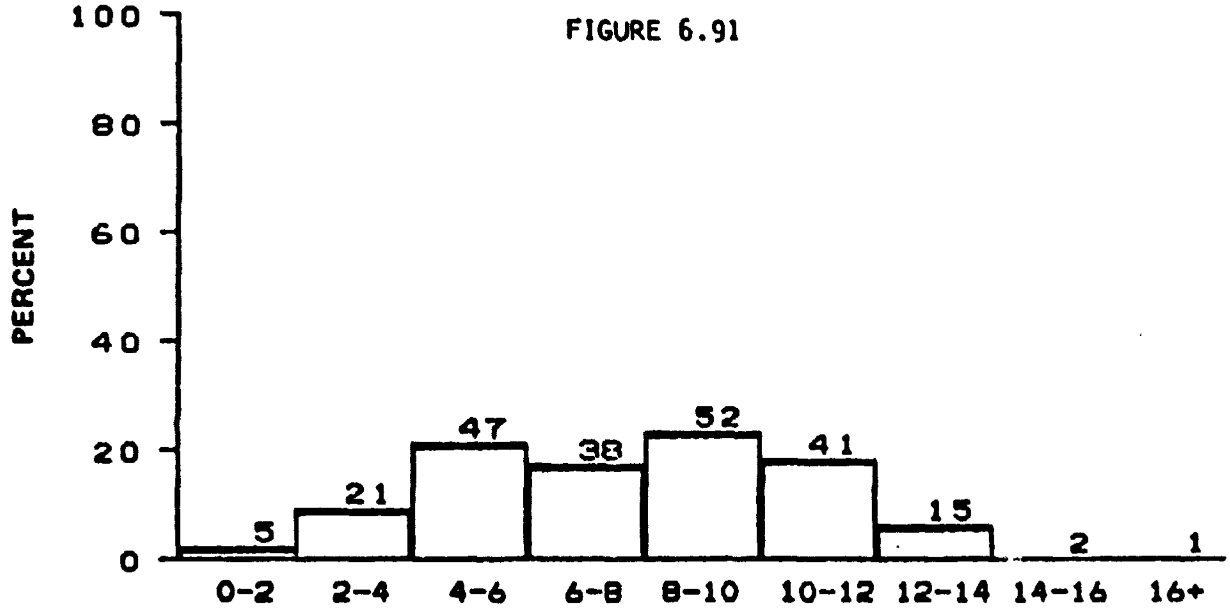
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
FALL SEASON
BLM AREA #5
N = 2351, MEAN = 5.8, SIGMA = 3.3

FIGURE 6.90



DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
FALL SEASON
ALL BLM AREAS
N = 5060, MEAN = 6.0, SIGMA = 3.4

FIGURE 6.91



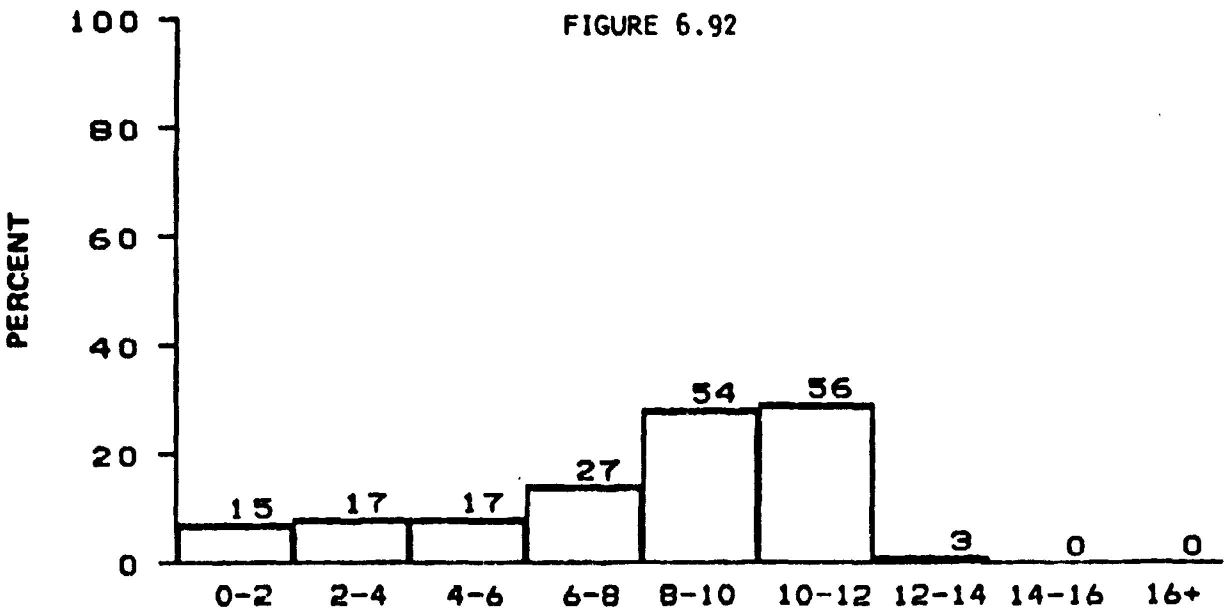
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

WINTER SEASON

BLM AREA #1

N = 222, MEAN = 7.8, SIGMA = 3.1

FIGURE 6.92



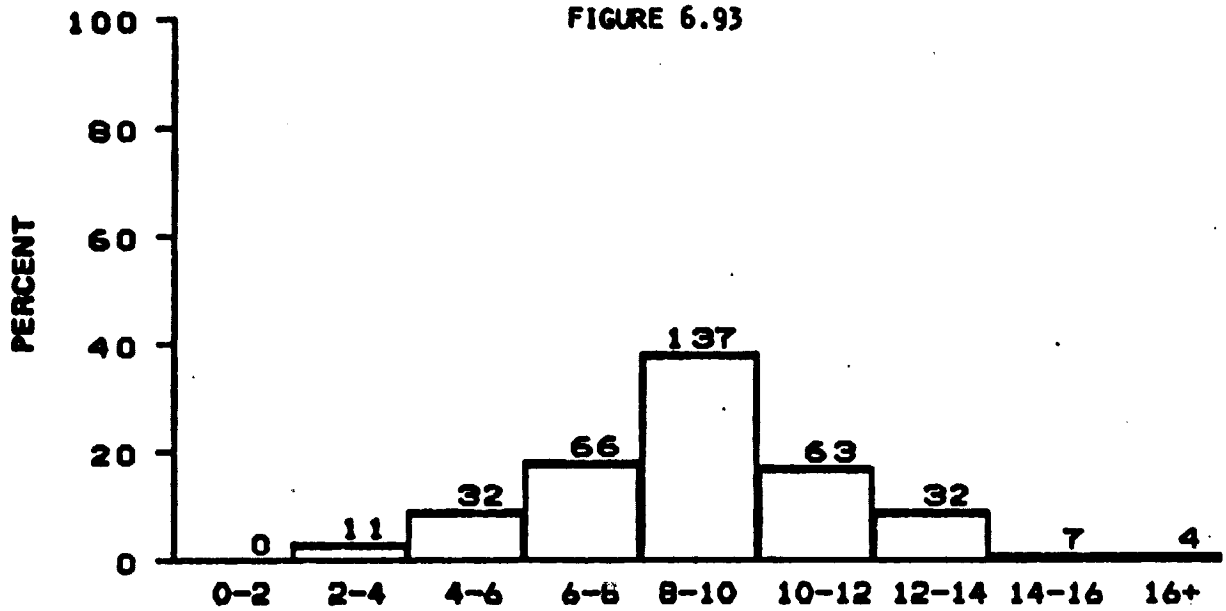
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

WINTER SEASON

BLM AREA #2

N = 189, MEAN = 7.8, SIGMA = 3.2

FIGURE 6.93



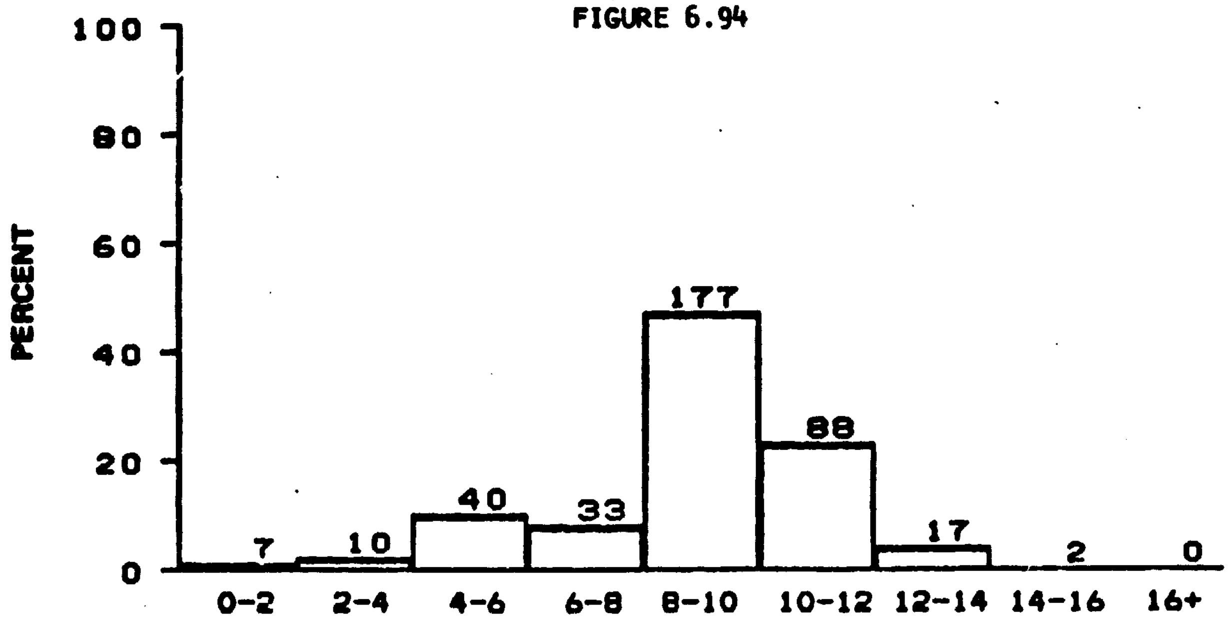
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

WINTER SEASON

BLM AREA #3

N = 352, MEAN = 9.0, SIGMA = 2.6

FIGURE 6.94



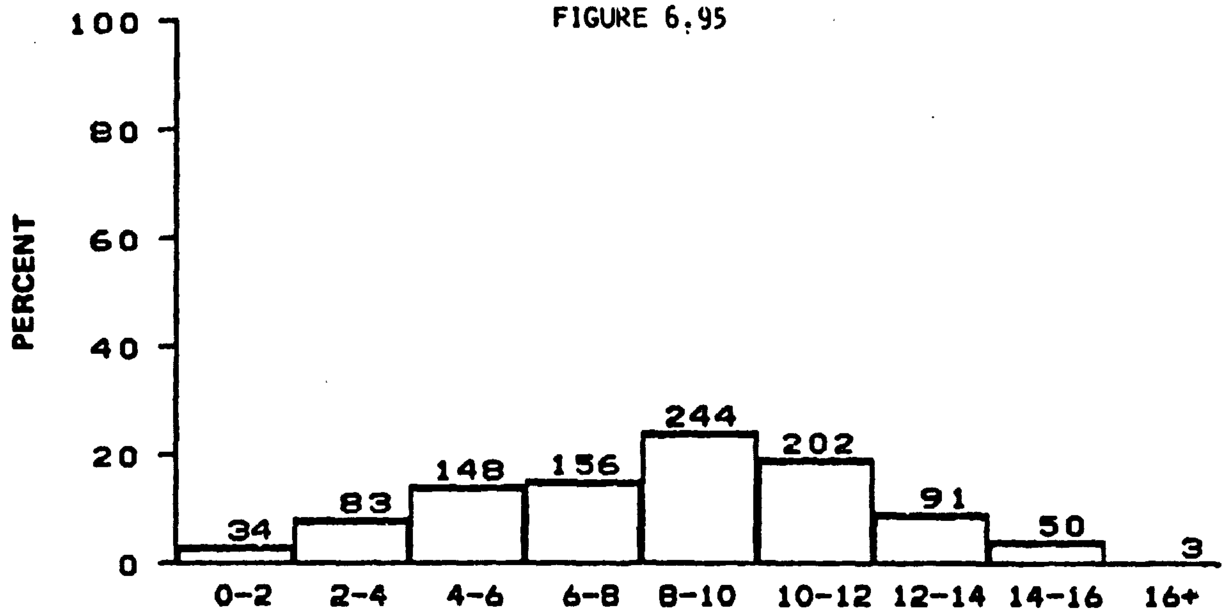
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

WINTER SEASON

BLM AREA #4

N = 374, MEAN = 8.8, SIGMA = 2.5

FIGURE 6.95



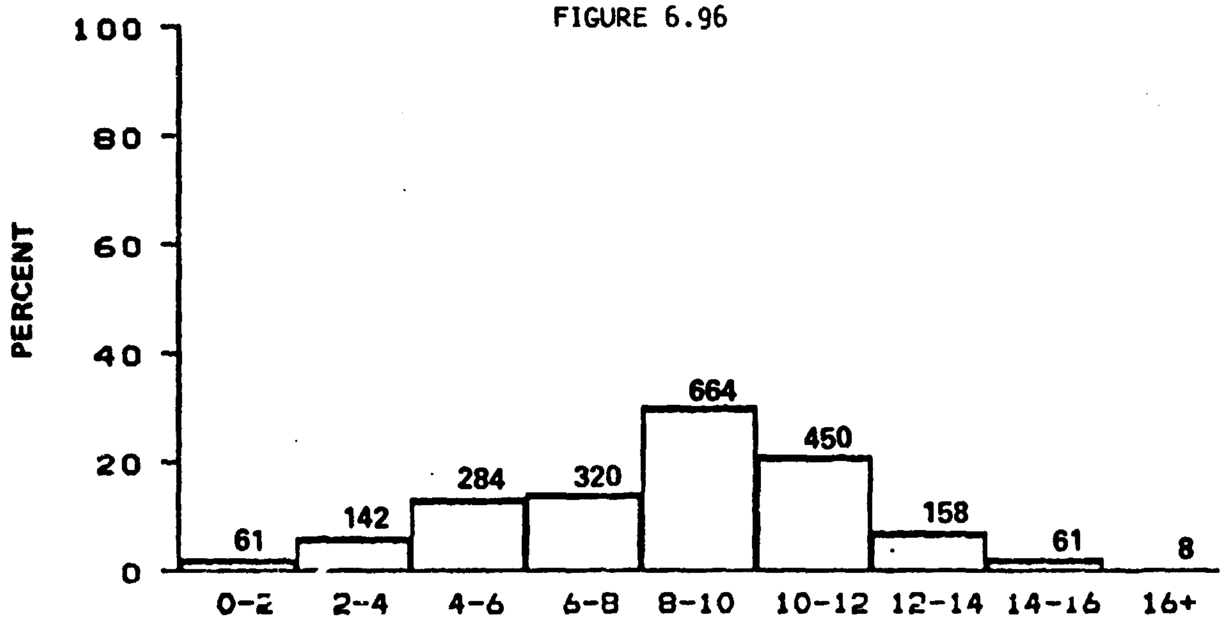
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

WINTER SEASON

BLM AREA #5

N = 1011, MEAN = 8.4, SIGMA = 3.5

FIGURE 6.96



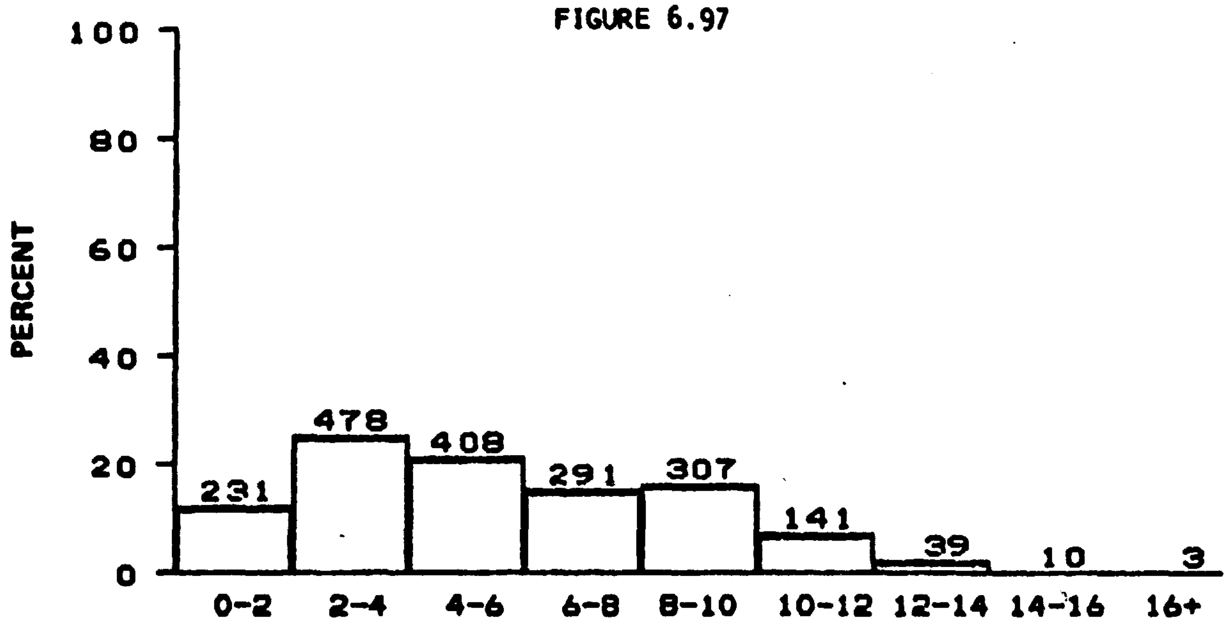
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

WINTER SEASON

ALL BLM AREAS

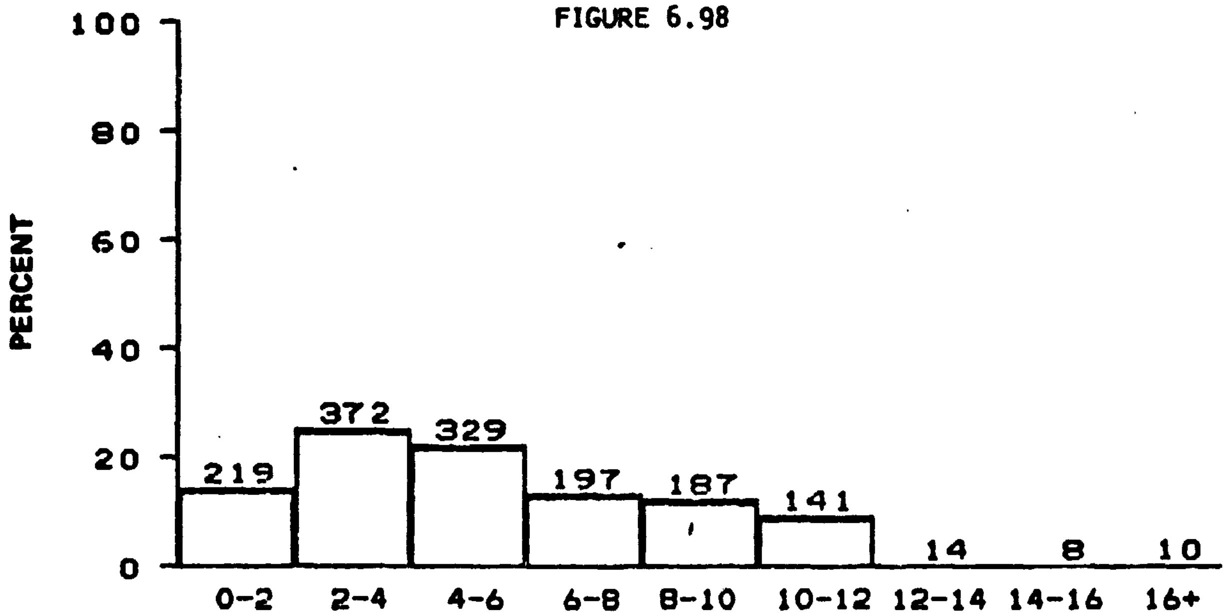
N = 2148, MEAN = 8.5, SIGMA = 3.2

FIGURE 6.97



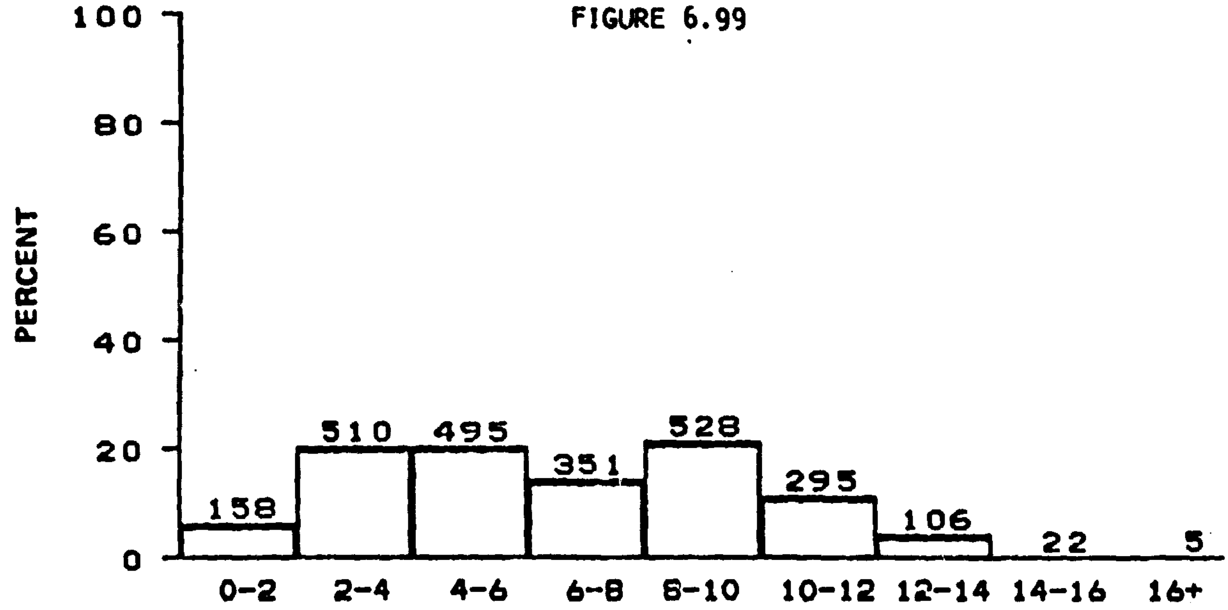
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
ENTIRE MISSION
BLM AREA #1
N = 1908, MEAN = 5.6, SIGMA = 3.2

FIGURE 6.98



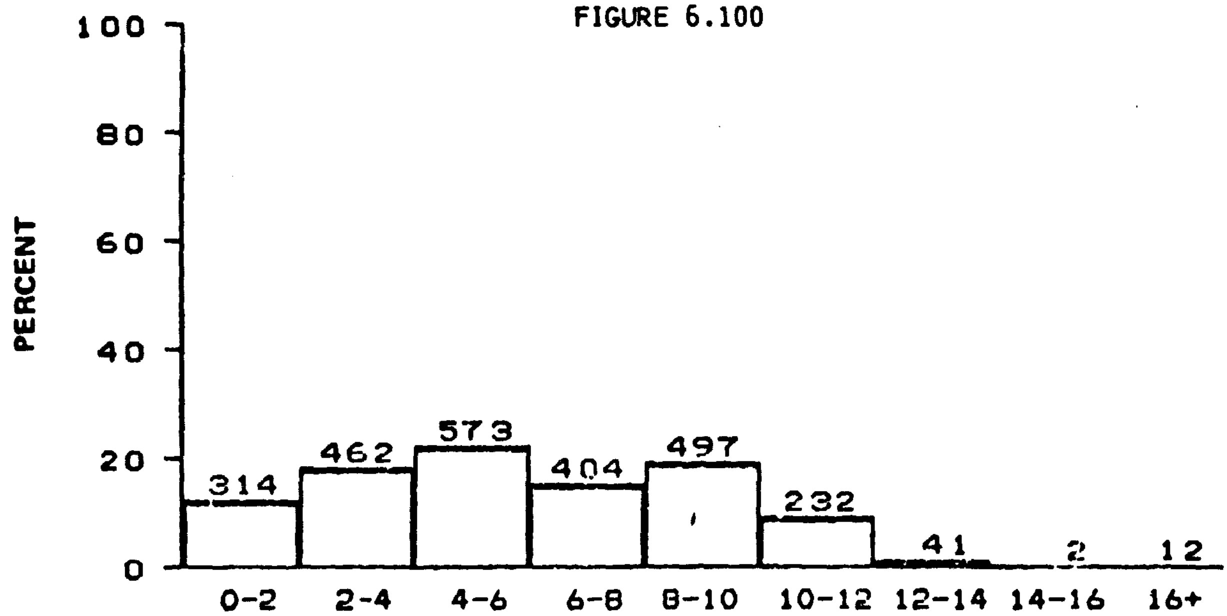
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
ENTIRE MISSION
BLM AREA #2
N = 1477, MEAN = 5.5, SIGMA = 3.4

FIGURE 6.99



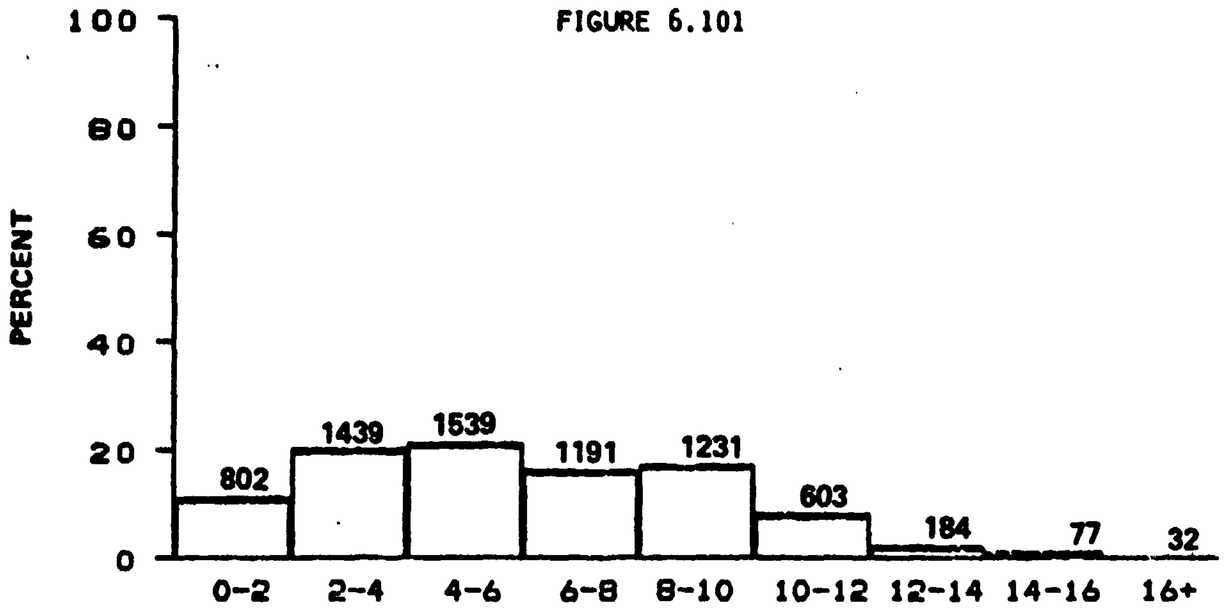
DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
ENTIRE MISSION
BLM AREA #3
N = 2470, MEAN = 6.6, SIGMA = 3.4

FIGURE 6.100



DISTRIBUTION OF WIND SPEED IN METERS PER SECOND
ENTIRE MISSION
BLM AREA #4
N = 2537, MEAN = 6.0, SIGMA = 3.3

FIGURE 6.101



DISTRIBUTION OF WIND SPEED IN METERS PER SECOND

ENTIRE MISSION

BLM AREA #5

N = 7090, MEAN = 6.0, SIGMA = 3.4

7.0 Conclusions

Significant wave height histograms have been presented for all five BLM investigation areas and for the composite of the five investigation areas. All of the histograms were presented for each month, for each season, and for the entire mission. The monthly histograms of the five BLM areas contained insufficient information for analysis but the seasonal histograms showed definite trends toward higher wave heights in the winter months and lower waveheights in the summer months. Any conclusions to be drawn from comparisons of the area histograms would be speculatory in nature.

Wind speed histograms have also been presented for all five BLM investigation areas and for the composite of the five investigation areas. All of the histograms were presented for each month, for each season, and for the entire mission. As in the case of the significant wave height histograms, the most useful information was derived from the seasonal histograms for the composite of all of the BLM investigation areas. These figures showed the wind speed remained at roughly the same levels for the spring, summer, and fall seasons, but rose dramatically during the winter months.

The accuracy of the algorithms presented for the calculation of ocean significant wave height and wind speed have been verified to be approximately 0.5 meters and 1.0 meters per second, respectively (McMillan and Roy, 1978). Furthermore, the algorithms have been independently verified to be accurate for all ocean conditions.

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