

The Resting Behavior of the Marmoset Monkey

by

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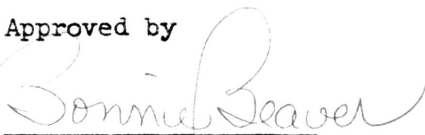
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Approved by

A handwritten signature in cursive script that reads "Bonnie Beaver". The signature is written in dark ink and is positioned above the printed name.

Bonnie Beaver, D.V.M.

April 1981

Abstract

A study was made of the diurnal and nocturnal resting behavior of captive common marmosets, Callithrix jacchus. Two twenty-four hour video tapes were made of each of twelve juvenile monkeys. Three of the juveniles were caged by themselves, six were caged as pairs and the other three were caged as a group. Comparisons were made between those caged as pairs to those caged both singly and in a group. It was found that those caged individually tended to spend much more time resting than did those caged either as pairs or in a group.

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Introduction

The subject of this behavioral study is the common marmoset, Callo-thrix jacchus. They are a new world primate indigenous to most of the riverine habitates of South America, with a natural diet consisting of fruits, tree saps, and insects. These monkeys are small, being about the size of a squirrel. Their normal litter size consists of twins with some triplets and single births occurring. The marmosets are diurnal and in their natural environment have a social group made up of an extended family unit. Their small size and litter size has recently made them more in demand as a research animal; however, to be of use to the research community an in depth study of these monkeys is needed to establish their normal statistics.

There has not been much information about the behavioral patterns of marmosets published. In addition, those studies that can be found are concerned with the communication, social, and parental behavior of the Callitrichidea. This paper presents the results of a study done on the resting behavior of the common marmoset, Callothrix jacchus.

D. G. Kleiman, ed., The Biology and Conservation of the Callitri-
chidea, Smithsonian Institution Press, (Washington, D.C. 1977).

Methods

The sample group for this study consisted of twelve juvenile Callo-thrix jacchus with ages ranging from thirteen to twenty-two months. They were all housed in sheltered nesting cages with an attached outside run that measured 45.72 cm deep, 40.64 cm wide, and 81.28 cm high. Their nests consisted of a plastic gallon milk jug with a hole cut in the side which were hung from the wall of the indoor cage. Three of the females were housed by themselves. Six of the monkeys, one female and five males, were housed as pairs, and two females along with one male were housed in a group of three. All of the juveniles in this study were kept within the same building.

Two twenty-four hour video tapes were made of each of the juveniles. These tapes were made within a five week period from August 12, 1980 to September 17, 1980. The temperatures were fairly uniform throughout the study being over 100° F during the day and about 70°F at night. Some later observations were made of eight of these same monkeys in the fall on October 28 and 29. No statistical information was obtained from these observations. They were used as a means of comparison with the earlier study.

The twenty-four hour video tapes were observed and time periods of quiet lasting over one minute during the day were recorded. The times at which they entered or left their nests, along with the times of any movements during the night were recorded. This data was divided up into diurnal rest activity, evening activity, and nocturnal rest activity.

The diurnal rest activity was made up of the number of times they entered and left the nest, the time between the first entrance and the last, the time of the last entrance of the nest, and the duration of the activity seen within the nest after the final entry. The nocturnal rest activity took note of the total time spent within the nest, the number of movements observed during the night, and time that they left their nests in the morning.

The means and standard deviation was established for the individual, paired, grouped, and entire sample population for each of the above named observations. Any data point that was found to have a probability of occurrence of less than .05 was eliminated. The means and standard deviation of the pairs were compared to those of the individuals and the group to determine whether they were truly separate populations.

TABLE 1: DIURNAL REST PERIODS

Population	Number of Diurnal Rest Periods	Duration of Diurnal Rest Periods (minutes)
Paired Mean M_p	0.42	1.36
Paired Standard Deviation S_p	0.79	3.04
Individual Mean M_x	2.40	16.60
Individual standard Deviation S_x	1.34	3.36
Grouped Mean M_g	0.00	0.00
Grouped Standard Deviation S_g	0.00	0.00
Paired + Grouped Mean M_{p+g}	0.06	0.88
Paired + Grouped Standard Deviation S_{p+g}	0.25	2.50
Entire Mean M_E	0.74	5.17
Entire Standard Deviation S_E	1.21	7.87

FIGURE 1

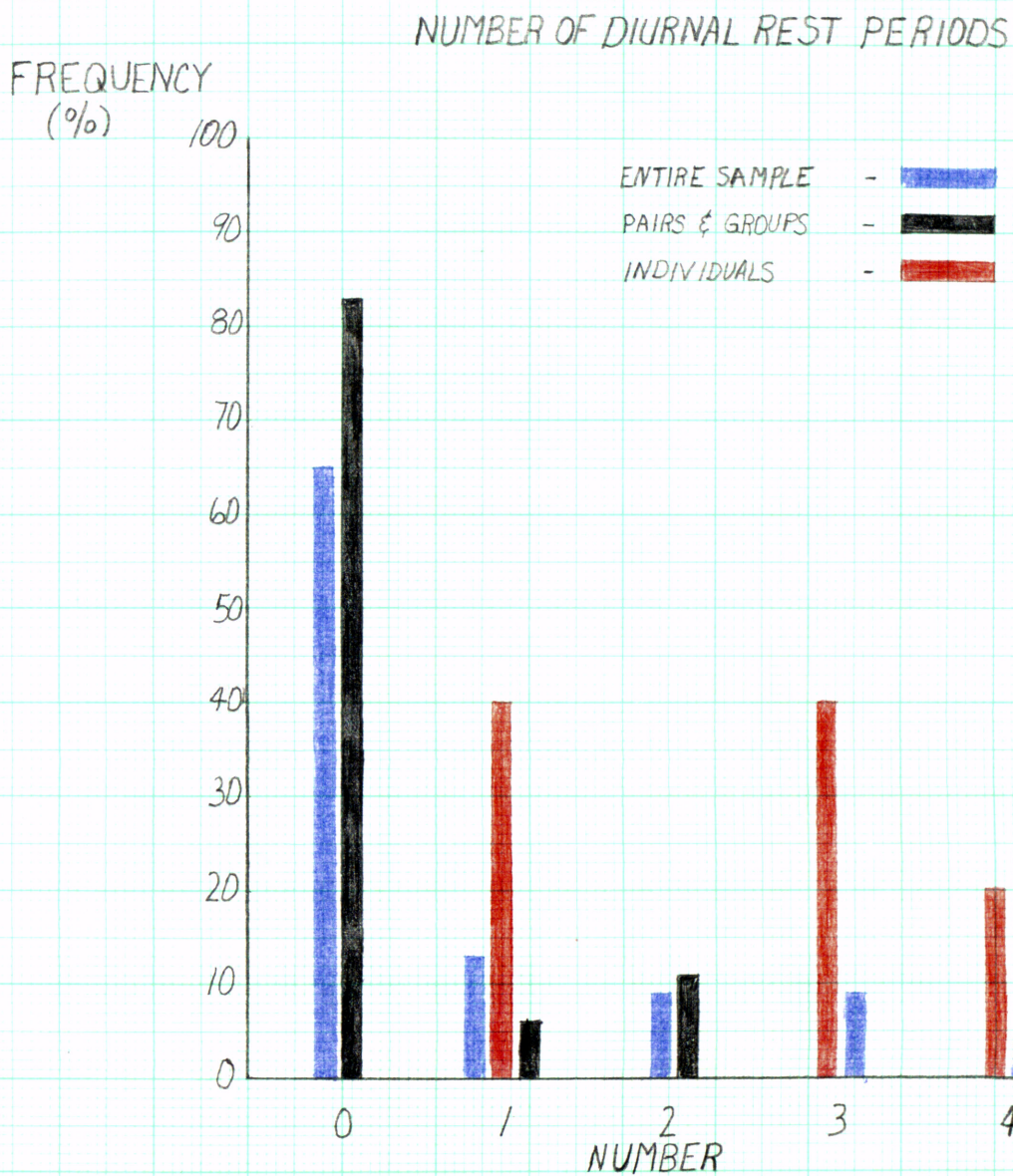


FIGURE 2

DURATION OF DIURNAL REST PERIODS

FREQUENCY (%)

100

90

80

70

60

50

40

30

20

10

0

ENTIRE SAMPLE

PAIRS & GROUPS

INDIVIDUALS



0-4

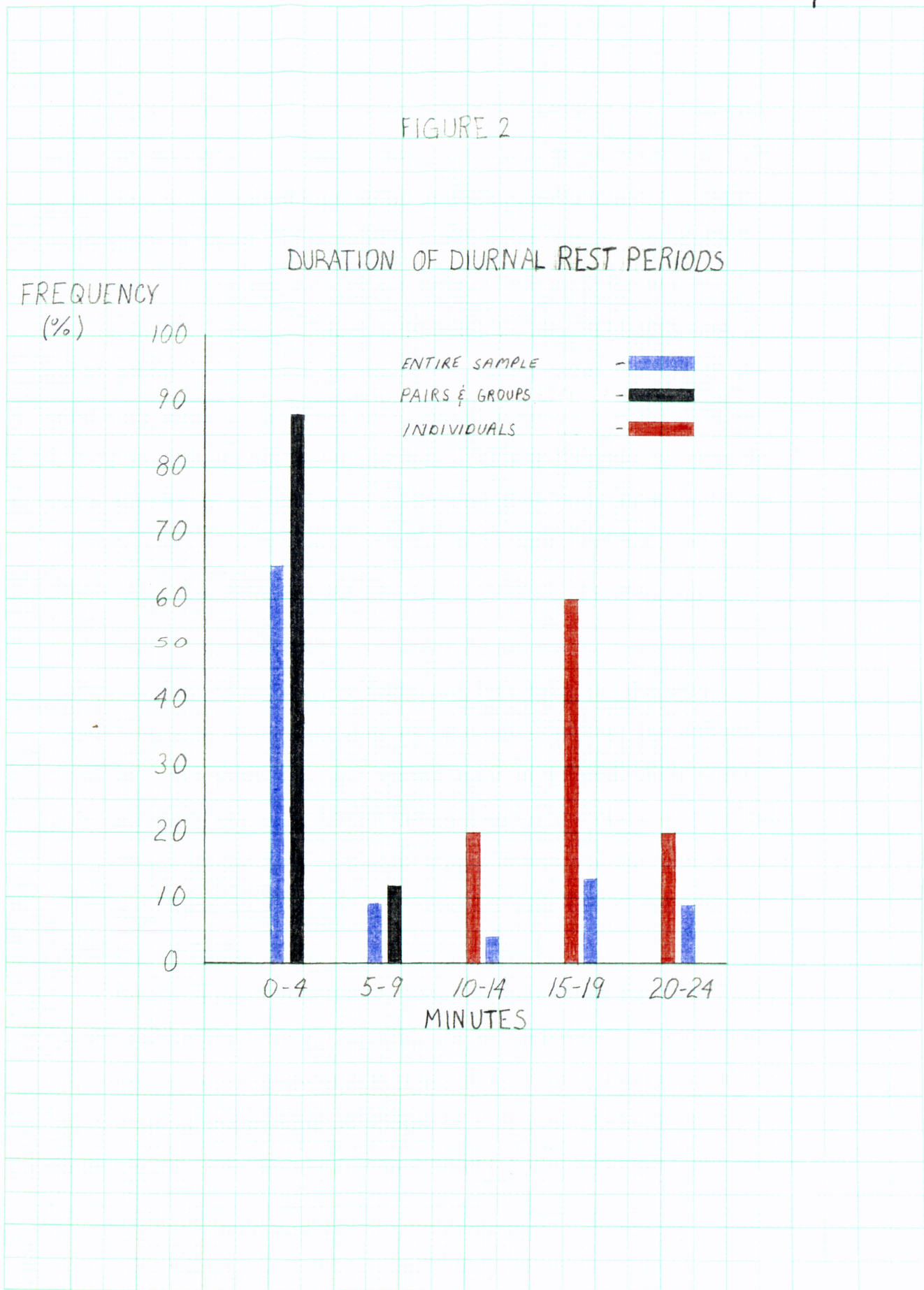
5-9

10-14

15-19

20-24

MINUTES



In the paired sample the same monkey was usually the first to enter the nest and stay each night. Also, in the paired and grouped juveniles one of the monkeys would usually spend part of the night resting either above the nest on a perch or partially out of the nest hanging on to the side of the cage. This activity was not noticed in the juveniles caged individually. It could have been due to either an increase in the nest's temperature, because of the added body heat, or simply a more crowded atmosphere within the nest.

It was found that there was very little difference between the three samples in the number of times that they would enter and leave the nest two or three times prior to their nocturnal nest entry (Table 2). The time between the first entry of the nest until the last entry was found to be statistically significant between all three sample populations. The paired population had the greatest amount of time between their first and last entry of the nest. This population also showed the greatest diversity between its members (Fig. 4). The pairs averaged almost one hour between their first entrance until the last, while the grouped sample averaged just under forty-five minutes. Those housed singly showed the shortest expanse of time between their first and nocturnal nest entry, only twenty minutes (Table 2).

The individual population tended to make their nocturnal nest entry before the others (Fig. 5). In an environment where sunset occurred at approximately 7:50 p.m., they entered the nest for the last time in the evening at a mean of 6:51 p.m. This is almost an hour earlier than the mean paired population's nocturnal nest en-

TABLE 2: EVENING ACTIVITY

Population	Number of entries and exits of nest prior to nocturnal nest entry	Time between first and nocturnal nest entry (minutes)	Time of nocturnal nest entry (P.M.)	Duration of Evening intra-nest activity (minutes)
Paired Mean M_p	2.55	58.50	7:53	14.91
Paired Standard Deviation S_p	1.86	53.61	58.95 min.	10.66
Individual Mean M_I	2.50	20.00	6:51	25.00
Individual Standard Deviation S_I	1.52	14.67	13.00 min.	15.27
Grouped Mean M_G	2.17	42.67	7:15	23.00
Grouped Standard Deviation S_G	0.75	34.05	38.05 min.	6.00
Entire Mean M_E	2.43	35.32	7:27	20.88
Entire Standard Deviation S_E	1.50	31.30	50.55	13.75

FIGURE 3

NUMBER OF TIMES ENTERED AND LEFT NEST
(PRIOR TO NOCTURNAL NEST ENTRY)

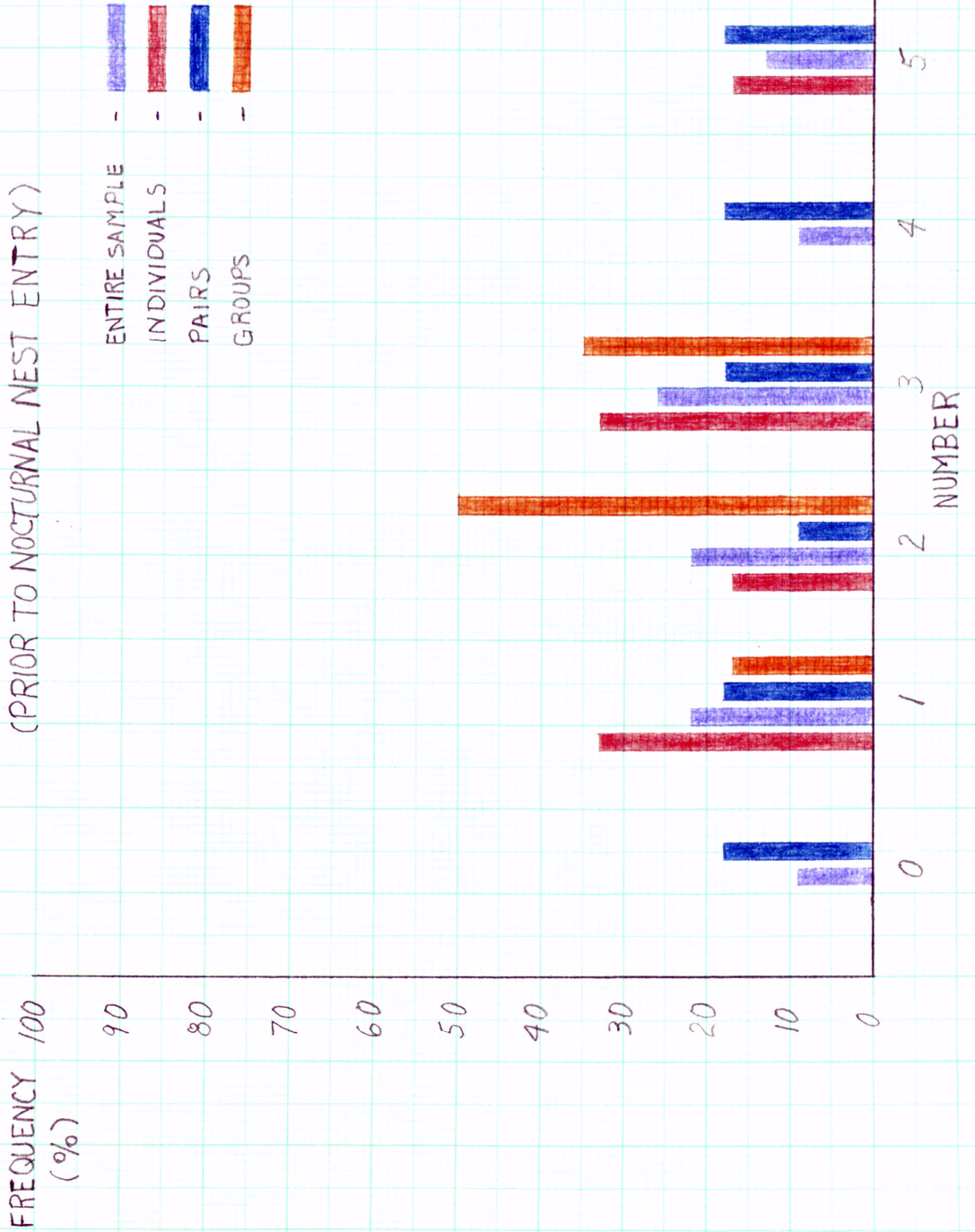
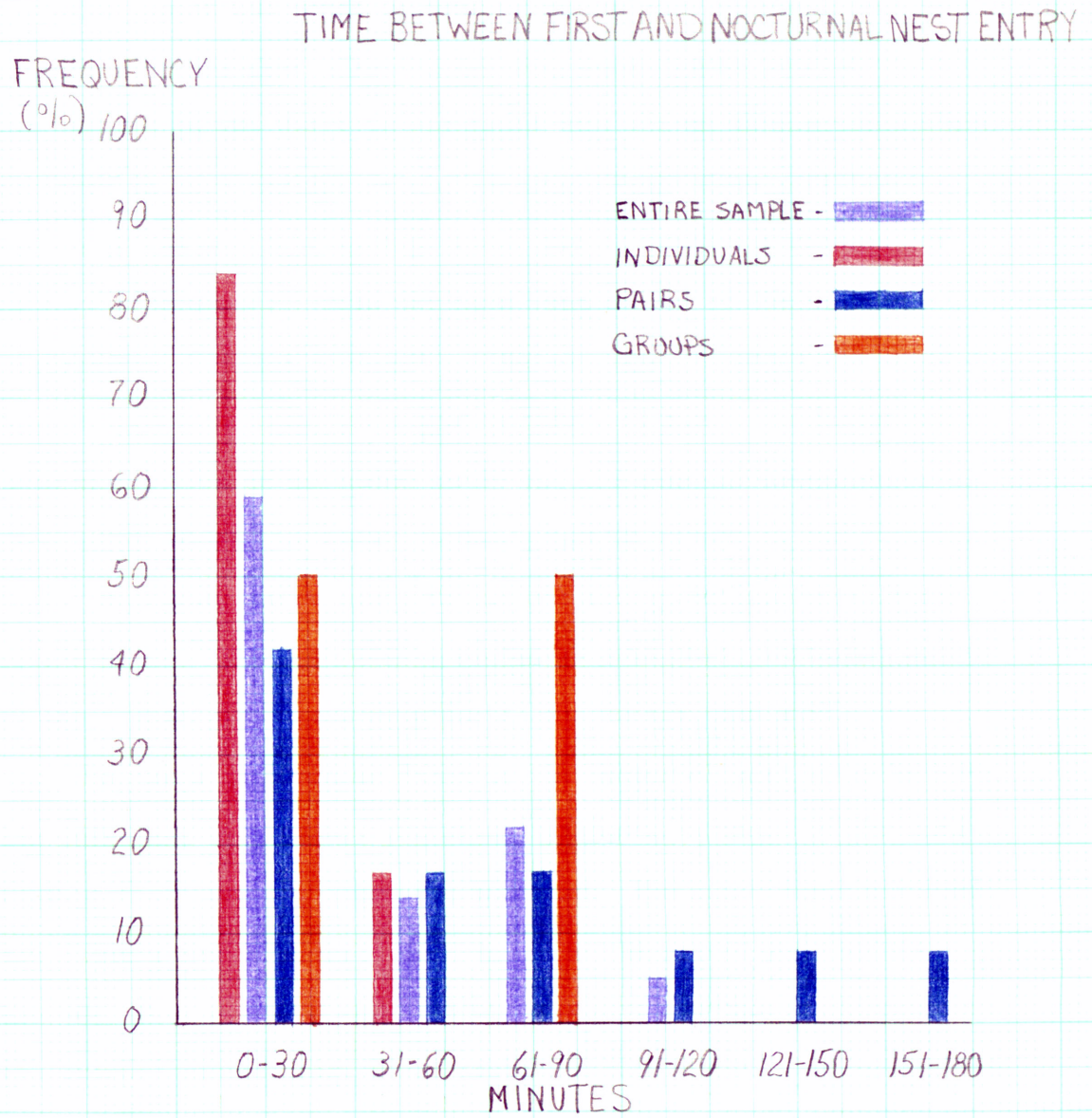


FIGURE 4

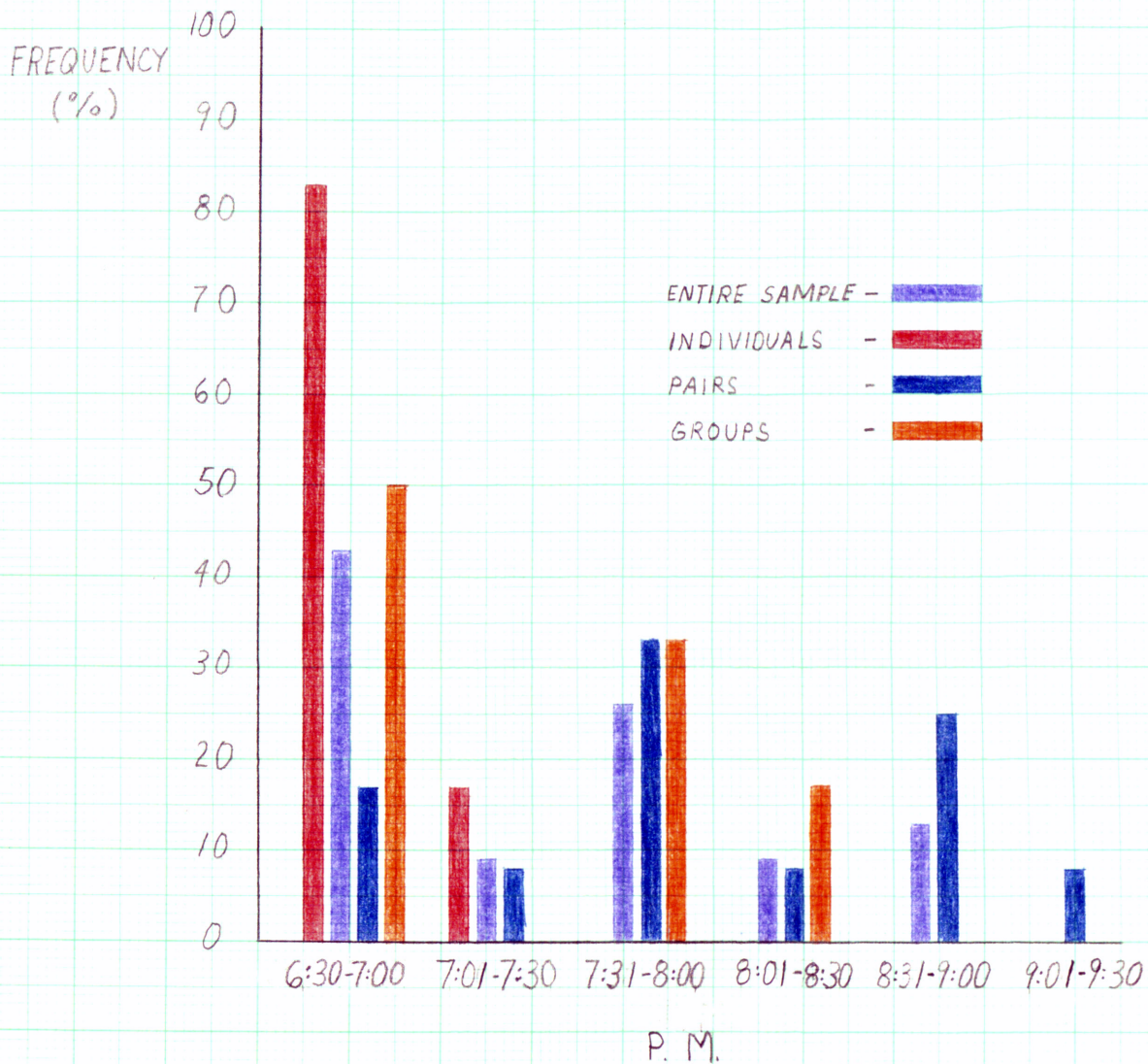


try of 7:53 p.m. The grouped population fell between the paired and individual populations making their mean final entrance at 7:15 p.m. (Table 2). While the individuals had the most uniformity, the pairs showed the least uniformity in the time of their nocturnal nest entrance (Fig. 5). During the observations made of these same monkeys in the Fall, it was found that all of them entered the nest over an hour earlier in the evening. Part of this difference was due to the daylight savings time, but it could not account for the total difference. This may have been caused by the cooler temperatures. Sunset occurred on the two days, in which the later observations were made, at approximately 5:40 p.m. The differences between the time of nocturnal entry and the time of sunset showed that, even though the sunset probably had an effect on the individuals' nocturnal entry time, it did not effect the nocturnal entry of the pairs. The individuals tended to make their nocturnal entry at about thirty-two minutes prior to the sunset (Table 4).

The large differences found in the nocturnal nest entry between the pairs and individuals was slightly counterbalanced by the duration of their evening intranest activity. The individuals averaged ten minutes more intranest activity than the paired populations; however, they averaged only two minutes more intranest activity than the grouped sample (Fig. 6 and Table 2). The individuals spent less time in activities outside the nest in the evening, but more time was spent settling down once they had entered the nest. The greatest difference was observed between the individuals and pairs.

FIGURE 5

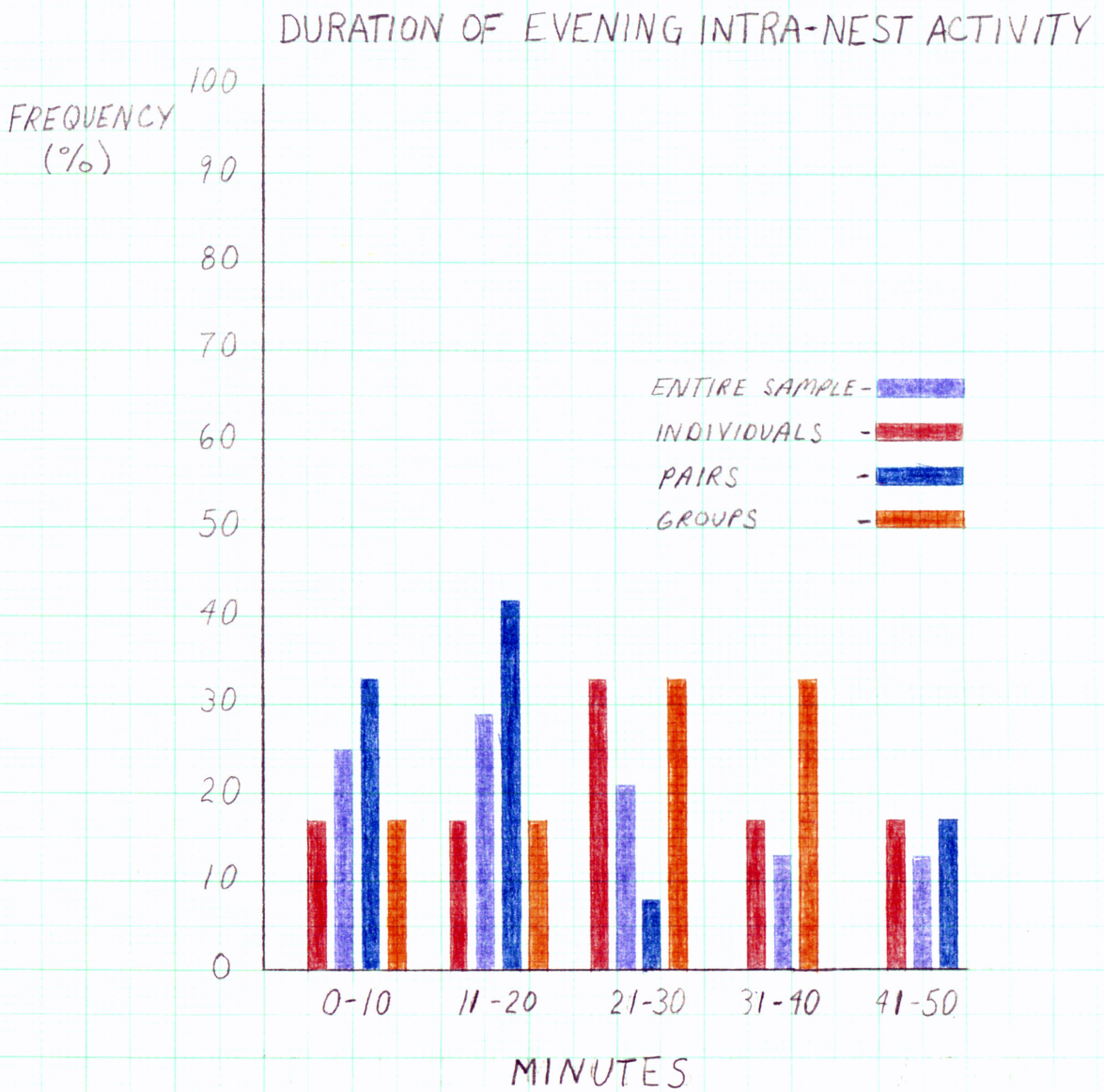
TIME OF NOCTURNAL NEST ENTRY



Cross Section 20 eps to a inch Made in U.S.A

MEAD PRODUCTS, DAYTON, OHIO 45463

FIGURE 6



3. Nocturnal Rest Activity

The nocturnal rest of these juveniles was recorded as the total amount of time spent in the nest during the night. The complete number of movements that were noted were also recorded, and the time span between the movements was used to divide the nocturnal rest up into four different rest periods. They are the nocturnal extended quiet periods, nocturnal quiet periods, nocturnal semi-quiet periods, and nocturnal pseudo-active periods. Also, time periods were noticed in which there was continual movements for one minute or longer. The time periods were looked at separately, and as part of the nocturnal pseudo-active periods.

As far as the total amount of time spent within the nest each night, all three populations were found to have independent means. Once again those housed by themselves were found to spend more time in the nest each night, the group sample fell in the middle, and the pairs spent the least amount of time within the nest. The individuals were found to be the most compact, uniform population, while the paired population was the most widespread and diverse (Fig. 7). The pairs averaged about ten hours and forty-five minutes in the nest each night, and the individuals spent around eleven and a half hours within the nest (Table 3).

All three samples were also found to have independent means for the total number of nocturnal movements observed with the group having the largest mean (Fig. 8). They averaged approximately forty-six movements per night, while the pairs averaged thirty-four and the

TABLE 3: NOCTURNAL REST ACTIVITY

Population	Time within the nest (min.)	Number of Nocturnal movements	No. of Extended Nocturnal Quiet Periods (≥ 50 min.)	Duration of Extended Nocturnal Quiet Periods (≥ 50 min.) (min.)	Duration of Nocturnal Quiet Periods (> 30 min. & < 50 min.) (min.)	Duration of Nocturnal Semi-Quiet Periods (≥ 10 min. & ≤ 30 min.) (min.)	Duration of Nocturnal pseudo-active periods (≤ 10 min.) (min.)	Number of Nocturnal Extended times of movement (≥ 1 min.)	Time of Arising (A.M.)
Paired Mean	642.25	34.25	2.33	172.83	129.00	196.17	103.83	3.83	6:25
Paired Standard Deviation	56.49	11.01	1.78	147.48	55.29	85.13	53.22	3.10	24.65 min.
Individual Mean	689.00	29.00	3.50	311.00	106.83	164.00	121.50	3.83	6:20
Individual Standard Deviation	14.90	11.56	0.84	172.00	73.81	78.20	48.04	3.19	7.27 min.
Grouped Mean	667.17	45.50	2.00	124.50	138.00	223.50	201.50	14.50	6:22
Grouped Standard Deviation	47.10	9.31	0.00	18.07	27.39	6.02	0.55	0.55	9.31 min.
Paired + Grouped Mean	—	—	2.22	—	—	—	—	—	6:24
Paired + Grouped Standard Deviation	—	—	1.44	—	—	—	—	—	20.54 min.
Paired + Individual Mean	—	—	—	—	—	—	—	3.89	—
Paired + Individual Standard Deviation	—	—	—	—	—	—	—	3.74	—
Entire Mean	660.17	35.79	2.54	176.78	130.85	186.00	125.36	6.54	6:23
Entire Standard Deviation	49.54	11.98	1.41	119.82	52.72	83.78	56.56	5.41	18.97 min.

FIGURE 7

DURATION OF TIME WITHIN THE NEST

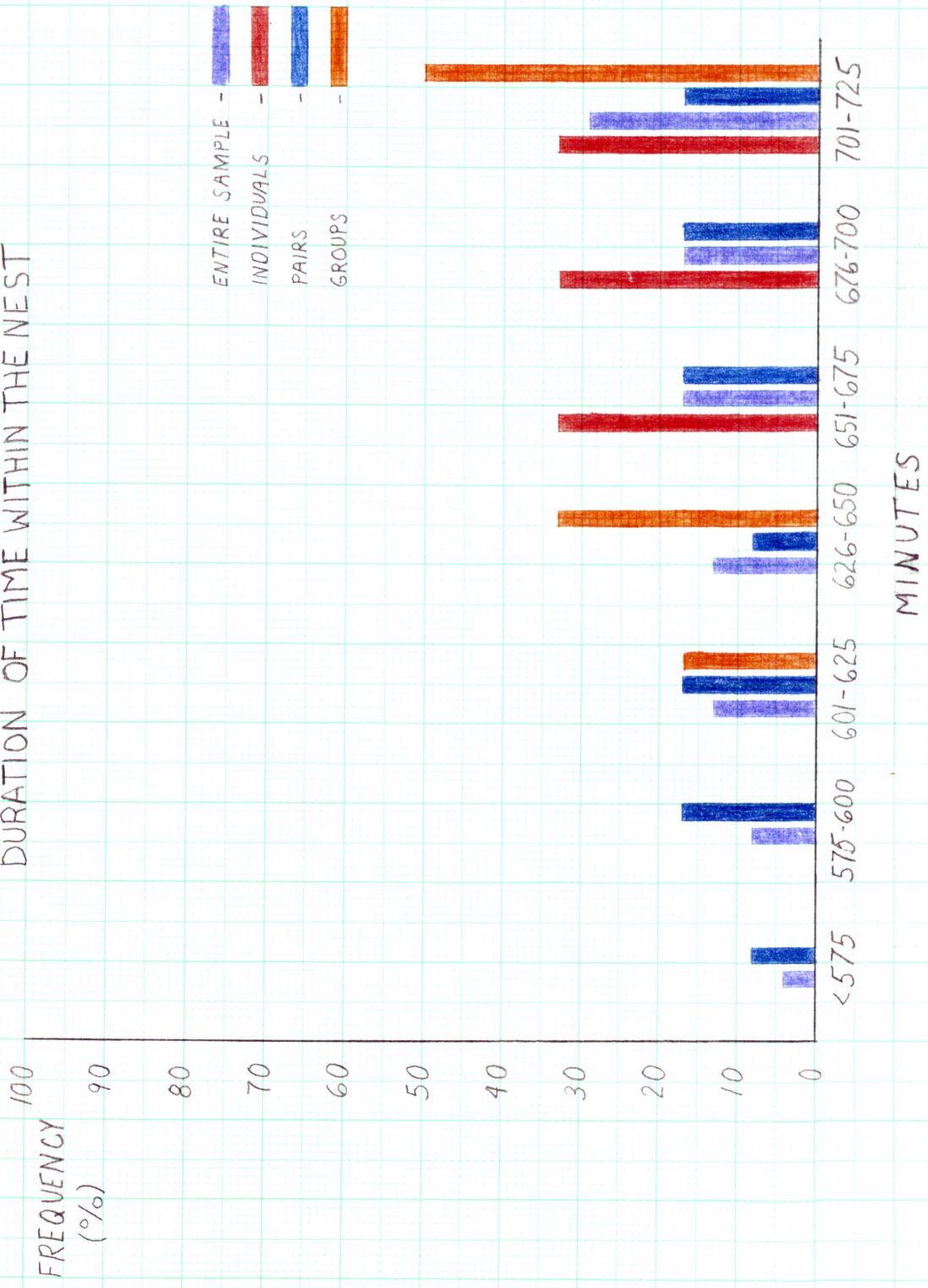


FIGURE 8

NUMBER OF NOCTURNAL MOVEMENTS

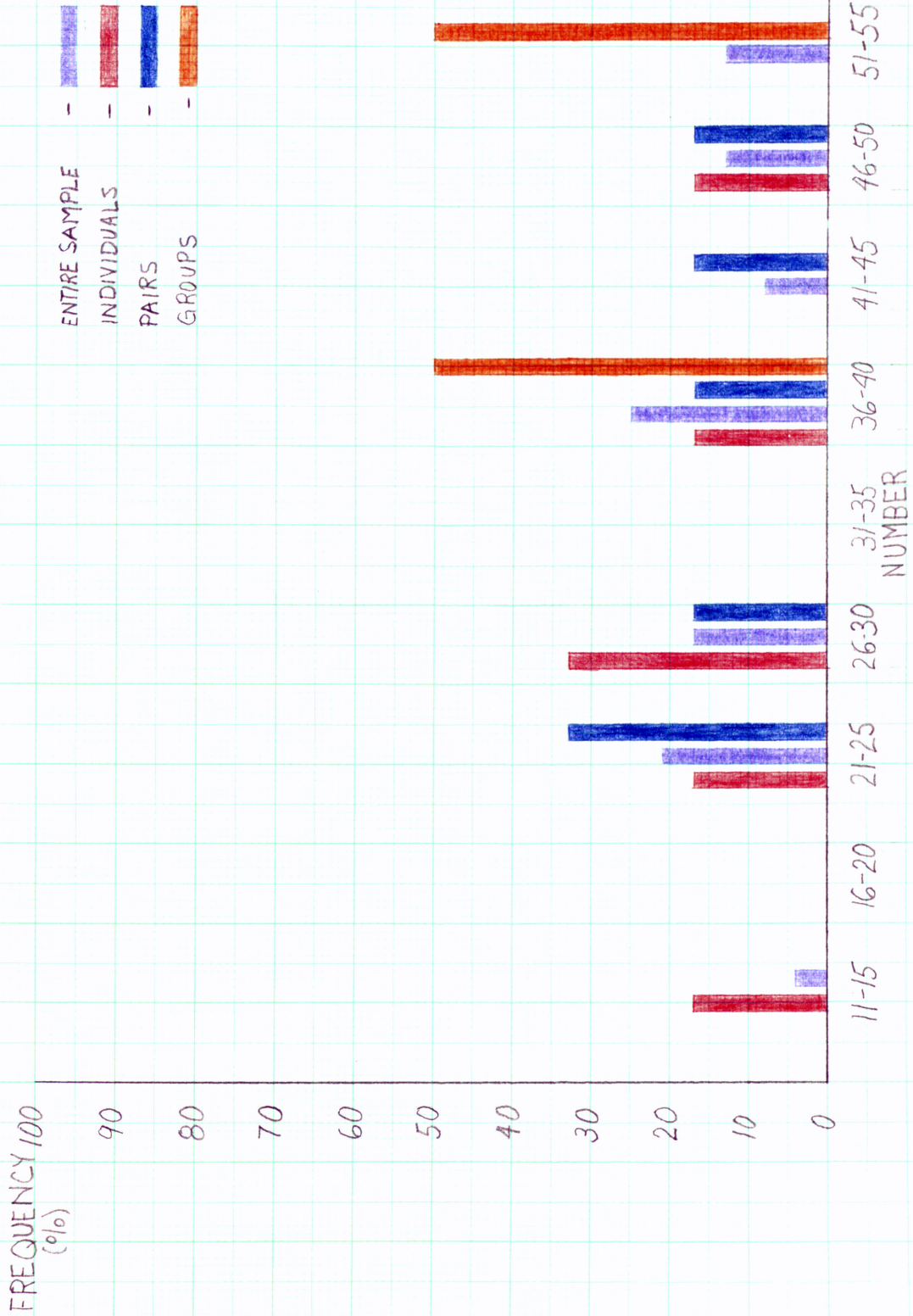


TABLE 4: SUNSET INFORMATION

Population	Time of Sunset (P.M.)	Nocturnal entry - sunset (minutes)
Paired Mean M_p	8:01	8.08
Paired Standard Deviation S_p	8.17 min.	56.78
Individual Mean M_I	7:33	31.83
Individual Standard Deviation S_I	3.43 min.	17.76
Grouped Mean M_G	7:44	11.50
Grouped Standard Deviation S_G	1.10 min.	47.50
Entire Mean M_E	7:50	—
Entire Standard Deviation S_E	13.63 min.	—

individuals showed the least amount of movement with an average of twenty-nine (Table 3).

The nocturnal extended quiet periods were those periods in which there was no movement observed for fifty minutes or longer. The number, duration, and time of occurrence was considered. The individuals tended to have one more nocturnal extended quiet period per night than did either the group or the pairs (Fig. 9). Both grouped and paired samples were found to have dependent means in this instance.

Duration of nocturnal extended quiet periods was greater for pairs than for the grouped sample with pairs averaging forty-eight minutes more of nocturnal extended quiet periods than the group (Fig. 10). Those juveniles caged by themselves had two and a quarter hours more time within this nocturnal time period (Table 3). The percentage of nocturnal extended quiet periods to the total time in the nest showed that the individuals spent 45% of the night in this period while the pairs spent only 27% of the nest time in this type of rest (Table 5).

The time spans during the night at which the nocturnal extended quiet periods occurred are shown in figure 11. Tape number 1 - 6 are the paired sample, tapes 7 and 8 are the group, and tapes 9 - 14 are the individuals. With the exceptions of tapes 1 and 6, both the paired and grouped populations had extended nocturnal quiet periods after 12:30 a.m. and most of them occurred in the early morning after 2:00 a.m. Conversely, the tapes of the individuals show extended nocturnal quiet periods on either side of 1:42 a.m. and 2:38 a.m. Thus, the individuals show a gap in the middle of their nocturnal rest time in which no extended nocturnal quiet periods occur.

TABLE 5: PERCENTAGE OF NOCTURNAL PERIODS

Population	EXTENDED NOCTURNAL QUIET PERIODS TIME IN NEST (%)	NOCTURNAL QUIET PERIODS TIME IN NEST (%)	NOCTURNAL SEMI-QUIET PERIODS TIME IN NEST (%)	NOCTURNAL PSEUDO-ACTIVE PERIODS TIME IN NEST (%)
PAIRS	26.91	20.10	30.54	16.17
INDIVIDUALS	45.14	15.51	23.80	17.63
GROUPS	18.66	20.68	33.50	30.22
ENTIRE	26.78	19.82	28.17	19.00

FIGURE 9

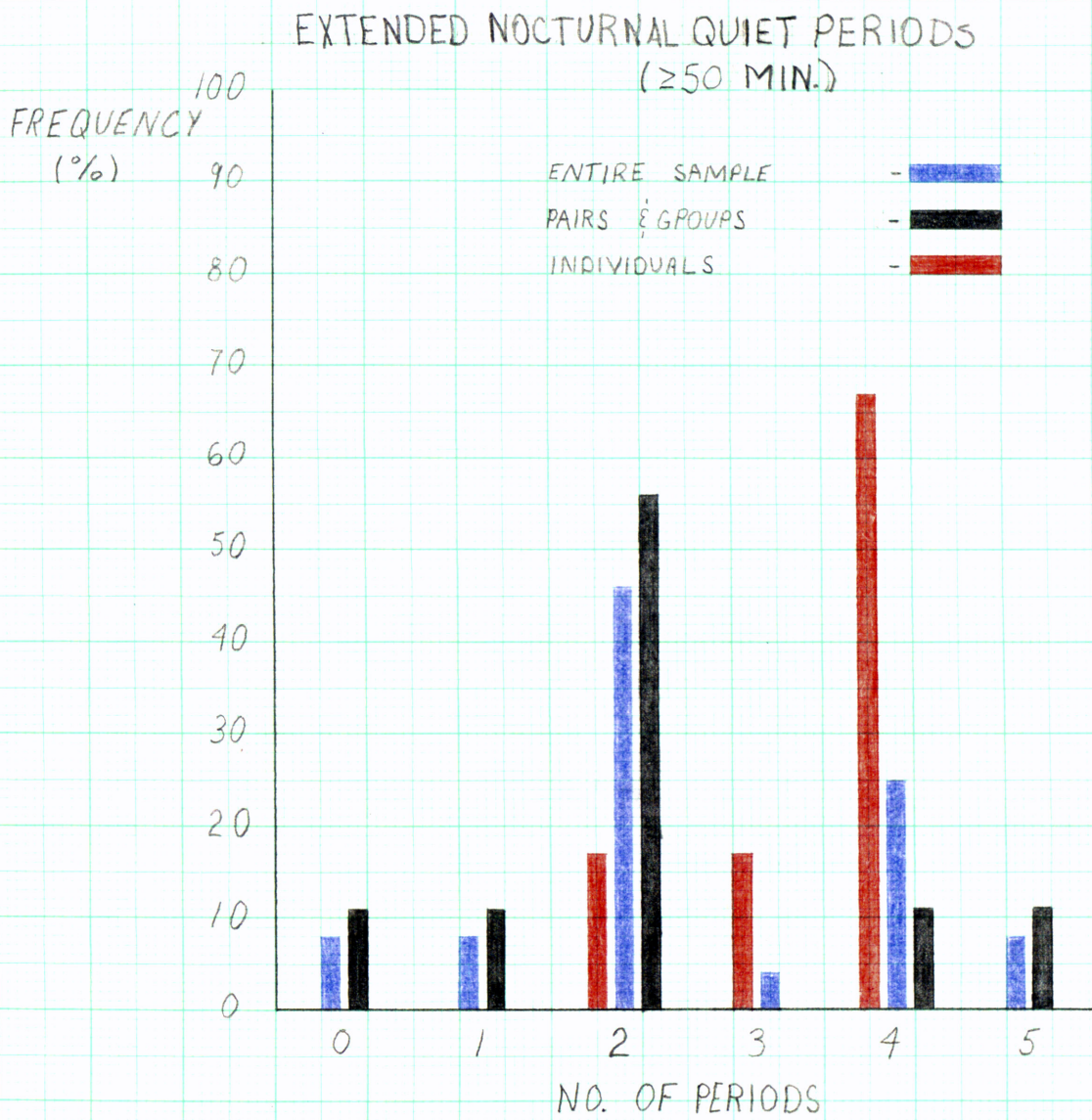
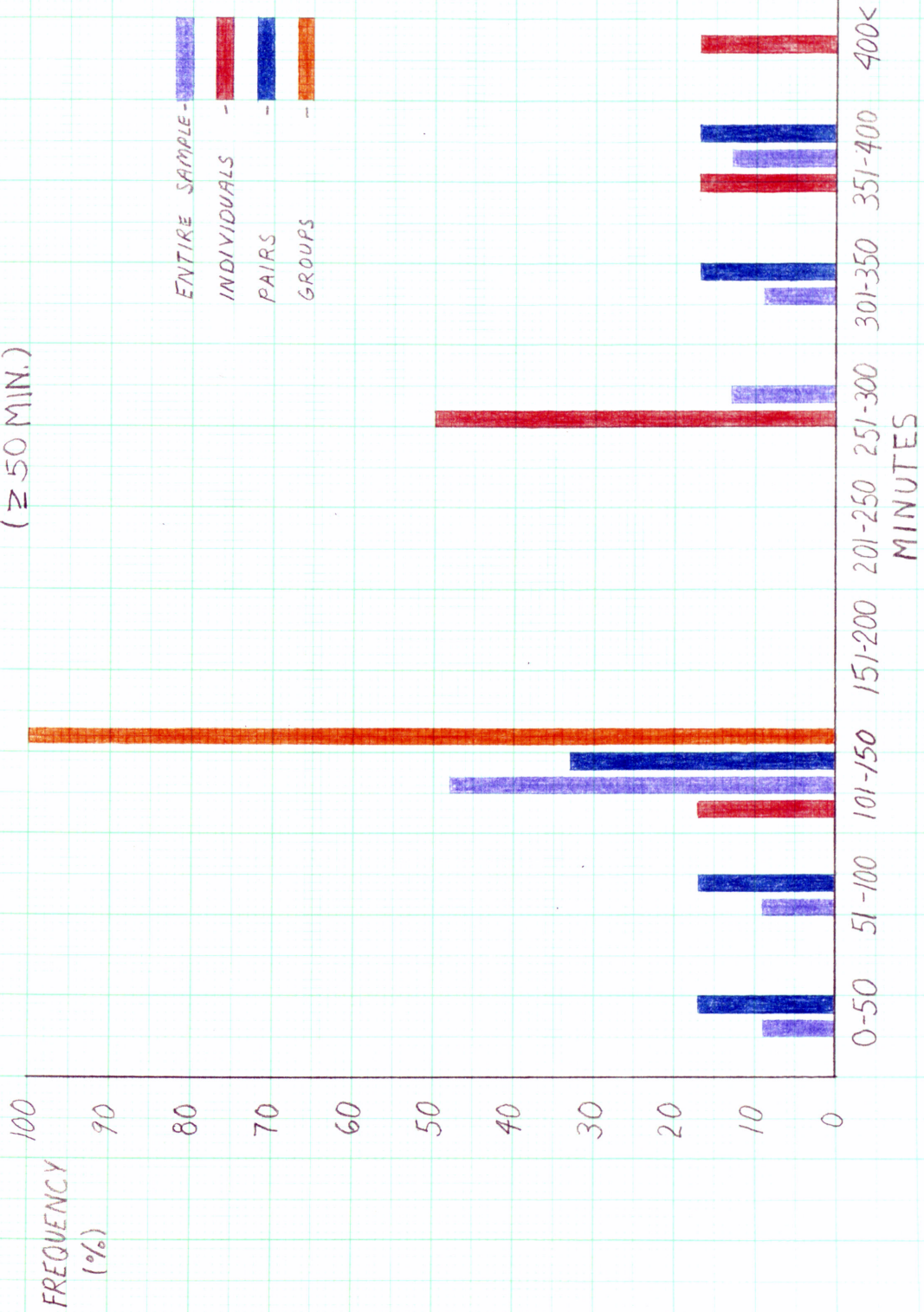


FIGURE 10

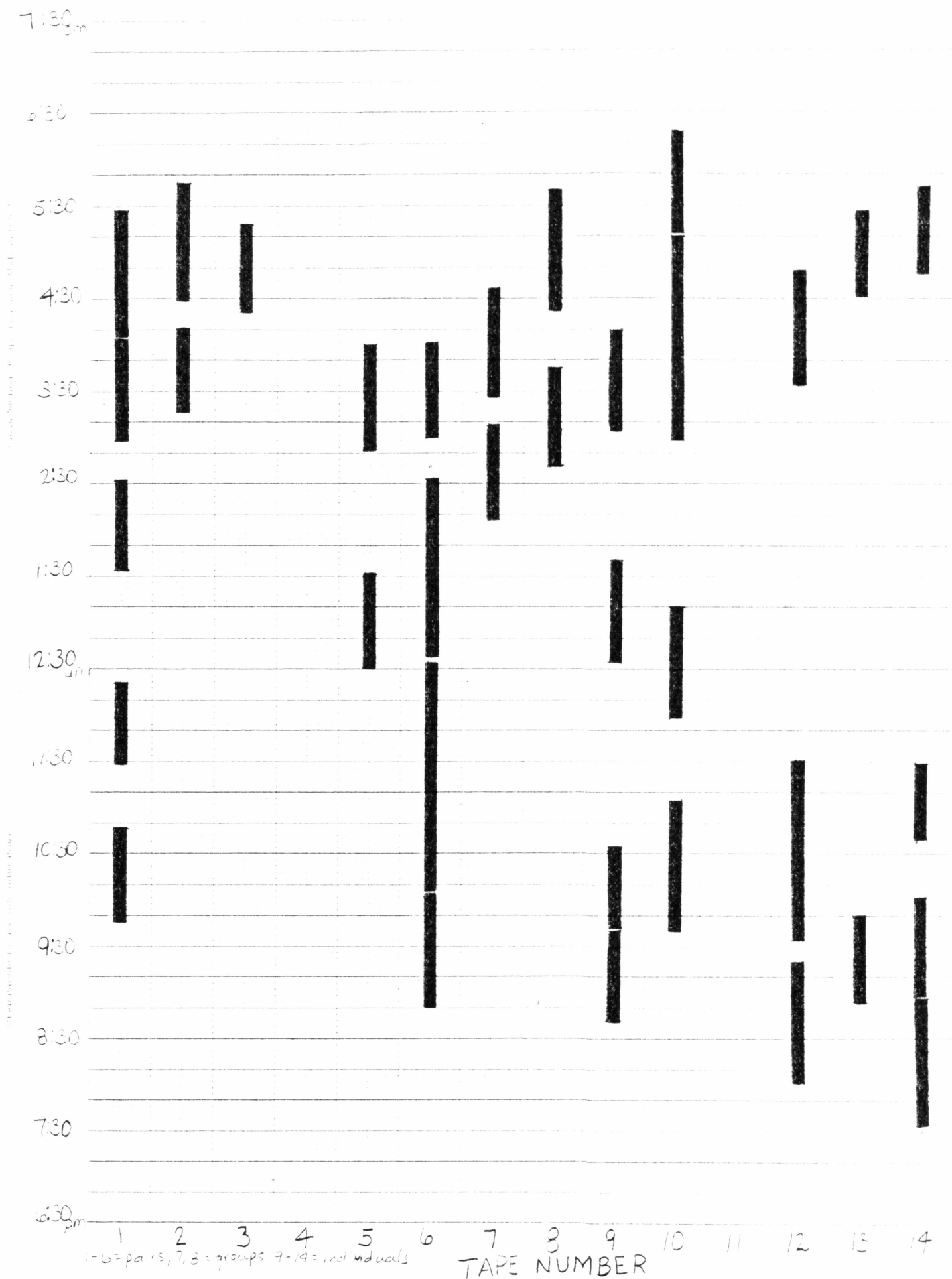
DURATION OF EXTENDED NOCTURNAL QUIET PERIODS
(≥ 50 MIN.)



TIME OF THE DAY

FIGURE 11

TIMES OF EXTENDED NOCTURNAL QUIET PERIODS (>50MIN)



1-6 = pairs, 7, 8 = groups 9-14 = individuals

TAPE NUMBER

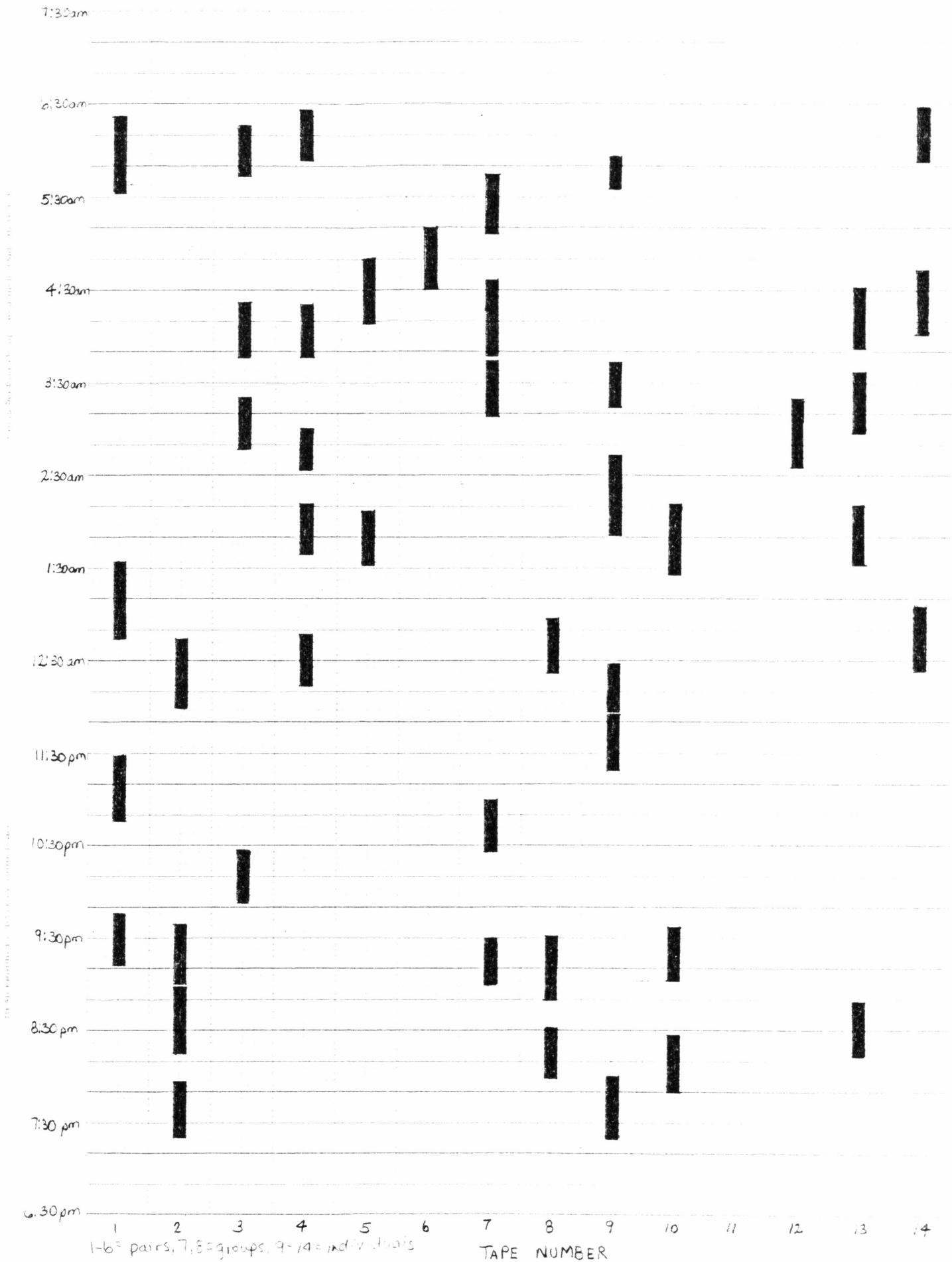
The nocturnal quiet period is defined as those time periods during the night in which movement occurred every thirty to fifty minutes. Individuals averaged about one hour and forty-five minutes in this phase of rest each night. The pairs spent around two hours in nocturnal quiet periods, while the group showed the largest mean of the three populations with two and one fourth hours (Table 3). All three populations showed approximately the same percentage of nocturnal quiet periods to total rest time between 16% and 21% of the night's rest (Table 5).

The time spans during the night in which the nocturnal quiet periods occurred are shown in figure 12. These periods seem to be fairly evenly distributed throughout the night and no specific differences can be noticed between the three sample populations. Individuals seem to show a greater diversity in the number of nocturnal quiet periods with a range from none to six; however, half of the individual population had three nocturnal quiet periods. The pairs and group have a range in the number of nocturnal quiet periods from one to five with the greatest frequency of occurrence being four periods of nocturnal quiet (Fig. 12).

The nocturnal semi-quiet periods are those time spans during the night in which there are movements observed between eleven and thirty minutes apart. The grouped sample averaged almost three hours and forty-five minutes of nocturnal semi-quiet time. The paired sample had a little over three and a fourth hours, and the individuals had about two hours and forty-five minutes of nocturnal semi-quiet periods (Table 3). Comparisons between nocturnal semi-quiet time and total

TIME OF THE DAY

TIMES OF NOCTURNAL QUIET PERIODS (NO MOVEMENTS FOR ≥ 30 MIN. & ≤ 50 MIN.)



rest time showed that the paired and grouped population had between 31% and 34% of their rest time in this phase. In contrast, the individuals spent only 24% of their rest time in nocturnal semi-quiet periods (Table 5).

Nocturnal semi-quiet periods tended to occur in clumps that are evenly distributed throughout the rest time (Fig. 13). The pairs and group often had a clump of semi-quiet periods close to the time they left the nest in the mornings. This tendency did not show up in those juveniles caged by themselves. All of the juveniles tended to show between four and five clumps of nocturnal semi-quiet periods per night.

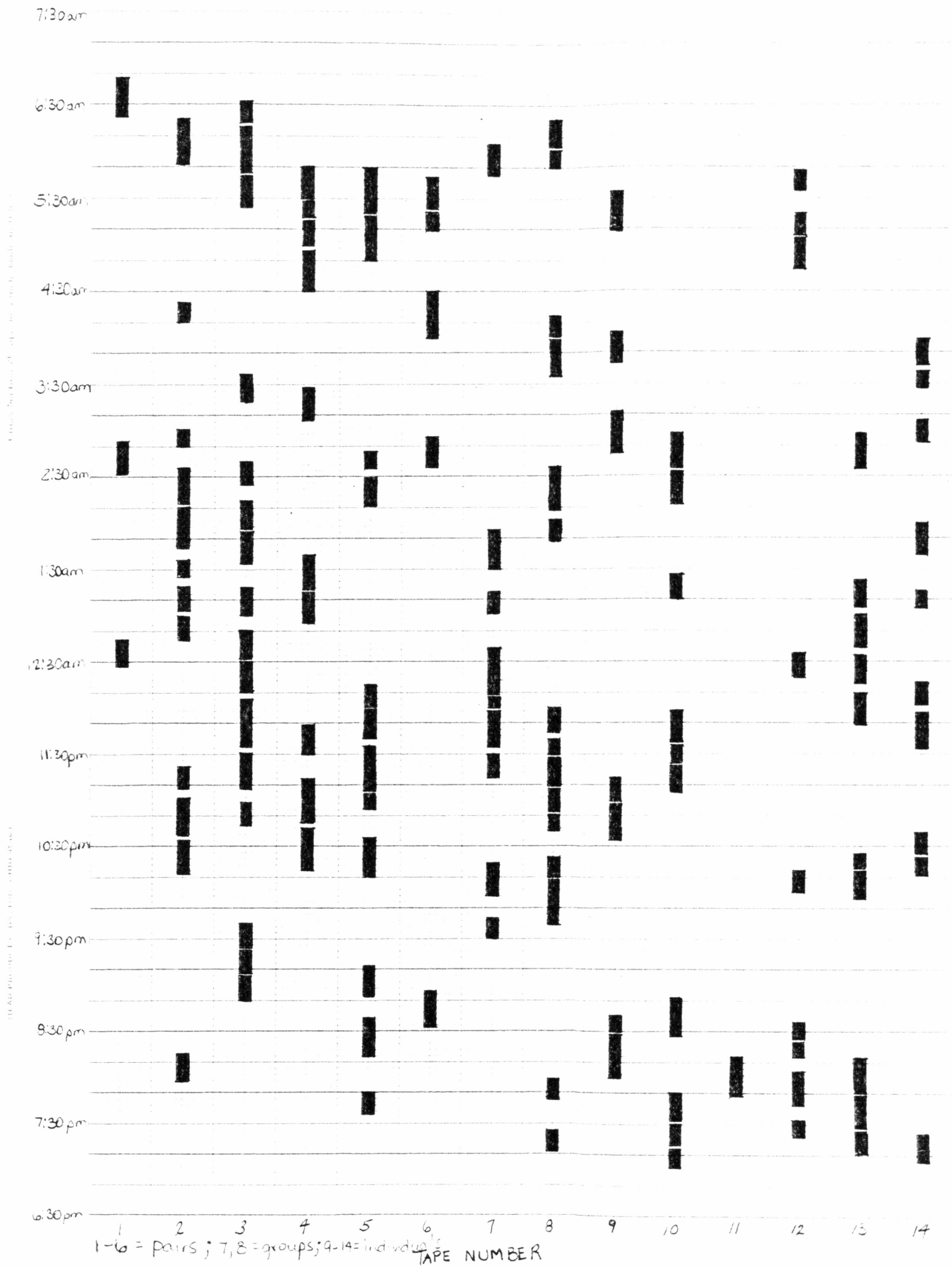
Nocturnal psuedo-active periods were those time spans at night when movement occurred every ten minutes or less. The paired population averaged approximately one hour and forty-five minutes of these psuedo-active periods. The individuals had a mean of about two hours, and the grouped sample showed the longest duration of nocturnal psuedo-active periods with a mean of three and a half hours (Table 3).

The percentage of nocturnal psuedo-active time to the total rest time showed that the pairs and individuals were very similar. The paired sample had about 16% and the individuals almost 18% of their rest in nocturnal psuedo-active periods (Table 5).

Individuals showed much larger gaps in which no nocturnal psuedo-active periods are seen when compared with either the group or pairs (Fig. 14). All three populations show nocturnal psuedo-active periods just after entering the nest and just prior to the time of arising in the morning.

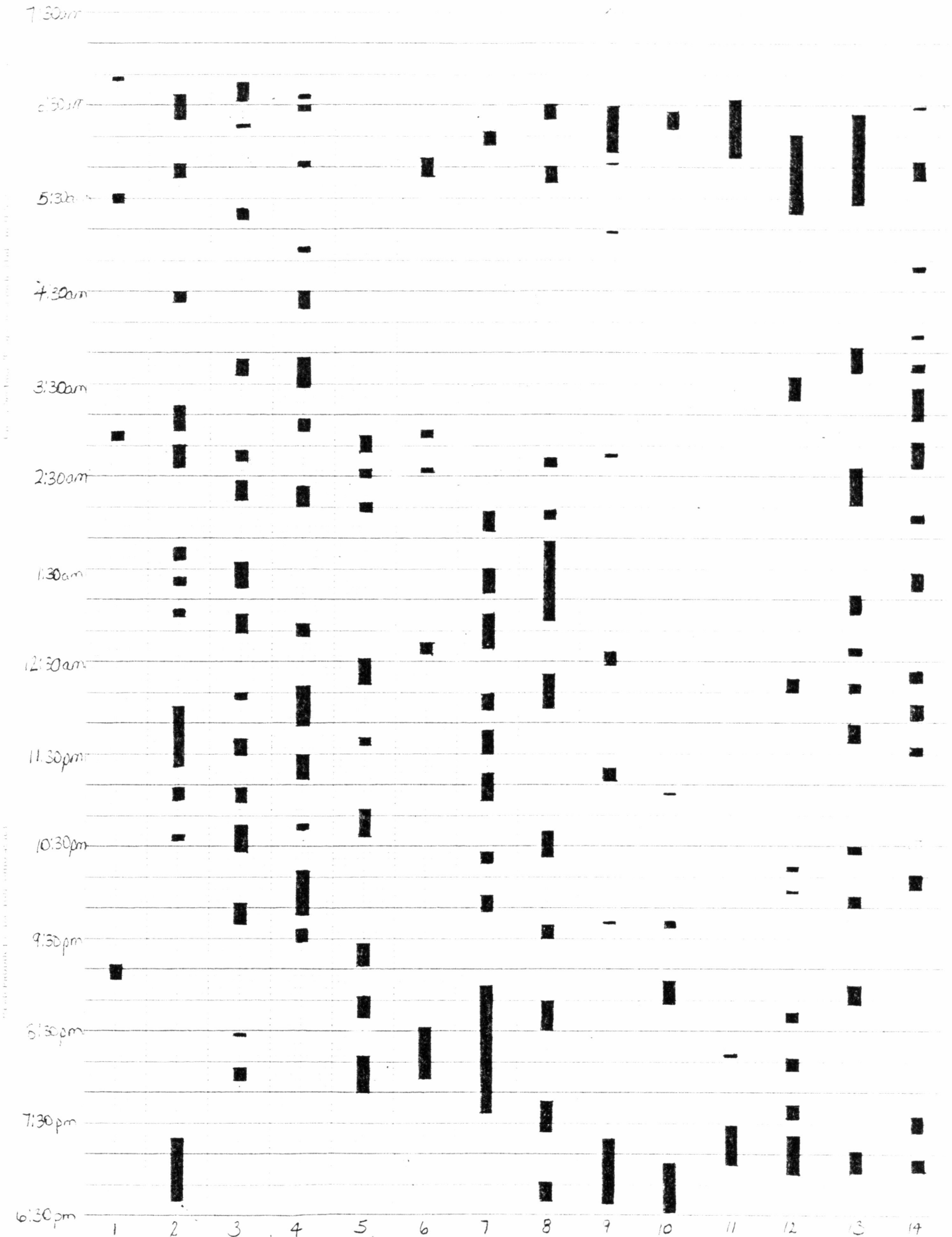
TIMES OF NOCTURNAL SEMI-QUIET PERIODS
(NO MOVEMENT FOR >10 MIN. OR ≤ 60 MIN.)

TIME OF
THE DAY



TIME OF THE DAY

TIMES OF NOCTURNAL PSEUDO-ACTIVE PERIODS (MOVEMENTS EVERY ≤ 10 MIN.)



1-6 = groups, 7, 8 = groups
9-14 = individuals

TAPE NUMBER

There were also time spans during the night where the monkeys would show continual movement within the nest for one minute or longer. These time periods were called extended nocturnal movements. The number of times this occurred during the night was showed there was no difference between those caged by themselves and those caged as pairs. The group had a much greater number of these time periods per night (Fig. 15). The pairs and individuals averaged around four of these time spans per night, while those caged in a group of three averaged between fourteen and fifteen of these periods per night (Table 3).

The last thing observed was the time that the juveniles left their nest in the morning, or the time of arising. Even though, the paired sample showed a slightly later arising time than the grouped sample, it was not a great enough difference to be statistically significant. The two populations together averaged an arising time of approximately 6:24 a.m. compared to a sunrise of approximately 7:01 a.m. The individual sample showed an average arousal time of 6:20 a.m. Even though there was only four minutes difference between the arising time of the individuals and the others, the individuals were a much more uniform population (Fig. 16 and Table 3).

When the same monkeys were observed later in the Fall, it was noted that at the time of arising all of the monkeys within one building tended to leave their nest within approximately ten minutes of each other. Also, there was a loud chatter from all of the monkeys during this time in the mornings. The sunrise of these two days was 6:40 a.m. and the monkeys arose at approximately 6:37 a.m. The difference between the time of arising and the time of sunrise showed

FIGURE 15
NUMBERS OF NOCTURNAL EXTENDED MOVEMENTS
(≥ 1 MIN)

FREQUENCY
(%)

100
90
80
70
60
50
40
30
20
10
0

ENTIRE SAMPLE
INDIVIDUALS & PAIRS
GROUPS

NO. OF TIME PERIODS

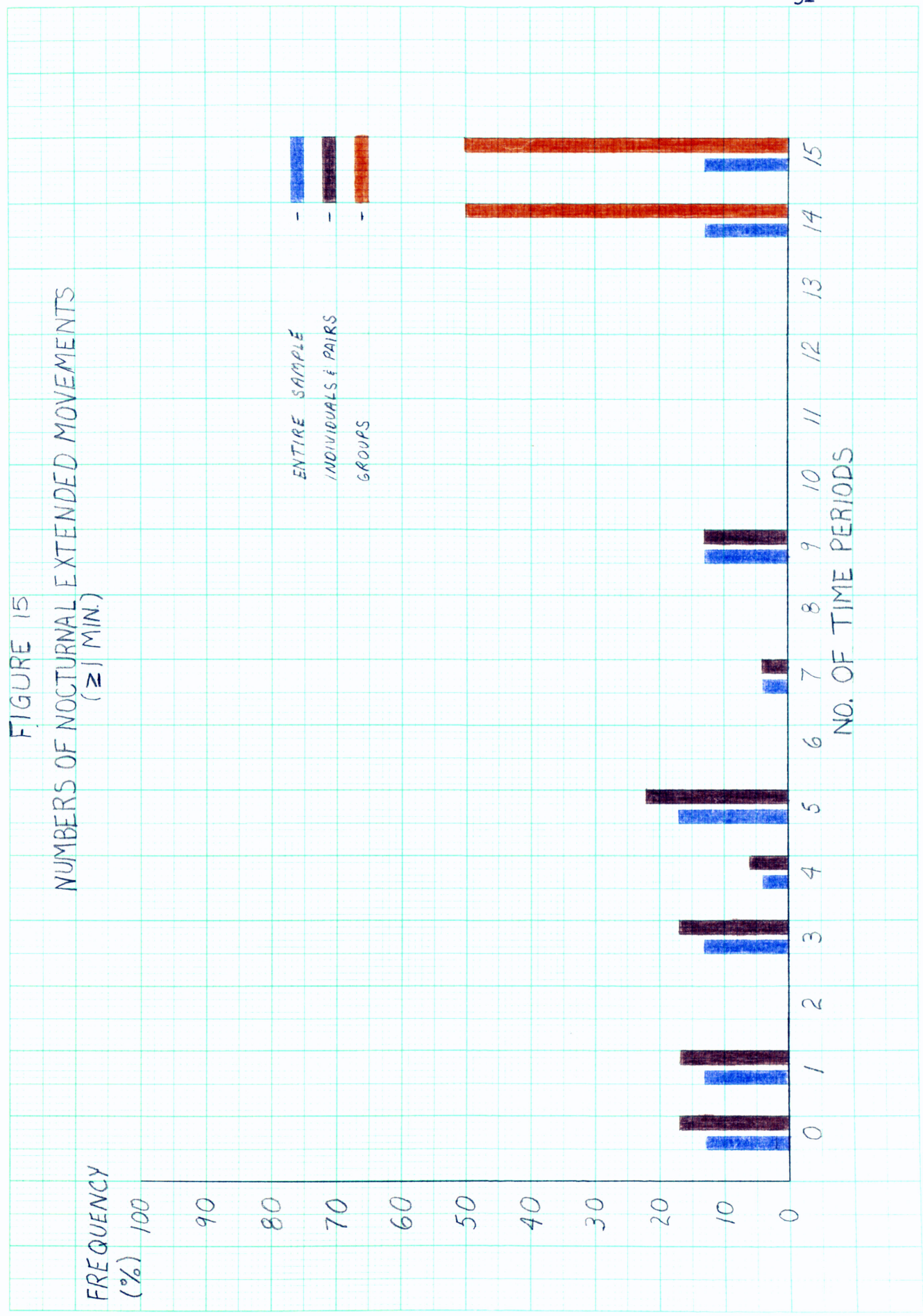


FIGURE 16

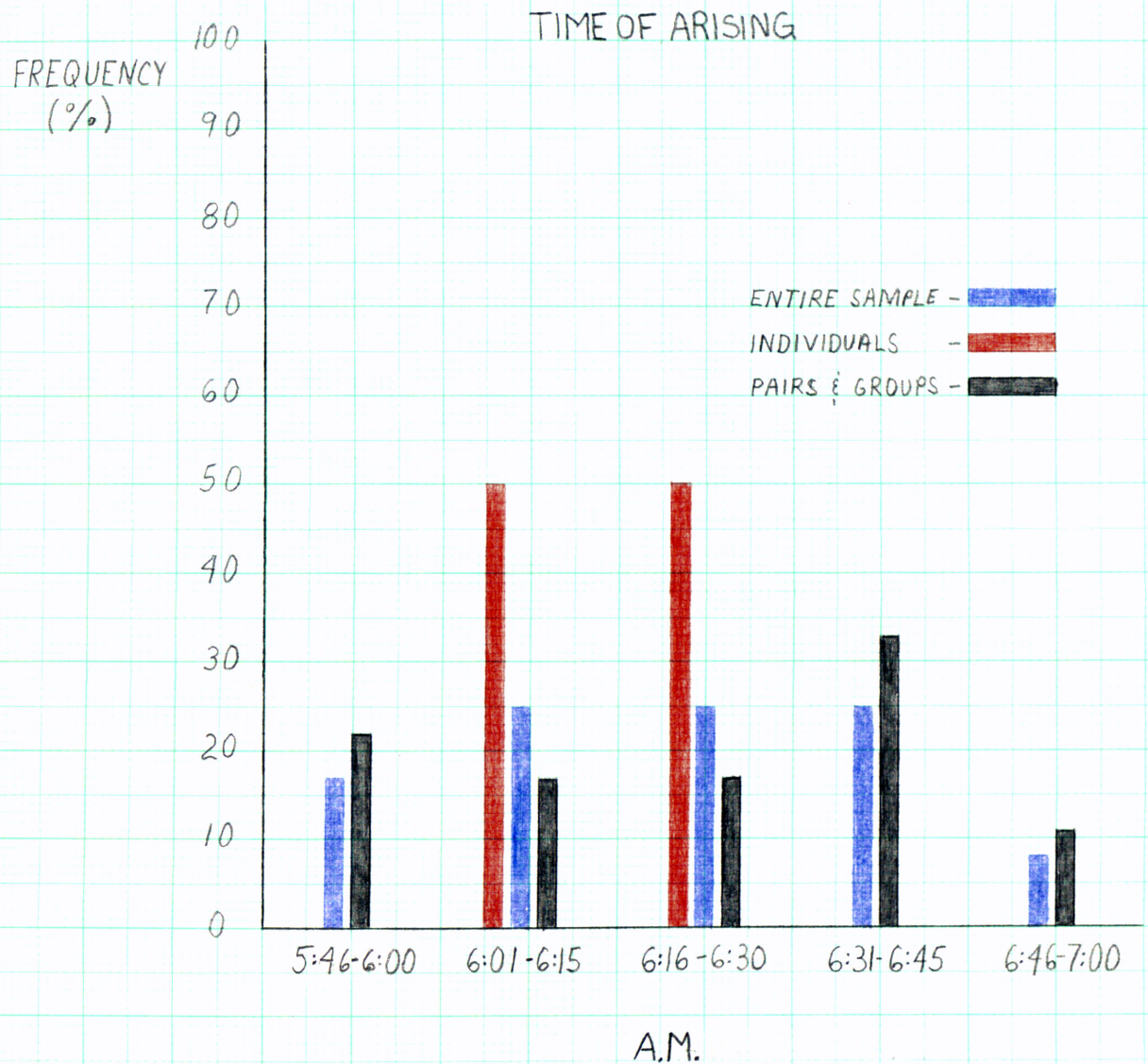


TABLE 6 : SUNRISE INFORMATION

Population	Time of Sunrise (A.M.)	Time of Arising - Sunrise (minutes)
Paired Mean M_p	6:56	30.50
Paired Standard Deviation S_p	4.15 min.	28.49
Individual Mean M_I	7:09	48.00
Individual Standard Deviation S_I	1.63 min.	9.42
Grouped Mean M_G	7:05	43.00
Grouped Standard Deviation S_G	0.55 min.	8.76
Entire Mean M_E	7:01	—
Entire Standard Deviation S_E	6.63 min.	—

that, although the Individual's and group's time of arising appeared to be affected by the sunrise, the paired population did not seem to show a connection between their time of arising and the sunrise. The group and individuals tended to leave their nest between forty-three and forty-nine minutes before sunset (Table 6).

Discussion

This study showed that the manner in which juvenile common marmosets are housed affects their resting pattern. The greatest difference was seen between those juveniles housed by themselves and those caged in pairs. The individuals tended to rest more both during the day and the night. It is assumed that they spend more time in slow wave sleep since all individuals within a species need about the same amount of REM sleep. The percentage of nocturnal extended quiet periods to the percentage of nocturnal pseudo-active periods during the night seem to uphold this theory, although electroencephalographic proof is needed to uphold this theory.

It was also seen in this study that the number of juveniles housed together affects the uniformity of the population's behavior. The individuals in most instances were a much more uniform population than either the paired or grouped population, but the paired population showed somewhat more diversity than the grouped population.

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