ENVIRONMENTAL INFLUENCE ON THE MATING BEHAVIOR OF <u>HYLA VERSICOLOR</u> AND <u>RANA CLAMITANS</u>

A Paper Presented to
Dr. Sunny K. Boyd

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of the Requirements of
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By:
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DEDICATION

This project is dedicated to Mary the mother of Jesus Christ, after whom the University of Notre Dame du Lac was founded. Her life and actions exemplify the values that all scientists should maintain in their pursuit of truth.

ACKNOWLEDGMENTS

I would like to thank Dr. Sunny K. Boyd for her time, effort, and assistance in guiding me through this experiment. Thanks are also in order to Mr. Bernard J. Hank without who's generous funding this project would never have been completed. Additionally, I would like to thank Dr. Martin B. Berg for his suggestions and assistance with this project. Also, many thanks to Christine Allison, Mary Bernard, Michael Chambers, John Gimnig, Timothy Piero, Karyn Siemansko, Damon Sinars, Jennifer Slate, and Christine Taafe, all of whom assisted in collecting frogs for this experiment. One final note of thanks to Captain George H. Dewhirst, USN and the United States Navy for cooperating with and assisting me in scheduling summer training around this project.

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ABSTRACT

Mating behavior in Hyla versicolor and Rana clamitans is regulated by environmental conditions. Research was conducted at the University of Notre Dame Environmental Research Center in Gogebic County, Michigan and Vilas County, Wisconsin ($46^{\circ}13'N$, $89^{\circ}32'E$) on this regulation. It was found that male frogs exhibit calling behavior when they are reproductively mature and it is this calling that attracts mature female frogs. The primary annual regulator of mating is photoperiod, as day length increases to a length of approximately 15 and 1/2 hours mating behavior in H. versicolor is demonstrated. Additionally, in both H. versicolor and R. clamitans daily calling behavior is apparently regulated primarily by light level. Once the light threshold is achieved, humidity becomes the deciding co-regulator. Additionally, the data suggests that air and water temperatures participate as co-regulators of calling behavior. However, their is evidence suggesting that abrupt environmental changes, such as quickly approaching violent thunder storms, may cause one co-regulator to take precedence over the others.

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ENVIRONMENTAL INFLUENCE ON THE MATING BEHAVIOR OF HYLA VERSICOLOR AND RANA CLAMITANS

INTRODUCTION

Over the last decade it has been found that the populations of various species of frogs has been declining (Barinaga). Multiple hypotheses have been offered to explain this unusual occurrence. These suggestions have included unusually hard freezes (Layne 1989), acid rain, an increase in Ultra Violet radiation due to the decrease in the density of the ozone layer of the atmosphere, lead poisoning (Birdsall 1986), and the decrease in habitat size, to name a few (Barinaga). These are all plausible suggestions, and if true they could be used as indicators of not only environmental contamination, but also of overall global climatic changes. However these hypotheses are difficult to prove using the existing techniques available for this type of research. At the present time work in these areas can only be accomplished in the field, where frogs exhibit normal behavior. Unfortunately this type of research is very difficult to control, therefore the preferred method to accomplish this research would utilize a laboratory setting. However, frogs do not exhibit normal behavior, specifically mating behavior, in the laboratory.

In working toward the eventual goal of determining what factors are causing the decline of the overall frog population it is necessary to first devise an efficient means by which to accomplish this. Since work in the laboratory is most likely the best means for accomplishing this goal it is desirable to entice the frogs to exhibit normal mating behavior in the laboratory. To do this it was necessary to create optimal environmental conditions for mating in the lab. Therefore, it was necessary to first determine what these optimal environmental conditions were.

It was suggested by Simms (1967), who worked specifically with the Crested Newt: Triturus Cristatus Laurentus, that light was the primary regulator of reproduction cycles in amphibians. Additionally, Bullough (1939) reported that Spaul and Gladwell found light to be the determinate factor in spermatogenesis, oogenesis, and spawning in Rana temporaria. Bullough (1939) also suggested that while mating in marine fishes seemed to be controlled by temperature, this was because of the regularity of temperature in the oceans. However, he suggested that fresh water bodies that are often small, fluctuate erratically in temperature, therefore it is more likely that fresh water organisms, such as amphibians, regulate reproduction cycles by a reliable source such as fluctuations in daylight length.

In contrast Ifft (1942) found that temperature was the primary regulator of spermatogenesis in Triturus viridescens, and that light did not affect the cycle. Similarly, Bauldauf (1952) reported that air temperature determined the emergence of Ambystoma maculatum from hibernation, thus beginning its migration to a breeding sight. Additionally, he felt that both temperature and humidity were the most important factors in determining spring migration of this salamander. The humidity often being a direct result of runoff from melting snow.

It has also been shown that rain and humidity have a direct effect on reproduction in various species of amphibia. Inger and Greenberg (1956) found that the regression and development of secondary sex characteristics in Bufo regularis and the maturation of ova in Bufo regularis and Bufo funereus are correlated to the changes in rainfall. It must be noted that humidity appeared to affect the expression of these characteristics in Bufo regularis and that the rainfall directly influenced the level of the humidity (Inger and Greenberg, p. 570).

Maslin (1939) reported that oviposition by the slender salamander, Batrachoseps attenuatus, was directly correlated to the beginning of the rainy season, which varies by geographic region. Similarly, Davis (1952) showed that rain levels (simulated by a lawn sprinkler) affect the deposition of salamander, Batrachoseps Pacificus Major, eggs. Apparently, when sufficient levels of moisture were present in the soil eggs were deposited, and when too much moisture was present the eggs were moved to the ground surface. Additionally, very few eggs were deposited in dry soil, and Davis felt that the few that were deposited were done so due to residual moisture in the deeper layers of the soil.

Likewise, Anderson (1967) found that rainfall governs the breeding migration of the *Ambystoma macrodactylum croceum*. Their breeding migration is stimulated by heavy rainfall which he hypothesized is the case because it is at that time that the temporary ponds, where the larval stages will mature, would exist. He also found that metamorphosis in this species is correlated to the drying of these temporary ponds.

METHODS AND MATERIALS

This project consisted of two field experiments, a lab experiment, and a body temperature experiment. The bulk of the observations were centered on Hyla versicolor and Rana clamitans, but additional data was taken on several other species.

The primary field experiment was designed to determine the optimal environmental conditions for maximum frog mating behavior in Hyla versicolor and Rana clamitans. Data was recorded every thirty minutes on: the species calling, the call level on a scale of zero to ten with zero being no calling and ten being maximal calling (objective), a one minute tape recording of the calling, time (on the twenty-four hour clock), relative humidity, air temperature in degrees Celsius, water temperature in degrees Celsius, light level in u mol s^{-1} m^{-2}, and sky conditions. It was also proposed that barometric pressure be taken, but the equipment was not available. Additionally, data was taken daily at 1400 on the fore mentioned items with the addition of conductivity. Data was also taken daily on rainfall, photoperiod, moon phase, and general weather conditions.

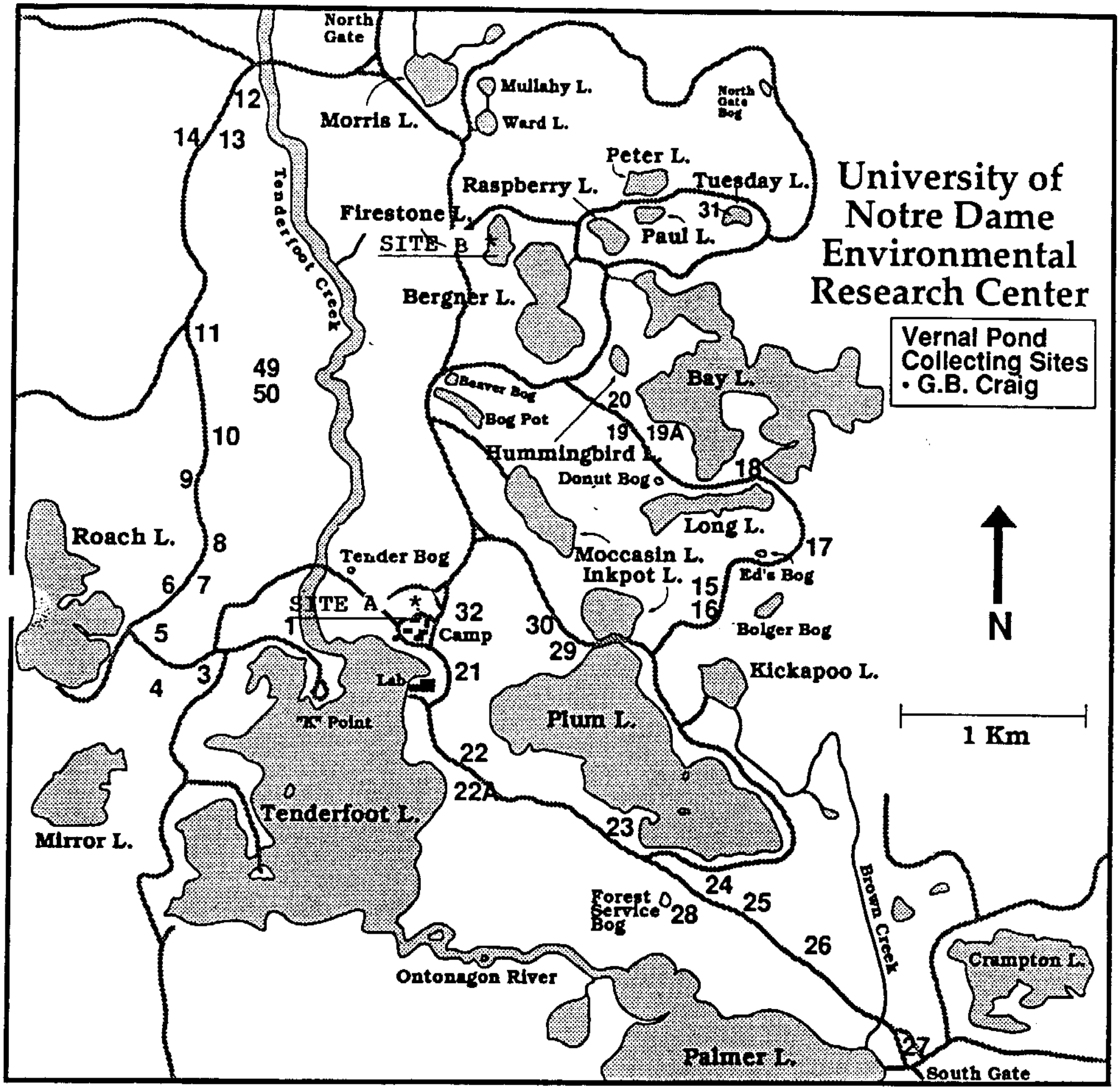
This data was taken at a vernal pond approximately 300 yards due North of camp for the first two weeks of the experiment (9 June thru 27 June 1990), (see map 1, site A). For the remainder of the experiment (27 June thru 14 July 1990) data was taken on Firestone Lake at position "A" for the third week and at position "B" for the fourth week (see fig. 1). These movements were necessitated by the changes in frog calling behavior; at the beginning of the observations the frogs called more at the north end of the lake and during the last week of observation the frogs called more intensely at the south end.

A station was set up so as to interfere minimally in the recording of the data (see fig 1). The light meter was operated in a totally unobstructed position for a minimum of sixty seconds before a reading was taken. Additionally, the temperature and humidity gauges were placed at a position four inches above the ground for the entire evening. Water temperature was taken at a depth of six inches for a minimum of sixty seconds or until the temperature gauge became steady. Both water and air temperatures were taken utilizing a mercury thermometer that was accurate to +/- .5 degrees Celsius.

The second field experiment was designed to determine if <u>H. versicolor</u> would call in captivity in the wild. The control for this experiment was to be the frogs in the first experiment. A comparison was to be made between the calling levels of the frogs in captivity and the frogs in the wild. Male frogs were captured at night while they were calling and placed in cages that were partially submersed in the same body of water from which they were captured (see fig 2). This experiment was conducted at site "A", the vernal pond north of camp (see map 1). The frogs were fed a meal of dragonflies every other day. The frogs were monitored and environmental conditions were recorded in the same method as in experiment one.

The third experiment was designed to monitor Hyla versicolor calling behavior in the lab. The control for this experiment was the first experiment. The lab was a large garage with windows on two sides. The windows were left opened at night so as to attempt to maintain consistent temperature and humidity levels inside as outside. Eight male frogs were placed in each of two cages labeled A and B (see figs. 3 and 4); additionally one female frog was placed in cage B. These cages each contained approximately 14 linear feet of tree branches, three containers of water two that were 20"x8"x7" and a third container that was 20"x10"x1". The cages were elevated one meter from the ground. For night observations only red light was used so as not to disturb the frogs' biological clocks. The same data was taken for this experiment as was taken in the first experiment.

The fourth portion of the project was an experiment designed to find whether or not a correlation existed between the body temperatures of Hyla versicolor and their calling status. Frogs were captured while calling at Firestone Lake (see map 1 site B). Immediately upon capture their cloacal temperatures were taken. Then the water and air temperatures in that location were taken. The frog was then marked by toe clipping and placed in a styrofoam cooler. At the end of the night the frogs were taken to the lab and placed in a large cage labeled C and one small cage labeled D (see Figs. 3 and 4). The body temperatures of the frogs and the air and water temperatures were then taken in the lab using the same procedures that had been used in the field.


University of Notre Dame Environmental Research Center
Vernal Pond Collecting Sites
• G.B. Craig
North Gate
Mullahy L.
Ward L.
Morris L.
North Gate Bog
Peter L.
Tuesday L.
Raspberry L.
31
Paul L.
Firestone L.
SITE B
Bergner L.
Tenderfoot Creek
12
14
13
11
49
50
10
9
8
7
6
5
4
3
1
Beaver Bog
Bog Pot
20
19
19A
Bay L.
Hummingbird L.
Donut Bog
18
Long L.
17
Moccasin L.
Inkpot L.
Ed's Bog
15
16
Bolger Bog
N
Roach L.
Tender Bog
SITE A
32
Camp
30
29
Lab
21
Kickapoo L.
"K" Point
Plum L.
1 Km
22
22A
Mirror L.
Tenderfoot L.
23
24
25
Forest Service Bog
28
Brown Creek
26
Ontonagon River
Crampton L.
Palmer L.
27
South Gate

MAP 1

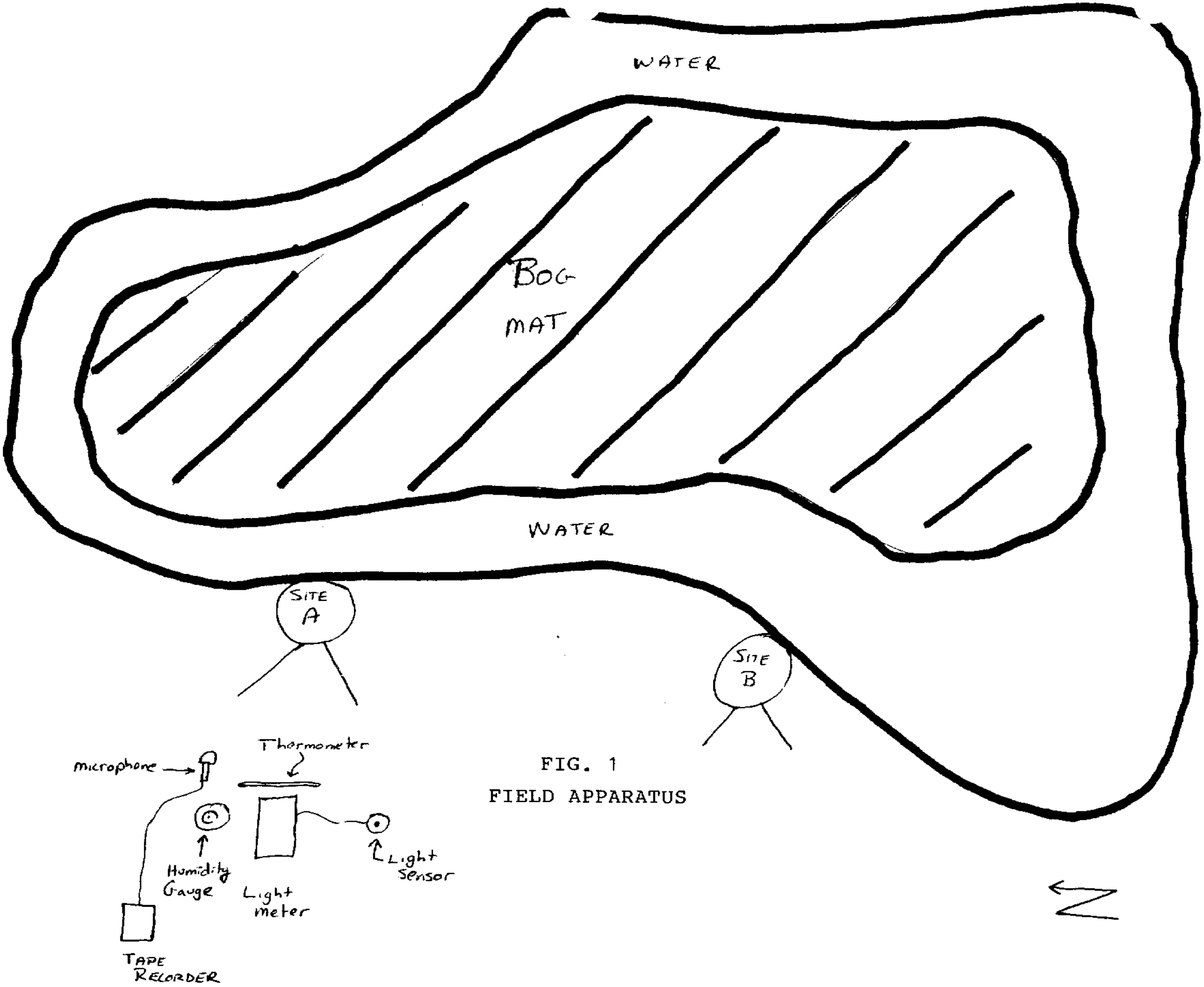


FIG. 1
FIELD APPARATUS

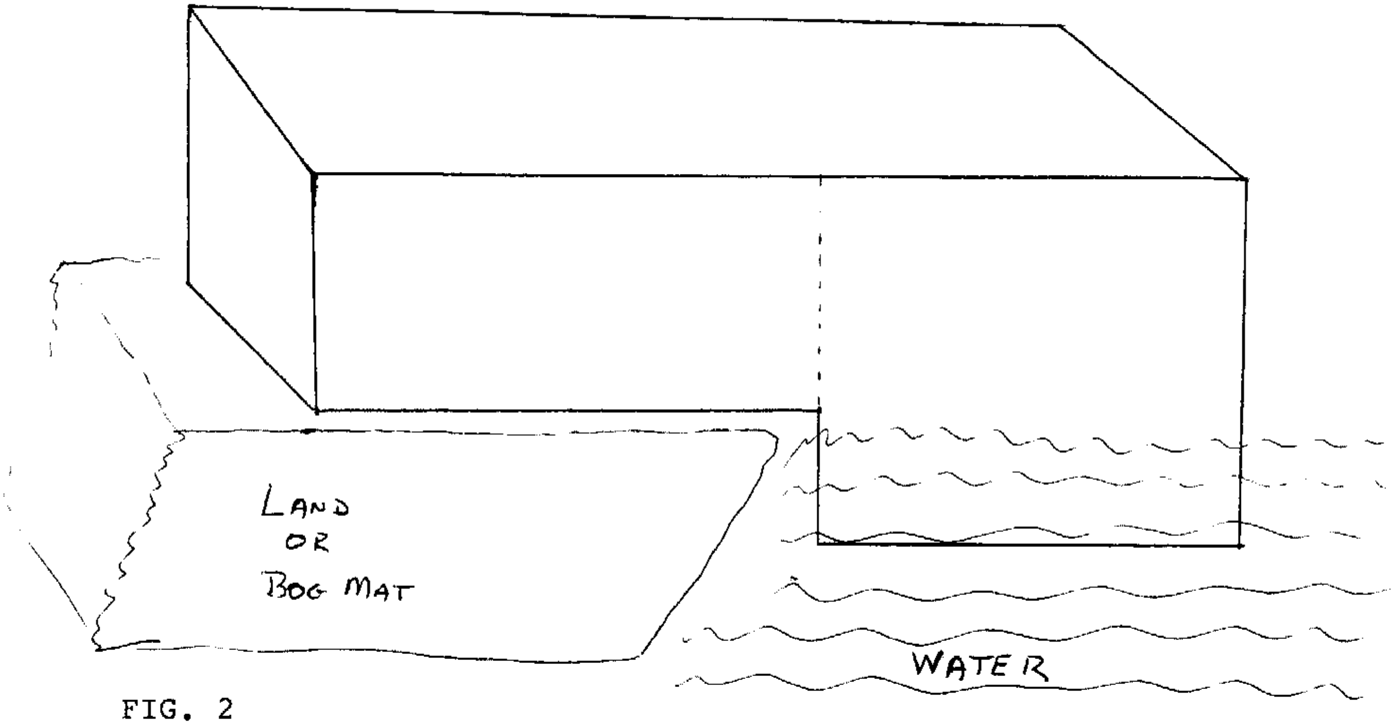


FIG. 2

ORIGINAL DESIGN FOR FIELD CAPTIVITY EXPERIMENT

In this experiment frogs were to be captured and placed in cages in the wild. They were to be observed as in the field experiment. This experiment was never completed due to frog escapes and predation by snakes.

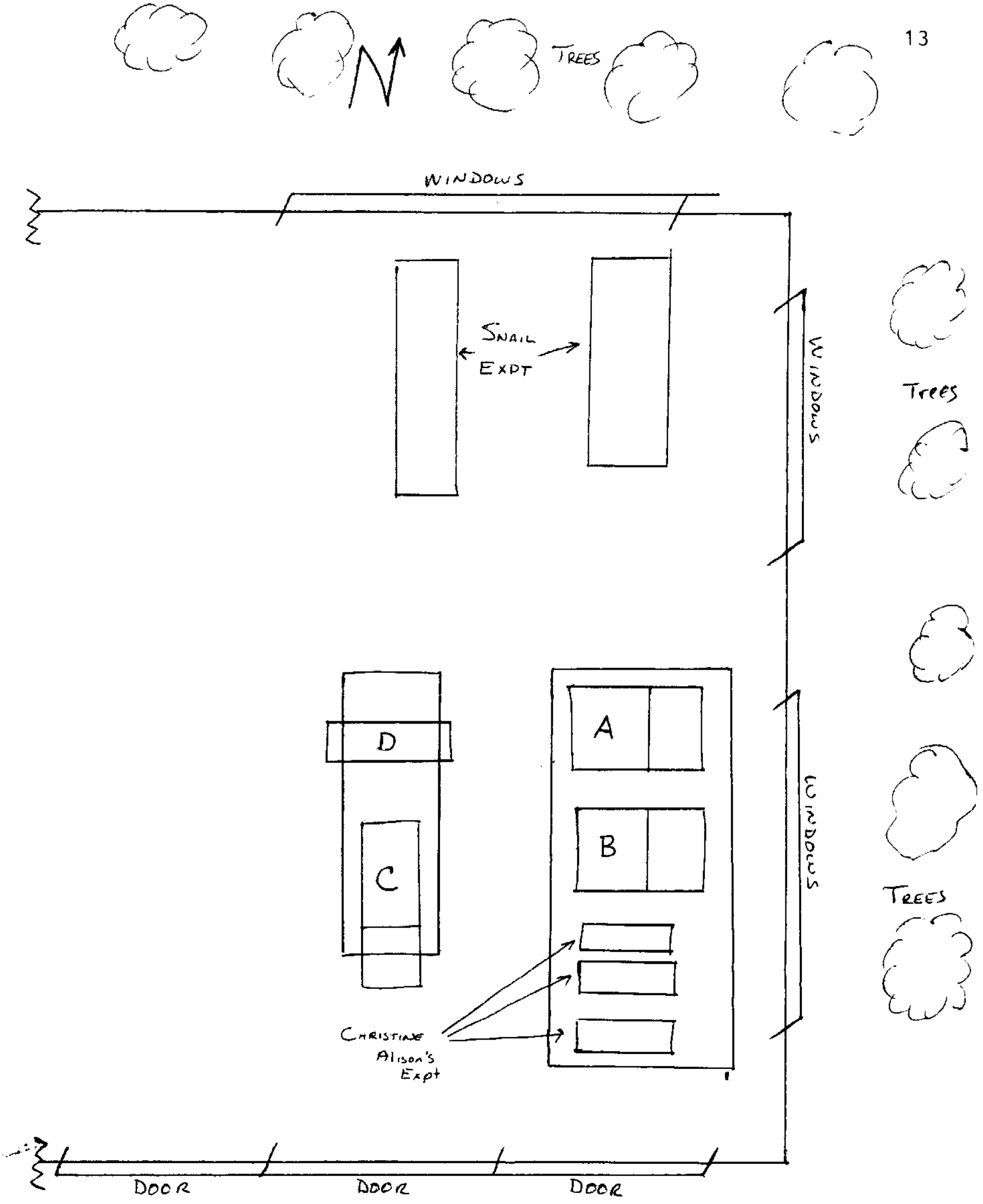
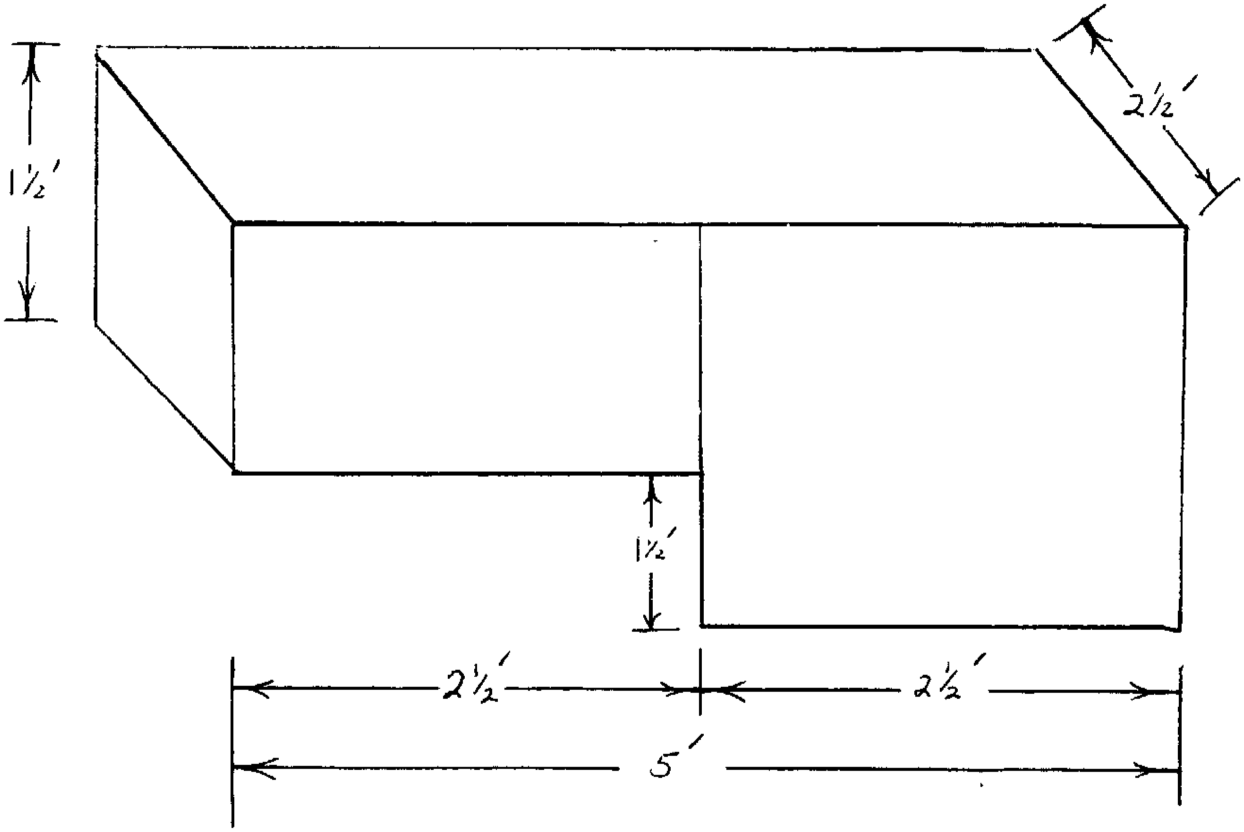
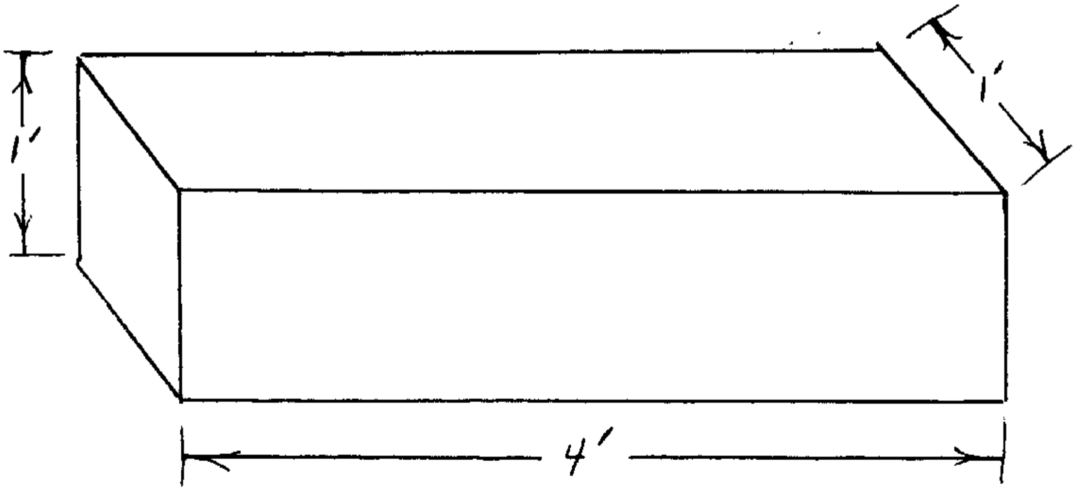


FIG. 3

LAB/GARAGE APPARATUS



LARGE CAGE



SMALL CAGE

FIG. 4

RESULTS

FIELD EXPERIMENT ONE

Hyla versicolor

The main regulator of mating in Hyla versicolor is most likely photoperiod. The photoperiod at the start of the mating season, June 9, was 15 hours and 33 minutes (Nautical 117) and at the end of the mating season, July 13, was 15 hours and 21 minutes (139).

There appeared to be a combination of factors that determined what time of day the frogs mated; both light level and humidity. The light level appears to be the primary regulator, with a threshold of approximately .505 to .220 u mol s^{-1} m^{-2}. No calling occurred at light levels above an average of 375.10 u mol s^{-1} m^{-2} (see Figs. 5 and 6). There is a significant probability that light level is correlated to calling level of .011. Once this light threshold has been met their is a significant probability of .002 that the relative humidity correlates to calling level.

The data suggests that the higher the humidity the more likely the frogs are to call. Calling began between an average of 66 and 78 percent, with no calling occurring at or below an average of 66 percent. The optimal humidity levels for calling appear to be above 80 percent (see Figs. 7 and 8).

Although there is not a significant probability, there is strong evidence to suggest that air and water temperature contribute to the regulation of mating in *H. versicolor.* Calling only occurred when the air temperature was between approximately 14 and 23 degrees Celsius. Optimal air temperature for calling to occur averaged between 18 and 19 degrees Celsius (see Figs. 9 and 10). Additionally, calling appeared to be favored with water temperatures of between approximately 12 and 25 degrees Celsius. The optimal water temperature for calling averaged approximately 20.6 degrees Celsius (see Figs. 11 and 12).

Summary of Optimal Mating Conditions:

1. Photoperiod between 15 hours 33 minutes and 15 hours 21 minutes.
2. Light level of .505 u mol s^{-1} m^{-2} and lower.
3. Relative humidity of 80 percent and above.
4. Air temperature between 18 and 19 degrees Celsius.
5. Water temperature of 20.6 degrees Celsius.

Rana clamitans

The primary regulator of mating in *Rana clamitans* is also most likely photoperiod. However, the start and finish of their mating season was not observed therefore this can only be hypothesized from the data. The evidence suggests that photoperiod is not as strong of a regulator in *R. clamitans* as it was in *H. versicolor.* This is shown by the long duration of their mating season and the high variability in when they mate. The data suggests that there is an average threshold light level of between 3.5 and 0.00 u mol s^{-1} m^{-2}.

Additionally, it suggests that there is a secondary average threshold of 101.3 u mol s^{-1} m^{-2} (see Figs. 13 and 14). The probability of a correlation between calling level and light level is 0.000.

Additionally, their are strong probabilities of correlation with calling level to humidity (0.000), air temperature (0.000), and water temperature (0.002). The average optimal relative humidity appears to be between 86 and 87 percent, but it must be noted that a consistent calling level is usually maintained above 71.6 percent humidity. No calling occurred below an average of 55.1 percent humidity (see Figs. 15 and 16). Additionally, The optimal air temperature appears to be between approximately 10 and 12 degrees Celsius (see Figs. 17 and 18), while, the optimal water temperature for mating is shown to be approximately 21.7 degrees Celsius (see Figs. 19 and 20).

Summary of Optimal Mating Conditions

1. Light level below 3.5 u mol s^{-1} m^{-2}.
2. Relative humidity above 86 percent
3. Air temperature between 10 and 12 degrees Celsius.
4. Water temperature of 21.7 degrees Celsius.

FIELD EXPERIMENT TWO

There were few results because the *Hyla versicolor* were subject to predation by snakes. However, before the predation became a problem no calling was observed. Data from this experiment would help to determine the effects of captivity on mating behavior and it should be attempted in the future.

LAB OBSERVATION EXPERIMENT

Hyla versicolor were observed calling in the laboratory for one day following capture. After this period of time, they never were observed calling other than an occasional release call.

BODY TEMPERATURE EXPERIMENT

STATUS	AVERAGE BODY TEMP	STANDARD DEVIATION	AVERAGE WATER TEMP	STANDARD DEVIATION
Calling	23.82	.83	19.92	.88
Non-calling	24.21	1.29	22.11	.08

Although very little data was obtained in this experiment, as the mating period of *H. versicolor* ended sooner than expected, it must be noted that the data indicated a possible correlation between body temperature and calling status. Calling frogs had an average body temperature of 23.82 degrees Celsius and non-calling frogs had an average body temperature of 24.21 degrees Celsius.

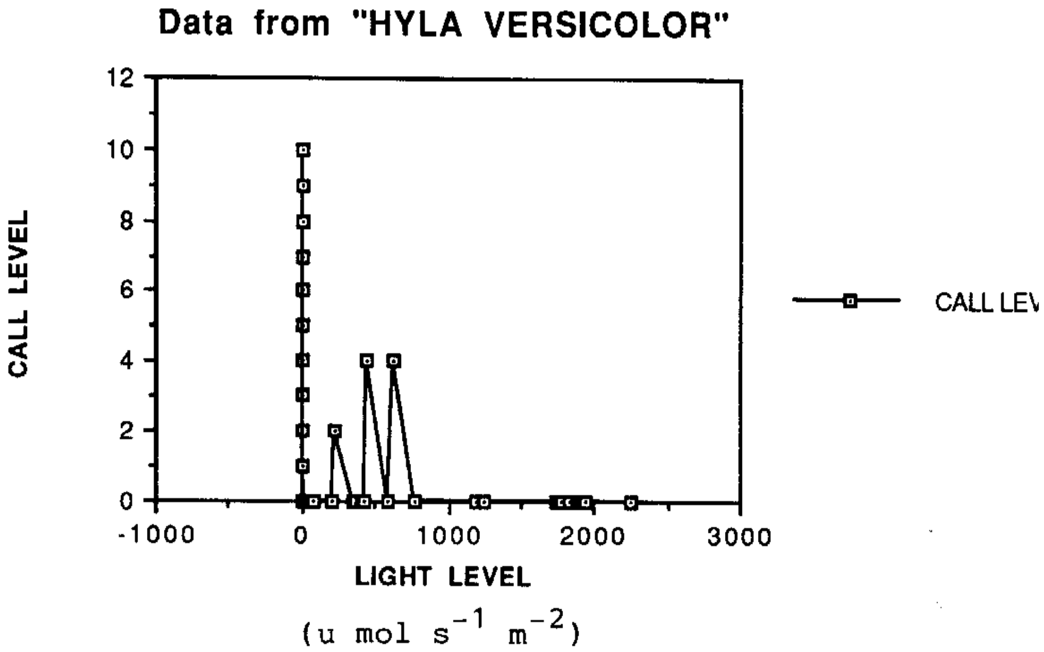


FIG 5

This plot shows the relationship between light level and calling level of <u>H. versicolor.</u> There is a significant correlation (by Pearson correlation) of .011 between light level and calling level.

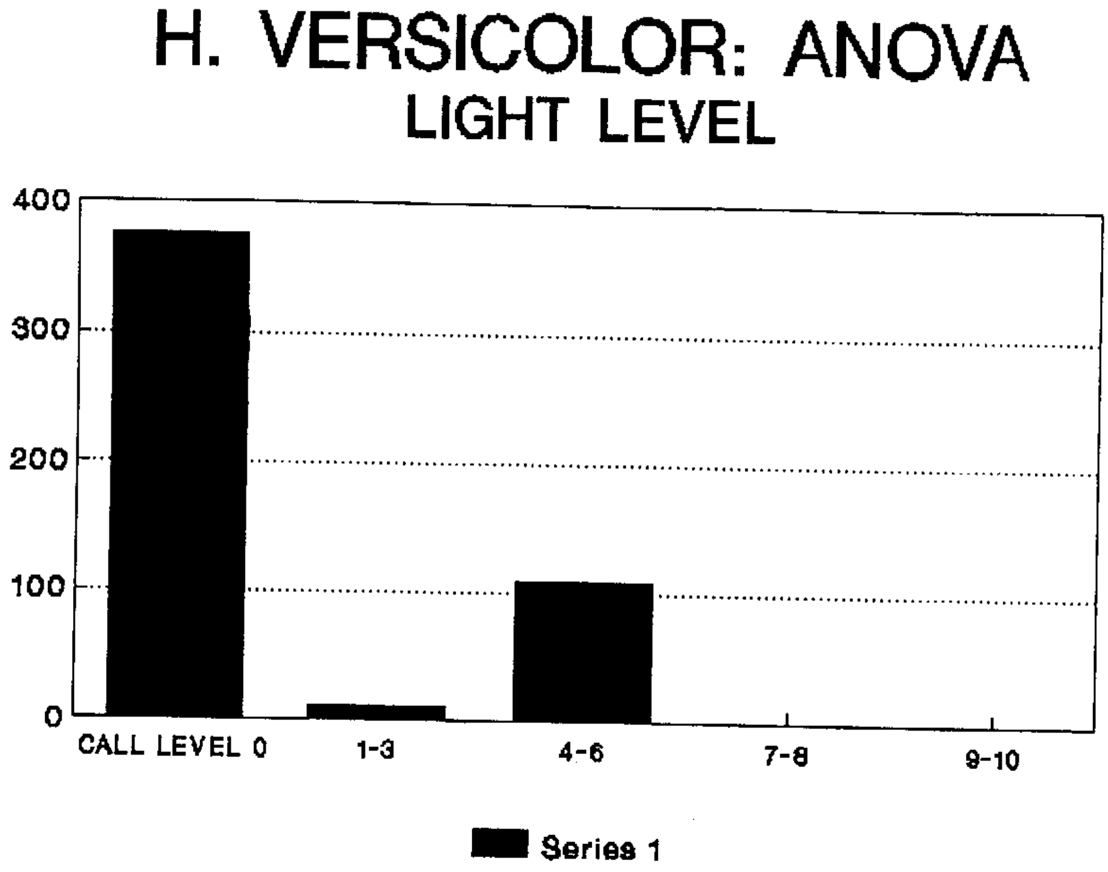


FIG 6

This graph shows analysis of variance for light level at various calling levels. It demonstrates that at and above an average of 375.3 u mol s^{-1} m^{-2} there was no calling. Calling levels from 1 to 3 were observed at an average of 10.7 u mol s^{-1} m^{-2}. Additionally, calling levels between 4 and 6 were observed at an average level of 108.0 u mol s^{-1} m^{-2}, calling levels of 7 thru 8 were observed at an average of .5 u mol s^{-1} m^{-2}, and calling levels of between 9 and 10 were observed at an average of .2 u mol s^{-1} m^{-2}. There appears to be a threshold of between .51 and .2 u mol s^{-1} m^{-2} for maximal calling to be observed.

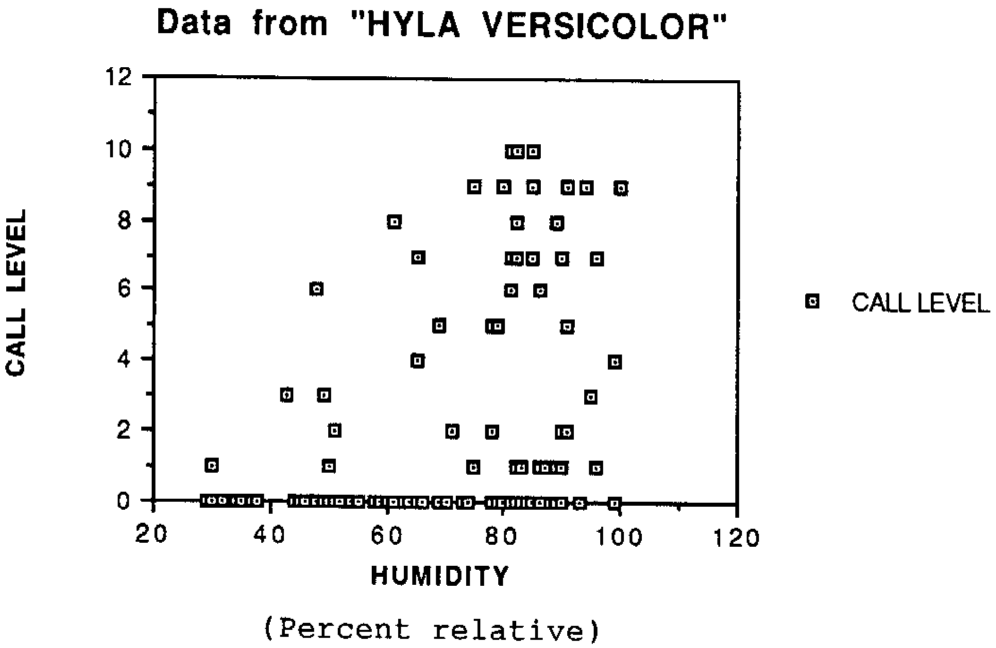


FIG 7

This plot shows the relationship between humidity and calling level of <u>H. versicolor.</u> There is a significant correlation (by Pearson correlation) of .002 between these variables.

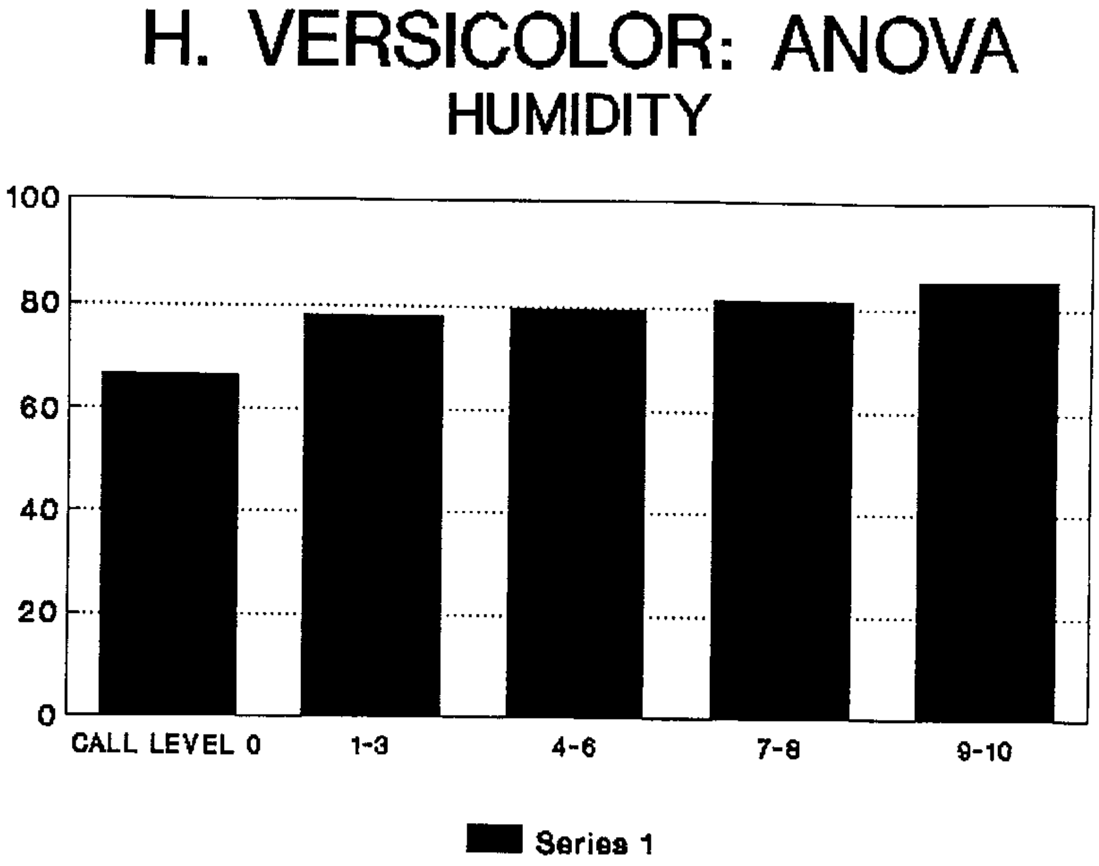


FIG 8

This graph shows analysis of variance for humidity at various calling levels. It demonstrates that at an average of 66 percent relative humidity and below no calling was observed. Calling levels of 1 to 3 were observed at an average of 78.0 percent. Additionally, calling levels of 4 to 6 were observed at an average of 79.5 percent, calling levels of 7 to 8 were observed at an average of 81.2 percent, and calling levels of 9 and 10 were observed at an average of 85.3 percent. There appears to be two thresholds for calling. Calling began between average humidities of 66 and 78.0 percent, whereas no calling occurred below the 66 percent average humidity. At humidity levels of approximately 80 percent and above maximal levels of calling were observed.

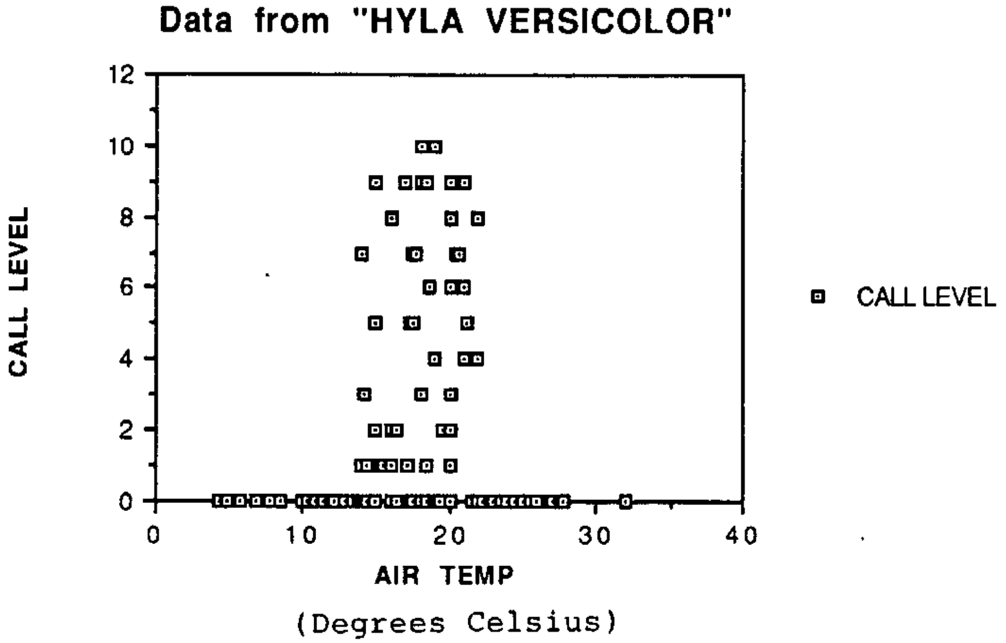


FIG 9

This plot shows the relationship between air temperature and calling level of H. versicolor. There is a correlation (by Pearson correlation) of .179 between these variables. From graphical analysis there appears to be a minimum threshold of 14 degrees Celsius and maximum threshold of 23 degrees Celsius air temperature for calling to occur.

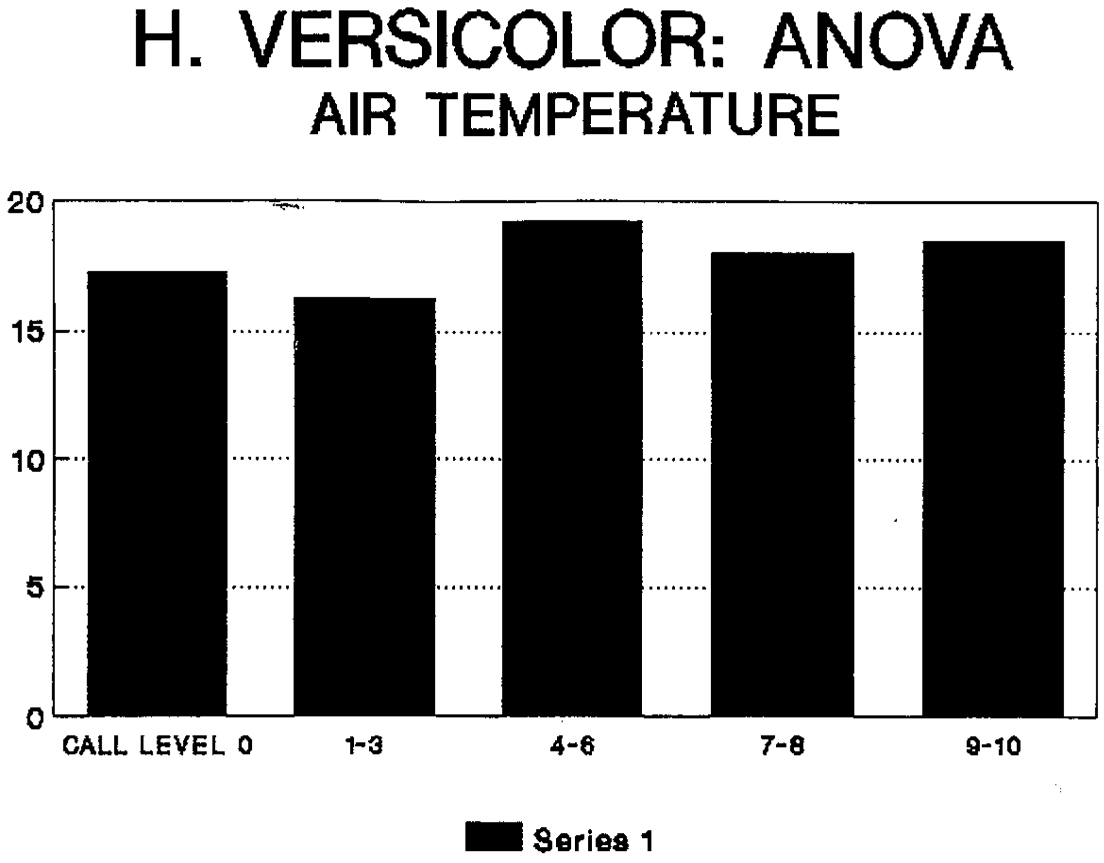


FIG 10

This graph shows analysis of variance for air temperature at various calling levels. It shows that calling does not occur at an average of 17.3 degrees Celsius. Calling levels of 1 to 3 were observed at an average of 16.3 degrees. Additionally, calling levels of 4 to 6 were observed at an average of 19.3 degrees, calling levels of 7 to 8 were observed at an average of 18.1 degrees, and calling levels of 9 to 10 were observed at an average of 18.5 degrees.

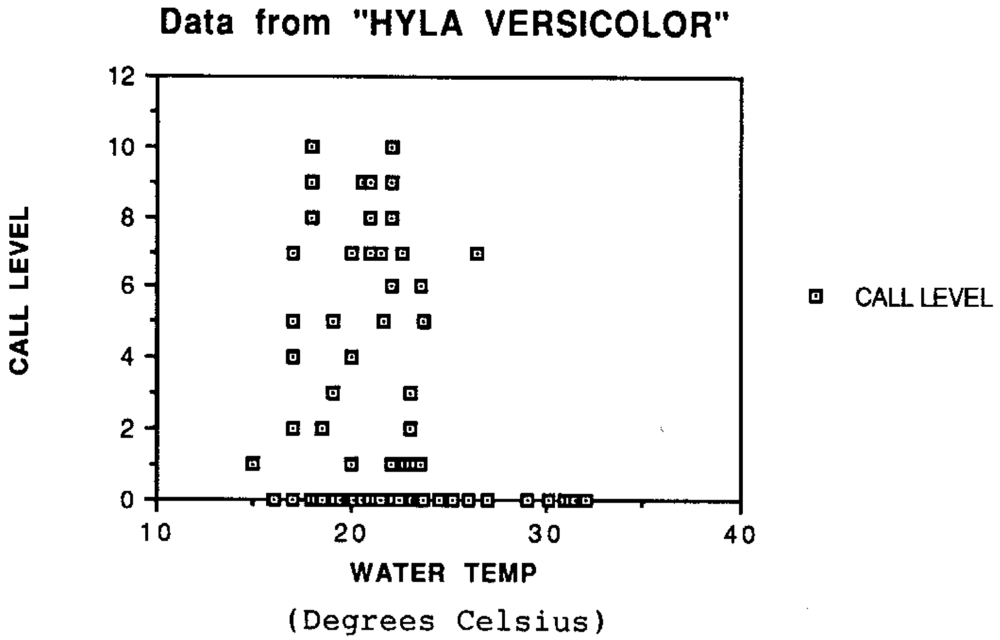


FIG 11

This plot shows the relationship between water temperature and calling level of <u>H. versicolor.</u> There is a correlation (by Pearson correlation) of .267 between these variables. From graphical analysis, there appears to be a minimum threshold of 16 degrees and a maximum threshold of 25 degrees water temperature for calling to occur.

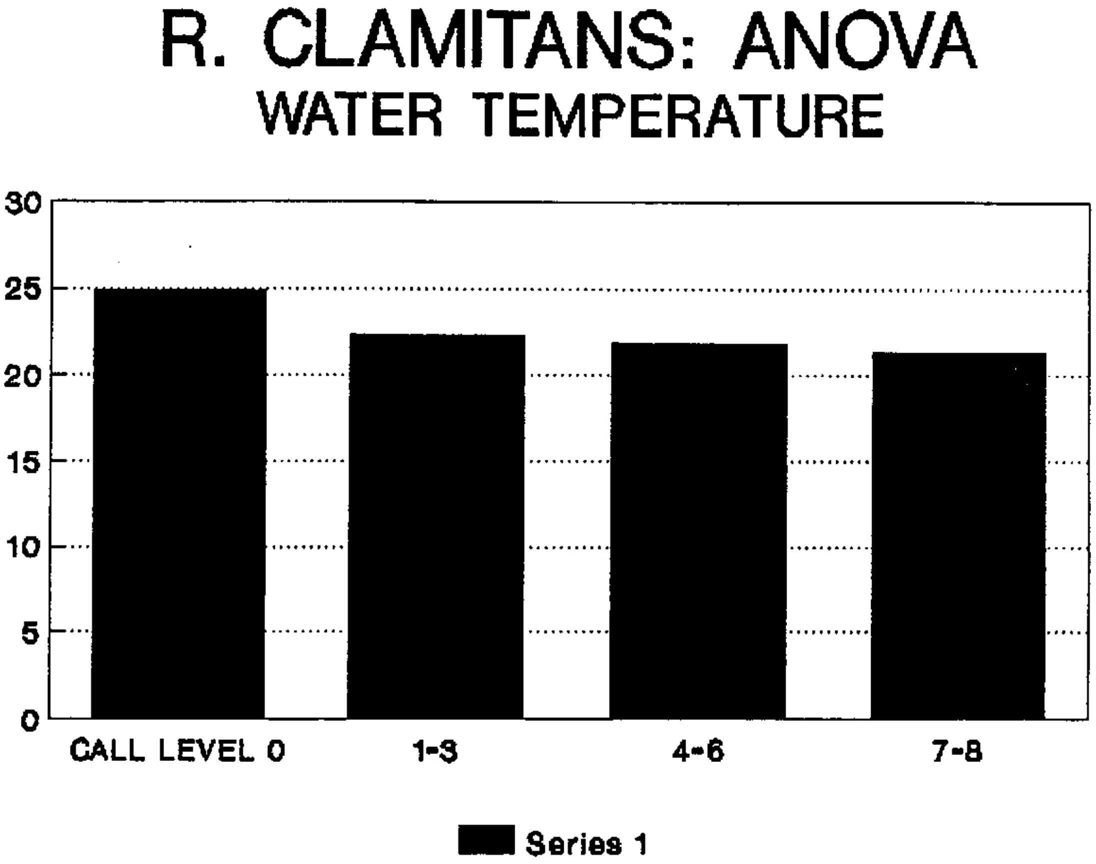


FIG 12

This graph shows analysis of variance for water temperature at various calling levels. It shows that at an average of 21.7 degrees Celsius no calling occurs. Calling levels of 1 to 3 were observed at an average temperature of 20.6 degrees. Additionally, calling levels of 4 to 6 were observed at an average of 20.1 degrees, calling levels of 7 to 8 were observed at an average of 21.1 degrees, and calling levels of 9 to 10 were observed at an average of 20.6 degrees.

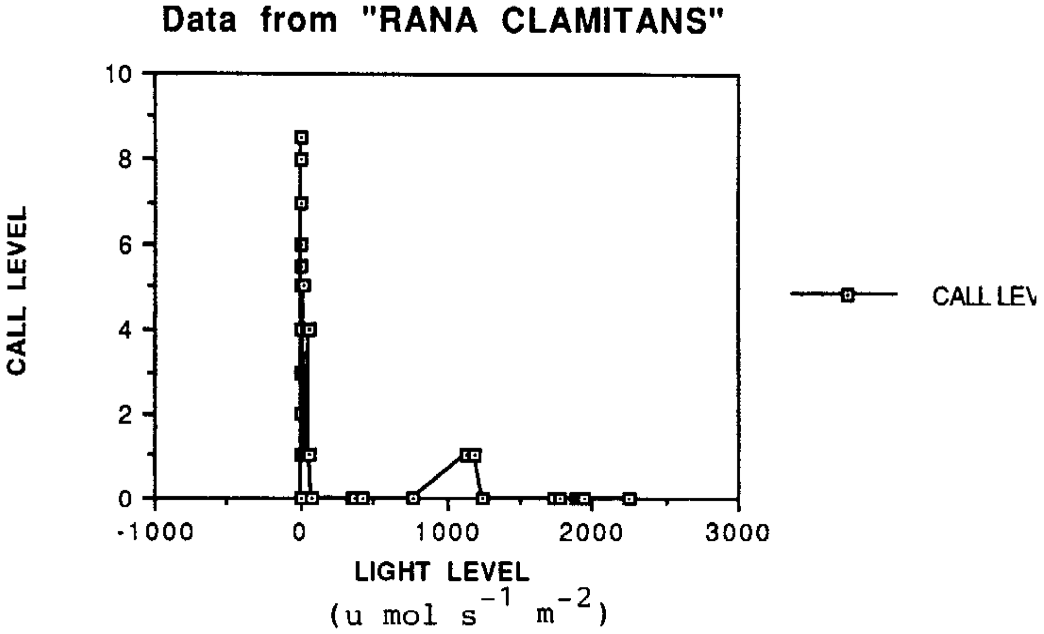


FIG 13

This plot shows the relationship between light level and calling level of R. clamitans. There is a significant correlation (by Pearson correlation) of .000 between these two variables.

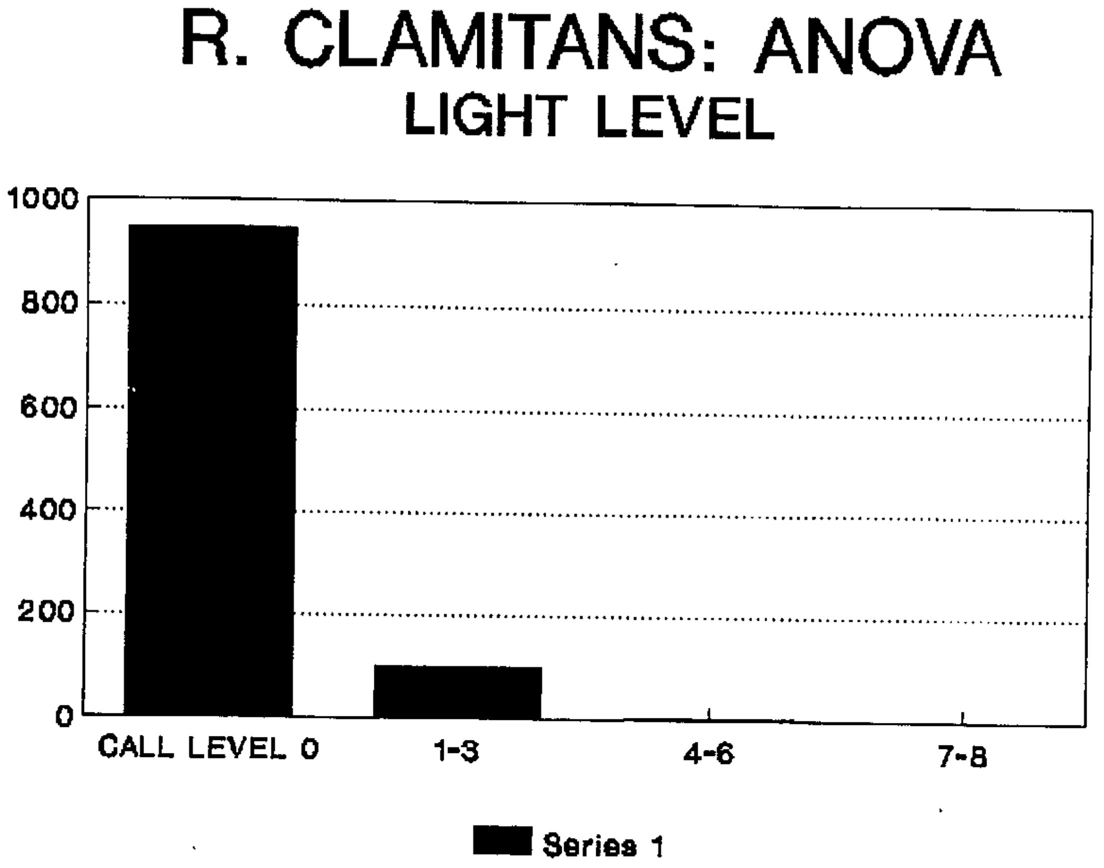


FIG 14

This graph shows analysis of variance for light level at various calling levels. Analysis of variance indicates that at and above a light level of 947.6 u mol s^{-1} m^{-2} there was no calling. Calling levels of 1 to 3 were observed at an average light level of 101.3 u mol s^{-1} m^{-2}. Additionally, calling levels of 4 to six were observed at an average light level of 3.5 u mol s^{-1} m^{-2}, and calling levels of 7 to 8 were observed at light levels of an average of 0.0 and below. This data suggests that there is a primary average threshold of between 3.5 u mol s^{-1} m^{-2} and 0.00 u mol s^{-1} m^{-2} and a secondary average threshold of 101.3 u mol s^{-1} m^{-2} for calling to occur.

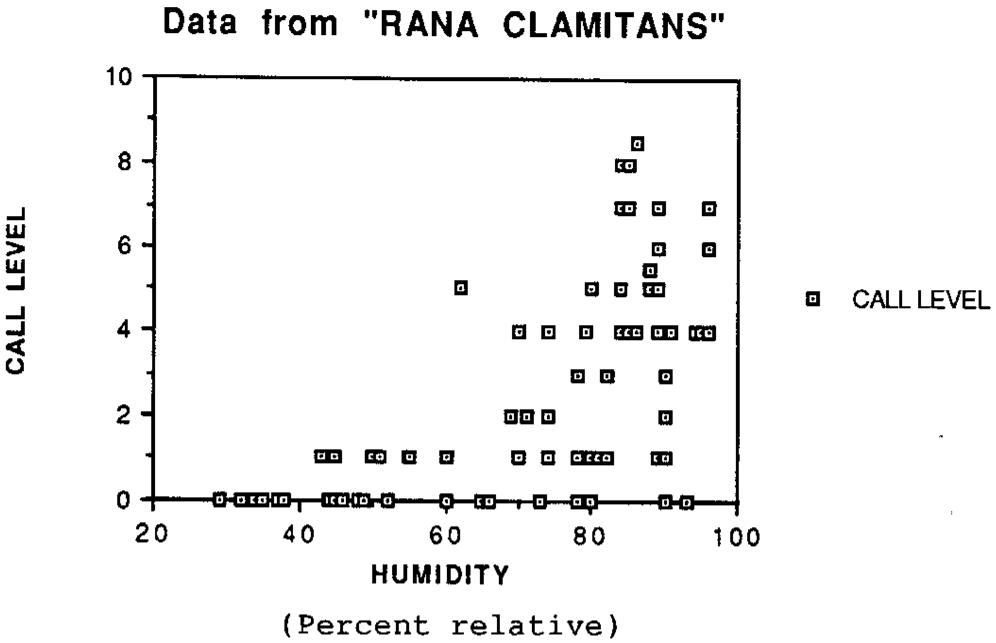


FIG 15

This plot shows the relationship between humidity and calling level of <u>R. clamitans.</u> There is a significant correlation (by Pearson correlation) of 0.000 between these two variables.

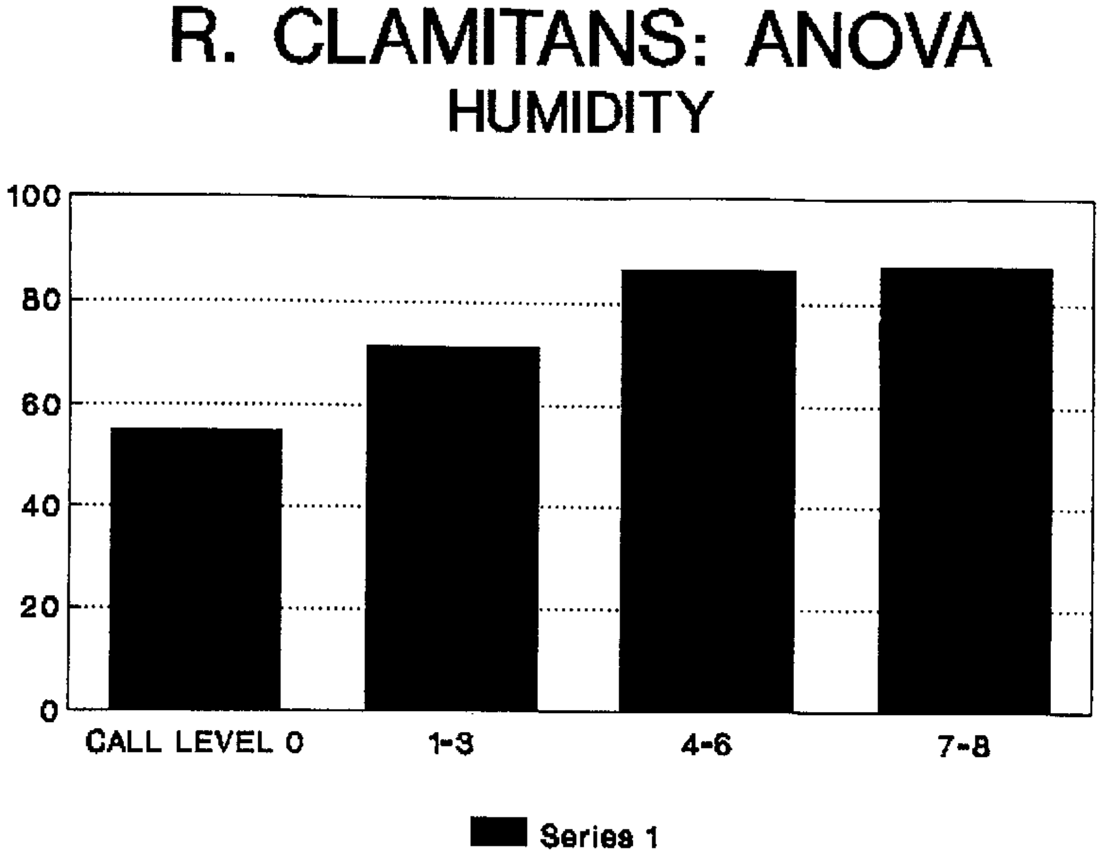


FIG 16

This graph shows analysis of variance for humidity at various calling levels. It indicates that no calling occurred at an average of 55.1 percent humidity and below. Calling levels of 1 to 3 were observed at an average humidity of 71.4 percent. Additionally, calling levels of 4 to 6 were observed at an average humidity of 86.2 percent and calling levels of 7 to 8 occurred at an average humidity of 87.2 percent. There appears to be a minimum average threshold of 55.1 percent humidity, for calling to occur, and a primary threshold of approximately 86 to 87 percent for higher levels of calling to occur.

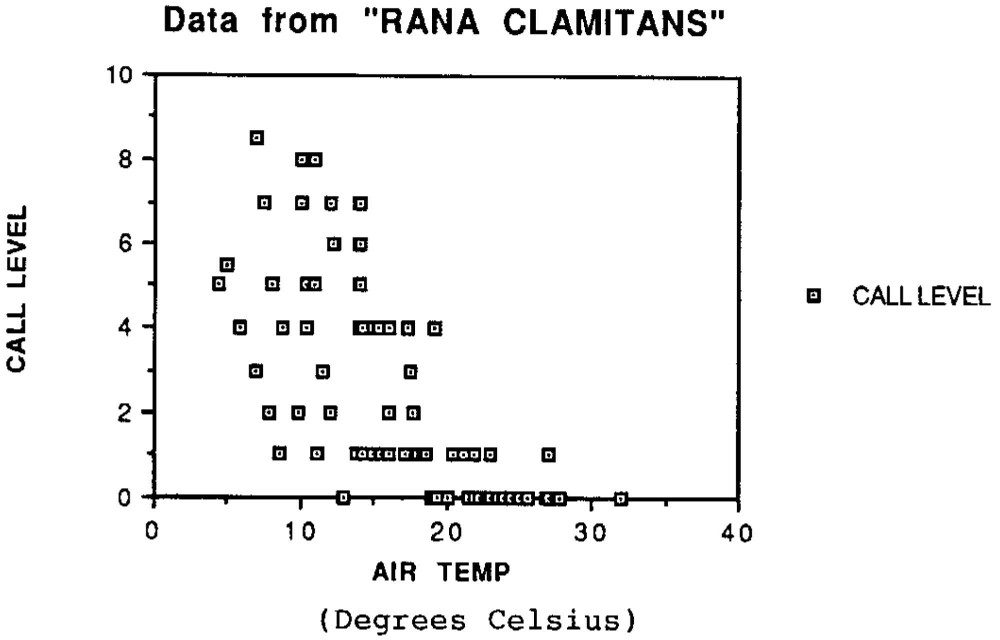


FIG 17

This plot shows the relationship between air temperature and calling level in R. clamitans. There is a significant correlation (by Pearson correlation) of 0.000 between these two variables. From graphical analysis there appears to be a minimum threshold of 5 degrees and a maximum threshold of 20 degrees for calling to occur.

R. CLAMITANS: ANOVA

AIR TEMPERATURE

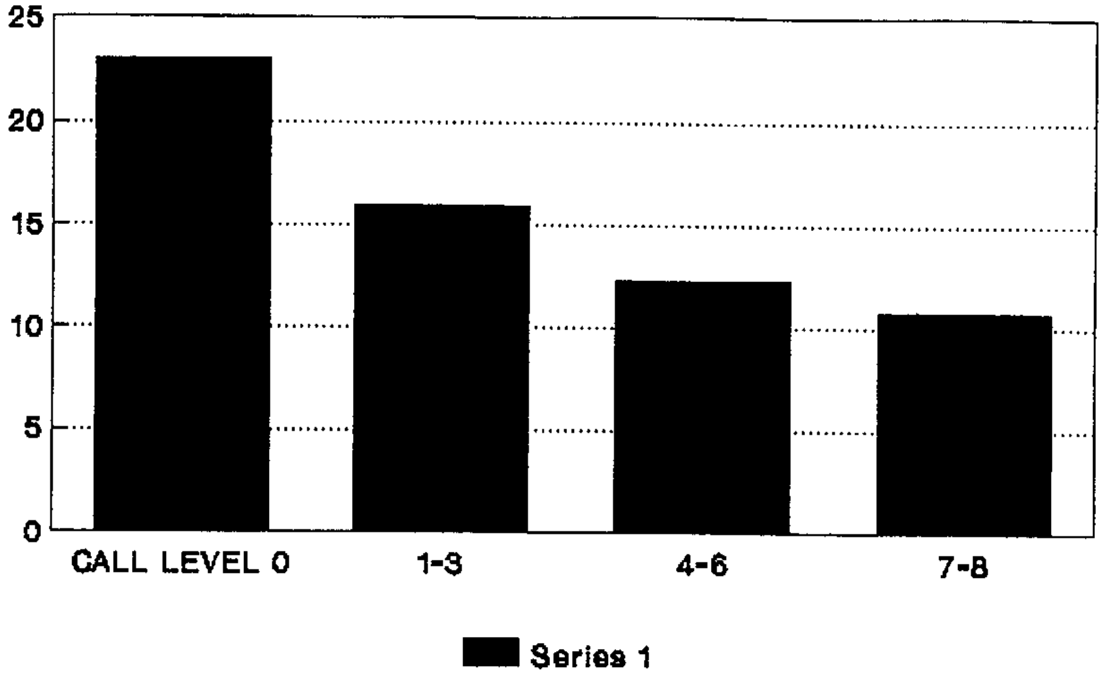


FIG 18

This graph shows analysis of variance for air temperature at various calling levels. It indicates that no calling occurred at an average temperature of 23.0 degrees Celsius. Calling levels of 1 to 3 occurred at an average temperature of 15.9 degrees. Additionally, calling levels of 4 to 6 were found at an average temperature of 12.4 degrees and calling levels of 7 to 8 occurred at an average temperature of 10.8 degrees. This data indicates that optimal air temperature for calling lies between approximately ten and twelve degrees Celsius.

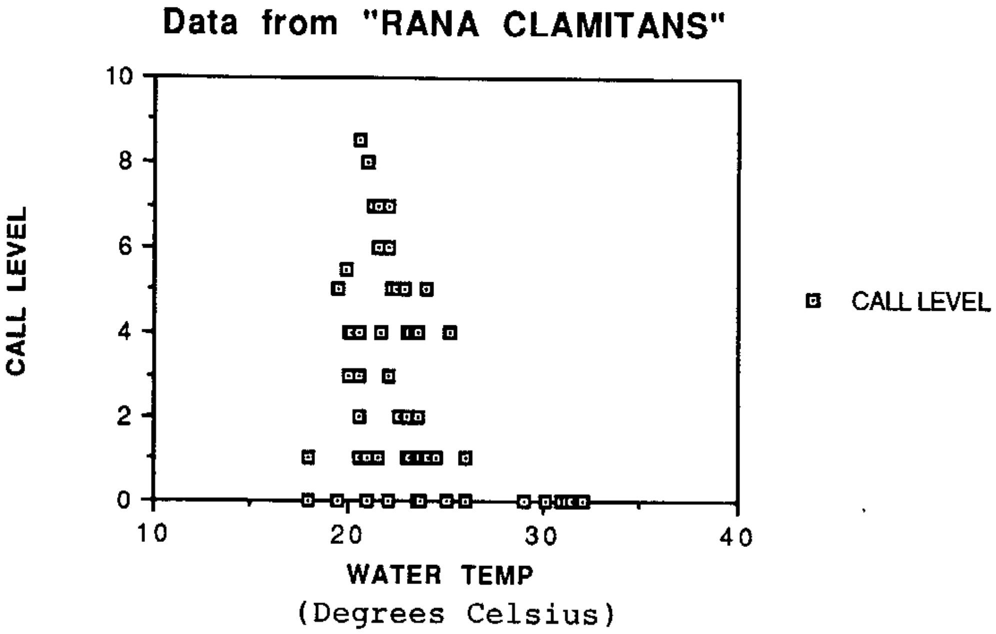


FIG 19

This plot shows the relationship between water temperature and calling level in R. clamitans. There is a significant correlation (by Pearson correlation) of .002 between these two variables. From graphical analysis there appears to be a minimum threshold of 20 degrees and a maximum threshold of 26 degrees for calling to occur.

H. VERSICOLOR: ANOVA
WATER TEMPERATURE

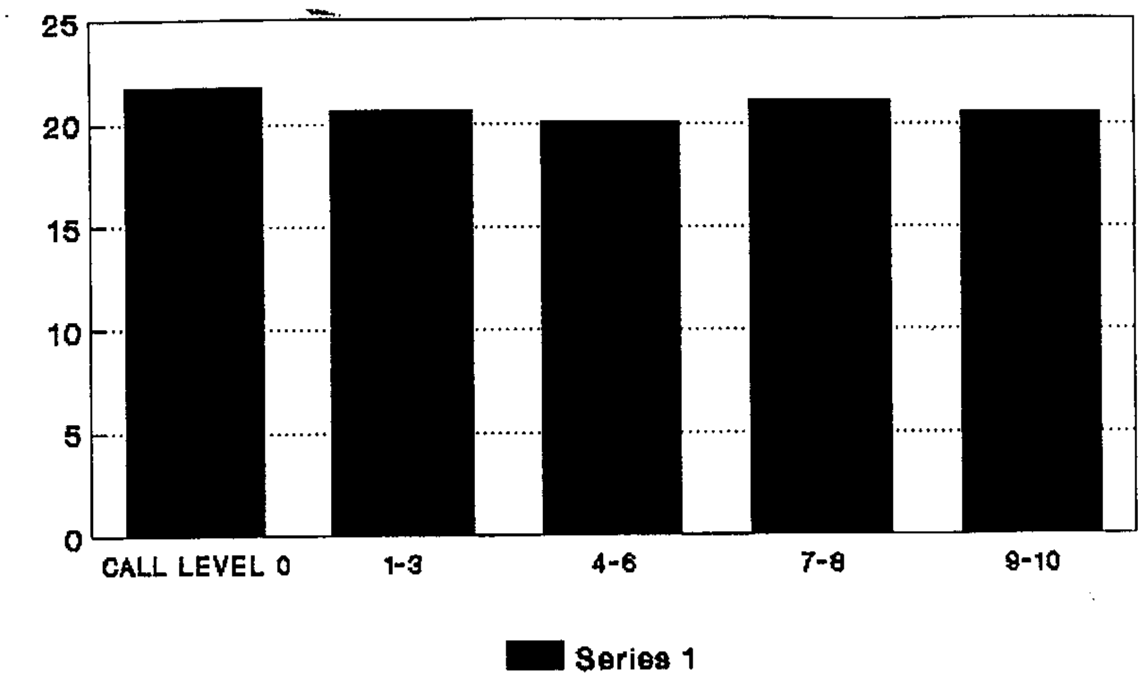


FIG 20

This graph shows analysis of variance for water temperature at various calling levels. It shows that no calling occurred at an average temperature of 24.9 degrees Celsius. Calling levels of 1 to 3 occurred at an average temperature of 22.3 degrees. Additionally, calling levels of 4 to 6 were shown at an average temperature of 21.9 degrees and calling levels of 7 to 8 were observed at an average temperature of 21.5 degrees. The data implies that the optimal water temperature for calling is approximately 21.7 degrees Celsius.

DISCUSSION

This data gives evidence for the likely environmental parameters that regulate mating behavior in H. versicolor and R. clamitans. Photoperiod is most likely the main regulator for reproduction in both species. This is a sensible inference because photoperiod is not influenced by environmental changes. Photoperiod is a constant annual cycle by which the frogs are able to regulate reproduction on a gross scale.

The data suggests that light level is the primary daily regulator of mating calls in both Hyla versicolor and Rana clamitans. Frogs very rarely called during the daylight hours. However, below the threshold light levels calling was consistently high. The data also suggests that humidity is a very strong daily co-regulator of calling in both species. Frogs did not call when the humidity was low, even if the light level was optimal. Occasionally, frogs called during the day when thunderstorms were approaching, when the humidity increased rapidly over a short duration of time. However, calling would cease during heavy rains, when conditions for fertilization of the ova were not optimal. This is likely because frogs reproduce externally and turbid water would not be to their advantage for it would inhibit the transfer of fertile sperm to the ova. This idea is supported by the tungara frog which breeds every month of the year on Barro Colorado Island, Panama (Ryan 32). In Panama the day length is fairly constant due to its proximity to the equator. Even though it mates year round most mating of the tungara frog takes place during the wet season from May to December (32). During heavy rains the tungara frog does not call (32).

Air temperature and water temperature are also likely co-regulators of daily frog mating. Their were both water and air temperature parameters which had to be met for calling to occur. Mating calls in *Rana montezumae* are observed between water temperatures of 21.5 and 16.5 degrees Celsius (Mecham 510). Whereas, release calls were observed in water temperatures of 24.0 degrees (512). A decrease in ten degrees water temperature causes the frog mating trill to decrease by almost 50 percent in the number of repetitions (511). Apparently, different temperatures are required physiologically for the frog to exhibit different calling patterns. If the temperature is too low the frog is physiologically unable to call and an higher temperatures different, non-mating, calling patterns were observed. This evidence is additionally supported by the data from the body temperature experiment in which calling *Hyla versicolor* had a different average body temperature than did non-calling frogs.

While this data gives evidence for the likely environmental parameters that regulate mating behavior, in some cases it covers a wide range of values. However this is consistent with the goal of reproduction; if the parameters were exact then the reproduction cycle of the frogs could be halted by extremely slight variations in environmental conditions which is most likely not the case. It is more likely that there is a set of environmental parameters by which the frogs physiologically determine when to mate. However, changes in overall global environmental conditions may be occurring faster than the frogs are able to adapt their reproductive cycles.

One cause of the decrease in frog populations is likely the decrease in the size of their habitats. As more and more swamp and marsh land is dried and filled for construction there follows a decrease in the number of habitats that are conducive to frog survival. In Europe the Hyla arborea were numerous, however in the North where their natural biotopes were changed and/or destroyed their population declined rapidly. In contrast the Hyla arborea did not experience a similar decline in Southern Europe where the alteration of their habitat was not to as great an extent (Schneider 296-297). However, it is not only these direct changes that effect the frog populations, but also much more indirect effects.

Hyla versicolor are freeze tolerant to -3.0 degrees Celsius (Layne 1989). Additionally, Rana sylvatica are tolerant to -3.5 degrees Celsius (Crerar 1988). These are relatively high temperatures considering that the habitats of these frogs stretch into the northern reaches of the continental United States where temperatures frequently drop to -20 degrees Celsius and lower. The frogs are protected from this extreme cold by water which has a high specific heat. However, as the water table is lowered by the increased demand for water by residential communities and industry, this water buffer is also decreased in depth in the lakes and ponds. This makes the frogs more susceptible to deadly temperatures below -3 degrees.

Additionally, male Ranid frog sperm are immotile in slightly acidic environments and only become functional when exposed to neutral or slightly alkaline water (Rugh 41). The North American wood frog, which is known to be tolerant of acidic conditions, has not experienced as great a decline as other species (Barinaga 1990). As more and more chemicals, from not only industry but also from simple household cleaners, infiltrate the groundwater the pH will also change. Because the pH for active sperm is fairly specific, even modest changes in groundwater pH would affect, if not stop, successful frog reproduction.

Additionally, changes in pH often cause heavy metals to fall out of solution. These heavy metals are known to plate the gills of fish thus suffocating them (Berg 1990). This could also be the case in tadpoles which utilize gills for gas exchange.

There are several other factors that could be causing a decrease in successful reproduction in frogs. The increasing ultra violet radiation reaching the earth due to the thinning ozone layer of the atmosphere may be affecting the development of the frog embryo. Since frogs reproduce externally, their eggs are subject to damage by the environment. They are defenseless against the ionizing effects of UV radiation. The increase in UV radiation may be causing a higher than normal number of less advantageous and lethal genetic mutations, thus contributing to the decrease in the overall populations of frogs.

It is also worth noting that frog calling was very high on nights when there were high numbers of mosquitoes emerging. It is possible that the vibrations from some frog calling patterns may attract mosquitoes and other insects, thus some calling may not be for mating purposes only, but also to attract food.

Additionally, as <u>Hyla</u> <u>versicolor</u> calling decreased through the night, <u>Rana</u> <u>clamitans</u>' calling increased. This could be a method by which competition for breeding sites is eliminated between species. Twice as many mating territories would be available to each species if there is no competition. This would be beneficial especially in cases where sites conducive to mating are limited in number.

Another phenomenon that occurred was that *Hyla versicolor* mating behavor at site "A" ended over one month before mating at site "B" discontinued. Since these two locations were approximately two miles from one another the environmental conditions were almost identical. The mating season at site "A" most likely occurred earlier than at site "B" because "A" is a semi-vernal pond, which potentially could have dried out late in the summer, thus killing the tadpoles. Conversely, site "B" is a lake, which does not dry out, thus tadpoles could remain viable later into the season. The frogs at site "A" adapted to the environmental pressure by mating earlier in the season when the environmental conditions were not optimal for reproduction, but the chances of their offspring surviving were greater.

Several complications were encountered through the course of the experiment. The second field experiment was ended because of predation on the frogs in the cages by snakes. In the future smaller cage mesh (1/4 sq.in.) should be used. This would prevent the snakes from entering the cages. It must be noted that the frogs must be fed a minimum of once every two days while in captivity. While fed in captivity, the insects must be placed in close proximity to each individual frog, in order for the Hyla versicolor to feed successfully. The Hyla versicolor did not actively pursue prey in captivity.

Additionally, other researchers' experiments in the lab, and activity in the field, both at night and during the day, may have overly disturbed the frogs and disrupted their normal behavior. Any light after sunset would disrupt their Circadian clock and any noise or commotion from humans could cause stress on the frogs and stop them from calling indefinitely. The population of Hyla versicolor at Firestone Lake (site B) stopped calling in the wild after two hours on the nights when students were capturing them for the experiment. It was observed that not only motion in the proximity of the frog caused calling to cease, but also proximal as well as distant voices caused them to discontinue calling. Additionally, while performing the body temperature experiment it would take each frog approximately fifteen to twenty minutes to recover from being handled before it would begin to call once again. It was also seen that disturbances from cars passing by, especially at site "A," caused the frogs to stop calling. When choosing sites in the future these affects should be taken into consideration.

Frogs, appear to be very selective breeders, in that their mating is governed by a set of interrelated environmental factors. As evidenced in the field, even disturbances as simple as a human voice can disrupt their mating cycle. We need to be aware that changes that humans make on the environment as society "advances" affect the entire ecosystem. Not only major changes such as excavation and construction, but also the simple discharge of chemicals into a septic system can and do affect ecosystems. Further experimentation on the effects of environmental change on frogs is needed because decreases in frog populations could be used as an indicator of environmental contamination. It is not only our duty, but it is quickly becoming a necessity that society become more conscious of the changes that it is affecting in the environment. If we as humans do not become environmentally conscious, not only will the extinction of many creatures result, but also the future of our own species' existence may come into question.

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APPENDIX I

DIFFICULTIES ENCOUNTERED DURING EXPERIMENT

1. The part of the experiment involving frogs in captivity in the wild was hindered by several difficulties. The Rana pipiens, that were first used, were too small to be contained within the 1/2" sq. fence used on the cages.
2. Snakes were able to fit into the cages through the 1/2" sq fence, where they ate the Hyla versicolor.
3. It was difficult to judge the relative intensity of calling. As of now no way has been devised for using the tape recording of the calling. However, this is available for future use.
4. There was one other professor's experiment going on in the research garage at the same time as the laboratory portion of this experiment. The light and noise from that experiment, at night, may have disturbed the frogs.
5. Not taking data during class weeks affected the true integrity of the data. More time to collect data would be helpful. Additionally, very often activities such as trips to lectures and to the grocery store were scheduled at night and these took time away from sampling. In the future more care needs to be taken in scheduling these events around the researcher(s) who work at night.

APPENDIX II

NOTES PERTAINING TO FIELD OBSERVATIONS

NOTES PERTAINING TO FIELD OBSERVATIONS OF FROGS

June 1:

1. found a large population of Rana pipiens in Doughnut Bog
2. put two cages into Donut

June 2:

1. placed ten R. pipiens into each of two cages at Doughnut

June 4:

1. found that many frogs escaped from cages. 1/2" sq. fence was too large for the immature R. pipiens.
2. collected 27 R. pipiens and placed them in styrofoam containers of five frogs each (in lab)

June 5:

1. five frogs escaped through 1/2" sq. fence lids, made new lids out of 1/4" fence.
2. 22 frogs remain
3. feed frogs dragonflies every other day

June 11:

1. thunderclaps seem to temporarily cause calling of H. versicolor to stop

June 12:

1. H. versicolor called during day, high humidity
2. H. versicolor stopped calling after sun came out
3. H. versicolor calling at maximum level during thunderstorm

June 13:

1. a few H. versicolor continue to call all night even several hours after others have stopped

June 14:

1. Calling started briefly, then stopped all night - low humidity

June 15:

1. redesigned project to use Hyla versicolor since the R.

pipiens were too immature to sex (see project outline).

2. transferred the two empty cages from Donut to pond North of camp

June 17:

1. caught 8 H. versicolor from pond North of camp
2. put the frogs into one cage

June 18:

1. all H. versicolor in the three vernal ponds north of camp stopped calling, also H. crucifer stopped calling - calling never started again all summer; however R. clamitans were still calling.

-cold weather over the past week may have caused the abrupt stop in calling

-may be the end of their natural breeding season

June 23:

1. found one garter snake eating a frog in the cage
2. caught the snake and transferred it to a new location

June 25:

1. investigated other sights to find out if H. versicolor were calling anywhere else: found calling at Firestone and Bogpot

July 1:

1. It appears as if one frog seems to attempt to start the others calling. One H. versicolor continuously started and stopped his calling until another H. versicolor responded. Then the number of calling frogs increased steadily
2. One H. versicolor continued calling long after all others stopped. By location it seems to be the same frog that started the calling
3. H. versicolor calling at Bergner, Tuesday, and Raspberry also

July 8:

1. No calling of H. versicolor - maybe because it has been cold for the last few days. Also, it rained the night before (1 inch).

July 9:

1. One H. versicolor called on several occasions. Calling from the same position as the "captain" did on earlier occasions. However, no other HV's responded.
2. No other HV's called.

- may be the end of their breeding season.
- breeding season at firestone may have ended after that of camp due to different environments (firestone is wide open, near camp is tree covered)

3. Noticed that as the mosquitoes became more intense, the calling of R. clamitans became more intense. Their voices may attract mosquitoes.

APPENDIX III

IDEAS

1. Use the large cages to run territory experiments.
2. Begin taking cloacal temperatures of all calling an non-calling *H. versicolor* at the beginning of the mating season.
3. Use *R. clamitans* for the lab experiment, they seem to adapt much better to captivity than do *H. versicolor.*
4. Use 1/4 sq.in. fence on the cages if they are to be put in the wild. This will keep the frogs in and the snakes out.
5. Start the field part of the experiment immediately upon arrival at UNDERC. Take data on all species, this way valuable data will be collected at the beginning of the mating period. Some of this information is missing in this experiment.
6. Call local television station and obtain barometric pressure as often as possible (before and after collecting data each night). This data may show a correlation to calling behavior
7. Have one student work on the field experiment and on work on the lab experiment, that way their data can be compared at a later date.

APPENDIX IV

STATISTICS,
ANOVA, and
PROBABILITIES OF CORRELATION

STATISTICS FOR BODY TEMPERATURE OF *H. versicolor*

```
THE FOLLOWING RESULTS ARE FOR:
           STATUS$     = CALLING

 OTAL OBSERVATIONS:        5


                 BODYTEMP    WATERTEM   AIRTEMP

  N OF CASES              5           5           0
  MINIMUM            23.300      18.700           .
  MAXIMUM            25.300      21.000           .
  RANGE               2.000       2.300           .
  MEAN               23.320      19.920           .
  VARIANCE            0.697       0.767           .
  STANDARD DEV        0.835       0.876           .


THE FOLLOWING RESULTS ARE FOR.
           STATUS$     = NC

TOTAL OBSERVATIONS:       22


                 BODYTEMP    WATERTEM    AIRTEMP

  N OF CASES             22           9          13
  MINIMUM            21.800      22.000      21.400
  MAXIMUM            27.400      22.200      22.700
  RANGE               5.600       0.200       1.300
  MEAN               24.214      22.111      21.938
  VARIANCE            1.686       0.006       0.313
  STANDARD DEV        1.298       0.078       0.559
```

PROBABILITY OF CORRELATION FOR H. VERSICOLOR

where data all = hv for analysis

```
THE FOLLOWING RESULTS ARE FOR:
               SP$      = hv

PEARSON CORRELATION MATRIX


                      CL          HU          AT          WT          LL

        CL          1.000
        HU          0.285       1.000
        AT          0.126      -0.448       1.000
        WT         -0.104      -0.439       0.412       1.000
        LL         -0.234      -0.614       0.667       0.587       1.000


BARTLETT CHI-SQUARE STATISTIC:  200.546 DF=   10 PROB=  .000



MATRIX OF PROBABILITIES


                      CL          HU          AT          WT          LL

        CL          0.000
        HU          0.002       0.000
        AT          0.179       0.000       0.000
        WT          0.267       0.000       0.000       0.000
        LL          0.011       0.000       0.000       0.000       0.000
```

PROBABILITY OF CORRELATION FOR R. CLAMITANS

where data all = rc for analysis

```
THE FOLLOWING RESULTS ARE FOR:
                SP$     = rc

PEARSON CORRELATION MATRIX


                         CL          HU          AT          WT          LL

        CL             1.000
        HU             0.609       1.000
        AT            -0.704      -0.558       1.000
        WT            -0.352      -0.597       0.546       1.000
        LL            -0.458      -0.734       0.699       0.725       1.000


BARTLETT CHI-SQUARE STATISTIC:   229.219 DF=    10 PROB=   .000




MATRIX OF PROBABILITIES


                         CL          HU          AT          WT          LL

        CL             0.000
        HU             0.000       0.000
        AT             0.000       0.000       0.000
        WT             0.002       0.000       0.000       0.000
        LL             0.000       0.000       0.000       0.000       0.000
```

ANALYSIS OF VARIANCE FOR HYLA VERSICOLOR

```
THE FOLLOWING RESULTS ARE FOR:
            CLLL     =         1.000
    4 CASES DELETED DUE TO MISSING DATA.

DEP VAR:       LL      N:      70   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:      683.699

  VARIABLE    COEFFICIENT    STD ERROR     STD COEF TOLERANCE    T     P(2 TAIL)

CONSTANT          375.310       81.718       0.000       .      4.593    0.000

--------------------------------------------------------------------------------

THE FOLLOWING RESULTS ARE FOR:
            CLLL     =         2.000
    1 CASES DELETED DUE TO MISSING DATA.

DEP VAR:       LL      N:      23   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:       46.399

  VARIABLE    COEFFICIENT    STD ERROR     STD COEF TOLERANCE    T     P(2 TAIL)

CONSTANT           10.720        9.675       0.000       .      1.108    0.280

--------------------------------------------------------------------------------

THE FOLLOWING RESULTS ARE FOR:
            CLLL     =         3.000

DEP VAR:       LL      N:      10   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:      230.206

  VARIABLE    COEFFICIENT    STD ERROR     STD COEF TOLERANCE    T     P(2 TAIL)

CONSTANT          108.021       72.798       0.000       .      1.484    0.172

--------------------------------------------------------------------------------

THE FOLLOWING RESULTS ARE FOR:
            CLLL     =         4.000

DEP VAR:       LL      N:       9   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:        1.452

  VARIABLE    COEFFICIENT    STD ERROR     STD COEF TOLERANCE    T     P(2 TAIL)

CONSTANT            0.505        0.484       0.000       .      1.044    0.327

--------------------------------------------------------------------------------
```

```
THE FOLLOWING RESULTS ARE FOR:
             CLLL      =         5.000

DEP VAR:        LL       N:        10   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000       STANDARD ERROR OF ESTIMATE:          0.468

  VARIABLE     COEFFICIENT    STD ERROR     STD COEF TOLERANCE    T    P(2 TAIL)

CONSTANT             0.220        0.148        0.000         .       1.485    0.172
```

```
THE FOLLOWING RESULTS ARE FOR:
               CLH      =         1.000
    1 CASES DELETED DUE TO MISSING DATA.

DEP VAR:       HU       N:       72   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:        19.018

  VARIABLE    COEFFICIENT    STD ERROR    STD COEF TOLERANCE    T     P(2 TAIL)

CONSTANT           66.8[illegible]         2.234         0.000        .       29.922     0.000

------------------------------------------------------------------------------

THE FOLLOWING RESULTS ARE FOR:
               CLH      =         2.000

DEP VAR:       HU       N:       24   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:        19.073

  VARIABLE    COEFFICIENT    STD ERROR    STD COEF TOLERANCE    T     P(2 TAIL)

CONSTANT           77.053         3.893         0.000        .       20.024     0.000

------------------------------------------------------------------------------

THE FOLLOWING RESULTS ARE FOR:
               CLH      =         3.000

DEP VAR:       HU       N:       10   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:        15.820

  VARIABLE    COEFFICIENT    STD ERROR    STD COEF TOLERANCE    T     P(2 TAIL)

CONSTANT           79.500         5.003         0.000        .       15.891     0.000

------------------------------------------------------------------------------

THE FOLLOWING RESULTS ARE FOR:
               CLH      =         4.000

DEP VAR:       HU       N:        9   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:        11.421

  VARIABLE    COEFFICIENT    STD ERROR    STD COEF TOLERANCE    T     P(2 TAIL)

CONSTANT           81.222         3.807         0.000        .       21.335     0.000

------------------------------------------------------------------------------
```

```
THE FOLLOWING RESULTS ARE FOR:
              CLH

DEP VAR:       HU      N:       10  MULTIPLE R:   .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:         7.570

  VARIABLE     COEFFICIENT    STD ERROR     STD COEF TOLERANCE     T     P(2 TAIL)

CONSTANT            35.300        2.395        0.000             35.6[illegible]    0.000
```

```
THE FOLLOWING RESULTS ARE FOR:
              CLAT      =          1.000

DEP VAR:        AT        N:      [illegible]   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000      STANDARD ERROR OF ESTIMATE:         5.000

  VARIABLE     COEFFICIENT     STD ERROR     STD COEF TOLERANCE     T     P(2 TAIL)

CONSTANT             17.255         0.694         0.000        .       24.870     0.000

------------------------------------------------------------------------------------

THE FOLLOWING RESULTS ARE FOR:
              CLAT      =          2.000

DEP VAR:        AT        N:       24   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000      STANDARD ERROR OF ESTIMATE:         2.008

  VARIABLE     COEFFICIENT     STD ERROR     STD COEF TOLERANCE     T     P(2 TAIL)

CONSTANT             16.304         0.410         0.000        .       39.779     0.000

------------------------------------------------------------------------------------

THE FOLLOWING RESULTS ARE FOR:
              CLAT      =          3.000

DEP VAR:        AT        N:       10   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000      STANDARD ERROR OF ESTIMATE:         2.185

  VARIABLE     COEFFICIENT     STD ERROR     STD COEF TOLERANCE     T     P(2 TAIL)

CONSTANT             19.280         0.691         0.000        .       27.907     0.000

------------------------------------------------------------------------------------

THE FOLLOWING RESULTS ARE FOR:
              CLAT      =          4.000

DEP VAR:        AT        N:        9   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000      STANDARD ERROR OF ESTIMATE:         2.926

  VARIABLE     COEFFICIENT     STD ERROR     STD COEF TOLERANCE     T     P(2 TAIL)

CONSTANT             18.056         0.975         0.000        .       18.513     0.000

------------------------------------------------------------------------------------
```

```
THE FOLLOWING RESULTS ARE FOR:
             CLAT      =         5.000

DEP VAR:       AT      N:       10   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:         1.707

  VARIABLE    COEFFICIENT    STD ERROR     STD COEF TOLERANCE    T    P(2 TAIL)

CONSTANT            18.450        0.540        0.000        .     34.179    0.000
```

```
THE FOLLOWING RESULTS ARE FOR:
              CLWT      =          1.000
    5 CASES DELETED DUE TO MISSING DATA.

DEP VAR:       WT       N:       40   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:         3.007

  VARIABLE    COEFFICIENT    STD ERROR    STD COEF TOLERANCE    T    P(2 TAIL)

CONSTANT           21.729        0.476        0.000      .      45.607    0.000

-------------------------------------------------------------------------------

THE FOLLOWING RESULTS ARE FOR:
              CLWT      =          2.000
    4 CASES DELETED DUE TO MISSING DATA.

DEP VAR:       WT       N:       20   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:         3.028

  VARIABLE    COEFFICIENT    STD ERROR    STD COEF TOLERANCE    T    P(2 TAIL)

CONSTANT           20.580        0.677        0.000      .      30.391    0.000

-------------------------------------------------------------------------------

THE FOLLOWING RESULTS ARE FOR:
              CLWT      =          3.000
    1 CASES DELETED DUE TO MISSING DATA.

DEP VAR:       WT       N:        9   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:         2.748

  VARIABLE    COEFFICIENT    STD ERROR    STD COEF TOLERANCE    T    P(2 TAIL)

CONSTANT           20.089        0.916        0.000      .      21.928    0.000

-------------------------------------------------------------------------------

THE FOLLOWING RESULTS ARE FOR:
              CLWT      =          4.000

DEP VAR:       WT       N:        9   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:         2.714

  VARIABLE    COEFFICIENT    STD ERROR    STD COEF TOLERANCE    T    P(2 TAIL)

CONSTANT           21.056        0.905        0.000      .      23.271    0.000

-------------------------------------------------------------------------------
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```
THE FOLLOWING RESULTS ARE FOR:
               CLWT       =          7.000

DEP VAR:        WT       N:        10   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:         1.833

  VARIABLE    COEFFICIENT    STD ERROR     STD COEF TOLERANCE    T    P(2 TAIL)

CONSTANT           20.550        0.580        0.000        .       35.461    0.000
```

ANALYSIS OF VARIANCE FOR RANA CLAMITANS

```
THE FOLLOWING RESULTS ARE FOR:
                CLLL      =          1.000
    3 CASES DELETED DUE TO MISSING DATA.

DEP VAR:       LL       N:       21   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:       861.263

  VARIABLE     COEFFICIENT    STD ERROR     STD COEF TOLERANCE     T     P(2 TAIL)

CONSTANT           947.588      187.943        0.000       .       5.042    0.000

-------------------------------------------------------------------------------------

THE FOLLOWING RESULTS ARE FOR:
                CLLL      =          2.000

DEP VAR:       LL       N:       26   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:       312.476

  VARIABLE     COEFFICIENT    STD ERROR     STD COEF TOLERANCE     T     P(2 TAIL)

CONSTANT           101.286       61.282        0.000       .       1.653    0.111

-------------------------------------------------------------------------------------

THE FOLLOWING RESULTS ARE FOR:
                CLLL      =          3.000

DEP VAR:       LL       N:       21   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:        11.654

  VARIABLE     COEFFICIENT    STD ERROR     STD COEF TOLERANCE     T     P(2 TAIL)

CONSTANT             3.450        2.543        0.000       .       1.357    0.190

-------------------------------------------------------------------------------------

THE FOLLOWING RESULTS ARE FOR:
                CLLL      =          4.000

DEP VAR:       LL       N:        6   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:         0.001

  VARIABLE     COEFFICIENT    STD ERROR     STD COEF TOLERANCE     T     P(2 TAIL)

CONSTANT            -0.000        0.000        0.000       .      -1.004    0.362

-------------------------------------------------------------------------------------
```

```
THE FOLLOWING RESULTS ARE FOR:
                 CLH       =          1.000
     1 CASES DELETED DUE TO MISSING DATA.

DEP VAR:        HU       N:       23   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:        20.362

  VARIABLE    COEFFICIENT    STD ERROR     STD COEF TOLERANCE     T     P(2 TAIL)

CONSTANT           55.087        4.246        0.000      .      12.974     0.000

         ----------------------------------------------------------------------

THE FOLLOWING RESULTS ARE FOR:
                 CLH       =          2.000

DEP VAR:        HU       N:       26   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:        15.671

  VARIABLE    COEFFICIENT    STD ERROR     STD COEF TOLERANCE     T     P(2 TAIL)

CONSTANT           71.346        3.073        0.000      .      23.214     0.000
-------------------------------------------------------------------------------

THE FOLLOWING RESULTS ARE FOR:
                 CLH       =          3.000

DEP VAR:        HU       N:       21   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:         9.148

  VARIABLE    COEFFICIENT    STD ERROR     STD COEF TOLERANCE     T     P(2 TAIL)

CONSTANT           86.238        1.996        0.000      .      43.199     0.000

-------------------------------------------------------------------------------

THE FOLLOWING RESULTS ARE FOR:
                 CLH       =          4.000

DEP VAR:        HU       N:        6   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:         4.708

  VARIABLE    COEFFICIENT    STD ERROR     STD COEF TOLERANCE     T     P(2 TAIL)

CONSTANT           87.167        1.922        0.000      .      45.350     0.000

-------------------------------------------------------------------------------
```

```
THE FOLLOWING RESULTS ARE FOR:
                CLAT       =          1.000
     1 CASES DELETED DUE TO MISSING DATA.

DEP VAR:       AT       N:       23   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:         4.017

  VARIABLE    COEFFICIENT    STD ERROR     STD COEF TOLERANCE     T    P(2 TAIL)

CONSTANT            23.022        0.838        0.000       .      27.484    0.000

THE FOLLOWING RESULTS ARE FOR:
                CLAT       =          2.000

DEP VAR:       AT       N:       26   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:         4.870

  VARIABLE    COEFFICIENT    STD ERROR     STD COEF TOLERANCE     T    P(2 TAIL)

CONSTANT            15.938        0.955        0.000       .      16.688    0.000

THE FOLLOWING RESULTS ARE FOR:
                CLAT       =          3.000

DEP VAR:       AT       N:       21   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:         4.085

  VARIABLE    COEFFICIENT    STD ERROR     STD COEF TOLERANCE     T    P(2 TAIL)

CONSTANT            12.357        0.892        0.000       .      13.861    0.000

THE FOLLOWING RESULTS ARE FOR:
                CLAT       =          4.000

DEP VAR:       AT       N:        6   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:         2.185

  VARIABLE    COEFFICIENT    STD ERROR     STD COEF TOLERANCE     T    P(2 TAIL)

CONSTANT            10.750        0.892        0.000       .      12.050    0.000
```

```
THE FOLLOWING RESULTS ARE FOR:
                CLWT       =          1.000
    3 CASES DELETED DUE TO MISSING DATA.

DEP VAR:       WT       N:       21   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:          4.800

  VARIABLE     COEFFICIENT    STD ERROR     STD COEF TOLERANCE    T     P(2 TAIL)

CONSTANT            24.857        1.047        0.000        .       23.740    0.000

---------------------------------------------------------------------------------

THE FOLLOWING RESULTS ARE FOR:
                CLWT       =          2.000

DEP VAR:       WT       N:       26   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:          1.780

  VARIABLE     COEFFICIENT    STD ERROR     STD COEF TOLERANCE    T     P(2 TAIL)

CONSTANT            22.288        0.349        0.000        .       63.849    0.000

---------------------------------------------------------------------------------

THE FOLLOWING RESULTS ARE FOR:
                CLWT       =          3.000

DEP VAR:       WT       N:       21   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:          1.633

  VARIABLE     COEFFICIENT    STD ERROR     STD COEF TOLERANCE    T     P(2 TAIL)

CONSTANT            21.829        0.356        0.000        .       61.262    0.000

---------------------------------------------------------------------------------

THE FOLLOWING RESULTS ARE FOR:
                CLWT       =          4.000

DEP VAR:       WT       N:        6   MULTIPLE R:  .000  SQUARED MULTIPLE R:  .000
ADJUSTED SQUARED MULTIPLE R:  .000     STANDARD ERROR OF ESTIMATE:          0.464

  VARIABLE     COEFFICIENT    STD ERROR     STD COEF TOLERANCE    T     P(2 TAIL)

CONSTANT            21.450        0.189        0.000        .      113.314    0.000

---------------------------------------------------------------------------------
```

APPENDIX V

RAW DATA

HYLA VERSICOLOR

	CALL LEVEL	HUMIDITY	AIR TEMP	WATER TEMP	LIGHT LEVEL
1	5.000	79.000	15.000	17.000	3.977
2	7.000	82.000	14.000	17.000	0.032
3	1.000	75.000	15.500	15.000	0.000
4	2.000	78.000	15.000	17.000	-0.001
5	2.000	91.000	20.000	17.000	222.900
6	4.000	99.000	21.000	17.000	451.800
7	0.000	99.000	22.000	17.000	594.700
8	4.000	99.000	22.000	17.000	624.100
9	0.000	81.000	22.000	17.000	411.900
10	8.000	82.000	22.000	18.000	4.337
11	9.000	91.000	21.000	18.000	1.200
12	9.000	100.000	20.000	18.000	1.050
13	10.000	81.000	19.000	18.000	0.000
14	2.000	51.000	19.500		0.000
15	1.000	50.000	18.500		0.000
16	0.000	50.000	18.000		0.000
17	6.000	48.000	20.000	22.000	0.307
18	8.000	61.000	20.000	22.000	0.023
19	9.000	75.000	20.000	22.000	0.002
20	9.000	80.000	18.500	22.000	0.000
21	9.000	80.000	18.000	22.000	-0.003
22	10.000	82.000	18.000	22.000	0.000
23	10.000	85.000	18.000	22.000	-0.003
24	9.000	85.000	17.000	21.000	-0.003
25	7.000	85.000	17.500	21.000	-0.002
26	4.000	65.000	19.000	20.000	-0.002
27	3.000	49.000	20.000		
28	0.000	30.000	18.500		
29	1.000	30.000	20.000		0.453
30	0.000	60.000	14.000	18.500	0.000
31	0.000	63.000	14.000	18.500	-0.001
32	0.000	45.000	15.000		
33	3.000	43.000	18.000	19.000	1.061
34	5.000	69.000	17.500	19.000	0.005
35	2.000	71.000	16.500	18.500	-0.002
36	0.000	73.000	16.000	18.500	-0.001
37	6.000	86.000	21.000		-0.001
38	7.000	65.000	20.600	26.400	0.095
39	0.000		25.000	27.000	1752.000
40	0.000	54.000	26.000	22.000	1829.000
41	5.000	78.000	21.200	23.700	0.025
42	6.000	81.000	18.700	23.500	0.002
43	7.000	90.000	17.800	22.600	-0.001
44	5.000	91.000	17.400	21.600	-0.001
45	0.000	90.000	17.500	22.000	0.000
46	7.000	81.000	20.500	21.500	0.026
47	8.000	89.000	16.000	21.000	0.000
48	9.000	94.000	15.000	20.500	-0.002
49	7.000	96.000	14.100	20.000	-0.002
50	1.000	96.000	14.000	20.000	0.000
51	1.000	96.000	14.000	20.000	-0.001
52	0.000	50.000	23.000	24.500	1193.000
53	0.000	30.000	22.000	21.000	211.800
54	0.000	58.000	16.000	19.500	32.770
55	0.000	61.000	15.000	19.200	7.378
56	0.000	69.000	14.000	19.000	1.842

HYLA VERSICOLOR

	CALL LEVEL	HUMIDITY	AIR TEMP	WATER TEMP	LIGHT LEVEL
57	0.000	74.000	13.500	18.500	0.007
58	0.000	79.000	13.000	18.200	-0.002
59	0.000	79.000	13.000	18.000	-0.003
60	0.000	79.000	13.000	18.000	-0.003
61	0.000	59.000	14.500	16.000	64.370
62	0.000	64.000	16.000	16.000	6.333
63	0.000	80.000	16.000	16.000	0.325
64	0.000	81.000	16.000	16.000	0.012
65	0.000	81.000	16.000	16.000	-0.002
66	0.000	81.000	16.000	16.000	-0.001
67	0.000	83.000	16.500	16.000	-0.001
68	0.000	70.000	18.500	23.500	46.190
69	0.000	74.000	17.200	23.500	25.390
70	1.000	82.000	15.500	23.500	7.483
71	1.000	83.000	15.500	23.500	3.745
72	0.000	84.000	16.000	23.500	2.118
73	1.000	86.000	16.000	23.500	0.000
74	1.000	90.000	16.000	23.500	0.038
75	2.000	90.000	16.000	23.000	0.001
76	3.000	95.000	14.300	23.000	0.001
77	1.000	96.000	14.100	22.000	-0.001
78	1.000	96.000	14.000	22.000	0.000
79	0.000	55.000	13.800	20.500	0.018
80	0.000	69.000	12.000	20.500	0.000
81	0.000	78.000	11.500	20.000	0.002
82	0.000	70.000	19.100	25.200	52.330
83	0.000	80.000	15.000	23.100	21.520
84	0.000	86.000	16.100	23.400	1.205
85	1.000	86.000	17.100	23.300	0.491
86	1.000	89.000	15.300	23.000	0.055
87	1.000	87.000	14.500	22.800	0.002
88	0.000	89.000	14.000	22.200	-0.002
89	0.000	89.000	12.200	21.500	0.000
90	0.000	89.000	12.000	21.200	0.001
91	0.000	45.000	18.500	21.500	61.310
92	0.000	60.000	14.200	20.500	26.770
93	0.000	74.000	10.500	20.500	1.928
94	0.000	80.000	10.500	22.500	0.031
95	0.000	84.000	10.000	22.000	-0.001
96	0.000	84.000	10.000	21.000	0.000
97	0.000	85.000	11.000	21.000	-0.002
98	0.000	51.000	8.600	21.500	25.970
99	0.000	74.000	7.900	20.500	2.871
100	0.000	82.000	6.900	20.500	0.035
101	0.000	85.000	5.900	20.100	0.001
102	0.000	88.000	4.900	19.900	-0.001
103	0.000	88.000	4.300	19.500	-0.001
104	0.000	90.000	17.300	21.500	-0.001
105	0.000	38.000	13.000	22.000	70.090
106	0.000	52.000	20.000		
107	0.000	80.000	20.000		
108	0.000	37.000	25.000	22.000	1777.000
109	0.000	48.000	23.500	18.000	378.000
110	0.000	45.000	25.000	19.500	1901.000
111	0.000	73.000	22.800	21.000	0.407
112	0.000	90.000	19.000	21.000	0.000

HYLA VERSICOLOR

	CALL LEVEL	HUMIDITY	AIR TEMP	WATER TEMP	LIGHT LEVEL
113	0.000	90.000	19.000	21.000	-0.001
114	0.000	93.000	19.300	21.000	-0.002
115	0.000	48.000	27.500	26.000	1249.000
116	0.000	60.000	24.400	23.700	355.800
117	0.000	65.000	19.100	22.100	0.144
118	0.000	78.000	23.100	19.500	425.000
119	0.000	46.000	32.000	29.000	2253.000
120	0.000	49.000	27.000	31.000	1746.000
121	0.000	66.000	22.200	23.500	78.480
122	0.000	44.000	26.800	32.000	1890.000
123	0.000	35.000	25.500	30.200	1239.000
124	0.000	29.000	22.000	31.900	1941.000
125	0.000	32.000	21.500	31.200	1907.000
126	0.000	34.000	27.800	31.500	1914.000
127	0.000	35.000	24.000	25.100	774.000

RANA CLAMITANS

	CALL LEVEL	HUMIDITY	AIR TEMP	WATER TEMP	LIGHT LEVEL
1	1.000	82.000	22.000	18.000	4.337
2	1.000	45.000	27.000	26.000	1128.000
3	1.000	78.000	21.200	23.700	0.025
4	1.000	81.000	18.700	23.500	0.002
5	2.000	90.000	17.800	22.600	-0.001
6	4.000	91.000	17.400	21.600	-0.001
7	3.000	90.000	17.500	22.000	0.000
8	1.000	81.000	20.500	21.500	0.026
9	1.000	89.000	16.000	21.000	0.000
10	4.000	94.000	15.000	20.500	-0.002
11	4.000	96.000	14.100	20.000	-0.002
12	4.000	96.000	14.000	20.000	0.000
13	4.000	96.000	14.000	20.000	-0.001
14	1.000	70.000	18.500	23.500	46.190
15	1.000	74.000	17.200	23.500	25.390
16	1.000	82.000	15.500	23.500	7.483
17	4.000	84.000	16.000	23.500	2.118
18	2.000	90.000	16.000	23.500	0.038
19	1.000	90.000	16.000	23.000	0.001
20	4.000	95.000	14.300	23.000	0.001
21	6.000	96.000	14.100	22.000	-0.001
22	7.000	96.000	14.000	22.000	0.000
23	1.000	55.000	13.800	20.500	0.018
24	2.000	69.000	12.000	20.500	0.000
25	3.000	78.000	11.500	20.000	0.002
26	4.000	70.000	19.100	25.200	52.330
27	1.000	80.000	15.000	23.100	21.520
28	4.000	86.000	16.100	23.400	1.205
29	4.000	89.000	15.300	23.000	0.055
30	5.000	89.000	14.000	22.200	-0.002
31	6.000	89.000	12.200	21.500	0.000
32	7.000	89.000	12.000	21.200	0.001
33	1.000	45.000	18.500	21.500	61.310
34	1.000	60.000	14.200	20.500	26.770
35	4.000	74.000	10.500	20.500	1.928
36	5.000	80.000	10.500	22.500	0.031
37	7.000	84.000	10.000	22.000	-0.001
38	8.000	84.000	10.000	21.000	0.000
39	8.000	85.000	11.000	21.000	-0.002
40	1.000	51.000	8.600	21.500	25.970
41	2.000	74.000	7.900	20.500	2.871
42	3.000	82.000	6.900	20.500	0.035
43	4.000	85.000	5.900	20.100	0.001
44	5.500	88.000	4.900	19.900	-0.001
45	5.000	88.000	4.300	19.500	-0.001
46	1.000	43.000	18.000	24.000	52.640
47	1.000	55.000	11.200	24.100	25.060
48	5.000	62.000	10.900	24.000	14.780
49	2.000	71.000	9.900	23.000	2.722
50	4.000	79.000	8.800	23.100	0.041
51	5.000	84.000	8.100	22.900	0.000
52	7.000	85.000	7.500	21.500	0.000
53	8.500	86.000	6.900	20.500	-0.001
54	0.000	38.000	13.000	22.000	70.090
55	1.000	50.000	23.000	24.500	1193.000
56	0.000	52.000	20.000		

RANA CLAMITANS

	CALL LEVEL	HUMIDITY	AIR TEMP	WATER TEMP	LIGHT LEVEL
57	0.000	80.000	20.000		
58	0.000	37.000	25.000	22.000	1777.000
59	0.000	48.000	23.500	18.000	378.000
60	0.000	45.000	25.000	19.500	1901.000
61	0.000	73.000	22.800	21.000	0.407
62	0.000	90.000	19.000	21.000	0.000
63	0.000	90.000	19.000	21.000	-0.001
64	0.000	93.000	19.300	21.000	-0.002
65	0.000	48.000	27.500	26.000	1249.000
66	0.000	60.000	24.400	23.700	355.800
67	0.000	65.000	19.100	22.100	0.144
68	0.000	78.000	23.100	19.500	425.000
69	0.000	46.000	32.000	29.000	2253.000
70	0.000	49.000	27.000	31.000	1746.000
71	0.000	66.000	22.200	23.500	78.480
72	0.000	44.000	26.800	32.000	1890.000
73	0.000	35.000	25.500	30.200	1239.000
74	0.000	29.000	22.000	31.900	1941.000
75	0.000	32.000	21.500	31.200	1907.000
76	0.000	34.000	27.800	31.500	1914.000
77	0.000	35.000	24.000	25.100	774.000

HYLA VERSICOLOR
BODY TEMP

Sat, Oct 27, 1990 PM

	STATUS	WATER TEMP	AIR TEMP	BODY TEMP
1	CALLING	21.000		23.300
2	CALLING	20.000		25.300
3	CALLING	20.400		23.600
4	CALLING	19.500		23.500
5	CALLING	18.700		23.400
6	NON-CALLING	22.200		24.700
7	NON-CALLING	22.200		24.600
8	NON-CALLING	22.200		23.600
9	NON-CALLING	22.100		24.100
10	NON-CALLING	22.100		26.300
11	NON-CALLING	22.100		24.500
12	NON-CALLING	22.100		24.200
13	NON-CALLING	22.000		27.400
14	NON-CALLING	22.000		24.200
15	NON-CALLING		22.700	24.500
16	NON-CALLING		22.700	24.700
17	NON-CALLING		22.700	25.100
18	NON-CALLING		22.600	25.200
19	NON-CALLING		22.000	23.900
20	NON-CALLING		22.000	24.100
21	NON-CALLING		21.900	24.100
22	NON-CALLING		21.600	24.800
23	NON-CALLING		21.400	24.100
24	NON-CALLING		21.400	22.100
25	NON-CALLING		21.400	22.700
26	NON-CALLING		21.400	22.000
27	NON-CALLING		21.400	21.800

DATA FOR STATISTICAL ANALYSIS

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                    DATE        [illegible]  [illegible]   MOON        [illegible]

                    [illegible]  [illegible]  TM           [illegible]  [illegible]

                    WT          BP           [illegible]   [illegible]  [illegible]

[illegible]         70790.000   25.400        .             .            .
[illegible]                      .            .             .            .
CASE     1              .        .            .
CASE     2         110690.000   0.000         .             .            .
CASE     2              all     0.000      1400.000       52.000       20.000
CASE     2              .        .            .             ca          cldy
CASE     3         120690.000  20.000         .                          .
CASE     3              all     0.000      1400.000       30.000       20.000
CASE     3              .        .            .             ca         tstorm
CASE     4         130690.000   7.000         .             .           0.027
CASE     4              all     0.000      1400.000       37.000       25.000
CASE     4             22.000    .         1777.000         ca          clear
CASE     5         170690.000   2.000         .             .           0.029
CASE     5              all     0.000      1400.000       48.000       23.500
CASE     5             18.000    .          378.000         ca          cldy
CASE     6         250690.000    .            .             .            .
CASE     6              all     0.000      1400.000       45.000       25.000
CASE     6             19.500    .         1901.000         ca          clear
CASE     7         250690.000    .            .             .            .
CASE     7              all     0.000      2100.000       73.000       22.800
CASE     7             21.000    .            0.407         ca          cldy
CASE     8         250690.000    .            .             .            .
CASE     8              all     0.000      2200.000       90.000       19.000
CASE     8             21.000    .           -0.000         ca          cldy
CASE     9         250690.000    .            .             .            .
CASE     9              all     0.000      2230.000       90.000       19.000
CASE     9             21.000    .           -0.001         ca          cldy
CASE    10         250690.000    .            .             .            .
CASE    10              all     0.000      2300.000       93.000       19.200
CASE    10             21.000    .           -0.002         ca         tstorm
CASE    11         260690.000    .            .             .            .
CASE    11              all     0.000      1730.000       48.000       27.500
CASE    11             26.000    .         1249.000       beaver        clear
CASE    12         270690.000   0.000         .             .            .
CASE    12              all     0.000      1400.000       60.000       24.400
CASE    12             23.700    .          355.800         ca          cldy
CASE    13         270690.000   0.000         .             .            .
CASE    13              all     0.000      2100.000       65.000       19.100
CASE    13             22.100    .            0.144         ca          cldy
CASE    14         280690.000   0.000         .             .            .
CASE    14              all     0.000      1400.000       78.000       23.100
CASE    14             19.500    .          425.000         ca          cldy
CASE    15         290690.000   3.000         .             .           0.026
CASE    15              all     0.000      1400.000       46.000       32.000
CASE    15             29.000    .         2253.000         fr          clear
CASE    16         300690.000   0.000         .             .           [illegible]
CASE    16              all     0.000      1400.000       49.000       27.000
CASE    16             31.000    .         1746.000         fr          clear
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CASE   17        [illegible]       0.000           .            .     [illegible]
CASE   17        [illegible]       0.000   [illegible]       96.000        22.200
CASE   17        [illegible]            [illegible]              fr          cldy
CASE   18         90790.000       0.000            .            .         0.015
CASE   18               all       0.000     1400.000       44.000        26.800
CASE   18            32.000           .     1900.000           fr         clear
CASE   19        100790.000       0.000            .            .         0.015
CASE   19               all       0.000     1400.000       35.000        25.500
CASE   19            30.200           .     1200.000           fr          cldy
CASE   20        110790.000       0.000            .            .             .
CASE   20               all       0.000     1400.000       29.000        22.000
CASE   20            31.000           .     1941.000           fr         clear
CASE   21        120790.000       0.000            .            .         0.016
CASE   21               all       0.000     1400.000       32.000        21.500
CASE   21            31.200           .     1907.000           fr         clear
CASE   22        130790.000       0.000            .            .         0.031
CASE   22               all       0.000     1400.000       34.000        27.800
CASE   22            31.500           .     1914.000           fr         clear
CASE   23        140790.000       0.000            .            .         0.032
CASE   23               all       0.000     1400.000       35.000        24.000
CASE   23            25.100           .      774.000           fr          cldy
CASE   24        120690.000      20.000            .            .             .
CASE   24                hc       1.000     2000.000       91.000        21.000
CASE   24            18.000           .        1.200           ca        tstorm
CASE   25        120690.000      20.000            .            .             .
CASE   25                hc       1.000     2245.000       81.000        19.000
CASE   25            18.000           .        0.000           ca        tstorm
CASE   26        130690.000       7.000            .            .         0.027
CASE   26                hc       2.000      145.000       51.000        19.500
CASE   26                 .           .        0.000           ca          cldy
CASE   27        130690.000       7.000            .            .         0.027
CASE   27                hc       2.000      300.000       50.000        18.000
CASE   27                 .           .        0.000           ca          cldy
CASE   28        130690.000       7.000            .            .         0.027
CASE   28                hc       4.000     2105.000       48.000        20.000
CASE   28            22.000           .        0.307           ca         clear
CASE   29        130690.000       7.000            .            .         0.027
CASE   29                hc       5.000     2130.000       61.000        20.000
CASE   29            22.000           .        0.023           ca         clear
CASE   30        130690.000       7.000            .            .         0.027
CASE   30                hc       5.000     2145.000       75.000        20.000
CASE   30            22.000           .        0.002           ca         clear
CASE   31        130690.000       7.000            .            .         0.027
CASE   31                hc       3.000     2200.000       80.000        18.500
CASE   31            22.000           .       -0.000           ca         clear
CASE   32        130690.000       7.000            .            .         0.027
CASE   32                hc       3.000     2215.000       80.000        18.000
CASE   32            22.000           .       -0.003           ca         clear
CASE   33        130690.000       7.000            .            .         0.027
CASE   33                hc       1.000     2230.000       82.000        18.000
CASE   33            22.000           .       -0.000           ca         clear
CASE   34        130690.000       7.000            .            .         0.027
CASE   34                hc       0.000     2300.000       85.000        18.000
CASE   34            22.000           .       -0.003           ca         clear
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CASE   35        [illegible]  [illegible]            .             .        0.02[illegible]
CASE   35                 hc       0.000      2000.000        85.000       17.[illegible]
CASE   35        [illegible]           .         0.004            ca      [illegible]
CASE   36         170690.000       2.000             .             .         0.020
CASE   36                 hc       2.000      2100.000        43.000        18.000
CASE   36             18.000           .         0.001            ca          cldy
CASE   37         170690.000       2.000             .             .         0.029
CASE   37                 hc       3.000      2180.000        63.000        17.500
CASE   37             19.000           .         0.005            ca          cldy
CASE   38         170690.000       2.000             .             .         0.023
CASE   38                 hc       0.000      2230.000        71.000        16.500
CASE   38             18.500           .        -0.002            ca          cldy
CASE   39         170690.000       2.000             .             .         0.021
CASE   39                 hc       0.000      2300.000        73.000        19.000
CASE   39             18.500           .        -0.001            ca          cldy
CASE   40         110690.000       0.000             .             .             .
CASE   40                 hv       5.000      2045.000        79.000        15.000
CASE   40             17.000           .         3.977            ca
CASE   41         110690.000       0.000             .             .             .
CASE   41                 hv       7.000      2120.000        82.000        14.000
CASE   41             17.000           .         0.032            ca
CASE   42         110690.000       0.000             .             .             .
CASE   42                 hv       1.000      2145.000        75.000        15.500
CASE   42             15.000           .        -0.000            sg
CASE   43         110690.000       0.000             .             .             .
CASE   43                 hv       2.000      2225.000        78.000        15.000
CASE   43             17.000           .        -0.002            ca
CASE   44         120690.000      20.000             .             .             .
CASE   44                 hv       2.000      1530.000        91.000        20.000
CASE   44             17.000           .       222.900            ca
CASE   45         120690.000      20.000             .             .             .
CASE   45                 hv       4.000      1535.000        99.000        21.000
CASE   45             17.000           .       451.800            ca          cldy
CASE   46         120690.000      20.000             .             .             .
CASE   46                 hv       0.000      1538.000        99.000        22.000
CASE   46             17.000           .       594.700            ca          cldy
CASE   47         120690.000      20.000             .             .             .
CASE   47                 hv       4.000      1542.000        99.000        22.000
CASE   47             17.000           .       624.100            ca          cldy
CASE   48         120690.000      20.000             .             .             .
CASE   48                 hv       0.000      1610.000        81.000        22.000
CASE   48             17.000           .       411.900            ca          cldy
CASE   49         120690.000      20.000             .             .             .
CASE   49                 hv       8.000      1950.000        82.000        22.000
CASE   49             18.000           .         4.377            ca          rain
CASE   50         120690.000      20.000             .             .             .
CASE   50                 hv       9.000      2000.000        91.000        21.000
CASE   50             18.000           .         1.200            ca        tstorm
CASE   51         120690.000      20.000             .             .             .
CASE   51                 hv      10.000      2015.000       100.000        20.000
CASE   51             18.000           .         1.005            ca        tstorm
CASE   52         120690.000      20.000             .             .             .
CASE   52                 hv      10.000      2245.000        81.000        19.000
CASE   52             18.000           .         0.000            ca        tstorm
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CASE     53      130690.000      7.000          .            .          0.027
CASE     53              hv      2.000    145.000       51.000         19.500
CASE     53                          .      0.000           ca           cldy
CASE     54      130690.000      7.000          .            .          0.027
CASE     54              hv [illegible]   215.000       50.000         18.500
CASE     54                          .      0.000           ca           cldy
CASE     55      130690.000      7.000          .            .          0.027
CASE     55              hv      0.000    200.000       50.000         18.000
CASE     55               .          .      0.000           ca           cldy
CASE     56      130690.000      7.000          .            .          0.027
CASE     56              hv      6.000   2105.000       48.000         20.000
CASE     56          22.000          .      0.307           ca          clear
CASE     57      130690.000      7.000          .            .          0.027
CASE     57              hv      8.000   2130.000       61.000         20.000
CASE     57          22.000          .      0.023           ca          clear
CASE     58      130690.000      7.000          .            .          0.027
CASE     58              hv      9.000   2145.000       75.000         20.000
CASE     58          22.000          .      0.002           ca          clear
CASE     59      130690.000      7.000          .            .          0.027
CASE     59              hv     10.000   2200.000       80.000         18.500
CASE     59          22.000          .     -0.000           ca          clear
CASE     60      130690.000      7.000          .            .          0.027
CASE     60              hv     10.000   2215.000       80.000         18.000
CASE     60          22.000          .     -0.003           ca          clear
CASE     61      130690.000      7.000          .            .          0.027
CASE     61              hv     10.000   2230.000       82.000         18.000
CASE     61          22.000          .     -0.000           ca          clear
CASE     62      130690.000      7.000          .            .          0.027
CASE     62              hv     10.000   2300.000       85.000         18.000
CASE     62          22.000          .     -0.003           ca          clear
CASE     63      130690.000      7.000          .            .          0.027
CASE     63              hv      9.000   2330.000       85.000         17.000
CASE     63          21.000          .     -0.004           ca          clear
CASE     64      140690.000      0.000          .            .          0.028
CASE     64              hv      7.000      0.000       55.000         17.500
CASE     64          21.000          .     -0.002           ca          clear
CASE     65      140690.000      0.000          .            .          0.028
CASE     65              hv      5.000     30.000       65.000         19.000
CASE     65          20.000          .     -0.002           ca          clear
CASE     66      140690.000      0.000          .            .          0.028
CASE     66              hv      3.000    130.000       49.000         20.000
CASE     66               .          .          .           ca          clear
CASE     67      140690.000      0.000          .            .          0.028
CASE     67              hv      0.000    305.000       30.000         18.500
CASE     67               .          .          .           ca          clear
CASE     68      140690.000      0.000          .            .          0.028
CASE     68              hv      0.000   1400.000            .         25.000
CASE     68          27.000          .   1752.000           ca          clear
CASE     69      140690.000      0.000          .            .          0.028
CASE     69              hv      1.000   2110.000       30.000         20.000
CASE     69               .          .      0.453           ca          clear
CASE     70      140690.000      0.000          .            .          0.028
CASE     70              hv      0.000   2200.000       60.000         14.000
CASE     70          18.500          .     -0.000           ca          clear
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CASE   71      1406[illegible]     0.000           .           .   [illegible]
CASE   71            hv     0.000    2000.000      60.000      14.500
CASE   71      1[illegible].500         .      -0.001          ca  [illegible]
CASE   72      140690.000     0.000           .           .   [illegible]
CASE   72            hv     0.000    1400.000      45.000      15.000
CASE   72   [illegible]         .           .          ca       clear
CASE   73      150690.000     0.000           .           .       0.028
CASE   73            hv     0.000    1400.000  [illegible]  [illegible]
CASE   73          21.000         .  [illegible]          ca        cldy
CASE   74      150690.000     0.000           .           .       0.028
CASE   74            hv     0.000    2010.000  [illegible]  [illegible]
CASE   74          18.500         .      32.770          ca        cldy
CASE   75      150690.000     0.000           .           .       0.028
CASE   75            hv     0.000    2030.000      61.000  [illegible]
CASE   75          19.000         .       7.378          ca        cldy
CASE   76      150690.000     0.000           .           .       0.028
CASE   76            hv     0.000    2100.000      69.000      14.000
CASE   76          19.000         .       1.342          ca        cldy
CASE   77      150690.000     0.000           .           .       0.028
CASE   77            hv     0.000    2130.000      74.000      13.500
CASE   77          18.500         .       0.007          ca        cldy
CASE   78      150690.000     0.000           .           .       0.028
CASE   78            hv     0.000    2200.000      76.000      13.000
CASE   78          18.200         .      -0.002          ca        cldy
CASE   79      150690.000     0.000           .           .       0.028
CASE   79            hv     0.000    2230.000      79.000      13.000
CASE   79          18.000         .      -0.003          ca        cldy
CASE   80      150690.000     0.000           .           .       0.028
CASE   80            hv     0.000    2300.000      79.000      13.000
CASE   80          18.000         .      -0.003          ca        cldy
CASE   81      160690.000    20.000           .           .       0.032
CASE   81            hv     0.000    1400.000      59.000      14.500
CASE   81          16.000    29.790      64.370          ca        cldy
CASE   82      160690.000    20.000           .           .       0.032
CASE   82            hv     0.000    2030.000      64.000      16.000
CASE   82          15.000         .       6.333          ca        rain
CASE   83      160690.000    20.000           .           .       0.032
CASE   83            hv     1.000    2100.000      80.000      16.000
CASE   83          16.000         .       0.325          ca        rain
CASE   84      160690.000    20.000           .           .       0.032
CASE   84            hv     1.000    2130.000      81.000      16.000
CASE   84          16.000         .       0.012          ca        rain
CASE   85      160690.000    20.000           .           .       0.032
CASE   85            hv     0.000    2200.000      81.000      16.000
CASE   85          16.000         .      -0.002          ca        rain
CASE   86      160690.000    20.000           .           .       0.032
CASE   86            hv     0.000    2230.000      81.000      16.000
CASE   86          15.000         .      -0.001          ca        cldy
CASE   87      160690.000    20.000           .           .       0.032
CASE   87            hv     0.000    2300.000      83.000      16.500
CASE   87          16.000         .      -0.001          ca        rain
CASE   88      170690.000     2.000           .           .       0.02[illegible]
CASE   88            hv     3.000    2100.000      42.000  [illegible]
CASE   88          19.000         .       1.061          ca        cldy
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CASE    89        170[illegible]      1.000         .          .        0.0[illegible]
CASE    89              hv       5.000   2100.000     69.000    17.000
CASE    89          19.000          .       0.005         ca      cldy
CASE    90      170690.000       0.000          .          .     0.020
CASE    90              hv       0.000   2200.000     [illegible]1.000    16.500
CASE    90          18.500          .      -0.002         ca      cldy
CASE    91      1[illegible]0690.000       0.000          .          .     0.029
CASE    91              hv       0.000   2300.000     73.000    16.000
CASE    91          1[illegible].500          .      -0.001         [illegible]      cldy
CASE    92      250690.000          .          .          .         .
CASE    92              hv       6.000   2310.000     86.000    21.000
CASE    92               .          .      -0.001         fs    tstorm
CASE    93      230690.000          .          .          .     0.036
CASE    93              hv       0.000   1400.000     54.000    26.000
CASE    93          22.000          .    1829.000         ca     clear
CASE    94      260690.000          .          .          .         .
CASE    94              hv       0.000   1700.000     50.000    23.000
CASE    94          24.500          .    1193.000         fs     clear
CASE    95      260690.000          .          .          .         .
CASE    95              hv       7.000   2130.000     65.000    20.600
CASE    95          26.400          .       0.095         fs     clear
CASE    96      270690.000       0.000          .          .     0.020
CASE    96              hv       5.000   2130.000     79.000    21.200
CASE    96          23.700          .       0.025         fs      cldy
CASE    97      270690.000       0.000          .          .     0.020
CASE    97              hv       6.000   2200.000     81.000    18.700
CASE    97          23.500          .       0.002         fs      cldy
CASE    98      270690.000       0.000          .          .     0.020
CASE    98              hv       7.000   2230.000     90.000    17.800
CASE    98          22.600          .      -0.001         fs      cldy
CASE    99      270690.000       0.000          .          .     0.020
CASE    99              hv       5.000   2300.000     91.000    17.400
CASE    99          21.600          .      -0.001         fs      cldy
CASE   100      270690.000       0.000          .          .     0.020
CASE   100              hv       0.000   2330.000     90.000    17.500
CASE   100          22.000          .      -0.000         fs      cldy
CASE   101      270690.000       0.000          .          .     0.020
CASE   101              hv       0.000   2335.000     90.000    17.300
CASE   101          21.500          .      -0.001         fs      cldy
CASE   102      280690.000       0.000          .          .     0.026
CASE   102              hv       7.000   2130.000     81.000    20.500
CASE   102          21.500          .       0.026         fs      cldy
CASE   103      280690.000       0.000          .          .     0.026
CASE   103              hv       8.000   2200.000     89.000    16.000
CASE   103          21.000          .       0.000         fs      cldy
CASE   104      280690.000       0.000          .          .     0.026
CASE   104              hv       9.000   2230.000     94.000    15.000
CASE   104          20.500          .      -0.002         fs     clear
CASE   105      280690.000       0.000          .          .     0.026
CASE   105              hv       7.000   2300.000     96.000    14.100
CASE   105          20.000          .      -0.002         fs     clear
CASE   106      280690.000       0.000          .          .     0.026
CASE   106              hv       1.000   2315.000     96.000    14.000
CASE   106          20.000          .      -0.000         fs     clear
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CASE   107     [illegible]     0.000             .            .    [illegible]
CASE   107                     1.000      2300.000       96.000    [illegible]
CASE   107     [illegible]         .         0.001           fs        clear
CASE   108     300[illegible].000  0.000         .            .        0.018
CASE   108                     0.000      2026.000       70.000       12.500
CASE   108          23.500         .        49.190           fr         cldy
CASE   109     [illegible]     0.000             .            .        0.018
CASE   109              hv     0.000      2030.000       74.000       17.200
CASE   109          23.500         .        25.390           fr         cldy
CASE   110      300690.000     0.000             .            .        0.018
CASE   110              hv     1.000      2050.000       82.000       15.500
CASE   110          23.500         .        17.483           fr         cldy
CASE   111      300690.000     0.000             .            .        0.018
CASE   111              hv     1.000      2056.000       93.000       15.500
CASE   111          23.500         .         3.745           fr         cldy
CASE   112      300690.000     0.000             .            .        0.018
CASE   112              hv     0.000      2100.000       84.000       16.000
CASE   112          23.500         .         2.118           fr         cldy
CASE   113      300690.000     0.000             .            .        0.018
CASE   113              hv     1.000      2106.000       86.000       16.000
CASE   113          23.500         .         0.000           fr         cldy
CASE   114      300690.000     0.000             .            .        0.018
CASE   114              hv     1.000      2130.000       90.000       16.000
CASE   114          23.500         .         0.038           fr         cldy
CASE   115      300690.000     0.000             .            .        0.018
CASE   115              hv     2.000      2200.000       90.000       16.000
CASE   115          23.000         .         0.001           fr         cldy
CASE   116      300690.000     0.000             .            .        0.018
CASE   116              hv     3.000      2230.000       95.000       14.300
CASE   116          23.000         .         0.001           fr         cldy
CASE   117      300690.000     0.000             .            .        0.018
CASE   117              hv     1.000      2300.000       96.000       14.100
CASE   117          22.000         .        -0.001           fr         cldy
CASE   118      300690.000     0.000             .            .        0.018
CASE   118              hv     1.000      2315.000       96.000       14.000
CASE   118          22.000         .         0.000           fr         cldy
CASE   119       80790.000     0.000             .            .        0.018
CASE   119              hv     0.000      2100.000       55.000       13.800
CASE   119          20.500         .         0.018           fr        clear
CASE   120       80790.000     0.000             .            .        0.018
CASE   120              hv     0.000      2200.000       69.000       12.000
CASE   120          20.500         .        -0.000           fr        clear
CASE   121       80790.000     0.000             .            .        0.018
CASE   121              hv     0.000      2230.000       78.000       11.500
CASE   121          20.000         .         0.002           fr        clear
CASE   122       90790.000     0.000             .            .        0.015
CASE   122              hv     0.000      2000.000       70.000       19.100
CASE   122          25.200         .        52.330           fr        clear
CASE   123       90790.000     0.000             .            .        0.015
CASE   123              hv     0.000      2030.000       80.000       15.000
CASE   123          23.100         .        21.520           fr        clear
CASE   124       90790.000     0.000             .            .        0.015
CASE   124              hv     0.000      2100.000       86.000       16.100
CASE   124          23.400         .         1.205           fr         cldy
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CASE   125      90790.000     0.000          .          .        0.015
CASE   125             hv     1.000   2105.000     86.000       17.100
CASE   125         22.000         .      0.401         fr         cldy
CASE   126      90790.000     0.000          .          .        0.015
CASE   126             hv     1.000   2130.000     90.000       15.300
CASE   126         23.000         .      0.055         fr         cldy
CASE   127      90790.000     0.000          .          .        0.015
CASE   127             hv     1.000   2141.000     87.000       14.500
CASE   127         22.300         .      0.002         fr         cldy
CASE   128      90790.000     0.000          .          .        0.015
CASE   128             hv     0.000   2200.000     89.000       14.000
CASE   128         22.200         .     -0.002         fr         cldy
CASE   129      90790.000     0.000          .          .        0.015
CASE   129             hv     0.000   2230.000     89.000       12.200
CASE   129         21.500         .     -0.000         fr        clear
CASE   130      90790.000     0.000          .          .        0.015
CASE   130             hv     0.000   2300.000     89.000       12.000
CASE   130         21.200         .      0.001         fr        clear
CASE   131     100790.000     0.000          .          .        0.016
CASE   131             hv     0.000   2000.000     45.000       18.500
CASE   131         21.500         .     61.310         fr        clear
CASE   132     100790.000     0.000          .          .        0.016
CASE   132             hv     0.000   2030.000     60.000       14.200
CASE   132         20.500         .     26.770         fr        clear
CASE   133     100790.000     0.000          .          .        0.016
CASE   133             hv     0.000   2100.000     74.000       10.500
CASE   133         20.500         .      1.928         fr        clear
CASE   134     100790.000     0.000          .          .        0.016
CASE   134             hv     0.000   2130.000     80.000       10.500
CASE   134         22.500         .      0.031         fr        clear
CASE   135     100790.000     0.000          .          .        0.016
CASE   135             hv     0.000   2200.000     84.000       10.000
CASE   135         22.000         .     -0.001         fr        clear
CASE   136     100790.000     0.000          .          .        0.016
CASE   136             hv     0.000   2230.000     84.000       10.000
CASE   136         21.000         .     -0.000         fr        clear
CASE   137     100790.000     0.000          .          .        0.016
CASE   137             hv     0.000   2300.000     85.000       11.000
CASE   137         21.000         .     -0.002         fr         cldy
CASE   138     120790.000     0.000          .          .        0.016
CASE   138             hv     0.000   2000.000     38.000       13.000
CASE   138         22.000         .     70.090         fr        clear
CASE   139     120790.000     0.000          .          .        0.016
CASE   139             hv     0.000   2030.000     51.000        8.600
CASE   139         21.500         .     25.970         fr        clear
CASE   140     120790.000     0.000          .          .        0.016
CASE   140             hv     0.000   2100.000     74.000        7.900
CASE   140         20.500         .      2.871         fr        clear
CASE   141     120790.000     0.000          .          .        0.016
CASE   141             hv     0.000   2130.000     82.000        6.900
CASE   141         20.500         .      0.035         fr        clear
CASE   142     120790.000     0.000          .          .        0.016
CASE   142             hv     0.000   2200.000     85.000        5.900
CASE   142         20.100         .      0.001         fr        clear
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CASE    143      1207[illegible].000    0.[illegible]           .             .           0.015
CASE    143           [illegible]       0.000   2030.000        88.000         4.000
CASE    143          [illegible].000               -0.001            fr         clear
CASE    144       1207[illegible].000   0.000           .             .           0.015
CASE    144               hv       0.000   [illegible]00.000  [illegible].000         4.300
CASE    144        [illegible]          .      -0.001            fr         clear
CASE    145     [illegible].000   20.000           .             .             .
CASE    145               rc       1.000   1050.000        92.000        22.000
CASE    145           18.000           .      4.[illegible]     [illegible]          rain
CASE    146     [illegible]90.000           .           .             .             .
CASE    146               rc       1.000   1700.000        50.000   [illegible].000
CASE    146           24.500           .   1193.000            fs         clear
CASE    147       [illegible]           .           .             .             .
CASE    147               rc       1.000   1745.000        45.000        27.000
CASE    147           26.000           .   1128.000       bogpot         clear
CASE    148       270690.000       0.000           .             .         0.020
CASE    148               rc       1.000   2130.000        78.000        21.200
CASE    148           23.700           .      0.025            fs          cldy
CASE    149       270690.000       0.000           .             .         0.020
CASE    149               rc       1.000   2200.000        81.000        18.700
CASE    149           20.500           .      0.002            fs          cldy
CASE    150       270690.000       0.000           .             .         0.020
CASE    150               rc       2.000   2230.000        90.000        17.800
CASE    150           22.600           .     -0.001            fs          cldy
CASE    151       270690.000       0.000           .             .         0.020
CASE    151               rc       4.000   2300.000        91.000        17.400
CASE    151           21.600           .     -0.001            fs          cldy
CASE    152       270690.000       0.000           .             .         0.020
CASE    152               rc       3.000   2330.000        90.000        17.500
CASE    152           22.000           .     -0.000            fs          cldy
CASE    153       280690.000       0.000           .             .         0.026
CASE    153               rc       1.000   2130.000        81.000        20.500
CASE    153           21.500           .      0.026            fs          cldy
CASE    154       280690.000       0.000           .             .         0.026
CASE    154               rc       1.000   2200.000        89.000        16.000
CASE    154           21.000           .      0.000            fs          cldy
CASE    155       280690.000       0.000           .             .         0.026
CASE    155               rc       4.000   2230.000        94.000        15.000
CASE    155           20.500           .     -0.002            fs         clear
CASE    156       280690.000       0.000           .             .         0.026
CASE    156               rc       4.000   2300.000        96.000        14.100
CASE    156           20.000           .     -0.002            fs         clear
CASE    157       280690.000       0.000           .             .         0.026
CASE    157               rc       4.000   2315.000        96.000        14.000
CASE    157           20.000           .     -0.000            fs         clear
CASE    158       280690.000       0.000           .             .         0.026
CASE    158               rc       4.000   2330.000        96.000        14.000
CASE    158           20.000           .     -0.001            fs         clear
CASE    159       300690.000       0.000           .             .         0.018
CASE    159               rc       1.000   2026.000        70.000        18.500
CASE    159           23.500           .     46.190            fr          cldy
CASE    160       300690.000       0.000           .             .         0.018
CASE    160               rc       1.000   2030.000        74.000        17.200
CASE    160           23.500           .     25.390            fr          cldy
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CASE  161      300[illegible]      0.000                  .          .      [illegible]
CASE  161                          1.000     2050.000      92.000     [illegible]
CASE  161          20.500                   [illegible]        fr       cldy
CASE  162      300690.000          0.000          .          .          0.018
CASE  162      [illegible]         1.000     2100.000   [illegible]   [illegible]
CASE  162          23.500            .      [illegible]        fr       cldy
CASE  163      300690.000          0.000                     .          0.018
CASE  163              rc          2.000     2130.000      90.000     [illegible]
CASE  163      [illegible]                  [illegible]        fr       cldy
CASE  164      300690.000          0.000          .          .          0.018
CASE  164              rc          1.000     2200.000      90.000     [illegible]
CASE  164          23.000            .          0.001          fr       cldy
CASE  165      300690.000          0.000          .          .          0.018
CASE  165              rc          4.000     2230.000      95.000     14.[illegible]
CASE  165          23.000                       0.001          fr       cldy
CASE  166      300690.000          0.000          .          .          0.018
CASE  166              rc          6.000     2200.000      96.000     14.100
CASE  166          22.000            .         -0.001          fr       cldy
CASE  167      300690.000          0.000          .          .          0.018
CASE  167              rc          7.000     2315.000      96.000     14.000
CASE  167          22.000            .          0.000          fr       cldy
CASE  168       80790.000          0.000          .          .          0.018
CASE  168              rc          1.000     2100.000      55.000     13.800
CASE  168          20.500            .          0.018          fr      clear
CASE  169       80790.000          0.000          .          .          0.018
CASE  169              rc          2.000     2200.000      69.000     12.000
CASE  169          20.500            .         -0.000          fr      clear
CASE  170       80790.000          0.000          .          .          0.018
CASE  170              rc          3.000     2230.000      78.000     11.500
CASE  170          20.000            .          0.002          fr      clear
CASE  171       90790.000          0.000          .          .          0.015
CASE  171              rc          4.000     2000.000      70.000     19.100
CASE  171          25.200            .         52.330          fr      clear
CASE  172       90790.000          0.000          .          .          0.015
CASE  172              rc          1.000     2030.000      80.000     15.000
CASE  172          23.100            .         21.520          fr      clear
CASE  173       90790.000          0.000          .          .          0.015
CASE  173              rc          4.000     2100.000      86.000     16.100
CASE  173          23.400            .          1.205          fr       cldy
CASE  174       90790.000          0.000          .          .          0.015
CASE  174              rc          4.000     2130.000      89.000     15.300
CASE  174          23.000            .          0.055          fr       cldy
CASE  175       90790.000          0.000          .          .          0.015
CASE  175              rc          5.000     2200.000      89.000     14.000
CASE  175          22.200            .         -0.002          fr       cldy
CASE  176       90790.000          0.000          .          .          0.015
CASE  176              rc          6.000     2230.000      89.000     12.200
CASE  176          21.500            .         -0.000          fr      clear
CASE  177       90790.000          0.000          .          .          0.015
CASE  177              rc          7.000     2300.000      89.000     12.000
CASE  177          21.200            .          0.001          fr       clea
CASE  178      100790.000          0.000          .          .          0.016
CASE  178              rc          1.000     2000.000      45.000     [illegible]
CASE  178          21.500            .         61.310          fr      clear
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CASE  179        100790.000     0.000           .            .         0.016
CASE  179                rc     1.000    2030.000       60.000        14.200
CASE  179            20.000         .      25.770           fr         clear
CASE  180        100790.000     0.000           .            .         0.016
CASE  180                rc     4.000    2100.000       74.000        10.500
CASE  180            20.500         .       1.321           fr         clear
CASE  181        100790.000     0.000           .            .         0.016
CASE  181                rc     5.000    2130.000       80.000        10.500
CASE  181            22.500         .       0.013           fr         clear
CASE  182        100790.000     0.000           .            .         0.016
CASE  182                rc     7.000    2200.000       84.000        10.000
CASE  182            22.000         .      -0.001           fr         clear
CASE  183        100790.000     0.000           .            .         0.016
CASE  183                rc     8.000    2230.000       84.000        10.000
CASE  183            21.000         .      -0.000           fr         clear
CASE  184        100790.000     0.000           .            .         0.016
CASE  184                rc     9.000    2300.000       85.000        11.000
CASE  184            21.000         .      -0.002           fr          cldy
CASE  185        120790.000     0.000           .            .         0.016
CASE  185                rc     0.000    2000.000       38.000        13.000
CASE  185            22.000         .      70.090           fr         clear
CASE  186        120790.000     0.000           .            .         0.016
CASE  186                rc     1.000    2030.000       51.000         8.600
CASE  186            21.500         .      25.970           fr         clear
CASE  187        120790.000     0.000           .            .         0.016
CASE  187                rc     2.000    2100.000       74.000         7.900
CASE  187            20.500         .       2.871           fr         clear
CASE  188        120790.000     0.000           .            .         0.016
CASE  188                rc     3.000    2130.000       82.000         6.300
CASE  188            20.500         .       0.035           fr         clear
CASE  189        120790.000     0.000           .            .         0.016
CASE  189                rc     4.000    2200.000       85.000         5.900
CASE  189            20.100         .       0.001           fr         clear
CASE  190        120790.000     0.000           .            .         0.016
CASE  190                rc     5.500    2230.000       88.000         4.900
CASE  190            19.900         .      -0.001           fr         clear
CASE  191        120790.000     0.000           .            .         0.016
CASE  191                rc     5.000    2300.000       88.000         4.300
CASE  191            19.500         .      -0.001           fr         clear
CASE  192        130790.000     0.000           .            .         0.031
CASE  192                rc     1.000    2000.000       43.000        13.000
CASE  192            24.000         .      52.640           fr         clear
CASE  193        130790.000     0.000           .            .         0.031
CASE  193                rc     1.000    2030.000       55.000        11.200
CASE  193            24.100         .      25.060           fr         clear
CASE  194        130790.000     0.000           .            .         0.031
CASE  194                rc     5.000    2041.000       62.000        10.900
CASE  194            24.000         .      14.780           fr         clear
CASE  195        130790.000     0.000           .            .         0.031
CASE  195                rc     2.000    2100.000       71.000         9.900
CASE  195            23.000         .       2.722           fr         clear
CASE  196        130790.000     0.000           .            .         0.031
CASE  196                rc     4.000    2130.000       70.000         8.900
CASE  196            23.100         .       0.041           fr         clear
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CASE   197         130790.000      0.000          .            .       [illegible]
CASE   197                 rs      1.000   2000.000       94.000        9.100
CASE   197             22.000        .        0.000           fr        clear
CASE   198         130790.000      0.000          .            .        0.031
CASE   198                 rs      7.000   2200.000       95.000        7.500
CASE   198             21.500        .        0.000           fr        clear
CASE   199         130790.000      0.000          .            .        0.031
CASE   199                 rs      9.500   2000.000       96.000        5.900
CASE   199             20.500        .       -0.001           fr        clear
CASE   200         270590.000      0.000          .            .       [illegible]
CASE   200               rcat      1.000   2300.000       91.000       17.400
CASE   200             21.600        .       -0.001           fs         cldy
CASE   201         130590.000      0.000          .            .        0.028
CASE   201               rcat      2.000   2300.000       96.000       14.100
CASE   201             20.000        .       -0.002           fs        clear
CASE   202         100790.000      0.000          .            .        0.016
CASE   202                 rs      1.000   2030.000       60.000       14.200
CASE   202             20.500        .       26.770           fr        clear
CASE   203         100790.000      0.000          .            .        0.016
CASE   203                 rs      1.000   2100.000       74.000       10.500
CASE   203             20.500        .        1.928           fr        clear
CASE   204         120790.000      0.000          .            .        0.016
CASE   204                 rs      1.000   2100.000       74.000        7.900
CASE   204             20.500        .        2.871           fr        clear
CASE   205         120790.000      0.000          .            .        0.016
CASE   205                 rs      0.000   2130.000       82.000        6.900
CASE   205             20.500        .        0.035           fr        clear
CASE   206         130790.000      0.000          .            .        0.031
CASE   206                 rs      1.000   2100.000       71.000        9.900
CASE   206             23.000        .        2.722           fr        clear
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