A TEST OF THE MECHANICAL ISOLATION HYPOTHESIS IN TWO SIMILAR SPIDER SPECIES

by

Amy Darby Ware

Thesis submitted to the Faculty of the

Virginia Polytechnic Institute and State University

in partial fulfillment of the requirements for the degree of

Master of Science

in

Zoology

APPROVED:

Brent D. Opell, Chairman | Bruce J. Turner

Bruce Wallace | David A. West

April, 1987

Blacksburg, Virginia

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(ABSTRACT)

External reproductive organs of spiders are often species-specific and are important taxonomic characters in species identification. One explanation of this phenomenon, the mechanical isolation hypothesis was tested in two Nuctenea (Araneidae) species. According to this hypothesis, a lock-and-key isolating mechanism should lead to character displacement (mechanical, ecological, or behavioral) between sympatric species with similar genitalia in order to prevent costly interspecific copulation attempts.

Homologous external genitalia of male and female Nuctenea sclopetaria and N. patagiata were measured, The measurement means and variances were statistically compared to determine if character displacement was occurring between areas of sympatry and allopatry. Differences in both mean and variance were observed, but the number that differed between regions of sympatry and allopatry was not greater than the number that differed between adjacent regions of sympatry. Thus,

these species failed to demonstrate the character displacement predicted by the mechanical isolation hypothesis.

Data collected in the study were also used to test a hypothesis that spider genital features tend to be less variable than overall size features, a hypothesis supported by an earlier study of the primitive spider Hypochilus.

F-tests of coefficients of variation showed measurements of the Nuctenea genitalia to be more variable than first femur length. Differences in environmental pressures and genital complexity between Nuctenea and Hypochilus may explain this disparity.

ACKNOWLEDGEMENTS

This manuscript is dedicated to Mr. and Mrs. Gary Darby and William F. Ware, Jr. Without the love and support of these three wonderful people, this work would never have been completed.

I would like to give my heartfelt thanks to Dr.'s Opell, Turner, Wallace, and West for their insights, assistance, and patience during the course of this research. In particular, I would like to thank Dr. Opell and Dr. W. G. Eberhard for the original idea behind this research, and Dr. Opell for all his invaluable assistance in organizing and carrying out the study. I would also like to thank Paula Cushing for always being there to lend support through the past two years when I needed a shoulder to lean on.

My sincere appreciation goes to the Museum of Comparative Zoology, the American Museum of Natural History, the California Academy of Sciences, and the Field Museum of Natural History for the loan of the specimens necessary to carry out this study.

This work was supported in part by grants from the California Academy of Sciences Exline-Frizzell Fund for Arachnological Research and from the Virginia Tech Department of Biology.

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INTRODUCTION

In spiders, as in many invertebrate groups, differences in the genitalia have been widely used to diagnose and designate species. The external reproductive organs of spiders are often so species-specific that they are used as important taxonomic characters in species identification. The "lock-and-key" mechanism of reproductive isolation postulates that male and female external genitalia are specifically shaped so that during mating they couple correctly only between members of the same species (Mayr 1963). Although this hypothesis is commonly used to explain the often small genitalic differences which separate species, this hypothesis has never been put to a test. One reason for caution in using the lock-and-key mechanism to explain the species-specific nature of genitalia in spiders is that many species have such complicated genitalia that the precise function of the various parts (sclerites) is unknown. If the function of the sclerite is unknown, it is more difficult to explain how shape differences preclude mating. Foelix (1982) states that although it is tempting to postulate a lock-and-key mechanism for external copulatory structures in spiders, there is no evidence for it. Also, although shape differences in sclerites are used to separate species, few studies quantify the variation in these sclerites and none have analyzed patterns of variation over a species' range.

Eberhard (1985) suggests an alternative to the lock-and-key mechanism. He postulates that differences in male pedipalp structures evolved in response to female preference for greater stimulation during mating, rather than as classical isolating mechanisms. If a preference is established by a portion of the females in a population, stabilizing selection may act on palpus size and shape independent of body size. In reviewing the literature on male genitalia and their often species-specific nature, Eberhard suggests five general possibilities for the evolution of differential pedipalp structures.

1. Species isolation by mechanical incompatibility (lock-and-key):

   This explanation requires the development of a pre-mating isolating mechanism (i.e. isolation occurs before mating is allowed to take place); females of a species evolve specialized genitalia which permit insemination only by conspecific males having appropiately shaped pedipalp structures. Eberhard raises several objections to this explanation, the first being that it was originally proposed for insects in which the female genitalia are relatively rigid, whereas the genitalia in many other groups are not rigid and therefore not likely to be capable of any type of mechanical exclusion. Another objection which he raises is that species-specific parts of the male genitalia of some species contact parts of the female genitalia that do not differ among species, a situation inconsistent with the lock-and-key explanation. A strong theoretical objection to the mechanical isolation hypothesis is that selection should favor females that can identify a potential mate's species early in courtship (prior to physical contact), since courtship and copulation are costly for a female (Daly 1978).

2. Species isolation by genitalic stimuli:

According to this explanation male genitalia are used in ways to stimulate the female. It hypothesizes that species identity is determined on the basis of these stimuli and that fertilization is avoided if the stimuli are not appropriate. Eberhard objects to this hypothesis because it predicts that character displacement in the genitalia will occur in ranges of closely related species overlap and that character release will occur when these species are isolated. He claims that although character release may occur in some species, it doesn't appear that either of the observed patterns are common.

3. Pleiotropic effects of alleles selected in other contexts:

This explanation attributes genitalic differences to changes in genes not directly related to genital structure; this selection for other features causes incidental changes in the genitalia. Eberhard postulates that selection for functional genitalia would limit the effect of pleiotropy. However, the effects of pleiotropy are widespread and cannot be discounted when considering differences in genitalia. Dobzhansky and Holz (1943) showed that secondary structures, including spermathecae, in Drosophila melanogaster can be inlulenced by non-related mutants. Eye-color, body-color, and wing-shape mutants, which were not suspected to cause differences in the internal anatomy and other structures, caused changes in the spermathecae of these flies, showing that pleiotropy does indeed have an effect in shaping genitalia.

4. Mechanical "conflict of interest" between males and females:

This explanation proposes that females often evolve more complex genitalia to prevent the male from forcing her into a situation which would not be to her advantage. For example, in the walking stick Callinda bucuspis males will hold the female to prevent her from mating again (Eberhard 1985). In some species the male will deposit a plug to prevent remating (e.g., various lepidopterans, mosquitoes, nematodes, spiders, and rodents) (Taylor 1967, Chapman 1969, Hope 1974, Levi 1959, Voss 1979), or in other cases, scoop out sperm from a previous mating before mating himself (e.g., damselflies) (Waage 1979). Thus, this hypothesis proposes that the female changes her genital structure to prevent this from occurring and the male genitalia changes to fit this new structure. Eberhard proposes that this hypothesis is unlikely because of its prediction that female genitalia evolve in a step-wise fashion corresponding to that of the male; he states that this is often not the case in the primary genitalia. Another objection he raises is that female devices designed to counteract male mating structures which place them at a disadvantage would seem likely in this hypothesis; however, there is a striking lack of such structures actually found in nature.

5. Sexual selection by female choice:

This is the hypothesis that Eberhard puts forward to account for the variety in male genitalia. He proposes that males that are more effective at stimulating a female's genital area, holding themselves in place, or entering the female have a selective advantage because they will have a higher reproductive fitness. He cites two main objections to this argument. The first is that only moderately intense selection is likely to operate on a species whose females remate infrequently. However, he proposes that the effect of natural selection on conspicuous genitalic differences is relatively slow. Another possible objection to his theory is that if females of some species only mate once, this mechanism wouldn't necessarily operate. That is, chance would play a greater role in determining which male a female first mated and there would be no subsequent opportunity for a female to select among males.

OBJECTIVES

The objective of this research is test certain predictions of the mechanical isolation hypothesis. According to the hypothesis, a lock-and-key isolating mechanism should lead to character displacement (mechanical, ecological or behavioral) between species with similar genitalia in order to prevent costly interspecific copulation attempts. When this situation arises, two predictions can potentially be tested. The first prediction is that if the genital features are subject to the influences of character displacement, there should be significant differences in the means of a substantial number of the measurement variables between areas of sympatry and allopatry. Such a difference would suggest that interspecific mating attempts were being avoided. A second prediction of the hypothesis is that if two species with similar genitalia are influenced by interspecific competition for mates, they should become less variable within areas of sympatry. This would also lessen the chances of hybrid copulation attempts, which are both costly and potentially dangerous to the individuals involved. In order to test these predictions, a study was undertaken to examine the effects of overlapping ranges in two spider species with similar genitalic structures. By measuring homologous genitalic structures of sympatric and allopatric specimens, the mean and variance of these structures can be statistically compared between these areas of their ranges. Results of these analyses can then be used to test predictions of the mechanical reproductive isolation hypothesis.

Before selecting study species, four requirements were established. The first was that the species have been recently revised and that specimens are available for study from various museum collections. The second was that the species have similar genitalic structures and occur in areas of sympatry and allopatry only with one another, or that their ranges are completely sympatric with one or more closely related species. This is necessary to insure that any effects detected did not result from interaction between a third species and only one of the two study species. The third condition was that the species have a reasonable size and seasonal overlap that provides the possibility of interbreeding; and the fourth requirement was that an adequate number of specimens are available to permit statistical tests. Surprisingly few spider species meet all of these requirements; however, two species of Nuctenea (Araneidae) met all these criteria -- Nuctenea sclopetaria (Clerck) and Nuctenea patagiata (Clerck) (Fig. 1). Both species are sympatric with Nuctenea cornuta (Clerck); however, the effect of this species can be discounted as it occurs across the entire continental U.S. and probably interacts equally with both species. Nuctenea sclopetaria and N. patagiata pose a particularly interesting problem, as they have regions of sympatry on both the east and west coasts and an area of allopatry for N. patagiata between. Grasshoff (1983) places these species and two others into the genus Larinioides Caporiacco 1934. Their more traditional inclusion in Nuctenea will be followed here.

Species were tested to determine if, within each, there were any changes between regions of sympatry and allopatry which could indicate release of character displacement resulting from intraspecific competition. In regions of sympatry, reduced variability within species diminishes the possibility of interbreeding between the populations. This, and changes across the species' range, indicative of possible geographic variation, were also investigated.

If either the lock-and-key hypothesis or the species isolation by genitalic stimuli hypothesis (1. or 2. above) hold, the homologous genitalic characters within a species should be less variable in the region of sympatry than in allopatry and the interspecific differences in these characters should be more pronounced in regions of sympatry than allopatry, due to effects of character displacement. The region of allopatry should serve as an area of character release within a species, and the homologous structures that contribute to species isolation should be more variable. If this type of variation is not observed, alternative hypotheses to mechanical reproductive isolation would gain support in explaining the small differences in genitalic structures that are currently used to distinguish spider species.

Geographic variation was examined because the patterns of variation within a species must be understood in order avoid the problem of interpreting clinal variation as support for the mechanical isolation hypothesis. A large difference in mean measurement values between regions of sympatry and allopatry could actually be due to clinal variation, rather than the effect of range overlap. For example, if one species showed a lower mean measurement variable in a region of sympatry, this could be interpreted as character displacement caused by the presence of the second species. However, the decrease in mean could actually be due solely to sympatry occurring in the terminal region of a clinally varying feature. To determine whether any potential differences are due to interspecific interactions, the possible effects of geographic variation must be considered.

Another objective of this research was to test a hypothesis presented by Coyle (1985) that genital (palpal) features tend to be less variable than overall size features, implying that stabilizing selection may be occurring as predicted by either the mechanical isolation hypothesis or the sexual selection by female choice hypothesis. Using the same methods described by Coyle, this hypothesis can be further tested at both the population and species levels. The Hypochilus that Coyle studied is a primitive spider with very simple male palps consisting of only two structures. Coyle was only able to take three usable measurements from these palps to test for coefficients of variation. In Hypochilus the female external genitalia are simple and unsclerotized (soft and flexible), making it impossible to evaluate the variability of their external features. By contrast, the male genitalia of N. patagiata and N. sclopetaria consist of five structures from which seventeen measurements of palpal features can be taken. Nuctenea females have scleortized (hardened) external genital plates with a number of measurable features. Therefore, these two species provide an opportunity to test Coyle's predictions in a more advanced spider.

SPIDER MATING SYSTEMS

Spiders have six pairs of appendages -- two anterior pairs of specialized appendages followed by four pairs of walking legs (Fig. 2). The first pair of appendages are the chelicerae, which bear fangs and function in prey capture and defense. The second pair are the pedipalps, small legs used primarily for prey handling.

Spiders are dioecious; that is, the sexes are separate. When females mature, the palp remains leg-like. When male spiders mature, the distal segment of the pedipalp is transformed into an accessory copulatory device, specialized for sperm storage and transfer (Figs. 3 and 5). Because the pedipalp is not a primary copulatory organ, the male spider must fill it with sperm prior to mating. He does this by first building a specialized triangular sperm web. Then he deposits semen from his genital opening (located on the ventral side of the abdomen) onto this web. The palps are dipped alternately into the semen droplet and take up sperm; the male is then ready to mate.

Following ritualized courtship patterns during which the female indicates her willingness to mate, copulation takes place. During copulation, the male's palpal organ is inserted into the female's genital opening (Figs. 4 and 5), and sperm is transfered to her internal sperm receptacles. Here the sperm is stored until the eggs are ready to be fertilized.

GENERAL STRUCTURE OF THE MALE PALPUS

The palp is highly specialized for its role in mating. The distal segment of the palp (the cymbium) has a bulb-like extension that contains a sperm reservoir (Figs. 3 and 5). A duct spirals from this reservoir through this bulb and connects to a projection at the palp's tip. This projection, the embolus, is generally narrow and is the portion of the palpus inserted into the female genital opening during copulation.

The palpal organ consists of hardened (sclerotized) parts (the sclerites) and soft, flexible regions which both bear specialized structures (apophyses). All of these parts are thought to play essential roles in copulation. The sclerites strengthen and aid in alignment of the palpus. Extensive pleated flexible regions (termed hematodocha) expand by hemolymph pressure and cause the sclerites and apophyses to rotate, become erect, and project from the palp in correct orientations for copulation. Other narrow flexible regions at the attachment points of the various sclerites permit more restricted movement, and the apophyses may have a function in the precise alignment and coupling of the male and female spiders (Grasshoff 1973).

GENERAL STRUCTURE OF THE FEMALE EPIGYNUM

In more advanced spiders such as Nuctenea the external female genitalia, the epigynum, is a small sclerotized plate located on the ventral side of the abdomen (Figs. 4 and 5). In this genus, the most prominent feature of the epigynal plate is the scape, a finger-like projection, which probably serves to help orient the palp in the correct general position for mating. During mating, the male spider palp couples with the epigynum, introducing the embolus into the female genital opening. Sperm is then ejected from the reservoir through the hollow embolus into cuticular tubes of the female genitalia and stored in receptacles (Fig. 4). Here it remains until it passes through fertilization ducts to fertilize the eggs as they pass through the uterus and out of the body.

MATERIALS AND METHODS

MEASUREMENTS

Sclerite measurements were taken at 50x using a Wild M8 dissecting stereomicroscope fitted with an ocular micrometer scale. Values were recorded to the nearest half unit, providing a resolution of 10 μm. Only measurements of sclerites which could be consistently positioned and had well-defined boundaries were used in this study. In order to determine which palpal indexes could be accurately taken, three duplicate sets of preliminary measurements were taken on five males of the same species over a period of ten days. Four types of measurements were used in this preliminary study: overall spider size (carapace length and first femur length), overall palp size (cymbium height and width), sclerite dimensions, and distances separating one sclerite from another. Analysis of coefficients of variation showed that all the measurements except the last type could be consistently taken. Separation of sclerites from one another varies because the sclerites can move at their flexible origins when specimens are preserved. Therefore, in this study overall spider size, palp size, and sclerite dimensions were measured in the males. Likewise, in the females, overall size, epigynal size and sclerite dimensions were taken.

In males of both species, one measurement (first femur length) for overall spider size and sixteen palpal measurements were taken. First femur length (FFL) was measured retrolaterally with the leg oriented perpendicular to the axis of measurement. Palpal characters were measured on the left pedipalp after it was removed from the body (unless the right pedipalp had been removed by a previous examiner). For the following palpal measurements (Fig. 6), the dimensions being measured were oriented perpendicular to the axis of observation (directions refer to palpal orientation): cymbium length (CYL), prolateral view; palpal femur length (PFL), prolateral view; conductor width (C1) and length (C2), retrolateral view; terminal apophysis width (A1), apical (anterior) slightly retrolateral view [In N. sclopetaria, the greatest width measurement was taken; in N. patagiata, width was measured where the edges of the apophysis become parallel to one another.]; curvature of the terminal apophysis (A2 - the distance from the main body beyond which the curved end projected), apical and slightly retrolateral view; embolus length (E1 - from the tip to the point where the base was curved on itself), anterior third width (E2), and basal width (E3), prolateral and ventral views, perpendicular to axis of measurement in a anterior-posterior direction and rotated laterally until the point where the base curved back on itself began to be eclipsed; median apophysis projection separation (M1) and depth (M2), prolateral and perpendicular to the axis of measurement in a lateral direction, rotated anterior-posteriorly until the main body just covered the upper edge of the bottom projection; median apophysis length (M3), upper 1/4 width (M4), central width (M5), basal width (M6), and projection length (M7) and width (M8), posterior and slightly ventral, then rotated until the gap between the two projections and the main body was just barely eclipsed.

In females of both species, one measurement of overall size and seven epigynal measurements were taken. First femur length (FFL) was taken prolateral and perpendicular to the axis of measurement. For all of the epigynal measurements (Fig. 7), the genital plate was oriented perpendicular to the axis of measurement. The measurements taken were as follows: scape width (SCW) and length (SCL - the flexible scape was pushed to the epigynal plate with forceps for an accurate total length measurement); width of the epigynal plate (TOTW) and of the depression in the center of the plate (DEPW); distance from the pit-like depressions in the upper part of the plate to the top edge of the basal sclerite (TOTHT); length of the epigynal crypt (DEPHT); height of the basal sclerite (SCLHT - the left was always measured); and the medial separation of the basal sclerites (SCLSEP - taken at the narrowest point).

All statistical tests were performed using SAS V (SAS Institute, Inc., SAS Circle, PO Box 8000, Cary, N. C., 27511-8000).

RANGE BLOCKS

Using state lines as boundaries, species ranges were divided into subunits (blocks) shown in Figure 8. These ranges had similar areas and enough specimens available to permit statistical tests.

ANALYSIS

Preliminary tests

Before comparative statistical tests were performed, four preliminary steps were necessary. First, the normality of all measurements was tested with the Kolmogarov goodness-of-fit test. As normality is an assumption in many of the statistical tests, this was a necessary first step. Second, a correlation analysis was performed on all of the palpal measurements, and the R values examined to determine if there was a relationship between overall spider size (first femur length) and genital measurements. Third, discriminant analysis was used to determine how well specimens could be assigned to the correct block. This was done to determine whether or not there were problems caused by pooling the specimens within each of the blocks. Fourth, F-tests comparing variablity between the population and state levels, and the state and block levels were performed to determine if, as hypothesized, variability was greater in more inclusive units. This means that blocks can be analyzed without bias by overly large population or state variation.

Test of character displacement

Evidence for character displacement was evaluated by using t-tests to compare means across adjacent geographic blocks. Differences in variance were analyzed in a similar manner using the F-test.

Knowledge of historical patterns of contact between species is important to any study of chatacter displacement. One must understand how the species first come into contact in order to determine whether observed differences within a species are actually evidence for character displacement. Using methods similar to those employed by Nyffeler et al. (1985), I compared the date and location of the earliest collected specimens of N. sclopetaria and N. patagiata to later records. Both species are found in Eurasia, but this study focused only on the specimens collected in North America. Levi (1974) mentions that N. sclopetaria may be introduced in North America due to its frequent association with buildings, and other man-made structures; however, no test of this assumption has been made.

Test of clinal variation

To reveal less conspicuous, but congruent patterns in sclerite size differences that would indicate clinal variation, I calculated sclerite measurement means for each geographic block (Fig. 8). For N. patagiata, this created a matrix of nine rows (blocks) and fifteen columns (one for each sclerite measurement except those measuring overall size - FFL, CYL, PFL). From this matrix, I determined the number of sclerites for which each block had the highest value, the next highest value, etc. until the ninth lowest position was reached. These ranking variables were compiled into a summary table (Table 3). For N. sclopetaria, a similar matrix of four blocks (the other two blocks included only one specimen each and were excluded from this analysis) and fifteen sclerites was constructed, and a summary table (Table 4) was compiled. From these summary tables, consensus rankings (Table 5) for each species were derived. These rankings were designed to detect any continuous trends in sclerite measurement means across the ranges of the two species. If sclerite measurements show a clinal variation, there will be a high percentage of congruity in the consensus ranking of the blocks, and the ranking should order blocks into a logical geographical sequence.

Test of genital variability

In order to determine if, as Coyle (1985) found, genital variability is less than overall size variability, the variability of first femur length was compared with the variability of the palpal measurements in males and the variablility of epigynal measurements in *N. sclopetaria* females. As all coefficients of variation (CV = standard deviation X 100 / mean) were less than 30.0, the squared CV's were treated as variances in an F-test (Lewontin 1966).

RESULTS

PRELIMINARY TESTS

The Kolmogarov goodness-of-fit test showed the data to be normally distributed. All values were significant at a level of 0.05 or less, indicating a 95 % or greater probability that the points fit a normal curve. When the correlation analysis was performed (Table 1), all but four of the Nuctenea patagiata and one of the N. sclopetaria sclerite measurements were significantly correlated ($p < 0.01$) with overall spider size. Those sclerites that did not correlate were embolus length and widths, median apophysis length (N. sclopetaria), and median apophysis projection width. The correlation of the remaining measurements indicates that size could have some influence on the analysis of absolute measurement values between blocks. However, overall size (first femur length) only varied significantly between blocks A and B for N. patagiata. In order to determine the effect of this difference on the sclerite measurement comparisons, values of N. patagiata embolus length as corrected for spider size, each block using the regression formula: 0.0133 (FFL) + 274.96. This resulted in a 1.4 % increase in the embolus length of N. patagiata Considering that the standard deviation of N. patagiata wmbolus length is 11 % of the mean, the influence of size on embolus length probably has little effect on the results of the t-tests. Discriminant analysis of block divisions (Table 2) shows a high percentage of specimens correctly identified, indicating that these block divisions are appropriate ones, and that pooling the data had no adverse effect on the subsequent calculations. Tests of variability between populations and states, and states and blocks showed that variability was significantly greater ($p < 0.05$) in more inclusive units.

TEST OF CHARACTER DISPLACEMENT

When mean genitalic measurements were compared across adjacent geographic blocks to test for evidence of character displacement, (Appendix B), significant differences were observed between several blocks; however, the number of sclerites whose mean differed between areas of sympatry and allopatry was no greater than the number of sclerites whose mean differed between adjacent areas of sympatry. Surprisingly, these differences were not always between the same sclerites. Differences between variances across blocks (Appendix B) yielded the same results; the percentage of sclerites showing significantly lower variability was no greater in areas of sympatry than in areas of allopatry.

If character displacement were occurring, changes in mean sclerite measurements should be observed between areas of sympatry and allopatry. Also, competition would have to be taking place before any displacement could occur (Mayr 1963), and the species should become less variable in these sympatric regions. Changes observed in mean and variance did not fit these expected patterns, therefore, character displacement does not seem to be occuring in sympatric populations of these two species.

The historical study of N. sclopetaria collection records showed that the earliest museum specimens were collected in the 1880's along the northeastern coast and on the shore of Lake Erie. Specimens collected at later dates were found farther west and farther inland than earlier localities. Although the resulting pattern in N. sclopetaria is consistent with the spread of an introduced species, it also coincides with the western movement of human collectors, and is not clear enough to prove a recent introduction of this species into North America. No definite pattern was observed in N. patagiata specimens examined.

TEST OF CLINAL VARIATION

Summary tables (Tables 3 and 4) from the consensus ranking procedure show blocks ranked by sclerite means. The number under each block is the number of sclerite means ranked in the first, second, third, etc. highest position. For example, in Table 3, Block A had one sclerite ranked in the first position (highest mean), two sclerites ranked in the second position (second highest mean), none in the third position, etc. The consensus ranking (Table 5) simply lists in order the block that has the greatest number of sclerites placing it in the first, second, third, etc. position for each species. For example, in Table 3, block G had the largest number of sclerites (8) in the first position, blocks F and I both had the largest number of sclerites (3) in the second position, etc. These ranks are recorded for N. patagiata in Table 5. The percentage of sclerites which contributed to the ranking of blocks was never much greater than 50 % and averaged about 39 % indicating that no strong consensus appeared in the ranking. Additionally, the resulting consensus ranking shows no consistent trends of clinal variation (east-west or north-south) in either species.

TEST OF GENITAL VARIABILITY

The F-tests using the coefficients of variation (Table 6) showed that at the species level, N. sclopetaria males fit the hypothesis that genital measurements are less variable than overall size measurements, with 73% (eleven of fifteen) of the sclerites less variable than first femur length. However in N. patagiata males, only 6.6% (one of fifteen) of the sclerites were less variable than femur length. Nuctenea sclopetaria females tested at the species level showed that only 12.5 % (one of 8) of the sclerites agreed with Coyle's prediction that genital sclerites are less variable than overall size.

At the population level for which this hypothesis was proposed, neither species had a substantial percentage of sclerites that were less variable than the femur length. Thus, these two species do not agree with Coyle's findings for Hypochilus

DISCUSSION

CHARACTER DISPLACEMENT

When adjacent regions of a species' distribution were compared, significant differences were observed in both the mean and variance of palpal sclerites. However, the number of sclerites that differed between regions of sympatry and allopatry was not greater than the number that differed between adjacent regions of sympatry. Therefore, these results fail to demonstrate the character displacement predicted by the lock-and-key hypothesis.

There are several levels of sclerite function: general orientation, alignment, and the physical coupling. The last of these has the greatest potential to function in reproductive isolation. Since the exact function of several of the sclerites is unknown, I made an effort not to weight any sclerite beyond the limits of my ability to measure it consistently. Additionally, several measurements were taken on each sclerite to avoid neglecting any feature which might play a role in the actual coupling of the palp with the female epigynum. Considering the large number of measurements taken from each specimen, a number of paramaters involved in palp coupling were almost certainly analysed. Two of the structures measured (the embolus and the conductor) are known to be directly involved in coupling (Grasshoff 1973, Shear 1967). Therefore, the failure of this study to find evidence for character displacement cannot be dismissed on the grounds that it analyses structures not involved in the coupling process.

One sampling consideration in this study is that, due to the necessary constraint of using museum specimens, I had data that were from differing localities and dates compiled into a continuous collection. Due to this type of collection, there are no assurances that specimens found sympatrically at the species level are actually sympatric at the more important population level. However, most of the collectors of museum specimens were not interested specifically in one or the other of these large, conspicuous species and both species probably had an equal chance of being collected if they occurred in the same area.

Several potential problems are encountered in studies of character displacement (Grant 1972). The first of these is clinal variation. Some studies that have claimed to show character displacment (e.g. Brown and Wilson 1956, Ficken et al. 1968) have later been refuted because the morphological changes attributed to character displacement could be explained by clinal variation across the range of the species (Grant 1972). That is, differences in regions of sympatry were no greater than predicted by clinal variation alone. In this study no clinal variation in sclerite size was found in either species' range, and this factor does not need to be considered when interpreting results.

A second difficulty which arises in character displacement studies is that the historical events responsible for sympatry of the two test species is often unknown. Grant (1972) questions several studies that claim to show character displacement because they neither identify the original and derived populations nor explain the pattern of historical movement of the species' range. This is a difficult problem because there is little historical evidence of most species' ranges available in the current literature. However, the entire definition of character displacement hinges on the pattern by which the species in question first came into contact. If the two species evolve in isolation and then came into contact, there would be opportunity for character displacement to occur. If the two species evolved sympatrically and then vacated part of the other's range, there would be opportunity for character release to occur in the vacated region. However, in this latter case there would not necessarily have been any character displacement in the region of overlap.

In this study, an attempt was made to determine the historical background of the two test species, N. patagiata and N. sclopetaria. Because of its close association with man, Levi (1974) suggests that N. sclopetaria may have been introduced into North America. The collection dates do not refute the idea that this species has moved in an east - west direction following an introduction by man; however, its sequential records could also coincide with European man's east-west migration in the nineteenth century. A more thorough investigation of the collection records is necessary before any definite conclusions about the historical background of either of these two species can be made.

Mayr (1963) lists three isolating mechanisms which function to increase the efficiency of mating where related species coexist: habitat isolation, ethological isolation, and mechanical isolation. The third problem with studies of character displacement is that usually only one of these mechanisms is explored by the study. Grant (1972) found that in some cases what passed for displacement involving morphological characters was actually the result of habitat isolation (Ripley 1959, Ficken et al. 1968). No comparative ecological data were available for N. patagiata and N. sclopetaria. However, they could have been occupying different habitats even when collected from the same locality. Consistent with Levi's observations, N. sclopetaria was frequently collected on buildings when any such habitat information was given. Ethological isolation can also explain the separation of species. In this study, behavioral isolation could be the isolating mechanism separating these species. Web spiders often use courtship rituals that prevent mating of similar species (Robinson and Robinson 1980); if such were the case differences in the external genitalia of males and females would not be due to the lock-and-key mechanism because the behavior would effectively separate the species and eliminate the need for mechanical isolation.

GENITAL VARIABILITY

Coyle's (1985) study of male genitalic variation showed that within a single population, over a two year period, palpal features are less variable than overall spider size. The low variability that Coyle found might be both because there must be a physical fit of the male and female genitalia in order for mating to take place, and because the male copulatory apparatus develops during the penultimate instar and is therefore subject to fewer nutritional or environmental influences than body size. However, at the population level neither of the species tested followed this hypothesis. One possible reason to explain this deviation is that the two species have different life cycles. The *Hypochilus sp.* that Coyle studied has a two-year life cycle, whereas the *Nuctenea* in this study have a one-year cycle. This difference may make *Nuctenea* species more susceptible than *Hypochilus* to yearly fluxuations in environmental changes. Another reason which may explain this difference is that *Nuctenea* sp. have a much more complex palp than the *Hypochiylus* sp. studied by Coyle. Some of the sclerites in the *Nuctenea* palp are probably not involved directly in the coupling or insertion into the female epigynum, and are perhaps not influenced by the necessity for low variation to insure an adequate fit. Predictably, the female *N. sclopetaria* tested in the same manner also did not agree with Coyle's observations. This could indicate that the genitalia of these species' as a whole tends to be more variable; if the females are not constrained to low genital variability then the males will also be free of any such constraint.

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TABLES

Table 1. Significant R values ($p < 0.01$) from correlation analysis of first femur length and palpal measurements.

Range of R values	Palpal Measurements: *N. sclopetaria*	Palpal Measurements: *N. patagiata*
0.20 - 0.29	E3	A1,M1,M2,M5,M6
0.30 - 0.39	A1,E2	C1,C2,M7
0.40 - 0.49	C2,E1,M6,M8	M4
0.50 - 0.59	M2,M4,M7	CYL,M3
0.60 - 0.69	C1,M5	---
0.70 - 0.79	CYL,M3,PFL	PFL

Table 2. Discriminant analysis of palpal features among geographic blocks. Letters in parentheses refer to those blocks into which the most frequently misidentified specimens were placed.

Species	Block	% identified correctly	highest % identified incorrectly
N. sclopetaria	A	75 %	14 % (B)
	B	90 %	5 % (A & C)
	C	73 %	12 % (A)
	D	92 %	4 % (A & B)
N. patagiata	A	77 %	13 % (E)
	B	86 %	11 % (D)
	C	92 %	4 % (D & E)
	D	100 %	0 %
	E	79 %	21 % (D)
	F	75 %	7 % (B & G)
	G	90 %	5 % (E & F)
	H	88 %	12 % (E)
	I	100 %	0 %

Table 3. Summary Table of _N_. _patagiata_ blocks ranked by sclerite means. Sclerites are ranked from high to low mean values. The number under each block is the number of sclerite means ranked in the first, second, third, etc. position.

Sclerite	Geographic Block								
Ranking	A	B	C	D	E	F	G	H	I
1	1	0	0	2	0	0	8	1	3
2	2	0	1	0	1	3	3	2	3
3	0	0	0	0	0	5	3	5	2
4	4	1	1	1	0	4	0	4	0
5	5	1	1	1	2	1	1	1	2
6	1	2	7	1	1	0	0	1	2
7	1	6	1	2	3	1	0	0	1
8	0	4	3	4	2	1	0	0	1
9	1	1	1	4	6	0	0	1	1

Table 4. Summary table of *N. sclopetaria* blocks ranked by sclerite means. Sclerites are ranked from high to low mean values. The number under each block is the number of sclerite means ranked in the first, second, third, etc. position.

Sclerite Ranking	Geographic Block			
	A	B	C	D
1	8	1	0	6
2	5	3	2	5
3	2	7	3	3
4	0	4	10	1

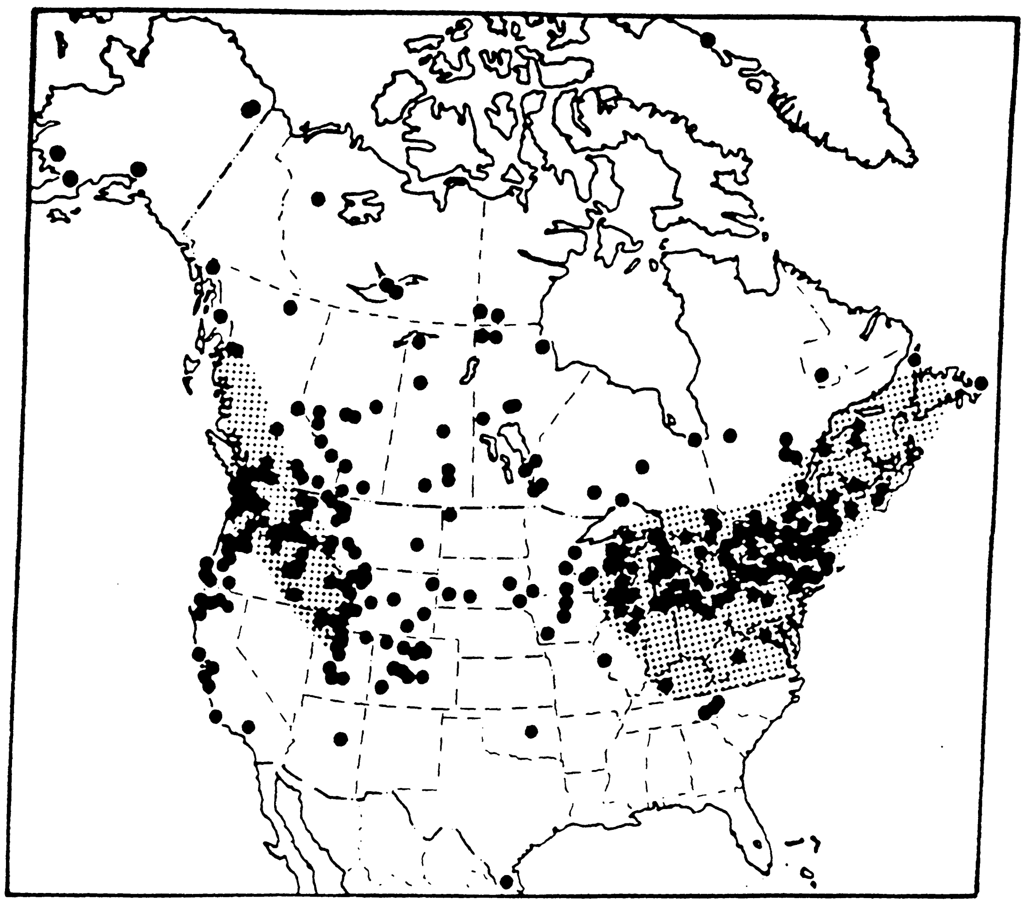
Table 5. Consensus ranking of geographic blocks. This table lists in order the block that has the greatest number of sclerites placing it in the first, second, third, etc. position.

Species	Rank	Block	% of sclerites contributing to block rank
N. patagiata	1	G	53.3 %
	2	F, I	20.0 %
	3	F, H	33.3 %
	4	A, F, H	26.7 %
	5	A	33.3 %
	6	C	46.7 %
	7	B	40.0 %
	8	B, D	26.7 %
	9	E	40.0 %
N. sclopetaria	1	A	53.3 %
	2	A, D	33.3 %
	3	B	46.6 %
	4	C	66.6 %

Table 6. Results of F-tests using coefficients of variation for fifteen sclerite measurements.

Species	Population: Sample size	Population: % of sclerites less variable than femur I	Species: Sample size	Species: % of sclerites less variable than femur I
N. sclopetaria	29	33.3 %	153	73.3 %
N. patagiata	31	6.6 %	225	6.6 %

FIGURES



• DISTRIBUTION OF N. PATAGIATA

░ DISTRIBUTION OF N. SCLOPETARIA

Figure 1. Range distribution of _N. patagiata_ and _N. sclopetaria_.

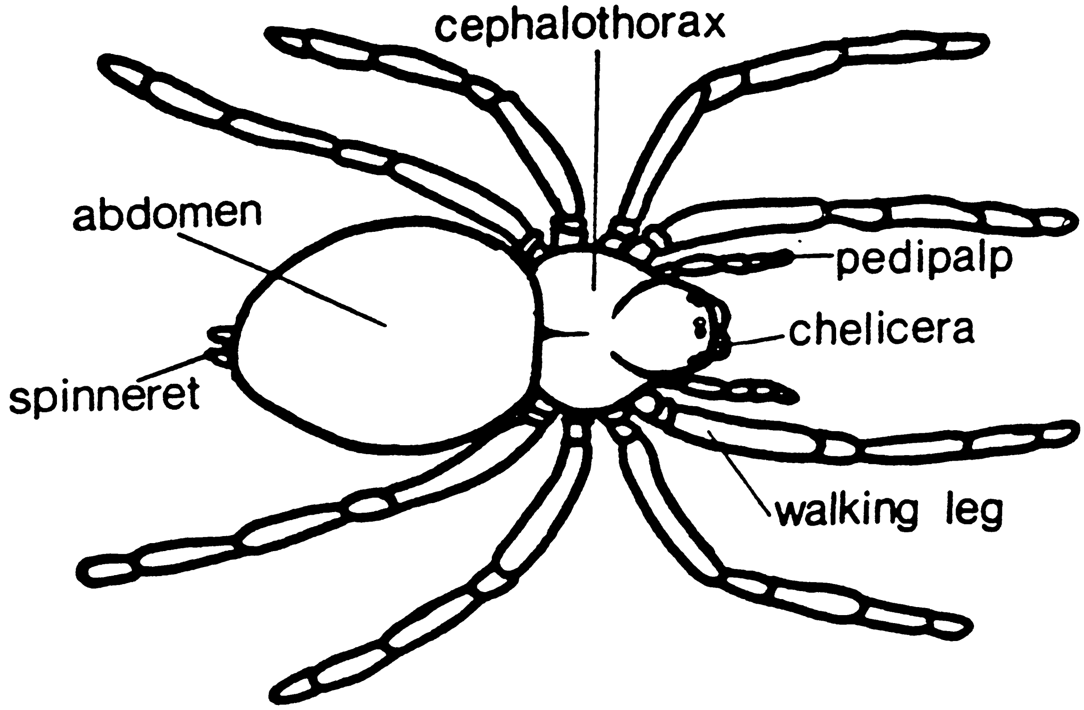


Figure 2. Generalized body plan of a spider.

Figure 3. Male pedipalp structure, ventral view.

Abbreviations. A, terminal apophysis; C, conductor; E, embolus; M, median apophysis; H, hematodocha.

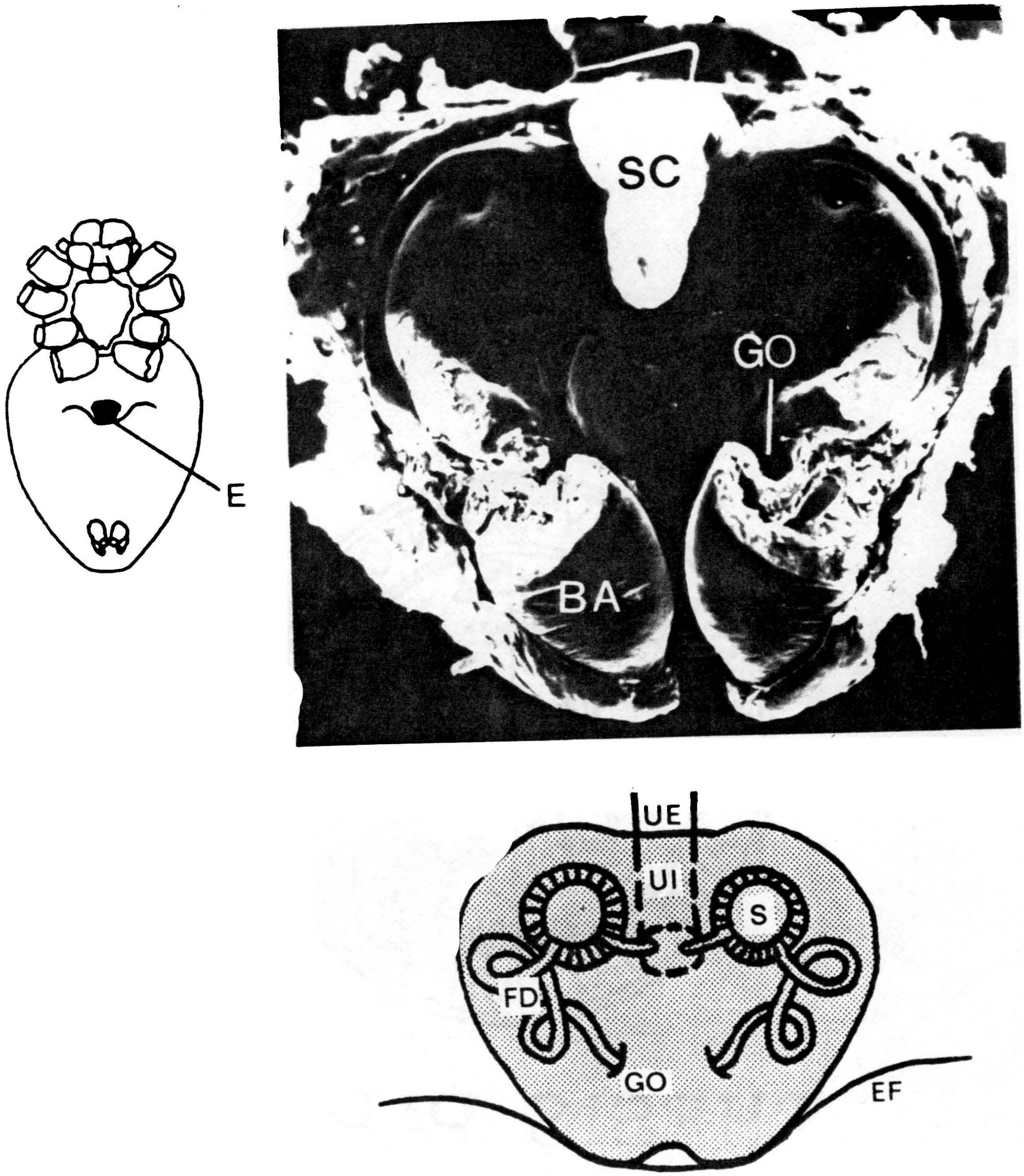


Figure 4. Female Epigynal Structure, ventral view. Abbreviations. (a) E, epigynum. (b) SC, scape; GO, genital opening; BA, basal apophysis. (c) UE, uterus externa; UI, uterus interna; S, spermathecae; FD, fertilization duct; GO, genital opening; EF, epigastric furrow.

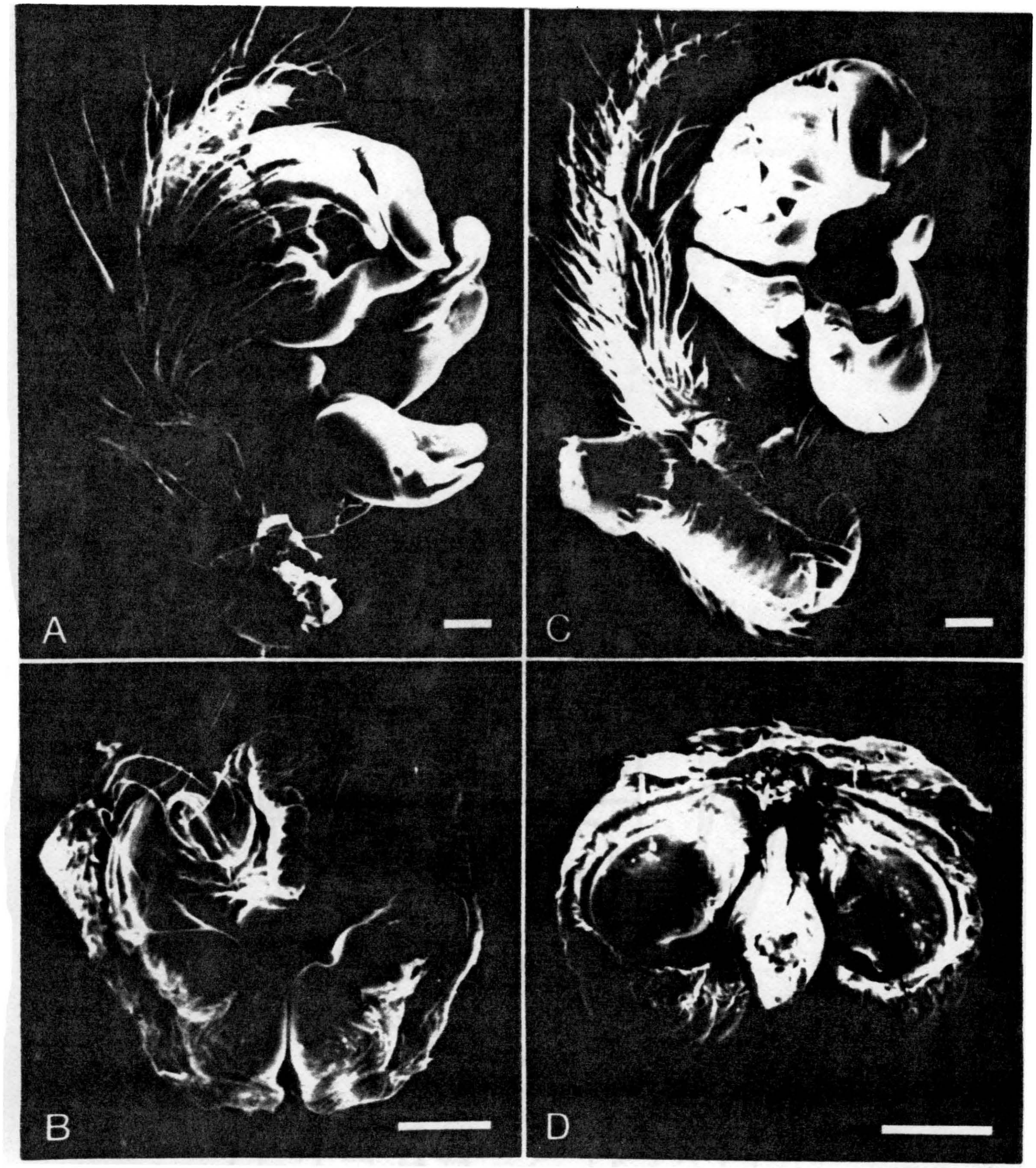


Figure 5. A and B - N. sclopetaria. (A) left male palp, ventral view; (B) female epigynal plate. C and D - N. patagiata. (C) left male palp, ventral view; (D) female epigynal plate. Scale line represents 200 um.

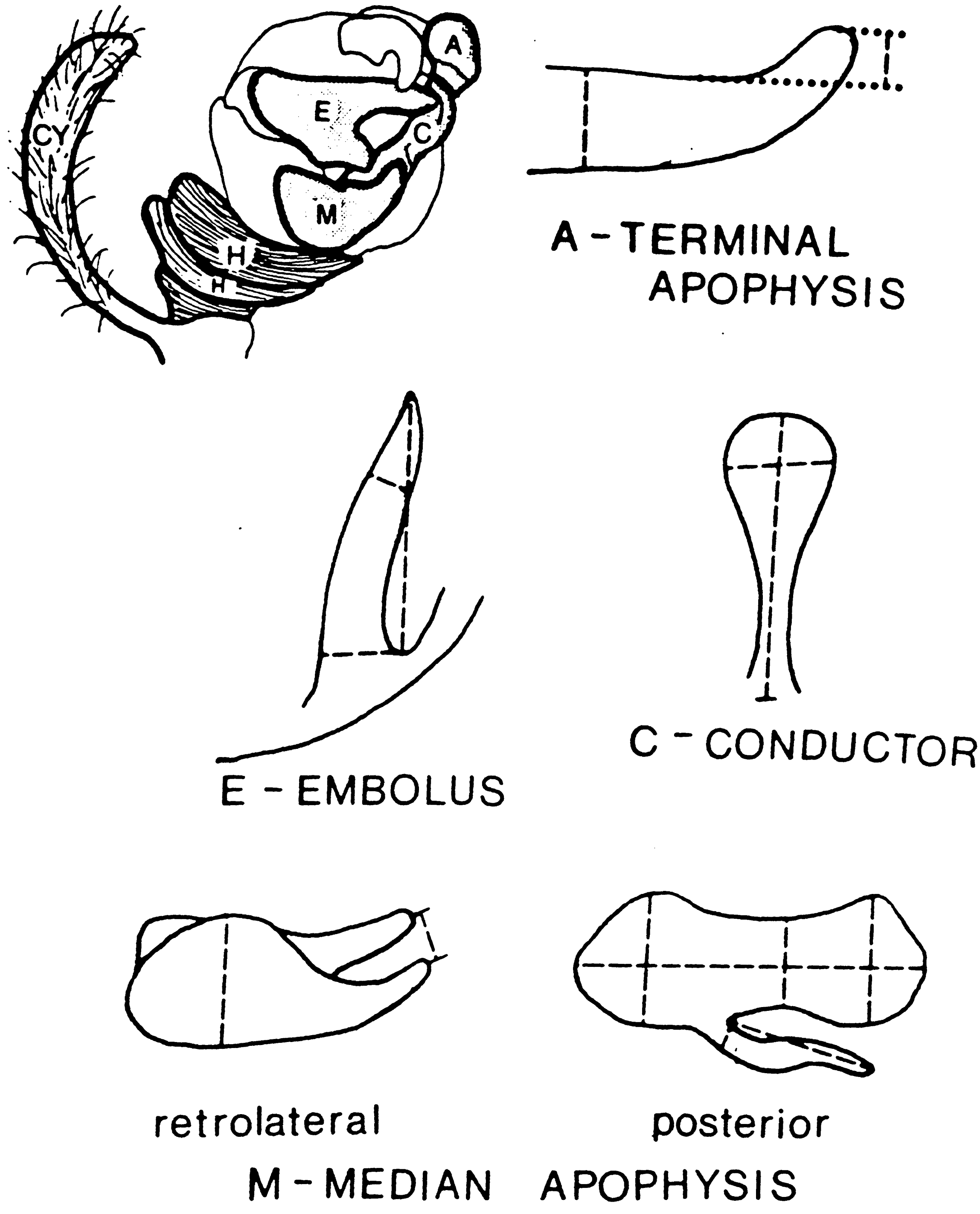


Figure 6. Palpal sclerite measurements.

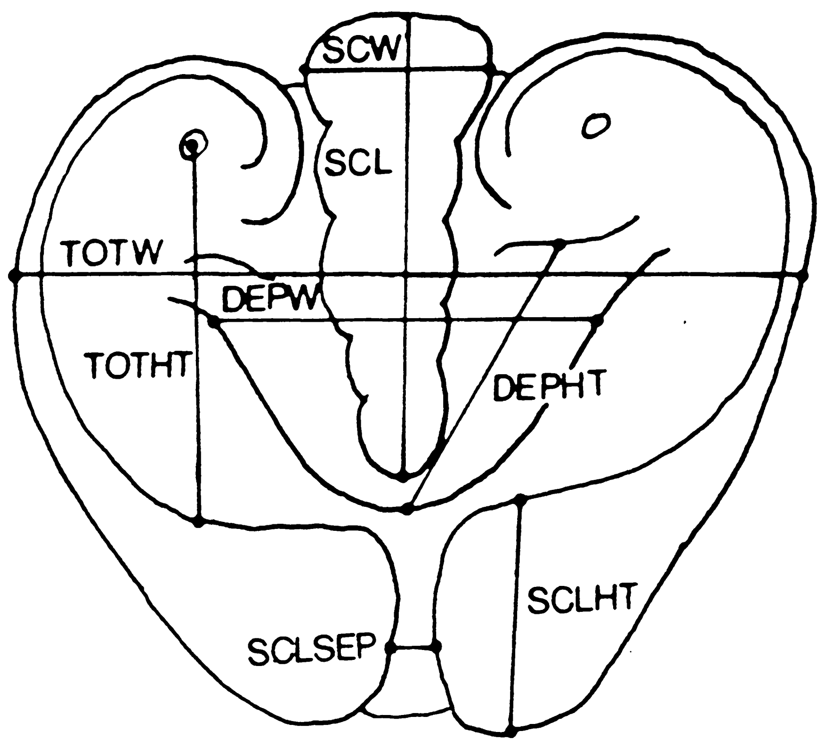
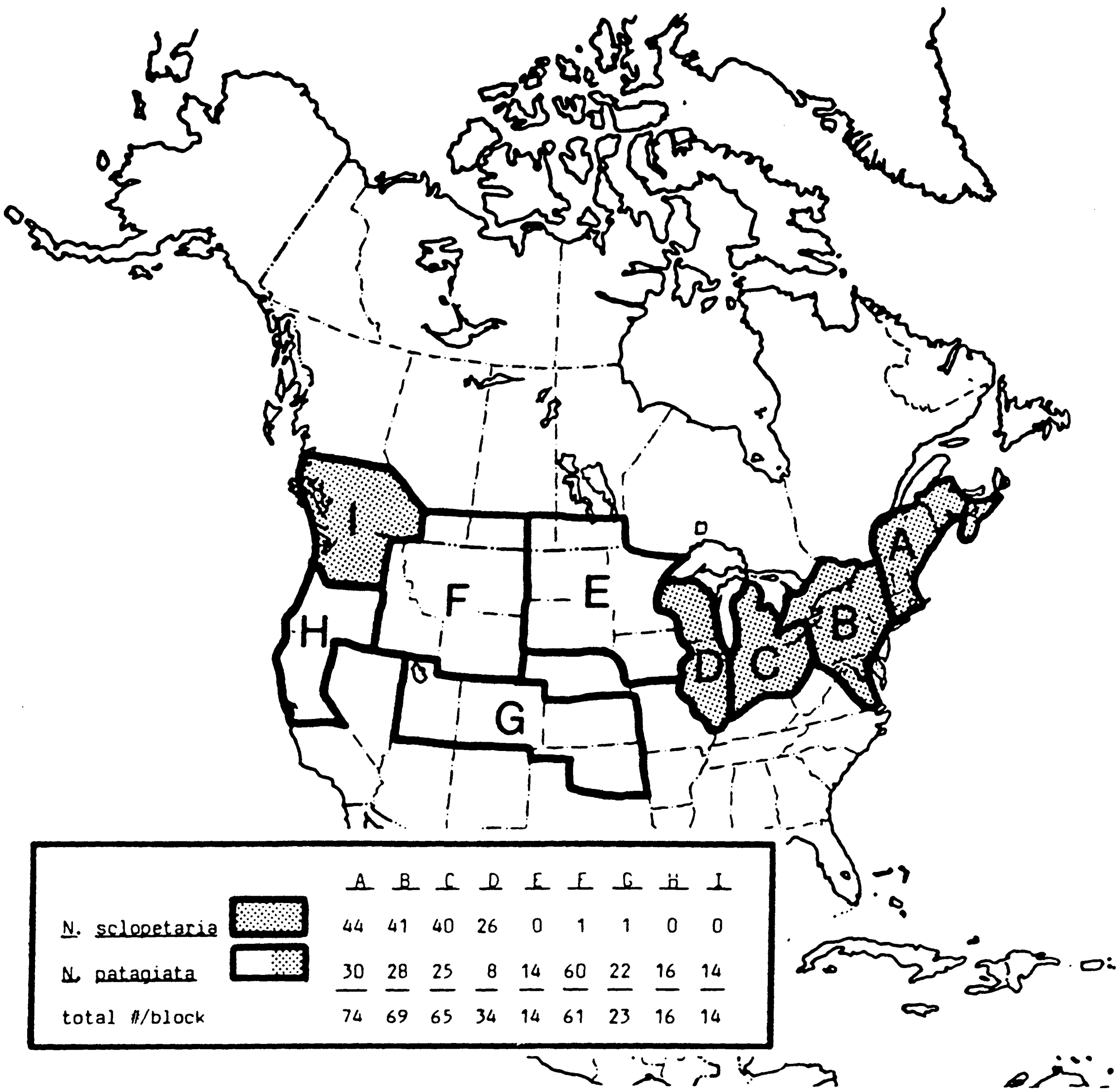


Figure 7. Epigynal sclerite measurements.



		A	B	C	D	E	F	G	H	I
N. sclopetaria		44	41	40	26	0	1	1	0	0
N. patagiata		30	28	25	8	14	60	22	16	14
total #/block		74	69	65	34	14	61	23	16	14

Figure 8. Geographic block divisions for N. patagiata and N. sclopetaria. Number of specimens for each species recorded within each block is given.

APPENDIX A

Section 1.: Palpal measurements in um

(Species 1 = Nuctenea sclopetaria)

(Species 2 = Nuctenea patagiata)

--- SPECIES=1 ---

OBS	NUMBER	SEX	STATE	COUNTY	FFL	CYL	C1	C2	A1	A2	E1	E2	E3	M1	M2	BLOCK	M3	M4	M5	M6	M7	M8	PFL
2	1	M	23	PENOBSCOT	5561	1320	260	420	180	70	320	100	140	140	220	A	610	230	240	340	220	80	760
3	2	M	55	DANE	6723	1380	260	540	200	60	340	120	140	140	240	D	670	240	210	320	270	80	930
4	3	M	55	DANE	5478	1280	230	360	180	60	300	90	120	130	240	D	620	230	210	320	210	60	720
5	4	M	55	DANE	6142	1360	280	460	160	50	370	100	160	120	280	D	600	230	200	260	200	70	840
6	5	M	55	OCONTO	5644	1260	240	500	180	50	270	120	160	120	250	D	560	210	180	260	220	70	780
7	6	M	26	MIDLAND	6806	1320	300	500	260	20	300	130	160	140	260	C	720	240	240	340	210	100	900
8	7	M	55	DANE	5644	1360	240	440	180	20	350	120	160	140	230	D	610	250	200	290	220	100	780
9	8	M	55	OCONTO	5312	1220	220	480	150	45	300	100	140	120	210	D	560	210	200	280	180	60	720
10	9	M	55	OCONTO	5893	1280	240	470	180	40	340	120	200	140	260	D	620	250	220	300	230	80	840
11	10	M	55	DANE	6142	1360	240	500	180	60	290	100	180	160	240	D	660	220	210	310	230	80	760
12	11	M	55	BUFFALO	5561	1280	240	410	200	50	320	140	160	130	220	D	630	220	200	280	220	70	800
13	12	M	26	CALHOUN	.	1240	230	440	200	60	330	95	160	150	220	C	600	220	200	300	200	70	800
14	13	M	26	CALHOUN	.	1260	240	500	200	60	320	100	180	120	260	C	600	230	210	320	200	60	700
15	14	M	26	EMMET	6142	1380	260	500	190	50	360	80	180	140	260	C	620	220	220	340	230	70	740
16	15	M	25	MIDDLESEX	5561	1280	260	490	200	40	310	100	140	130	230	A	620	240	200	280	200	80	800
17	16	M	26	CALHOUN	4897	1380	260	500	180	40	320	120	140	130	200	C	580	190	200	280	160	60	820
18	17	M	26	CALHOUN	4856	1220	230	400	180	50	300	100	120	120	220	C	535	200	220	320	200	70	740
19	18	M	26	CALHOUN	6225	1320	260	420	200	40	300	100	140	120	200	C	620	230	220	300	200	70	840
20	19	M	26	DELTA	4980	1240	130	540	180	90	310	100	180	120	220	C	560	250	200	330	140	50	760
21	20	M	26	DELTA	4565	1200	230	500	190	40	300	90	240	140	200	C	580	150	190	270	180	50	660
22	21	M	23	HANCOCK	7885	1580	240	580	200	80	380	160	160	140	280	A	700	300	260	360	300	80	800
23	22	M	25	BARNSTABLE	4731	1280	240	500	180	50	320	160	100	140	250	A	560	260	260	380	220	50	720
24	23	M	25	BARNSTABLE	6142	1420	240	440	180	60	380	160	120	120	250	A	640	240	220	240	240	80	760
25	24	M	25	BARNSTABLE	5146	1420	240	500	160	70	380	100	140	160	240	A	620	240	240	320	220	60	.
26	25	M	25	BARNSTABLE	5810	3500	260	510	200	100	300	120	140	150	240	A	620	260	240	340	260	80	780
27	26	M	26	CALHOUN	5229	1399	240	469	160	30	300	100	140	130	220	C	630	220	200	280	200	80	720
28	27	M	26	CALHOUN	6225	1380	220	460	200	60	280	120	140	120	220	C	620	230	220	320	200	70	800
29	28	M	39	ASHATABULA	5727	1300	220	460	180	60	300	100	120	120	220	C	620	240	220	320	260	70	780
30	29	M	26	CALHOUN	3735	1180	200	400	180	40	260	100	100	100	180	C	520	170	170	260	140	60	540
31	30	M	18	KNOX	4565	1200	210	420	160	50	280	100	130	120	220	D	540	180	180	280	180	50	700
32	31	M	25	ESSEX	6889	1420	270	500	180	20	340	120	160	160	240	A	660	280	240	320	210	60	920
33	32	M	23	WASHINGTON	5229	1340	260	540	160	30	300	120	140	130	230	A	580	210	190	260	230	60	740
34	33	M	26	EMMET	5146	1160	210	380	170	60	320	100	120	100	240	C	540	220	200	320	180	50	.

35	34	M	25	CALHOUN	7055	1460	260	530	200	40	360	120	160	120	260	A	580	280	230	340	260	100	.
36	35	M	25	ESSEX	6391	1360	240	490	180	40	350	100	160	120	230	A	600	260	220	340	200	70	620
37	36	M	26	CALHOUN	5437	1280	240	440	140	40	220	70	120	140	180	C	640	220	180	280	170	50	720
38	37	M	26	CALHOUN	5395	1320	240	500	180	30	280	100	140	120	230	C	580	200	190	300	220	50	760
39	38	M	36	TOMPKINS	8300	1500	280	480	200	20	300	100	120	120	280	B	640	280	240	320	290	100	1000
40	39	M	25	ESSEX	6308	1420	270	520	200	40	330	80	120	120	230	A	660	250	230	300	220	60	800
41	40	M	25	ESSEX	5727	1340	240	500	300	20	280	80	140	140	240	A	620	220	200	280	250	70	760
42	41	M	39	ASHATABULA	5146	1280	220	500	210	70	300	100	140	140	230	C	590	240	220	280	210	60	660
43	42	M	26	EMETT	5312	1240	240	440	160	50	320	80	120	140	240	C	580	240	220	280	180	40	.
44	43	M	26		5810	1360	240	480	180	60	290	120	160	140	240	C	620	240	240	320	200	60	900
45	44	M	26	CALHOUN	4316	1280	200	420	140	50	300	120	120	140	220	C	600	230	200	340	200	40	780
46	45	M	26	CALHOUN	4150	1320	240	540	220	60	280	100	120	120	260	C	580	240	230	320	200	100	700
47	46	M	25	PLYMOUTH	6806	1520	280	500	200	30	380	120	140	120	260	A	680	250	240	300	280	70	860
48	47	M	94	QUEBEC	4980	1220	260	460	160	80	320	110	140	130	260	A	630	200	200	260	210	60	700

-- SPECIES=1 --

OBS	NUMBER	SEX	STATE	COUNTY	FFL	CYL	C1	C2	A1	A2	E1	E2	E3	M1	M2	BLOCK	M3	M4	M5	M6	M7	M8	PFL
49	48	M	94	QUEBEC	4565	1320	260	460	180	70	310	100	140	120	260	A	660	260	220	300	240	80	700
50	49	M	94	QUEBEC	5395	1280	260	500	180	40	300	80	120	140	240	A	620	240	210	300	200	80	760
51	50	M	94	QUEBEC	4648	1220	240	420	200	20	280	80	120	120	230	A	580	260	220	280	200	50	700
52	51	M	23	PENOBSCOT	4150	1120	220	400	140	30	260	80	140	120	210	A	520	220	200	300	150	70	760
53	52	M	23	PENOBSCOT	4731	1160	220	400	160	40	280	100	120	110	230	A	500	200	200	290	170	60	840
54	53	M	55	OCONTO	5312	1340	230	500	200	40	320	100	100	140	240	D	600	240	210	280	200	60	740
55	54	M	26	CALHOUN	5063	1280	220	480	200	65	260	120	160	110	240	C	570	210	200	300	190	40	.
56	55	M	26	CALHOUN	6391	1410	260	560	200	40	210	90	120	120	260	C	660	230	220	320	260	80	800
57	56	M	26	OAKLAND	5063	1260	230	420	180	40	320	80	130	100	200	C	560	220	200	300	160	60	680
58	57	M	26	OAKLAND	4524	1280	220	480	160	40	280	80	120	120	230	C	580	240	210	300	220	80	680
59	58	M	26	WAYNE	5063	1300	260	440	200	20	340	100	140	110	220	C	600	240	220	300	200	60	700
60	59	M	26	WAYNE	4731	1220	240	440	170	50	310	100	120	120	250	C	600	240	210	330	200	70	700
61	60	M	26	WAYNE	5312	1340	250	500	180	30	340	130	160	120	240	C	600	260	220	260	210	80	800
62	61	M	26	WAYNE	5810	1300	260	480	200	70	320	120	120	100	240	C	640	240	250	340	210	60	640
63	62	M	26	CALHOUN	4316	1200	230	490	160	60	280	100	140	120	200	C	520	190	190	280	200	70	.
64	63	M	26		6474	1480	260	560	200	40	360	130	180	140	260	C	720	260	240	320	230	60	1000
65	64	M	26	MIDLAND	6059	1400	260	580	200	40	320	100	130	140	240	C	640	260	220	320	230	60	800
66	65	M	26	MIDLAND	5810	1220	240	460	160	20	300	80	140	110	240	C	560	260	230	320	170	40	740

67	66	M	26	MIDLAND	5810	1360	250	530	160	110	310	100	140	120	260	C	640	250	230	330	180	80	840
68	67	M	26	MIDLAND	5478	1280	240	510	180	40	320	80	140	110	180	C	640	230	200	280	210	80	.
69	68	M	50	CHITTENDEN	5727	1300	260	500	160	60	330	100	150	120	240	A	600	240	200	280	230	80	700
70	69	M	50	CHITTENDEN	5769	1380	270	540	180	80	280	100	120	130	260	A	640	280	240	300	220	60	800
71	70	M	50	CHITTENDEN	5478	1260	240	440	160	30	280	100	120	100	210	A	580	220	210	300	200	70	680
72	71	M	25	ESSEX	5976	1410	280	560	200	60	340	120	160	130	270	A	650	280	250	340	250	80	940
73	72	M	25	DUKE	5644	1440	260	540	200	40	340	120	130	140	240	A	650	240	210	300	250	80	860
74	73	M	25	DUKE	6889	1460	280	550	170	120	320	120	150	150	260	A	660	260	230	340	270	80	860
75	74	M	50	WINDHAM	4399	1180	220	500	180	40	320	100	140	150	220	A	540	180	180	250	190	60	740
76	75	M	50	WINDHAM	4814	1360	220	480	200	50	340	100	120	140	220	A	640	220	200	300	210	80	660
77	76	M	50	WINDHAM	4399	1260	240	500	200	40	340	90	120	120	230	A	620	240	220	320	170	80	780
78	77	M	25	MIDDLESEX	7553	1560	280	590	220	60	400	120	160	140	280	A	730	240	230	340	290	90	1000
79	78	M	25	MIDDLESEX	7055	1520	260	540	180	60	380	100	120	120	270	A	630	250	240	340	230	60	940
80	79	M	25	MIDDLESEX	7719	1620	280	640	200	70	380	120	140	140	280	A	680	250	230	330	250	90	960
81	80	M	25	ESSEX	5478	1240	250	460	180	40	300	120	140	140	230	A	560	200	200	300	190	60	760
82	81	M	25	ESSEX	5976	1340	260	500	180	60	320	100	130	120	250	A	630	240	230	310	240	80	820
83	82	M	25	DUKE	5810	1340	280	560	180	70	300	100	120	120	240	A	660	260	230	300	260	60	820
84	83	M	94	NOVA SCOTIA	4648	1240	230	640	180	60	290	100	130	120	220	A	560	220	200	260	200	60	790
85	84	M	95	ONTARIO	6723	1520	300	580	220	40	350	120	140	140	270	B	680	240	230	320	240	60	900
86	85	M	26	CALHOUN	5810	1260	260	520	180	40	340	100	140	140	260	C	660	250	210	310	220	80	860
87	86	M	23	CUMBERLAND	7802	1560	280	600	200	60	400	120	160	140	260	A	700	280	240	300	260	80	900
88	87	M	23	CUMBERLAND	6225	1440	240	600	180	40	320	120	140	120	220	A	680	240	200	300	260	80	840
89	88	M	23	CUMBERLAND	6142	1380	260	590	160	40	320	120	140	140	240	A	680	240	220	320	240	90	860
90	89	M	23	CUMBERLAND	6474	1400	280	500	180	40	340	100	120	140	240	A	600	250	220	320	240	80	900
91	90	M	23	CUMBERLAND	6640	1420	260	480	160	60	320	100	140	140	240	A	640	230	220	320	240	80	900
92	91	M	55	DOOR	4897	1160	240	460	180	70	300	100	150	120	220	D	550	220	200	280	220	60	700
93	92	M	55	DOOR	5229	1120	230	500	160	30	300	100	140	140	220	D	540	200	200	260	190	50	700
94	93	M	55	DOOR	5478	1300	260	500	180	40	320	100	120	120	250	D	640	250	210	320	210	60	760
95	94	M	55	DOOR	5810	1340	260	500	180	40	340	120	140	120	240	D	600	250	220	340	210	40	780
96	95	M	55	DOOR	5561	1300	260	460	180	60	340	100	140	120	220	D	600	260	200	320	180	40	760
97	96	M	16	BOUNDARY	7470	1640	300	590	240	40	380	120	120	140	260	F	740	240	230	320	280	80	1000
98	97	M	55	OUTAGAMIE	6557	1480	270	480	200	100	340	120	120	140	260	D	680	260	240	320	260	80	760
99	98	M	55	OUTAGAMIE	7553	1560	280	580	200	110	380	100	140	140	260	D	680	290	260	340	300	80	1000
100	99	M	55	OUTAGAMIE	6474	1460	290	620	200	40	340	110	140	120	260	D	680	270	250	330	160	80	800
101	100	M	55	OUTAGAMIE	7221	1560	280	590	240	60	320	120	160	160	260	D	700	260	240	340	250	80	1000
102	101	M	55	OUTAGAMIE	7304	1540	280	460	220	40	320	140	160	120	250	D	670	280	250	340	200	70	1080

-- SPECIES=1 --

OBS	NUMBER	SEX	STATE	COUNTY	FFL	CYL	C1	C2	A1	A2	E1	E2	E3	M1	M2	BLOCK	M3	M4	M5	M6	M7	M8	PFL
103	102	M	55	OUTAGAMIE	7470	1580	300	580	180	100	340	140	160	140	240	D	720	260	250	340	280	80	1000
104	103	M	26		5395	1320	240	470	240	30	310	120	150	140	220	C	620	200	200	260	240	70	860
105	104	M	26	MARQUETT	6640	1300	250	500	180	40	340	100	140	140	240	C	620	220	200	300	180	80	840
106	105	M	55	DANE	5561	1340	240	500	180	60	310	100	140	140	240	D	620	250	230	290	220	50	840
107	106	M	25	SUFFOLK	4565	1320	220	500	180	80	320	100	120	120	220	A	580	200	200	280	220	60	760
108	107	M	42	WASHINGTON	6440	1400	260	440	160	80	340	90	110	120	260	B	640	260	240	400	280	80	720
109	108	M	42	BUCKS	5320	1300	240	540	160	40	360	100	160	120	240	B	600	220	200	300	220	90	780
110	109	M	42	BUCKS	6608	1240	240	500	180	60	300	100	120	120	240	B	620	200	220	320	220	80	780
111	110	M	40	PAYNE	7802	1640	280	600	200	100	400	120	140	120	260	G	680	240	220	300	280	100	1000
112	111	M	17	COOK	6608	1420	250	560	200	60	320	120	160	110	260	C	640	280	240	340	260	80	880
113	112	M	17	COOK	5432	1320	240	440	180	40	320	100	140	120	230	C	620	260	220	320	310	80	660
114	113	M	55	OUTAGAMIE	5376	1220	240	560	180	20	280	100	120	120	240	D	560	260	200	300	200	80	660
115	114	M	55	JEFFERSON	5824	1220	240	460	220	40	300	120	140	100	240	D	560	240	220	280	270	80	800
116	115	M	55	DANE	7885	1560	260	640	200	40	340	120	160	120	280	D	720	280	240	340	300	100	980
117	116	M	36	MUNROE	5488	1260	240	460	200	30	300	80	120	140	240	B	580	200	200	300	180	60	800
118	117	M	36	MUNROE	5600	1280	240	500	180	30	300	120	100	120	220	B	610	240	200	300	260	60	820
119	118	M	36	MUNROE	5712	1220	230	580	160	100	300	80	100	100	220	B	560	220	200	280	260	70	760
120	119	M	36	SUFFOLK	6608	1480	280	580	180	30	340	100	140	140	240	B	640	280	220	310	220	80	920
121	120	M	36	ALBANY	6384	1260	240	500	160	40	300	100	120	120	220	B	640	220	220	300	240	90	740
122	121	M	36	STEUBEN	5544	1280	240	500	160	40	300	100	120	140	220	B	600	240	220	340	160	60	740
123	122	M	36	ORANGE	6160	1320	260	560	200	60	300	100	120	120	240	B	660	260	250	320	240	80	880
124	123	M	94	NOVA SCOTIA	5936	1380	220	560	180	40	320	100	120	120	220	A	600	200	200	260	240	80	840
125	124	M	94	NOVA SCOTIA	6664	1400	260	600	180	30	340	100	120	120	260	A	660	260	240	340	240	80	880
126	125	M	34	HUNTERDON	5600	1200	240	500	200	40	340	100	100	100	220	B	540	220	200	280	220	60	660
127	126	M	34	HUNTERDON	5544	1260	240	480	200	40	300	100	120	100	220	B	600	320	220	340	220	60	800
128	127	M	34	HUNTERDON	4760	1200	220	520	180	30	320	100	120	120	240	B	560	220	200	320	220	60	700
129	128	M	34	HUNTERDON	5488	1280	240	580	180	60	300	100	120	140	220	B	560	220	200	300	240	80	760
130	129	M	34	HUNTERDON	5040	1260	240	500	160	40	280	100	120	140	240	B	600	220	200	320	240	60	720
131	130	M	34	HUNTERDON	4760	1300	240	460	180	40	320	80	100	140	200	B	620	260	240	340	180	80	780
132	131	M	34	HUNTERDON	5600	1280	240	500	180	40	320	100	120	140	240	B	580	220	220	320	260	60	760
133	132	M	34	HUNTERDON	5656	1300	260	480	180	60	300	80	100	120	220	B	660	220	220	340	200	60	700
134	133	M	34	HUNTERDON	4592	1180	240	520	160	20	300	80	100	120	200	B	560	210	200	300	200	60	660
135	134	M	34	HUNTERDON	5376	1290	240	500	180	40	320	100	120	120	200	B	600	250	220	320	220	60	700
136	135	M	34	HUNTERDON	5880	1340	240	520	160	20	320	100	120	120	240	B	660	250	220	300	240	80	820

137	136	M	34	HUNTERDON	6160	1360	260	540	180	50	340	120	140	120	260	B	600	250	220	300	280	80	840
138	137	M	34	HUNTERDON	6216	1260	240	500	180	40	300	100	120	140	240	B	580	220	220	330	220	80	840
139	138	M	34	HUNTERDON	6272	1380	260	600	180	20	300	100	120	120	220	B	620	240	220	340	210	70	900
140	139	M	34	HUNTERDON	5992	1360	260	500	200	40	320	110	140	120	220	B	620	240	220	300	240	80	800
141	140	M	34	HUNTERDON	6640	1400	260	600	200	40	320	100	140	140	220	B	640	260	220	340	220	100	820
142	141	M	34	HUNTERDON	6160	2340	240	520	170	40	320	100	120	120	240	B	620	240	220	300	200	80	820
143	142	M	34	HUNTERDON	6216	1320	280	500	180	60	300	100	120	120	240	B	600	240	210	340	260	80	800
144	143	M	34	HUNTERDON	5320	1220	240	500	180	50	320	80	100	120	220	B	600	240	220	300	240	60	720
145	144	M	34	HUNTERDON	6048	1360	240	440	200	60	300	100	120	120	240	B	640	250	220	320	160	60	820
146	146	M	34	HUNTERDON	4704	1240	240	460	160	40	320	100	120	140	210	B	560	200	180	260	220	80	740
147	147	M	34	HUNTERDON	5600	1260	240	500	160	40	320	100	140	120	230	B	580	220	200	300	220	60	760
148	148	M	34	HUNTERDON	5320	1220	240	500	160	60	300	100	110	130	240	B	600	220	200	300	200	60	740
149	149	M	34	HUNTERDON	5208	1200	240	540	160	60	320	100	120	120	220	B	540	240	200	300	200	60	700
150	150	M	34	HUNTERDON	6272	1340	260	500	200	40	340	100	120	140	220	B	640	230	200	340	220	60	800
151	151	M	34	HUNTERDON	6048	1320	260	500	200	20	320	100	130	140	260	B	640	200	200	300	240	90	860
152	152	M	34	HUNTERDON	5600	1260	240	440	160	40	320	120	140	140	260	B	600	220	220	300	240	60	760
153	153	M	34	HUNTERDON	5880	1300	240	500	200	40	300	100	140	120	240	B	640	240	220	300	260	60	760
154	154	M	34	HUNTERDON	5040	1240	220	520	180	40	300	100	120	100	200	B	580	240	200	280	180	60	700

-- SPECIES=2 --

OBS	NUMBER	SEX	STATE	COUNTY	FFL	CYL	C1	C2	A1	A2	E1	E2	E3	M1	M2	BLOCK	M3	M4	M5	M6	M7	M8	PFL
155	1001	M	55	DOOR	4144	1340	180	520	140	200	300	80	100	200	280	D	460	200	240	340	420	80	630
156	1002	M	55	DOOR	4088	1440	200	560	140	10	220	80	120	220	260	D	500	240	380	300	540	60	680
157	1003	M	27	FREEBORN	3808	920	140	400	120	0	280	60	60	120	200	E	380	140	280	200	360	40	520
158	1004	M	55	VILAS	3752	1280	180	450	180	20	260	80	120	240	220	D	500	180	250	280	340	60	700
159	1005	M	16	BONNER	3640	1300	160	500	180	20	260	100	120	180	300	F	500	160	400	340	480	40	.
160	1006	M	46	TODD	3808	1200	200	480	160	15	280	80	80	140	260	E	400	180	280	240	420	60	680
161	1007	M	46	TODD	3584	1210	190	440	160	5	260	100	90	240	190	E	300	180	350	260	420	40	660
162	1008	M	8	GRAND	3920	1540	240	500	140	20	340	140	180	260	280	G	540	180	420	280	480	50	760
163	1009	M	25	BERKSHIRE	4312	1300	200	520	200	40	320	80	80	140	260	A	480	180	240	200	440	50	660
164	1010	M	56	TETON	3584	1380	220	540	120	40	340	100	100	200	260	F	480	100	320	320	420	80	680
165	1011	M	46	LAWRONCE	3416	1140	180	500	160	20	300	80	100	180	240	E	460	180	320	280	440	50	640
166	1012	M	46	LAWRONCE	4088	1200	200	480	150	10	320	80	100	160	220	E	480	180	320	280	500	40	720
167	1013	M	46	LAWRONCE	3304	1040	140	440	140	10	260	100	80	180	160	E	420	160	300	220	400	30	580
168	1014	M	30	GLACIER	3472	1260	200	560	180	10	320	100	80	220	200	F	260	160	340	220	260	60	640

169	1015	M	98	SASKATCH.	3304	1240	160	480	180	20	260	80	100	140	220	F	480	180	340	240	480	40	640
170	1016	M	56	TETON	3584	1300	220	540	160	30	340	100	100	180	260	F	500	120	340	340	500	60	700
171	1017	M	56	TETON	3136	1320	200	540	120	20	380	100	100	220	200	F	460	140	320	280	500	80	600
172	1018	M	56	TETON	3080	1180	210	520	160	20	300	80	120	220	200	F	440	140	340	240	440	60	540
173	1019	M	56	TETON	3472	1340	180	560	120	20	360	100	100	180	260	F	480	140	380	240	500	60	680
174	1020	M	26	EATON	3808	1240	180	540	200	30	280	60	80	180	220	C	460	180	340	320	420	60	660
175	1021	M	26	EATON	3360	1180	200	480	120	20	300	80	100	180	180	C	440	140	280	320	410	40	600
176	1022	M	26	EATON	3584	1160	160	500	120	10	280	80	100	140	140	C	460	140	320	240	440	40	600
177	1023	M	26	EATON	3920	1200	160	460	160	20	280	80	100	220	200	C	440	180	320	220	500	40	640
178	1024	M	26	EATON	3528	1180	180	460	100	20	300	100	120	240	240	C	460	160	320	260	480	50	600
179	1025	M	26	EATON	3136	1140	160	500	160	40	260	80	120	180	260	C	420	180	260	240	480	50	.
180	1026	M	26	EATON	3472	1200	140	500	160	40	300	60	100	180	180	C	460	180	300	220	440	40	640
181	1027	M	26	EATON	2800	1100	160	440	100	20	300	80	100	180	220	C	420	160	300	200	380	40	540
182	1028	M	33	COOS	4032	1500	200	640	200	60	360	110	140	260	240	A	580	180	400	220	560	60	820
183	1029	M	25	MARIN	3248	1200	180	500	160	20	280	80	80	180	200	A	480	140	300	280	480	40	620
184	1030	M	6	MARIN	3136	1240	180	500	140	20	320	80	100	240	220	H	500	120	300	280	480	60	580
185	1031	M	50	CHITTENDEN	3472	1380	200	560	180	10	320	90	100	200	280	A	480	160	340	280	460	80	660
186	1032	M	2		2800	1080	180	440	140	10	300	80	80	200	200		440	140	300	200	400	60	500
187	1033	M	0		3192	1260	220	540	160	30	300	80	120	100	260		500	180	300	240	260	60	600
188	1034	M	23	WASHINGTON	3192	1320	160	500	140	20	300	100	120	200	200	A	300	200	300	300	500	100	620
189	1035	M	95	ONTARIO	3920	1280	200	500	140	20	260	100	100	220	240	B	460	140	280	300	440	80	660
190	1036	M	95	ONTARIO	3752	1320	200	520	140	20	300	100	100	200	260	B	480	180	340	280	480	80	700
191	1037	M	95	ONTARIO	3920	1340	210	550	160	40	320	90	100	200	260	B	520	180	320	280	540	100	640
192	1038	M	53	KING	3696	1340	210	540	170	20	340	100	80	220	260	I	560	180	400	340	500	100	720
193	1039	M	26	CALHOUN	3976	1320	220	560	140	20	320	80	120	250	220	C	520	160	340	320	300	60	.
194	1040	M	26	CALHOUN	4144	1300	220	540	220	30	300	80	100	220	200	C	500	140	250	260	440	100	680
195	1041	M	49	CACHE	3920	1380	210	500	220	20	400	100	140	200	260	G	540	180	400	300	560	50	700
196	1042	M	23	PISCATAQUIS	3752	1340	200	580	140	20	380	100	100	200	240	A	320	180	320	320	500	80	.
197	1043	M	26	ST.JOSEPH	3192	1080	180	440	140	40	280	80	100	190	220	C	440	140	300	280	440	80	.
198	1044	M	.		3136	1160	160	500	160	30	300	80	100	180	260		460	160	320	240	400	60	600
199	1045	M	94	QUEBEC	4144	1340	220	560	220	20	280	80	100	260	260	A	320	180	340	280	520	60	700
200	1046	M	94	QUEBEC	4480	1440	200	540	200	50	300	80	100	180	300	A	520	200	340	240	460	80	720
201	1047	M	94	QUEBEC	4088	1280	200	500	160	20	260	80	80	200	200	A	480	200	300	280	500	60	680
202	1048	M	33	COOS	4312	1440	220	560	200	40	260	100	100	200	240	A	500	200	380	280	520	40	740
203	1049	M	33	COOS	4032	1320	200	580	140	40	320	80	80	200	220	A	500	180	320	260	460	60	640
204	1050	M	96	MANITOBA	3472	1300	160	540	140	20	320	80	100	220	240	E	460	160	300	300	520	100	.
205	1051	M	96	MANITOBA	3752	1360	180	610	180	20	340	80	80	240	200	E	500	180	320	260	520	120	660
206	1052	M	96	MANITOBA	3472	1220	200	460	180	20	320	60	80	200	180	E	460	160	340	220	420	40	560

207	1053	M	53	SPOKANE	3752	1440	220	570	120	10	380	100	100	210	200	I	520	200	340	340	560	100	700
208	1054	M	94	QUEBEC	3920	1300	200	540	160	10	340	80	90	180	200	A	520	160	340	280	480	80	720

-- SPECIES=2 --

OBS	NUMBER	SEX	STATE	COUNTY	FFL	CYL	C1	C2	A1	A2	E1	E2	E3	M1	M2	BLOCK	M3	M4	M5	M6	M7	M8	PFL
209	1055	M	33	CARROLL	4088	1320	210	540	200	30	300	100	140	200	260	A	500	180	360	240	560	60	720
210	1056	M	33		4144	1400	190	570	140	30	320	90	120	260	280	A	480	180	320	300	540	100	720
211	1057	M	25	ESSEX	4312	1280	200	500	160	20	280	80	100	220	200	A	600	200	360	300	500	100	720
212	1058	M	26	EMMET	3808	1300	180	520	100	20	320	80	100	220	180	C	540	160	340	300	440	100	680
213	1059	M	26	EMMET	4032	1360	220	580	180	30	300	80	100	200	240	C	520	180	370	300	540	100	680
214	1060	M	26	EMMET	3808	1300	200	500	180	20	320	80	120	180	260	C	500	180	340	300	500	120	700
215	1061	M	26	CALHOUN	4368	1380	180	520	180	20	360	80	100	240	260	C	510	180	360	300	520	100	780
216	1062	M	26	MACKINAC	2912	1300	180	600	140	20	320	100	120	200	240	C	500	180	340	280	540	100	640
217	1063	M	26	MARQUETTE	3584	1240	180	520	120	10	300	100	100	180	200	C	480	140	320	340	480	100	620
218	1064	M	26	CHEBOYGAN	3808	1220	180	520	120	20	300	80	100	180	200	C	480	180	300	280	460	100	600
219	1065	M	26	CLARE	3528	1280	170	520	140	20	320	100	120	220	240	C	440	200	360	220	480	80	660
220	1066	M	55	DANE	3528	1160	160	400	120	40	300	80	100	180	240	D	480	180	280	260	480	90	640
221	1067	M	8	CHAFFEE	3640	1500	210	600	200	60	400	100	110	.	.	G	.	.	.	.	.	.	720
222	1068	M	95	ONTARIO	3080	1100	180	500	140	10	260	90	80	180	200	B	420	140	320	240	460	80	520
223	1069	M	95	ONTARIO	3752	1240	160	440	160	40	300	80	80	200	180	B	380	200	320	180	340	40	720
224	1070	M	95	ONTARIO	3584	1200	180	480	120	20	280	80	90	180	180	B	480	200	320	200	480	80	600
225	1071	M	56	MORAN	3080	1340	200	280	140	20	300	100	80	240	200	F	500	140	380	280	460	80	640
226	1072	M	96	MANITOBA	3976	1380	220	540	140	30	300	80	100	220	220	E	540	220	400	260	500	80	700
227	1073	M	55	DANE	4088	1340	200	560	100	40	300	70	80	220	240	D	500	200	390	260	560	40	740
228	1074	M	97	SASKATCH.	3528	1220	180	520	140	30	320	70	80	220	220	E	460	160	300	280	500	140	600
229	1075	M	33		4312	1340	180	520	180	40	340	100	120	240	240	A	500	180	300	280	50	60	740
230	1076	M	33		4312	1360	200	560	140	40	280	100	100	200	280	A	500	200	380	260	580	40	700
231	1077	M	33		4256	1260	180	440	180	40	280	100	110	220	220	A	540	180	400	280	480	120	720
232	1078	M	8	GUNNISON	3472	1400	220	540	200	40	280	100	100	240	260	G	500	180	340	300	540	100	660
233	1079	M	41	BENTON	3640	1340	210	500	140	20	320	80	80	160	220	H	300	160	340	320	500	140	640
234	1080	M	19	CERRO GORDO	4424	1340	200	520	120	30	300	60	80	240	240	E	500	200	340	240	440	100	740
235	1081	M	49	SUMMIT	3640	1400	200	560	120	20	300	100	80	240	180	G	540	180	340	340	500	100	700
236	1082	M	96	MANITOBA	3528	1320	200	500	160	20	300	80	90	200	260	E	480	180	340	300	520	140	620
237	1083	M	36	FRANKLIN	3696	1300	220	460	100	20	320	80	100	200	240	B	500	190	300	260	500	100	600
238	1084	M	36	FRANKLIN	4032	1340	200	560	160	20	320	100	100	220	240	B	480	140	280	340	520	100	740

239	1085	M	36	FRANKLIN	3640	1300	200	560	140	20	300	80	100	210	260	B	480	180	320	300	480	140	600
240	1086	M	95	ONTARIO	3920	1160	180	460	180	20	280	80	100	180	260	B	440	200	300	260	460	60	580
241	1087	M	95	ONTARIO	2912	1180	160	460	120	40	280	80	80	220	240	B	440	180	280	260	460	100	600
242	1088	M	95	ONTARIO	3640	1120	160	460	160	20	240	80	80	200	240	B	460	140	280	240	420	80	560
243	1089	M	95	ONTARIO	3920	1240	180	480	130	20	300	60	80	160	220	B	460	120	320	240	520	100	640
244	1090	M	95	ONTARIO	3808	1320	200	540	140	20	300	60	80	200	300	B	460	200	320	200	490	60	660
245	1091	M	95	ONTARIO	3808	1260	180	520	110	30	340	60	60	180	240	B	480	160	280	280	460	120	620
246	1092	M	95	ONTARIO	3920	1200	140	500	140	20	300	80	90	220	200	B	440	200	320	280	500	80	590
247	1093	M	95	ONTARIO	3584	1180	180	460	160	40	300	90	80	200	220	B	480	160	280	240	460	80	560
248	1094	M	55	KENOSHA	3584	1160	180	510	130	30	280	60	80	220	260	D	480	190	300	240	440	80	640
249	1095	M	55	KENOSHA	3976	1220	160	520	140	40	340	80	80	160	240	D	460	180	300	200	490	80	680
250	1096	M	26	CHIPPEWA	3472	1200	180	500	140	40	280	80	100	220	200	C	480	120	320	260	440	70	560
251	1097	M	56	TETON	3640	1300	210	560	140	40	280	80	100	240	260	F	480	140	320	300	520	80	640
252	1098	M	56	TETON	3416	1260	200	500	120	30	340	100	80	240	220	F	420	140	340	300	480	80	630
253	1099	M	16	FREMONT	3136	1220	200	510	120	30	340	60	70	200	200	F	420	140	340	280	500	80	600
254	1100	M	30	SHERIDAN	3640	1360	220	560	140	30	340	120	100	220	240	F	480	180	340	300	500	80	660
255	1101	M	30	BEAVERHEAD	3528	1300	220	530	140	20	360	100	90	190	200	F	440	160	320	260	520	80	640
256	1102	M	23		4032	1380	200	520	160	5	300	80	80	240	260	A	500	220	360	260	540	60	700
257	1103	M	55	DANE	4200	1340	180	520	160	20	300	80	100	240	200	D	560	220	380	320	500	100	700
258	1104	M	33	COOS	3808	1320	220	540	120	20	320	60	100	240	240	A	500	200	320	240	480	60	660
259	1105	M	51	FRANKLIN	3360	1360	220	580	120	20	420	100	100	250	260	B	500	180	380	240	520	100	600
260	1106	M	98	SASKATCH.	4088	1300	180	510	160	5	320	80	80	220	260	F	480	200	360	300	500	200	640
261	1107	M	98	SASKATCH.	3080	1220	180	540	120	20	320	90	100	200	260	F	480	160	300	250	500	110	540
262	1108	M	50	WINDSOR	3528	1200	140	500	140	30	300	80	100	220	200	A	460	160	320	260	500	80	620

--- SPECIES=2 ---

OBS	NUMBER	SEX	STATE	COUNTY	FFL	CYL	C1	C2	A1	A2	E1	E2	E3	M1	M2	BLOCK	M3	M4	M5	M6	M7	M8	PFL
263	1109	M	53	PIERCE	3528	1210	180	520	120	20	300	60	80	160	180	I	420	200	320	260	440	80	600
264	1110	M	9	NEW HAVEN	3976	1269	200	490	120	30	320	80	90	200	260	A	400	200	320	220	520	60	680
265	1111	M	33	COOS	4312	1540	240	600	160	20	360	100	140	260	260	A	500	240	380	320	520	60	800
266	1112	M	2		2968	1280	190	520	160	20	300	80	90	180	240		480	160	260	240	490	100	600
267	1113	M	33	CARROLL	4144	1340	200	500	140	20	320	80	100	200	220	A	500	200	320	260	500	80	660
268	1114	M	49	CACHE	3416	1400	180	560	140	40	340	100	100	260	220	G	480	180	280	300	500	80	.
269	1115	M	49	CACHE	3752	1440	200	630	160	40	400	110	100	280	240	G	520	160	340	320	540	120	700
270	1116	M	30	GALLATIN	4200	1260	180	460	140	30	280	100	100	180	240	F	480	180	300	260	480	100	640

271	1117	M	25	ESSEX	3864	1180	180	480	120	20	280	60	60	180	200	A	440	180	320	300	520	40	720
272	1118	M	8	RIO GRANDE	3752	1480	240	610	160	20	400	100	140	260	240	G	520	200	340	300	540	120	640
273	1119	M	49	CACHE	3416	1340	220	540	120	40	340	80	100	260	260	G	500	180	360	300	520	80	660
274	1120	M	30	FLATHEAD	3584	1180	200	480	140	40	320	100	100	200	200	F	460	180	300	260	540	100	620
275	1121	M	30	GALLATIN	3360	1260	200	480	120	40	360	100	100	160	260	F	480	140	240	240	500	100	620
276	1122	M	30	GALLATIN	3752	1360	200	540	100	20	300	100	100	220	200	F	480	180	380	280	500	100	620
277	1123	M	30	GALLATIN	3360	1300	220	520	100	20	320	100	80	190	200	F	440	140	260	260	480	110	620
278	1124	M	36		4200	1360	180	520	140	10	300	70	90	220	300	B	500	200	320	320	600	80	700
279	1125	M	49	CACHE	3360	1380	230	560	160	30	400	90	120	220	240	G	510	180	320	320	540	120	660
280	1126	M	33	GRAFTON	3752	1280	160	500	120	20	340	80	80	240	220	A	460	140	320	260	540	80	700
281	1127	M	33	GRAFTON	3808	1360	180	580	100	30	320	100	100	200	240	A	560	240	360	260	540	90	620
282	1128	M	33	GRAFTON	4480	1420	220	580	200	20	340	80	80	210	300	A	540	160	300	300	500	100	760
283	1129	M	39	ASHATABULA	4144	1260	220	500	160	10	340	80	80	200	160	C	560	220	320	300	440	100	700
284	1130	M	20		3584	1180	150	440	120	30	320	80	100	240	240	G	460	200	300	280	440	60	640
285	1131	M	33	CARROLL	3752	1220	200	540	160	50	320	80	120	220	160	A	480	160	320	300	500	80	660
286	1132	M	56	TETON	3472	1240	200	540	120	30	320	80	80	220	200	F	460	160	280	320	500	120	660
287	1133	M	50	GRAND ISLE	4144	1420	190	520	140	30	260	80	80	200	220	A	500	200	360	300	520	100	720
288	1134	M	99	B.COLUMBIA	3360	1280	190	520	180	20	280	60	100	220	160	H	500	180	360	300	520	80	600
289	1135	M	36	TOMPKINS	3080	1140	180	440	140	20	280	80	80	200	180	B	460	160	280	300	480	120	580
290	1136	M	26	EMMET	4200	1400	180	540	120	20	320	100	120	220	260	C	500	180	300	340	500	120	700
291	1137	M	26	EMMET	4648	1400	180	580	140	0	280	100	100	200	200	C	500	180	340	300	500	120	.
292	1138	M	53	WHITMAN	3192	1300	220	540	120	30	280	80	100	180	180	I	460	140	320	300	520	60	620
293	1139	M	53	WALLA WALLA	3416	1340	200	520	120	20	300	100	100	200	200	I	480	140	300	300	540	120	620
294	1140	M	8	LARIMER	3080	1040	180	460	80	40	240	60	60	180	180	G	400	160	300	160	440	40	540
295	1141	M	0	QUEBEC	3640	1260	160	540	180	20	320	100	120	240	240		480	140	220	240	520	100	640
296	1142	M	95	ONTARIO	3472	1240	180	480	160	20	300	100	120	200	160	B	480	180	360	300	440	80	580
297	1143	M	95	ONTARIO	3976	1320	200	580	140	20	280	90	110	200	200	B	500	180	260	300	500	120	700
298	1144	M	95	ONTARIO	3360	1200	200	500	140	20	260	80	100	220	180	B	460	200	340	300	400	100	600
299	1145	M	99	B.COLUMBIA	3080	1400	240	560	140	20	340	100	120	180	260	H	520	240	340	280	600	60	660
300	1146	M	16	PAYETTE	3808	1360	220	580	140	40	340	80	80	200	200	F	480	180	320	300	500	100	700
301	1147	M	16	PAYETTE	3528	1360	230	520	140	20	320	80	100	260	220	F	500	200	320	300	580	100	660
302	1148	M	16	PAYETTE	3192	1300	220	480	140	20	320	80	80	200	260	F	460	160	340	200	520	60	640
303	1149	M	16	PAYETTE	3920	1420	240	560	200	20	360	80	120	340	300	F	50	260	420	280	520	100	700
304	1150	M	16	PAYETTE	4032	1400	240	560	140	20	340	100	120	220	240	F	500	220	580	260	560	80	740
305	1151	M	16	PAYETTE	4032	1400	220	600	160	20	360	120	120	220	300	F	420	200	320	340	560	80	700
306	1152	M	16	PAYETTE	3864	1440	240	580	160	20	400	80	100	240	240	F	520	200	380	340	500	120	660
307	1153	M	16	PAYETTE	4312	1500	240	600	200	40	320	80	100	260	220	F	540	180	360	300	540	120	740
308	1154	M	16	PAYETTE	4088	1440	220	620	200	20	340	80	100	240	220	F	520	180	320	360	540	100	720

309	1155	M	16	PAYETTE	3752	1360	200	620	140	40	380	100	130	240	240	F	520	180	320	260	580	100	660
310	1156	M	16	PAYETTE	4032	1360	200	600	160	20	320	100	120	220	260	F	500	160	300	300	540	100	700
311	1157	M	16	PAYETTE	4144	1500	240	580	180	10	360	100	100	240	220	F	500	140	320	340	580	100	740
312	1158	M	16	PAYETTE	3864	1440	240	600	140	20	300	80	100	220	180	F	500	180	360	320	500	100	700
313	1159	M	16	PAYETTE	3920	1540	220	620	120	20	360	100	120	220	220	F	540	200	340	300	560	100	760
314	1160	M	16	PAYETTE	4200	1480	220	540	160	20	340	80	100	240	220	F	560	180	380	300	560	100	740
315	1161	M	16	PAYETTE	3976	1400	240	640	180	20	320	100	120	220	240	F	500	180	300	320	580	140	700
316	1162	M	16	PAYETTE	3864	1380	220	560	160	20	340	80	100	200	220	F	480	180	320	300	600	120	640

--- SPECIES=2 ---

OBS	NUMBER	SEX	STATE	COUNTY	FFL	CYL	C1	C2	A1	A2	E1	E2	E3	M1	M2	BLOCK	M3	M4	M5	M6	M7	M8	PFL
317	1163	M	16	PAYETTE	4368	1520	240	620	140	20	360	100	120	180	220	F	540	200	340	280	560	140	800
318	1164	M	16	PAYETTE	3920	1320	220	580	140	10	340	100	100	220	200	F	500	200	300	240	500	120	720
319	1165	M	16	PAYETTE	3920	1420	220	560	120	20	360	100	100	220	200	F	480	180	300	240	540	100	760
320	1166	M	16	PAYETTE	4144	1420	220	600	160	30	400	100	120	220	240	F	500	200	300	240	520	100	700
321	1167	M	16	PAYETTE	3976	1400	220	500	140	20	340	100	100	200	240	F	500	180	320	300	560	120	700
322	1168	M	16	PAYETTE	3808	1360	220	560	120	20	380	100	100	240	240	F	480	160	280	280	540	100	.
323	1169	M	16	PAYETTE	3584	1300	220	600	140	10	340	100	100	240	220	F	500	160	260	220	500	120	700
324	1170	M	16	PAYETTE	4200	1380	230	560	200	40	380	100	120	240	220	F	520	220	400	320	500	80	760
325	1171	M	16	PAYETTE	3920	1380	260	620	140	20	380	100	120	220	260	F	540	200	300	260	540	100	800
326	1172	M	16	PAYETTE	4144	1440	240	600	160	10	340	80	100	240	220	F	520	200	320	260	500	100	720
327	1173	M	16	PAYETTE	3808	1300	220	540	160	20	300	100	120	220	220	F	500	160	320	280	520	140	660
328	1174	M	16	PAYETTE	3640	1480	220	580	140	20	340	100	100	240	220	F	480	200	380	240	540	80	700
329	1175	M	16	PAYETTE	3808	1340	220	560	140	20	340	100	100	200	200	F	500	180	320	280	520	100	600
330	1176	M	16	PAYETTE	3920	1360	220	560	140	10	340	100	120	220	220	F	460	200	340	260	500	100	700
331	1177	M	41	CLACKAMAS	3640	1420	200	540	160	20	340	80	100	220	200	H	500	180	300	340	540	100	680
332	1178	M	41	BENTON	3920	1400	220	520	160	20	340	100	120	200	240	H	500	220	380	280	360	100	660
333	1179	M	41	KLAMATH	3864	1380	200	540	160	20	360	80	100	240	200	H	480	200	320	300	520	100	700
334	1180	M	41	CURRY	3416	1400	180	480	120	10	380	100	100	230	200	H	500	160	320	300	520	120	600
335	1181	M	41	LANE	4088	1360	220	540	140	20	360	100	120	240	240	H	480	200	340	300	580	100	700
336	1182	M	41	LANE	3136	1160	200	480	170	30	340	80	120	200	200	H	480	180	340	260	500	100	500
337	1183	M	41	JEFFERSON	4200	1580	230	600	180	40	400	100	100	240	220	H	560	240	400	300	600	100	740
338	1184	M	41	LANE	3304	1160	200	580	120	20	360	80	100	220	200	H	500	180	300	260	500	100	580
339	1185	M	41	LANE	3416	1320	210	500	120	10	340	100	100	220	200	H	480	200	320	280	540	100	740
340	1186	M	41	WALLOWA	4032	1400	230	540	140	20	380	80	100	200	220	H	480	220	360	300	600	100	660

341	1187	M	41	CURRY	3360	1320	200	500	140	20	340	100	140	200	140	H	500	240	360	240	500	100	600
342	1188	M	41	CURRY	3640	1300	220	500	120	20	360	100	100	240	220	H	480	260	360	300	520	100	660
343	1189	M	53	LINCOLN	3976	1460	240	640	120	20	340	100	120	220	280	I	540	180	320	300	560	100	800
344	1190	M	53	LINCOLN	4200	1480	220	560	120	10	340	100	100	200	220	I	520	220	320	260	560	80	720
345	1191	M	53	LINCOLN	4256	1560	260	580	140	20	340	120	100	220	200	I	580	200	340	300	580	110	780
346	1192	M	53		3136	1180	200	500	120	10	340	80	100	200	180	I	420	220	320	240	480	100	560
347	1193	M	53		3304	1100	200	480	140	20	340	80	100	200	200	I	480	180	300	260	540	100	600
348	1194	M	53	STEVENS	3472	1360	220	540	140	20	360	100	100	240	240	I	480	200	300	240	560	100	660
349	1195	M	53		3136	1240	210	500	140	20	340	100	100	220	200	I	480	180	280	300	500	100	580
350	1196	M	53	BENTON	4088	1420	220	540	160	20	400	100	120	220	240	I	560	200	320	300	540	120	740
351	1197	M	53	BENTON	3808	1340	220	560	160	20	340	100	120	220	200	I	560	160	300	280	520	140	720
352	1198	M	17	ADAMS	4704	1340	260	500	140	40	340	80	100	240	200	C	500	240	340	300	580	100	800
353	1199	M	17	WINNEBAGO	3696	1210	180	460	160	20	300	80	120	220	200	C	480	180	280	260	500	100	640
354	1200	M	2		3360	1260	200	500	120	10	300	80	100	220	220		460	180	320	260	520	80	620
355	1201	M	2		3136	1300	200	500	140	20	300	80	100	200	180		480	220	360	360	480	80	640
356	1202	M	2		3360	1300	180	500	140	40	340	80	100	220	220		480	240	340	280	560	100	640
357	1203	M	42		3976	1200	200	520	100	5	300	80	120	220	260	B	500	160	280	240	480	120	620
358	1204	M	30		3472	1300	220	540	120	10	360	100	110	240	220	F	460	240	400	280	520	80	660
359	1205	M	30		3136	1280	200	560	120	20	340	80	100	220	220	F	460	180	300	240	520	100	580
360	1206	M	49	SUMMIT	4144	1500	240	560	140	0	340	80	100	240	220	G	500	200	340	300	560	100	740
361	1207	M	49	SALT LAKE	4256	1520	240	620	140	20	400	100	100	240	240	G	520	200	360	300	400	160	660
362	1208	M	97	SASKATCH.	3304	1140	180	500	140	30	360	80	100	200	240	E	420	200	300	200	500	100	620
363	1209	M	49	UTAH	3976	1500	240	580	120	20	360	80	120	280	220	G	460	220	360	260	600	80	800
364	1210	M	49	UTAH	3920	1500	240	640	160	20	380	100	100	240	240	G	520	200	320	260	580	100	820
365	1211	M	49	UTAH	4256	1560	260	580	160	20	360	100	120	260	280	G	560	200	440	300	560	100	940
366	1212	M	49	UTAH	3864	1300	220	660	120	10	360	80	100	240	240	G	500	280	480	240	560	60	660
367	1213	M	49	UTAH	3360	1360	200	580	120	0	340	80	100	240	200	G	460	160	300	300	540	100	680
368	1214	M	49	UTAH	4200	1480	220	620	180	20	340	80	100	240	200	G	580	200	400	320	540	120	740
369	1215	M	49	UTAH	4480	1640	200	500	160	20	380	80	80	280	240	G	520	240	320	300	540	100	800
370	1216	M	49	UTAH	4172	1440	220	620	120	10	380	100	120	260	240	G	500	180	240	240	580	120	720

-- SPECIES=2 --

OBS	NUMBER	SEX	STATE	COUNTY	FFL	CYL	C1	C2	A1	A2	E1	E2	E3	M1	M2	BLOCK	M3	M4	M5	M6	M7	M8	PFL
371	1217	M	36	ONEIDA	3528	1260	160	540	140	20	340	60	100	200	220	B	480	240	300	300	500	120	700
372	1218	M	36	OSWEGO	4200	1320	180	560	140	10	300	80	100	220	200	B	500	240	340	240	500	100	.

373	1219	M	36	JEFFERSON	3248	1160	140	500	160	10	320	80	100	250	180	B	420	180	280	240	440	100	620
374	1220	M	36	JEFFERSON	3360	1180	160	520	140	20	260	80	80	220	200	B	460	140	240	260	540	100	600
375	1221	M	16	TETON	3416	1400	220	580	120	10	340	80	100	240	240	F	480	220	340	260	520	100	640
376	1222	M	16	BONNEVILLE	3920	1460	200	580	180	20	360	80	100	260	280	F	500	200	400	400	600	120	740
377	1223	M	56	PARK	3416	1180	180	500	80	10	360	80	100	180	260	F	460	180	280	320	500	110	600
378	1224	M	56	TETON	2520	1300	180	520	160	80	300	80	100	200	200	F	520	140	300	320	480	80	.
379	1225	M	56	TETON	3192	1260	200	480	160	30	400	80	120	180	180	F	420	180	320	260	420	120	660

APPENDIX A (CONT.)

Section 2.: Epigynal measurements in um

(Species 1 = Nuctenea sclopetaria)

OBS	NUMBER	SPECIES	SEX	STATE	COUNTY	FFL	SCW	TOTW	DEPW	SCLSEP	TOTHT	RIM	DEPHT	SCL	SCLHT
1	500	1	F	55	DANE	4928	220	740	460	60	260	2	300	440	320
2	501	1	F	55	OCONTO	5152	200	720	480	80	240	2	300	500	320
3	502	1	F	55	OCONTO	4704	130	760	540	90	360	1	320	440	300
4	503	1	F	55	OCONTO	5040	200	820	440	70	360	0	260	420	200
5	504	1	F	55	OCONTO	4928	249	729	599	80	260	1	300	600	200
6	505	1	F	26	CALHOUN	5040	240	760	400	40	440	0	260	440	200
7	506	1	F	26	CALHOUN	5264	240	800	460	60	320	0	260	520	240
8	507	1	F	26	CALHOUN	4256	120	700	360	20	300	0	280	460	260
9	508	1	F	26	CALHOUN	4200	200	780	520	20	280	1	300	460	140
10	509	1	F	25	MIDDLESEX	4032	220	720	420	20	300	1	250	400	320
11	510	1	F	25	DUKE	4032	80	600	400	60	260	1	260	420	220
12	511	1	F	25	MIDDLESEX	6308	240	1000	560	50	240	2	360	440	240
13	512	1	F	26	MACKINAC	4200	140	760	540	100	300	1	260	510	200
14	513	1	F	25	MIDDLESEX	5152	220	740	500	120	300	1	300	420	300
15	514	1	F	26	EATON	5208	180	740	540	100	300	2	200	400	220
16	515	1	F	26	CALHOUN	5320	260	780	400	60	240	2	300	460	240
17	516	1	F	23	OXFORD	5656	220	800	440	40	320	0	560	540	260
18	517	1	F	44	NEWPORT	6160	200	800	420	100	340	2	300	270	240
19	518	1	F	44	NEWPORT	5992	300	780	500	80	340	0	340	500	240
20	519	1	F	44	NEWPORT	6640	260	800	500	60	300	2	260	240	200
21	520	1	F	26	......	6160	240	940	560	80	400	1	360	680	280
22	521	1	F	26	......	6216	220	940	540	60	440	0	400	600	260
23	522	1	F	25	ESSEX	5880	220	820	560	30	560	0	320	460	280
24	523	1	F	25	ESSEX	5432	200	720	480	40	380	1	340	540	260
25	524	1	F	36	TOMPKINS	5712	240	880	520	80	380	1	240	580	240
26	525	1	F	36	TOMPKINS	5824	160	860	500	30	390	2	340	520	340
27	526	1	F	26	EMMET	4648	180	760	460	40	320	1	200	460	140
28	527	1	F	23	CUMBERLAND	3976	160	740	580	30	340	1	320	220	270
29	528	1	F	23	CUMBERLAND	4536	160	700	440	40	300	0	240	500	240
30	529	1	F	17	COOK	5432	210	840	520	40	300	0	280	500	140
31	530	1	F	53	KING	6328	180	880	540	80	260	2	300	560	200
32	531	1	F	.	ONTARIO	5712	280	760	480	40	340	0	240	580	240
33	532	1	F	26	WAYNE	4200	160	640	460	80	300	1	240	400	200
34	533	1	F	26	WAYNE	6048	200	800	380	60	260	2	340	420	300
35	534	1	F	26	WAYNE	5320	260	860	520	30	300	1	300	500	320
36	535	1	F	26	WAYNE	5096	180	780	420	40	340	2	300	680	280

OBS	NUMBER	SPECIES	SEX	STATE	COUNTY	FFL	SCW	TOTW	DEPW	SCLSEP	TOTHT	RIM	DEPHT	SCL	SCLHT
37	536	1	F	26	WAYNE	5712	200	860	560	60	340	1	380	460	360
38	537	1	F	25	ESSEX	6888	280	1040	700	40	440	1	260	640	340
39	538	1	F	25	ESSEX	5656	220	840	500	40	320	1	240	520	320
40	539	1	F	25	ESSEX	7138	240	860	560	60	400	0	380	660	200
41	540	1	F	55	OCONTO	4424	220	740	360	80	260	2	280	460	180
42	541	1	F	55	OCONTO	5376	220	820	500	80	420	2	320	600	220
43	542	1	F	55	OCONTO	5656	160	820	460	80	330	1	320	480	260
44	543	1	F	30	FLATHEAD	5376	180	860	560	40	360	2	320	500	260
45	544	1	F	30	FLATHEAD	5152	120	800	500	60	260	1	300	780	320
46	545	1	F	55	OCONTO	5824	180	820	420	60	300	2	340	540	220
47	546	1	F	55	OCONTO	4760	140	780	560	40	280	2	280	500	240
48	547	1	F	33	CARROLL	4200	180	520	320	30	220	0	240	280	180
49	548	1	F	33	CARROLL	5040	220	800	460	60	360	2	340	560	300
50	549	1	F	33	CARROLL	4480	180	760	480	80	490	0	260	460	260
51	550	1	F	23	PENOBSCOT	4200	200	740	440	40	220	1	280	380	320
52	551	1	F	23	PENOBSCOT	5436	200	740	440	80	260	0	300	440	260
53	552	1	F	17	COOK	5824	180	860	540	80	380	1	400	580	220
54	553	1	F	25	BARNSTABLE	4032	140	660	360	60	260	0	260	400	260
55	554	1	F	25	BARNSTABLE	5546	160	720	360	40	360	2	320	480	180
56	555	1	F	.	QUEBEC	4592	160	780	480	60	340	1	260	300	300
57	556	1	F	.	QUEBEC	4368	240	820	520	30	360	1	240	400	260
58	557	1	F	51	NORFOLK	4480	240	680	400	60	260	2	260	460	280
59	558	1	F	26	INGHAM	5712	140	760	440	60	300	2	320	440	380
60	559	1	F	26	INGHAM	5152	200	760	500	20	300	2	240	420	300
61	560	1	F	26	CALHOUN	4704	240	800	460	80	260	0	280	500	200
62	561	1	F	26	CALHOUN	5432	280	920	540	50	300	2	280	460	220
63	562	1	F	26	CALHOUN	4984	220	880	440	20	300	0	300	340	340
64	563	1	F	36	OLD CANSO	5992	380	840	540	.	340	1	340	520	.
65	564	1	F	36	OLD CANSO	4704	180	760	500	40	300	1	260	460	260
66	565	1	F	36	OLD CANSO	5712	160	740	440	60	340	1	340	420	200
67	566	1	F	36	OLD CANSO	5040	360	740	480	80	300	0	260	440	300
68	567	1	F	36	OLD CANSO	4312	160	700	460	80	280	1	280	480	240
69	568	1	F	36	OLD CANSO	5544	140	800	420	80	240	0	300	580	240
70	570	1	F	36	OLD CANSO	5656	220	800	500	80	320	2	320	500	320

71	571	1	F	36	OLD CANSO	4760	240	800	440	80	280	1	280	480	220
72	572	1	F	36	OLD CANSO	3920	220	660	300	40	240	2	260	500	220
73	573	1	F	25	ESSEX	6720	280	1000	600	60	380	1	540	640	320
74	574	1	F	25	ESSEX	5936	160	800	440	60	340	0	260	500	300
75	575	1	F	55	DANE	4928	200	800	400	100	300	2	260	580	220
76	576	1	F	55	DANE	4368	200	700	440	40	280	1	280	460	200
77	577	1	F	55	WINN	5432	200	860	460	60	320	1	300	540	320
78	578	1	F	33	HILLSBORO	6552	260	840	500	50	320	1	320	540	380
79	579	1	F	33	HILLSBORO	5880	200	800	600	80	340	1	360	510	300
80	580	1	F	23	CUMBERLAND	5544	200	880	480	80	340	0	320	540	300
81	581	1	F	23	CUMBERLAND	6832	260	960	580	60	400	1	300	520	380
82	582	1	F	25	MIDDLESEX	5936	240	800	480	40	340	0	380	520	280
83	583	1	F	25	MIDDLESEX	5488	200	820	520	70	280	1	320	480	300
84	584	1	F	50	WINDHAM	3752	140	720	480	60	300	0	260	400	260
85	585	1	F	50	WINDHAM	4984	200	760	540	60	340	1	300	500	340
86	586	1	F	25	MIDDLESEX	5152	200	720	440	60	300	2	280	540	200
87	587	1	F	25	MIDDLESEX	5544	200	760	460	40	320	0	240	560	220
88	588	1	F	25	ESSEX	5152	200	520	380	60	360	1	300	560	220
89	589	1	F	25	ESSEX	3920	200	800	460	40	220	2	280	440	180
90	590	1	F	25	DUKE	6602	160	900	500	40	320	2	320	540	260
91	591	1	F	25	DUKE	4816	180	520	420	60	140	2	260	520	300
92	592	1	F	25	DUKE	5320	160	780	420	80	300	2	320	520	380
93	593	1	F	25	DUKE	5376	200	860	500	80	340	0	340	530	380
94	594	1	F	25	DUKE	5768	220	760	430	80	300	2	260	480	280
95	595	1	F	55	MONITOWE	4368	160	620	400	40	320	0	240	420	220
96	596	1	F	55	MARTINETTE	4144	160	700	420	100	260	2	240	480	200
97	597	1	F	23	PENOBSCOT	5320	200	800	460	80	280	0	200	540	360
98	598	1	F	23	PENOBSCOT	5264	140	700	460	60	240	1	260	480	420
99	599	1	F	26	MACOMB	5376	220	780	440	120	280	2	300	440	360
100	600	1	F	36		6608	180	860	540	20	420	0	320	580	.
101	601	1	F	36		5488	200	820	600	40	320	1	400	540	320
102	602	1	F	25	ESSEX	5208	180	840	500	50	300	1	280	560	260
103	603	1	F	25	ESSEX	5208	140	720	500	80	360	2	280	400	280
104	604	1	F	26	WAYNE	4648	200	760	420	60	240	0	280	520	340
105	605	1	F	26	WAYNE	4592	220	780	340	70	240	0	280	460	320
106	606	1	F	44	PROVIDENCE	5936	180	720	400	60	320	2	340	500	300
107	607	1	F	44	PROVIDENCE	5208	200	740	440	60	300	2	260	420	260
108	608	1	F	55	MARTINETTE	5320	140	740	500	60	340	1	320	400	280

109	609	1	F	55	MARTINETTE	6272	240	820	460	50	320	2	260	500	300
110	610	1	F	55	DANE	5264	120	740	400	40	260	0	280	400	300

OBS	NUMBER	SPECIES	SEX	STATE	COUNTY	FFL	SCW	TOTW	DEPW	SCLSEP	TOTHT	RIM	DEPHT	SCL	SCLHT
111	611	1	F	55	DANE	4872	200	800	380	60	240	1	300	440	340
112	612	1	F	23	CUMBERLAND	5040	140	740	500	20	340	1	320	500	280
113	613	1	F	54	SUMMERS	5040	200	740	460	40	300	2	320	560	200
114	614	1	F	26	CALHOUN	5544	100	800	460	70	300	0	300	460	320
115	615	1	F	23	CUMBERLAND	7221	160	840	480	80	460	0	360	440	220
116	616	1	F	55	MILCO	5012	120	800	460	20	300	1	300	400	220
117	617	1	F	25	ESSEX	4872	180	720	480	60	300	2	260	400	260
118	618	1	F	95	NOVASCOTIA	4256	200	740	260	20	300	0	260	500	240
119	619	1	F	95	NOVASCOTIA	3584	140	640	400	20	270	1	220	340	200
120	620	1	F	95	OTTOWA	4648	180	720	400	80	280	2	260	440	280
121	621	1	F	23	CUMBERLAND	5264	220	700	420	80	280	1	340	460	300
122	622	1	F	55	DOOR	6216	180	840	400	80	260	2	260	560	400
123	623	1	F	55	DOOR	5880	220	860	520	20	380	1	360	460	300
124	624	1	F	55	OUTAGAMIE	5936	100	760	400	20	280	0	380	420	320
125	625	1	F	55	OUTAGAMIE	6496	160	900	740	60	420	0	320	580	260
126	626	1	F	26	MARQUETTE	4480	240	720	420	60	320	0	320	380	240
127	627	1	F	26	MARGUETTE	6328	200	920	540	40	340	2	360	600	260
128	628	1	F	55	OCONTO	6048	240	880	500	120	240	2	360	540	240
129	629	1	F	26	CALHOUN	4872	160	800	460	100	300	1	340	400	400
130	630	1	F	26	EMMET	6776	140	820	460	40	340	2	340	560	300
131	631	1	F	26	EMMET	5040	140	780	460	60	260	2	300	540	200
132	632	1	F	25	MIDDLESEX	5656	180	680	440	100	280	0	340	300	340
133	633	1	F	39	ASHATABULA	5040	100	740	460	60	280	2	320	500	260
134	634	1	F	26	EMMET	5712	160	800	480	100	280	1	340	580	400
135	635	1	F	55	OCONTO	5376	200	800	500	80	280	0	340	480	300
136	636	1	F	23	HANCOCK	6048	180	760	500	140	300	2	360	600	220
137	637	1	F	23	HANCOCK	4816	120	800	520	80	320	1	320	540	240
138	638	1	F	26	CALHOUN	4424	160	760	500	60	300	0	260	460	180
139	639	1	F	26	CALHOUN	4536	160	760	440	40	320	0	260	420	160
140	640	1	F	26	CALHOUN	5656	180	740	460	100	280	1	340	460	300
141	641	1	F	26	CALHOUN	5152	220	880	540	40	320	2	320	380	300
142	642	1	F	26	DELTA	4984	160	840	540	40	320	0	240	460	200

143	643	1	F	26	DELTA	4760	300	760	480	40	320	0	200	500	200
144	644	1	F	26	MIDLAND	4760	240	780	500	60	340	0	240	420	280
145	645	1	F	26	CALHOUN	5320	140	800	440	80	220	2	240	560	300
146	646	1	F	26	CALHOUN	5712	180	800	480	120	260	2	240	400	260
147	647	1	F	26	CALHOUN	4872	140	740	420	60	280	2	280	400	300
148	648	1	F	26	CALHOUN	4704	160	700	440	80	300	2	280	500	300
149	649	1	F	25	BARNSTABLE	4760	180	600	480	80	360	0	320	420	300
150	650	1	F	25	BARNSTABLE	4312	140	700	400	80	260	2	240	400	280
151	651	1	F	50	CHITTENDEN	5264	160	760	480	100	320	1	260	440	300
152	652	1	F	50	CHITTENDEN	4872	200	840	440	80	280	2	320	480	240
153	.	.		.		.	.	.	.	.	.	.	.	.	.

APPENDIX B

Mean and variances by geographic block

(Species 1 = *Nuctenea sclopetaria*)

(Species 2 = *Nuctenea patagiata*)

VARIABLE	N	MEAN	VARIANCE
---------------	SPECIES=1	BLOCK=A ----------------	
FFL	44	5852.09090909	978894.828753
CYL	44	1413.40909091	116422.991543
C1	44	253.40909091	376.479915
C2	44	514.31818182	3480.919662
A1	44	184.77272727	583.668076
A2	44	52.27272727	459.830867
E1	44	327.72727273	1208.668076
E2	44	108.18181818	364.059197
E3	44	135.22727273	230.179704
M1	44	130.68181818	173.942918
M2	44	242.04545455	356.183932
M3	44	623.40909091	2404.386892
M4	44	241.36363636	695.771670
M5	44	220.45454545	371.881607
M6	44	306.36363636	944.608879
M7	44	228.86363636	1010.306554
M8	44	72.72727273	136.575053
PFL	42	804.04761905	7488.095238

VARIABLE	N	MEAN	VARIANCE
---------------	SPECIES=1	BLOCK=B ----------------	
FFL	41	5801.92682927	474286.819512
CYL	41	1325.12195122	32635.609756

C1	41	247.56097561	263.902439
C2	41	510.73170732	1701.951220
A1	41	179.75609756	282.439024
A2	41	43.41463415	263.048780
E1	41	313.90243902	304.390244
E2	41	99.02439024	104.024390
E3	41	121.21951220	195.975610
M1	41	125.12195122	155.609756
M2	41	231.95121951	361.097561
M3	41	607.56097561	1213.902439
M4	41	235.60975610	585.243902
M5	41	213.90243902	209.390244
M6	41	313.17073171	577.195122
M7	41	225.85365854	919.878049
M8	41	70.97560976	159.024390
PFL	41	782.43902439	5263.902439

--------------- SPECIES=1 BLOCK=C ----------------

FFL	38	5418.10526316	546909.826458
CYL	40	1300.22500000	5135.871154
C1	40	237.75000000	669.166667
C2	40	480.22500000	2300.486538
A1	40	185.75000000	553.269231
A2	40	48.37500000	326.137821
E1	40	304.75000000	969.166667
E2	40	101.87500000	238.060897
E3	40	142.75000000	635.833333

M1	40	124.50000000	194.615385
M2	40	229.75000000	571.730769
M3	40	605.62500000	1981.009615
M4	40	229.00000000	670.769231
M5	40	212.50000000	311.538462
M6	40	306.25000000	577.884615
M7	40	204.00000000	1091.282051
M8	40	66.00000000	224.615385
PFL	35	765.71428571	8413.445378

VARIABLE	N	MEAN	VARIANCE
---------------	SPECIES=1	BLOCK=D	----------------
FFL	26	6023.69230769	762481.821538
CYL	26	1348.46153846	17669.538462
C1	26	252.30769231	522.461538
C2	26	498.84615385	4298.615385
A1	26	187.30769231	412.461538
A2	26	52.88461538	496.346154
E1	26	321.15384615	754.615385
E2	26	111.53846154	205.538462
E3	26	145.38461538	441.846154
M1	26	130.00000000	192.000000
M2	26	242.69230769	332.461538
M3	26	622.69230769	3116.461538
M4	26	242.69230769	692.461538
M5	26	216.53846154	487.538462

M6	26	304.61538462	777.846154
M7	26	223.46153846	1399.538462
M8	26	69.61538462	251.846154
PFL	26	816.53846154	12759.538462

--------------- SPECIES=1 BLOCK=F ----------------

FFL	1	7470.00000000	.
CYL	1	1640.00000000	.
C1	1	300.00000000	.
C2	1	590.00000000	.
A1	1	240.00000000	.
A2	1	40.00000000	.
E1	1	380.00000000	.
E2	1	120.00000000	.
E3	1	120.00000000	.
M1	1	140.00000000	.
M2	1	260.00000000	.
M3	1	740.00000000	.
M4	1	240.00000000	.
M5	1	230.00000000	.
M6	1	320.00000000	.
M7	1	280.00000000	.
M8	1	80.00000000	.
PFL	1	1000.00000000	.

VARIABLE	N	MEAN	VARIANCE

--------------- SPECIES=1 BLOCK=G ----------------

FFL	1	7802.00000000	.
CYL	1	1640.00000000	.
C1	1	280.00000000	.
C2	1	600.00000000	.
A1	1	200.00000000	.
A2	1	100.00000000	.
E1	1	400.00000000	.
E2	1	120.00000000	.
E3	1	140.00000000	.
M1	1	120.00000000	.
M2	1	260.00000000	.
M3	1	680.00000000	.
M4	1	240.00000000	.
M5	1	220.00000000	.
M6	1	300.00000000	.
M7	1	280.00000000	.
M8	1	100.00000000	.
PFL	1	1000.00000000	.

--------------- SPECIES=2 BLOCK= ----------------

FFL	8	3199.00000000	66696.0000000
CYL	8	1237.50000000	5992.8571429
C1	8	186.25000000	426.7857143
C2	8	505.00000000	1000.0000000
A1	8	150.00000000	342.8571429
A2	8	22.50000000	107.1428571

E1	8	307.50000000	221.4285714
E2	8	82.50000000	50.0000000
E3	8	101.25000000	183.9285714
M1	8	192.50000000	1821.4285714
M2	8	227.50000000	792.8571429
M3	8	472.50000000	335.7142857
M4	8	177.50000000	1307.1428571
M5	8	302.50000000	1992.8571429
M6	8	257.50000000	2221.4285714
M7	8	453.75000000	9341.0714286
M8	8	80.00000000	342.8571429
PFL	8	605.00000000	2142.8571429

VARIABLE	N	MEAN	VARIANCE
---------------	SPECIES=2	BLOCK=A ----------------	
FFL	30	4000.26666667	110881.029885
CYL	30	1334.96666667	7292.447126
C1	30	195.66666667	404.712644
C2	30	535.33333333	1749.885057
A1	30	159.33333333	951.264368
A2	30	28.16666667	166.350575
E1	30	310.00000000	958.620690
E2	30	86.33333333	148.160920
E3	30	99.66666667	396.436782
M1	30	211.66666667	814.367816
M2	30	236.66666667	1160.919540

M3	30	481.33333333	4742.988506
M4	30	186.00000000	583.448276
M5	30	334.66666667	1211.954023
M6	30	272.00000000	871.724138
M7	30	492.33333333	8039.195402
M8	30	72.00000000	451.034483
PFL	29	696.55172414	2573.399015

--------------- SPECIES=2 BLOCK=B ---------------

FFL	28	3666.00000000	113240.296296
CYL	28	1243.57142857	5838.624339
C1	28	183.21428571	452.248677
C2	28	506.78571429	1718.915344
A1	28	140.00000000	362.962963
A2	28	21.25000000	84.490741
E1	28	298.57142857	1153.439153
E2	28	81.78571429	148.544974
E3	28	92.85714286	184.126984
M1	28	206.07142857	402.513228
M2	28	225.71428571	1388.359788
M3	28	468.57142857	931.216931
M4	28	177.50000000	856.481481
M5	28	305.71428571	973.544974
M6	28	265.00000000	1440.740741
M7	28	478.92857143	2402.513228
M8	28	93.57142857	475.661376
PFL	27	625.55555556	3033.333333

VARIABLE	N	MEAN	VARIANCE
---------------	SPECIES=2	BLOCK=C	----------------
FFL	25	3745.28000000	230840.960000
CYL	25	1251.60000000	7897.333333
C1	25	186.00000000	666.666667
C2	25	511.20000000	1769.333333
A1	25	145.60000000	950.666667
A2	25	23.20000000	114.333333
E1	25	304.00000000	533.333333
E2	25	83.20000000	122.666667
E3	25	104.80000000	142.666667
M1	25	203.20000000	697.666667
M2	25	212.80000000	1029.333333
M3	25	480.40000000	1320.666667
M4	25	171.20000000	702.666667
M5	25	318.40000000	922.333333
M6	25	278.40000000	1530.666667
M7	25	466.00000000	3266.666667
M8	25	80.40000000	812.333333
PFL	21	653.33333333	4053.333333
---------------	SPECIES=2	BLOCK=D	----------------
FFL	8	3920.00000000	68992.0000000
CYL	8	1285.00000000	9800.0000000
C1	8	180.00000000	228.5714286

C2	8	505.00000000	2971.4285714
A1	8	138.75000000	583.9285714
A2	8	50.00000000	3800.0000000
E1	8	287.50000000	1250.0000000
E2	8	76.25000000	55.3571429
E3	8	97.50000000	278.5714286
M1	8	210.00000000	800.0000000
M2	8	242.50000000	621.4285714
M3	8	492.50000000	1021.4285714
M4	8	198.75000000	469.6428571
M5	8	315.00000000	3657.1428571
M6	8	275.00000000	2028.5714286
M7	8	471.25000000	4955.3571429
M8	8	73.75000000	369.6428571
PFL	8	676.25000000	1426.7857143

VARIABLE	N	MEAN	VARIANCE
---------------	SPECIES=2	BLOCK=E ----------------	
FFL	14	3676.00000000	103057.230769
CYL	14	1213.57142857	16270.879121
C1	14	183.57142857	547.802198
C2	14	495.00000000	2719.230769
A1	14	149.28571429	345.604396
A2	14	18.57142857	93.956044
E1	14	304.28571429	810.989011
E2	14	77.85714286	156.593407

E3	14	87.14285714	145.054945
M1	14	197.14285714	1406.593407
M2	14	219.28571429	899.450549
M3	14	447.14285714	3606.593407
M4	14	177.14285714	421.978022
M5	14	320.71428571	1022.527473
M6	14	252.85714286	1145.054945
M7	14	461.42857143	2797.802198
M8	14	77.14285714	1545.054945
PFL	13	638.46153846	4097.435897

--------------- SPECIES=2 BLOCK=F ----------------

FFL	60	3689.46666667	142245.948023
CYL	60	1348.33333333	7448.022599
C1	60	213.00000000	424.745763
C2	60	548.50000000	3070.593220
A1	60	145.33333333	676.158192
A2	60	23.25000000	137.139831
E1	60	338.00000000	972.203390
E2	60	92.50000000	134.322034
E3	60	102.33333333	184.293785
M1	60	217.66666667	879.209040
M2	60	229.33333333	819.887006
M3	60	475.16666667	4933.870056
M4	60	175.66666667	855.480226
M5	60	334.33333333	2455.480226
M6	60	283.50000000	1480.762712

M7	60	513.00000000	2573.898305
M8	60	97.16666667	661.327684
PFL	57	672.80701754	3277.694236

VARIABLE	N	MEAN	VARIANCE
---------------	SPECIES=2	BLOCK=G ----------------	
FFL	22	3799.09090909	132562.181818
CYL	22	1421.81818182	16987.012987
C1	22	216.36363636	652.813853
C2	22	566.36363636	3452.813853
A1	22	147.27272727	1087.445887
A2	22	24.54545455	206.926407
E1	22	354.54545455	1835.497835
E2	22	92.72727273	258.874459
E3	22	107.72727273	589.826840
M1	21	245.71428571	605.714286
M2	21	234.28571429	765.714286
M3	21	506.19047619	1564.761905
M4	21	193.33333333	773.333333
M5	21	347.61904762	3139.047619
M6	21	286.66666667	1493.333333
M7	21	526.66666667	2573.333333
M8	21	93.33333333	883.333333
PFL	21	711.42857143	6902.857143
---------------	SPECIES=2	BLOCK=H ----------------	

FFL	16	3577.00000000	128314.666667
CYL	16	1341.25000000	10745.000000
C1	16	208.12500000	309.583333
C2	16	525.00000000	1200.000000
A1	16	145.62500000	426.250000
A2	16	20.62500000	46.250000
E1	16	347.50000000	793.333333
E2	16	88.75000000	158.333333
E3	16	106.25000000	198.333333
M1	16	215.62500000	572.916667
M2	16	208.75000000	851.666667
M3	16	485.00000000	2853.333333
M4	16	198.75000000	1358.333333
M5	16	340.00000000	853.333333
M6	16	290.00000000	586.666667
M7	16	523.75000000	3478.333333
M8	16	97.50000000	366.666667
PFL	16	643.75000000	4118.333333

VARIABLE	N	MEAN	VARIANCE
---------------	SPECIES=2	BLOCK=I ----------------	
FFL	14	3640.00000000	151010.461538
CYL	14	1340.71428571	16222.527473
C1	14	215.71428571	364.835165
C2	14	542.14285714	1602.747253
A1	14	135.00000000	319.230769

A2	14	18.57142857	28.571429
E1	14	338.57142857	951.648352
E2	14	94.28571429	210.989011
E3	14	101.42857143	151.648352
M1	14	207.85714286	402.747253
M2	14	212.85714286	960.439560
M3	14	504.28571429	2718.681319
M4	14	185.71428571	641.758242
M5	14	320.00000000	800.000000
M6	14	287.14285714	1021.978022
M7	14	528.57142857	1459.340659
M8	14	100.71428571	376.373626
PFL	14	672.85714286	5945.054945

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