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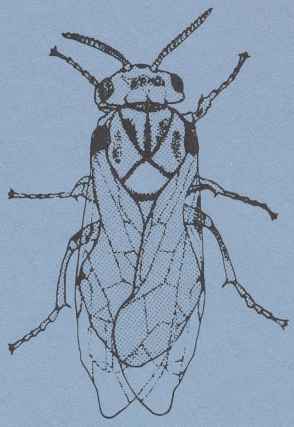

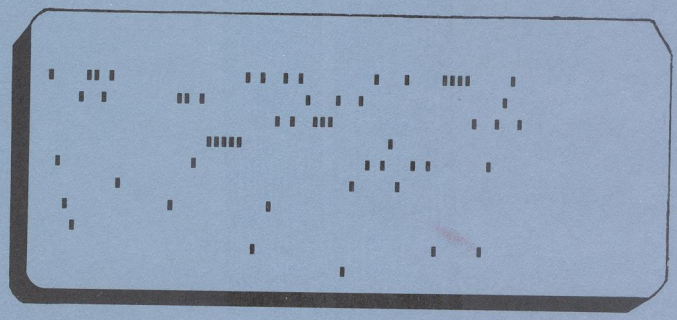

The Swaine jack pine sawfly life system: sampling techniques for small mammals

J. M. McLEOD, G. DÉSALLIERS AND R. LAGUË

CENTRE DE RECHERCHES FORESTIERES DES LAURENTIDES

Pêches et Environnement Canada
Service des forêts

Fisheries and Environment Canada
Forestry Service

Le Centre de recherches forestières des Laurentides (CRFL), un organisme relevant du Service de la Gestion de l'Environnement (Pêches et Environnement Canada), s'intéresse autant à l'environnement qu'aux industries forestières. Le but de ses travaux est de favoriser, par la recherche et par la mise en application des connaissances acquises, l'aménagement et l'utilisation la plus efficace et rationelle possible des ressources forestières de façon à ce qu'ils soient en harmonie avec les besoins de l'environnement.

Le CRFL se veut un élément actif de recherche scientifique au Québec. En collaboration avec divers groupes et organismes québécois, les chercheurs du CRFL visent à trouver des solutions pratiques aux nombreux problèmes forestiers du Québec. Le CRFL développe des projets susceptibles d'être appliqués par les usagers de la forêt québécoise: le gouvernement du Québec, les administrations régionales et municipales, l'industrie forestière et la population en général. Il joue aussi un rôle important dans le développement de méthodes acceptables pour l'amélioration et la sauvegarde de l'environnement forestier, de même qu'il veille à l'évaluation de l'impact du milieu forestier sur la qualité de l'environnement.

Les activités du CRFL peuvent être regroupées comme suit: la recherche dans le domaine des ressources forestières, la recherche dans le domaine de la protection, l'aménagement de terrains fédéraux et les services d'information au public. La recherche sur les ressources forestières comprend les projets tendant à l'amélioration des forêts et des arbres proprement dits alors que la recherche sur la protection vise à protéger les arbres contre deux de leurs ennemis naturels: les insectes nuisibles et les maladies. Soucieux de communiquer les résultats de recherche du CRFL, la Section de l'information diffuse de l'information sous forme de rapports scientifiques, de feuillets techniques ou de publications vulgarisées conçues spécialement pour le grand public.

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THE SWAINE JACK PINE SAWFLY LIFE SYSTEM: SAMPLING TECHNIQUES FOR SMALL MAMMALS

J.M. McLEOD, G. DESALLIERS AND R. LAGUE

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CENTRE DE RECHERCHES FORESTIERES DES LAURENTIDES
SERVICE CANADIEN DES FORETS
MINISTERE DES PECHES ET DE L'ENVIRONNEMENT
1080 ROUTE DU VALLON
C.P. 3800
SAINTE-FOY, QUEBEC
G1V 4C7

Copies available

Cover: Gilles Désalliers

ABSTRACT

This manual summarizes field sampling techniques for small mammals during population studies on the Swaine jack pine sawfly. A FORTRAN IV programme for summarizing the data using Zippen's technique is described.

RESUME

Ce manuel fournit un résumé des techniques d'échantillonnage des petits mammifères durant les études sur les populations de la tenthrède de Swaine. Un programme FORTRAN IV qui sert au traitement sommaire des données utilisant la technique de Zippen est décrit.

INTRODUCTION

This short manual summarizes field and analytical techniques for the study of small mammal populations during investigations of their numerical response to changes in numbers of the Swaine jack pine sawfly, *Neodiprion swainei* Middleton. The reader is referred to the manual of coded sampling forms (McLeod, 1973), form 04:01 for small mammals, as reference is frequently made to it in this text. Other manuals to the sawfly life system are either available (McLeod and Laguë, 1973; McLeod and Brochu, 1973; McLeod, 1974) or in preparation.

METHODS

All animals are live trapped. One hundred trapping stations are established in each study area at 20 m intervals in a grid (McLeod, 1973). A longworth Chitty trap and a one-gallon maple syrup bucket (Figure 1), the former for trapping rodents, and the latter for insectivores are set out at each station.

The trapping period is seven consecutive days, and traps are visited at intervals of 8 h, i.e. 8:00 h, 16:00 h, and 24:00 h. The traps and bait are prepared the day before initiation of trapping. Traps are opened at 8:00 h on the first day, and the first trapping period is 16:00 h. Trapping is completed at 8:00 h on the seventh day at which time the traps are closed or removed; trapping is best performed by a two-man crew.

Prior to trapping, the bucket traps are placed in holes in the ground made with a post-hole digger. The buckets are inserted so that their rims are flush with the surface of the ground. The buckets are provided with a series of 1 mm holes pierced around the bottom to permit passage of water. For shelter, a 30 cm square of plywood is placed on upright post about 12 cm above the rim of the bucket. The supports are cut from small branches and should be about 20 cm long to allow for an insertion of 20 cm in the ground. Posts are to be placed at each corner of the square. These traps are closed and left *in situ* between trapping periods. To close

Fig. 1. Longworth Chitty trap and bucket trap used for sampling populations of mice and shrews respectively.

them, the 30 cm square of plywood is removed from the posts, placed directly on the bucket rim and weighted down with a fist-sized rock. The 30 cm square may accidentally be displaced, in which case animals may enter into the bucket; to facilitate their escape, a small branch of spruce is placed in each bucket previous to closing.

The main boxes of the Chitty traps are half filled with excelsior and supplied with two or three morsels of fox chow as bait. For packing and distribution they are placed in large haversacks, 50 per haversack in the dismanteled condition, with the neck inserted into the main box.

Food for insectivores is supplied in ½ 1 autopak containers (Figure 1). A small hole in the side of the container permits entrance of the animals and the top serves as shelter from the elements. Blotting paper is placed in the bottom of each container to prevent moisture from accumulating. Food supplied consists of 20 live mealworm larvae. Small cubes of cheeze are also added. The live mealworms are stored in ½ 1 containers. On opening the traps, the food is introduced into the "autopak" and the tops adjusted. They are then placed in the bottom of the buckets, then the shelter put in place.

The two samplers walk adjacent lines, and when an animal is found by one of them, the other sampler is called for verification of identification and assistance in marking or recording. The animals are marked by toe clipping (Figure 2). No more than two toes must be clipped on each foot, and the system permits numbering up to 9999. At this time the animals' sex, vitality and reproductive condition are verified and the information entered on form 04:01 (McLeod, 1973, pp. 61, 62).

In practice, specimen mark numbers for a given locality should run consecutively from one for three consecutive years trapping. After three years, the mark numbers start at one again, since the probability or recovering previously marked individuals after three years is minimal. Clipping should be in the joint so as to prevent excessive bleeding. If a trapped animal has been previously marked, the recapture sequence is noted.

Samplers should always wear heavy duty leather gloves when handling animals, except for smaller shrews which may be manipulated safely with bare hands. Animals trapped in buckets may be seized directly. More caution is required with animals caught in Chitty traps. The trap should be inserted neck down in a clear plastic bag. Holding the bag around the main box of the traps with one hand, the neck is pushed free with the other hand, so that the animal will fall into the bag. The trap parts may be removed, then the animal.

To mark them, animals should be held by the nape, ventrun up and marked as in Figure 2. Note that rodents have four toes on the fore feet whereas shrews have five. The "thumbs" are never marked.

On completion of marking, the animal is released, the traps are cleared and fresh bait replaced. If a dead animal is encountered, it is preserved in formalin in a ½ l jar and the following information entered on a tag:

Locality
Trap Day
Date
Hour
Coordinates of Trap

The sex of shrews may be determined by applying light pressure on either side of the genital region. If it is a mature male, the penis will protrude. Lactating females are indicated by the presence of swollen mammae. In mature shrews, the base of the cuspids are usually dark red-brown, whereas in immatures they are white.

For rodents the criterion for male is the presence of hair between the genital and anal orifices. In females, this area is smooth, and the distance between the orifices shorter than for males.

The samplers should carry with them a field guide (Burt and Grossenheimier, 1962) and a set of mounted skins of the commonly encountered animals for identification.

For ease in locating lines at night, plastic tape is banded to trees along the line and at each station, the nearest tree bears a white

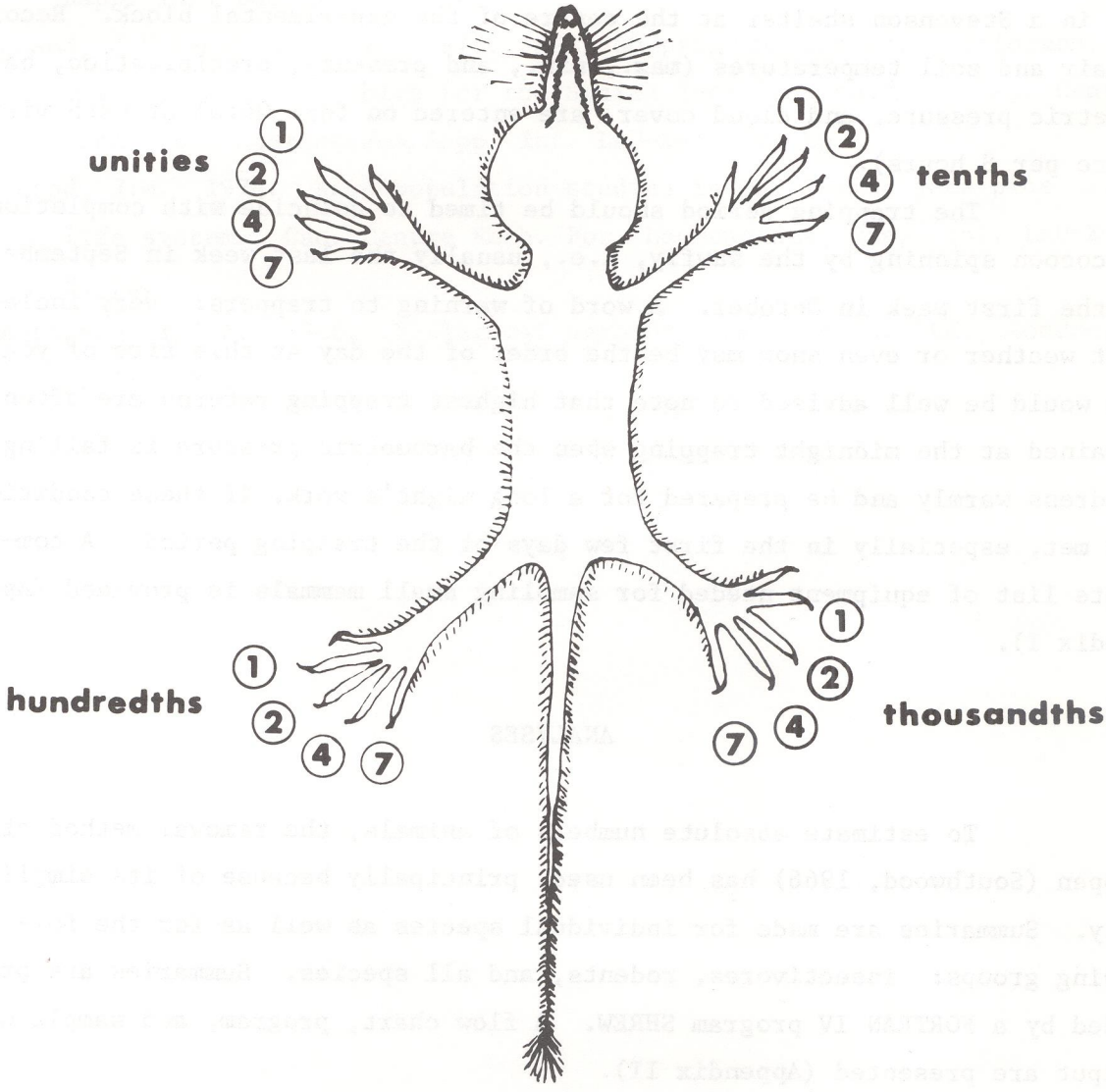


Fig. 2. Sequence for marking animals by the toe-clipping technique.

card, marked with the sub-block coordinates. Meteorological records should be kept during the trapping period. Recording instruments should be located in a Stevenson shelter at the centre of the experimental block. Records of air and soil temperatures (max., min., and present), precipitation, barometric pressure, and cloud cover, are entered on form 04:01 at each visit (once per 8 hours).

The trapping period should be timed to coincide with completion of cocoon spinning by the sawfly, i.e., usually the last week in September or the first week in October. A word of warning to trappers: very inclement weather or even snow may be the order of the day at this time of year. You would be well advised to note that highest trapping returns are often obtained at the midnight trapping when the barometric pressure is falling. So dress warmly and be prepared for a long night's work, if these conditions are met, especially in the first few days of the trapping period. A complete list of equipment needed for sampling small mammals is provided (Appendix I).

ANALYSES

To estimate absolute numbers of animals, the removal method of Zippen (Southwood, 1966) has been used, principally because of its simplicity. Summaries are made for individual species as well as for the following groups: insectivores, rodents, and all species. Summaries are provided by a FORTRAN IV program SHREW. A flow chart, program, and sample of output are presented (Appendix II).

REFERENCES

Burt, W.H. and Grossenheider, R.P. 1964. A field guide to the mammals. Houghton Mifflin Co., Boston. 284 pp.

McLeod, J.M. 1973. Information retrieval for the Swaine jack pine sawfly life system: a manual of coded sampling forms. Can. Centre Rech. For. Laurentides, Rapp. Inf. LAU-X-2. 95 pp.

McLeod, J.M. and Brochu, D. 1973. Fortran IV data summaries for the Swaine jack pine sawfly life system. Can. Centre Rech. For. Laurentides, Rapp. Inf. LAU-X-3. 59 pp.

McLeod, J.M. and Laguë, R. 1973. APL/360 programs for the development and analysis of life tables for the Swaine jack pine sawfly. Can. Centre Rech. For. Laurentides, Rapp. Inf. LAU-X-4. 72 pp.

McLeod, J.M. 1974. Bird population studies in the Swaine jack pine sawfly life system. Can. Centre Rech. For. Laurentides, Rapp. Inf. LAU-X-10. 86 pp.

Southwood, T.R.E. 1966. Ecological methods. Methuen Co. Ltd., London, p. 181-186.

APPENDIX I

The Swaine Jack Pine Sawfly Life System:
List of Equipment Required for Small Mammal Trapping

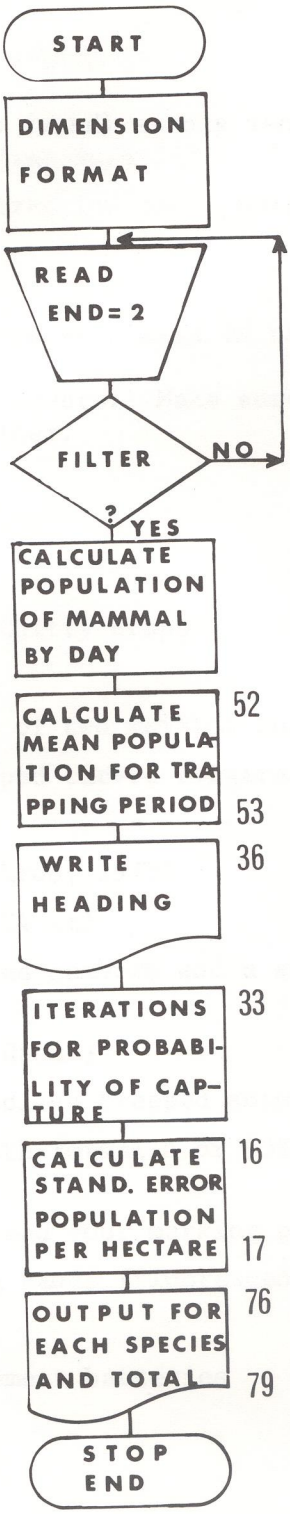
1. 100 Longworth Chitty traps
2. 100 bucket traps — to be placed in the field in advance
3. 100 "autopak" containers with covers. Make sure a 1.5 cm hole has been drilled in side of container.
4. Two large harversacks
5. Two shoulder knapsacks
6. One package of blotting paper
7. Excelsior sufficient for 100 Chitty traps
8. One-half gallon of fox-chow
9. Mealworm larvae (2000 in each of two mailing tubes)
10. Two pairs of sharp, short-tipped curved fingernail scissors
11. Field guide for small mammals
12. Twenty-five of form 04:01 (McLeod, 1973)
13. One aluminum clipboard (14 x 24 cm)
14. A sheet showing previously used numbers and a sketch indicating how to mark the animals.
15. 50 metal rimmed tags (2.5 cm diam.)
16. 6 large plastic bags, for handling trapped animals
17. Three ½ l jars half filled with formalin or 95% alcohol for preserving dead specimens
18. Four HB pencils with erasers and four marking pencils
19. Four rolls of plastic marking bands (fluorescent red preferably)
20. Two axes
21. Two "radar" lamps and replacement batteries
22. Two rainsuits
23. Weather instruments

    Hygro thermograph
    Max-Min air thermometer
    Max-Min soil thermometer
    Eight inch rain guage and measuring beaker — for Stevenson shelter
    Barograph--to be kept in camp
    Ink and charts for instruments

24. Two compasses

25. Two pair of leather gloves (heavy duty)

Appendix II


START
DIMENSION
FORMAT
READ
END= 2
FILTER
?
NO
YES
CALCULATE
POPULATION
OF MAMMAL
BY DAY
CALCULATE
MEAN POPULA-
TION FOR TRA-
PPING PERIOD
52
53
WRITE
HEADING
36
ITERATIONS
FOR PROBABI-
LITY OF CAP-
TURE
33
CALCULATE
STAND. ERROR
POPULATION
PER HECTARE
16
17
OUTPUT FOR
EACH SPECIES
AND TOTAL
76
79
STOP
END

```
C
C      SHREWS
C
       REAL SS(5)/.1,.05,.01,.005,.0001/
       INTEGER IPOP1(6,12,4,7)/2016*0/,IPOP2(6,12,8,7)/4032*0/,NPLACE(6,1
      12,7)/504*0/,NT1(6,12,4)/288*0/,NT2(6,12,8)/576*0/,NU1(6,12,4)/288*
      20/,NU2(6,12,8)/576*0/
C
C      FORMAT
C
    24 FORMAT(T50,F8.3,T64,'NA *',T77,I4,T86,F3.4)
    38 FORMAT(1H+,T35,'SOREX'/T32,'CINEREUS'/)
    39 FORMAT(1H+,T30,'MICROSOREX'/T36,'HOYI'/)
    40 FORMAT(1H+,T33,'BLARINA'/T30,'BREVICAUDA'/)
    41 FORMAT(1H+,T31,'CONDYLURA'/T32,'CRISTATA'/)
    42 FORMAT(1H+,T30,'PEROMYSCUS'/T29,'MANICULATUS'/)
    43 FORMAT(1H+,T30,'SYNAPTOMYS'/T33,'COOPERI'/)
    44 FORMAT(1H+,T30,'PHENACOMYS'/T29,'INTERMEDIUS'/)
    45 FORMAT(1H+,T27,'CLETHRIONOMYS'/T33,'GAPPERI'/)
    46 FORMAT(1H+,T32,'MICROTUS'/T26,'PENNSYLVANICUS'/)
    47 FORMAT(1H+,T32,'MICROTUS'/T27,'CHROTORAHINUS'/)
    48 FORMAT(1H+,T35,'ZAPUS'/T31,'HUDSONUS'/)
    49 FORMAT(1H+,T30,'NAPEOZAPUS'/T32,'INSIGNIS'/)
    26 FORMAT(T50,F8.3,5X,F7.4,T77,I4,T86,F9.4)
    77 FORMAT(///,T26,'* OBSERVED POP. FALLS WITHIN'/,T26,'95% CONF. LIMI
      1TS OF ESTIMATES POP.')
    34 FORMAT(3I2,2X,I2,21X,I4,25X,I1,I2)
C
C      LECTURE
C
     1 READ(1,34,END=2) ICAT,IAN,MONTH,LOCAL,IESPE,JOUR,NSEQUE
C
C      FILTER
C
       IF(ICAT.NE.4) GO TO 1
       IF(IAN.LT.62.OR.IAN.GT.73) GO TO 1
       IF(LOCAL.LT.2.OR.LOCAL.GT.7) GO TO 1
       IF(IESPE.EQ.6501.OR.IESPE.EQ.6801.OR.IESPE.EQ.3299) GO TO 1
       IF(JOUR.LT.1.OR.JOUR.GT.7) GO TO 1
       IF(NSEQUE.GT.1) GO TO 1
       IF(MONTH.LT.9) GO TO 1
C
C      END OF FILTER
C
       I=LOCAL-1
       J=IAN-61
       L=JOUR
       IF(IESPE.GT.0801) GO TO 27
       IF(IESPE-201)100,104,100
  100  IF(IESPE-301)101,105,101
  101  IF(IESPE-601)102,106,102
  102  IF(IESPE-801)1,107,1
  104  K=1
       GO TO 103
  105  K=2
       GO TO 103
  106  K=3
       GO TO 103
```

```
  107 K=4
C
C     CALCULATE THE POPULATION OF MAMMALS PER DAY
C
  103 IPOP1(I,J,K,L)=IPOP1(I,J,K,L)+1
      GO TO 35
   27 IF(IESPE-7905)109,116,109
  109 IF(IESPE-8501)110,117,110
  110 IF(IESPE-8701)111,118,111
  111 IF(IFSPE-8802)112,119,112
  112 IF(IESPE-8901)113,120,113
  113 IF(IESPE-8910)114,121,114
  114 IF(IESPE-9601)115,122,115
  115 IF(IESPE-9701)1,123,1
  116 K=1
      GO TO 125
  117 K=2
      GO TO 125
  118 K=3
      GO TO 125
  119 K=4
      GO TO 125
  120 K=5
      GO TO 125
  121 K=6
      GO TO 125
  122 K=7
      GO TO 125
  123 K=8
  125 IPOP2(I,J,K,L)=IPOP2(I,J,K,L)+1
   35 NPLACE(I,J,L)=JOUR
      GO TO 1
C
C     END OF LECTURE
C
    2 DO 3 I=1,6
      DO 4 J=1,12
      NUTS1=0
       NUTR2=0
       NUTSR=0
       NTOT2=0
      NTOT=0
      NTOTAL=0
C
C     CALCULATE THE POPULATION OF MAMMALS FOR ALL DAYS
C
       DO 5 K=1,8
      DO 6 L=1,7
       IF(K.GT.4) GO TO 52
      NT1(I,J,K)=NT1(I,J,K)+IPOP1(I,J,K,L)
   52  NT2(I,J,K)=NT2(I,J,K)+IPOP2(I,J,K,L)
      IF(NPLACE(I,J,L).EQ.0) GO TO 6
      NP=NPLACE(I,J,L)
       IF(K.GT.4) GO TO 53
      NU1(I,J,K)=NU1(I,J,K)+((NP-1)*IPOP1(I,J,K,L))
   53 NU2(I,J,K)=NU2(I,J,K)+((NP-1)*IPOP2(I,J,K,L))
    6 CONTINUE
       IF(K.GT.4) GO TO 54
```

```
      NT=NTOTAL
   14 IF(NT.EQ.0) GO TO 8
      IF(NT.LT.10) GO TO 17
      R=NU/FLOAT(NT)
      IF(R.GE.NT) GO TO 50
      N=1
      S=0.
C
C     CALCULATE ITERATION FOR ZIPPEN'S FORMULA
C
   15 TQ=((S/(1.-S))-((NP*S**NP)/(1.-S**NP)))-R
      S=S+SS(N)
      IF(S.GE.1.) GO TO 51
      IF(TQ.LT.0.) GO TO 15
   51 S=S-2*SS(N)
      N=N+1
      IF(N.GT.5) GO TO 16
      S=S+SS(N)
      GO TO 15
   50 TQ=NT
      IF(TQ.EQ.1.) GO TO 17
C
C     CALCULATE MEANS AND STANDARD ERRORS OF
C     NUMBER OF ANIMALS PER HECTARE
C
   16 P=NT/(1.-S**NP)
      PP=1.-S
      IF((P*(P-NT)).GE.(NT**2)) GO TO 17
      STER=SQRT((P*(P-NT)*NT)/((NT**2-P*(P-NT))*((NP*PP)**2/(1.-PP))))
      P1=P-(2*STER)
      IF(NT.GE.P1) GO TO 17
      POPULA=P/4.0468564224
      GO TO 28
   17 IF(NT.EQ.0) GO TO 8
      P=NT
      POPULA=P/4.0468564224
   28 GO TO (19,20,21,22,23),IE
   19 NCT=1
      IF(STER.NE.0.) GO TO 76
C
C     OUTPUT DATA
C     OUTPUT FOR EACH SPECIES IF NECESSARY
C
      WRITE(3,24) P,NT,POPULA
      NAST=NAST+1
      GO TO 82
   76 WRITE(3,26) P,STER,NT,POPULA
   82 GO TO (55,56,57,58),K
   55 WRITE(3,38)
      GO TO 8
   56 WRITE(3,39)
      GO TO 8
   57 WRITE(3,40)
      GO TO 8
   58 WRITE(3,41)
      GO TO 8
   20 NCT=2
      IF(STER.NE.0.) GO TO 78
```

```
      NT1A=NT1(I,J,K)
      NTOT=NTOT+NT1A
      NU1A=NU1(I,J,K)
      NUTS1=NUTS1+NU1A
   54 NT2B=NT2(I,J,K)
      NTOT2=NTOT2+NT2B
      NU2B=NU2(I,J,K)
    NUTR2=NUTR2+NU2B
    5 CONTINUE
    NUTSR=NUTS1+NUTR2
    NTOTAL=NTOT2+NTOT
    IANN=J+61
    LOCALI=I+1
C
C     OUTPUT HEADING
C
    IF(NUTSR.EQ.0) GO TO 4
   36 FORMAT(1H1,T30,'STUDY AREA',I2,4X,'YEAR 19',I2,T60,'SMALL MAMMAL P
     1OPULATIONS'///T33,'SPECIES',T53,'MEAN',T64,'S.E.',T77,'NO OF',/T75
     2,'TRAPPINGS',T87,'HECTARE'/)
    WRITE(3,36) LOCALI,IANN
    IE=1
    M=4
    NAST=0
C
C     PREPARATION OF ITERATION FOR ZIPPEN'S FORMULA
C     (FOR EACH SPECIES AND GROUP)
C
   33 DO 8 K=1,M
    STER=0.
    GO TO (9,10,11,12,13),IE
    9 NU=NU1(I,J,K)
    NT=NT1(I,J,K)
    DO 70 L=1,7
    IF(L.GT.1) GO TO 67
    MC=IPOP1(I,J,K,L)
   67 IF(L.GT.NP) GO TO 70
    MC1=IPOP1(I,J,K,L)
   70 CONTINUE
    IF(MC1.GE.MC) GO TO 17
    GO TO 14
   10 NU=NUTS1
    NT=NTOT
    GO TO 14
   11 NU=NU2(I,J,K)
    NT=NT2(I,J,K)
    DO 68 L=1,7
    IF(L.GT.1) GO TO 69
    KL=IPOP2(I,J,K,L)
   69 IF(L.GT.NP) GO TO 68
    KL1=IPOP2(I,J,K,L)
   68 CONTINUE
    IF(KL1.GE.KL) GO TO 17
    GO TO 14
   12 NU=NUTR2
    NT=NTOT2
    GO TO 14
   13 NU=NUTSR
```

```
   90 FORMAT(///T28,'TOTAL SHREWS',T50,F8.3,T64,'NA *',T77,I4,T86,F9.4///
     1)
      WRITE(3,90) P,NTOT,POPULA
      NAST=NAST+1
      GO TO 8
   18 FORMAT(///T28,'TOTAL SHREWS',T50,F8.3,5X,F7.4,T77,I4,T86,F9.4////)
   78 WRITE(3,18) P,STER,NTOT,POPULA
      GO TO 8
   21 NCT=3
      IF(STER.NE.0.) GO TO 79
      WRITE(3,24) P,NT,POPULA
      NAST=NAST+1
      GO TO 81
   79 WRITE(3,26) P,STER,NT,POPULA
   81 GO TO (59,60,61,62,63,64,65,66),K
   59 WRITE(3,42)
      GO TO 8
   60 WRITE(3,43)
      GO TO 8
   61 WRITE(3,44)
      GO TO 8
   62 WRITE(3,45)
      GO TO 8
   63 WRITE(3,46)
      GO TO 8
   64 WRITE(3,47)
      GO TO 8
   65 WRITE(3,48)
      GO TO 8
   66 WRITE(3,49)
      GO TO 8
   22 NCT=4
      IF(STER.NE.0.) GO TO 80
   91 FORMAT(///T27,'TOTAL RODENTS',T50,F8.3,T64,'NA *',T77,I4,T86,F9.4/)
C
C     OUTPUT TOTAL FOR EACH GROUP
C
      WRITE(3,91) P,NTOT2,POPULA
      NAST=NAST+1
      GO TO 8
   25 FORMAT(///T27,'TOTAL RODENTS',T50,F8.3,5X,F7.4,T77,I4,T86,F9.4,/)
   80 WRITE(3,25) P,STER,NTOT2,POPULA
      GO TO 8
   23 IF(STER.NE.0.) GO TO 83
   92 FORMAT(///T29,'GRAND TOTAL',T50,F8.3,T64,'NA *',T77,I4,T86,F9.4)
      WRITE(3,92) P,NTOTAL,POPULA
      NAST=NAST+1
      GO TO 8
   37 FORMAT(///T29,'GRAND TOTAL',T50,F8.3,5X,F7.4,T77,I4,T86,F9.4)
   83 WRITE(3,37) P,STER,NTOTAL,POPULA
    8 CONTINUE
      IF(IE.EQ.5) GO TO 7
      GO TO (29,30,31,32),NCT
   29 IE=2
      M=1
      GO TO 33
   30 IE=3
      M=8
```

```
      GO TO 33
   31 IE=4
      M=1
      GO TO 33
   32 IE=5
      M=1
      GO TO 33
    7 IF(NAST.GE.1) WRITE(3,77)
    4 CONTINUE
    3 CONTINUE
      STOP
      END
```

STUDY AREA 5 YEAR 1964 SMALL MAMMAL POPULATIONS

SPECIES	MEAN	S.E.	NO OF TRAPPINGS	HECTARE
SOREX CINEREUS	69.927	5.5542	51	17.2794
MICROSOREX HOYI	1.000	NA *	1	0.2471
BLARINA BREVICAUDA	3.000	NA *	3	0.7413
TOTAL SHREWS	69.041	3.1908	55	17.0604
PHENACOMYS INTERMEDIUS	1.000	NA *	1	0.2471
CLETHRIONOMYS GAPPERI	115.612	0.4312	113	28.5683
MICROTUS PENNSYLVANICUS	3.000	NA *	3	0.7413
MICROTUS CHROTORHINUS	1.000	NA *	1	0.2471
TOTAL RODENTS	120.732	0.4488	118	29.8483
GRAND TOTAL	182.522	1.0976	173	45.1021

* OBSERVED POP. FALLS WITHIN
95% CONF. LIMITS OF ESTIMATES POP.