

Reproduction and Age Structure of Three Indiana Shrews

THOMAS W. FRENCH*
Department of Life Sciences
Indiana State University
Terre Haute, Indiana 47809

Introduction

Seasonal patterns of reproduction and age structure have been studied in several individual species of shrew (Hamilton 1940, Pearson 1945, Conaway 1952, Jameson 1955, Clough 1963, Dapson 1968, French 1980a), but the relationship of these patterns between species in the same geographical areas is poorly known. The purpose of this study is to compare the seasonal patterns of reproduction and age structure of the Southeastern Shrew (*Sorex longirostris*), Masked Shrew (*S. cinereus*) and Short-tailed Shrew (*Blarina brevicauda*) in the vicinity of Terre Haute, Indiana.

Materials and Methods

A study of the Southeastern and Masked Shrews was conducted in Vigo County between 1976 and 1979 (French 1980b). During this study 145 Southeastern, 214 Masked and 216 Short-tailed Shrews were trapped. These specimens, plus previously existing Vigo County museum specimens and 107 specimens of *Blarina* from adjacent Clay County, were used to plot age structure. Reproductive data were gathered from these specimens, and because of the natural scarcity of pregnant shrews (Jameson 1955, Dapson 1968), the data were supplemented with data from 4 Masked and 14 Short-tailed Shrew females from other parts of Indiana.

Four major age classes were recognized, and each class was broken into three subgroups following the procedure of Rudd (1955). Each age class covered about four months of life and was based on tooth wear rather than reproduction status. In Rudd's study breeding was initiated in age class 2. In this study a representative specimen of each species was selected from Vigo County to represent each age class. Subsequent shrews were compared and assigned the number of the standard that they most closely resembled. Plus or minus designations were used if tooth wear was more or less advanced than the standard. Thus, the youngest possible designation is 1 - and the oldest 4+.

Results

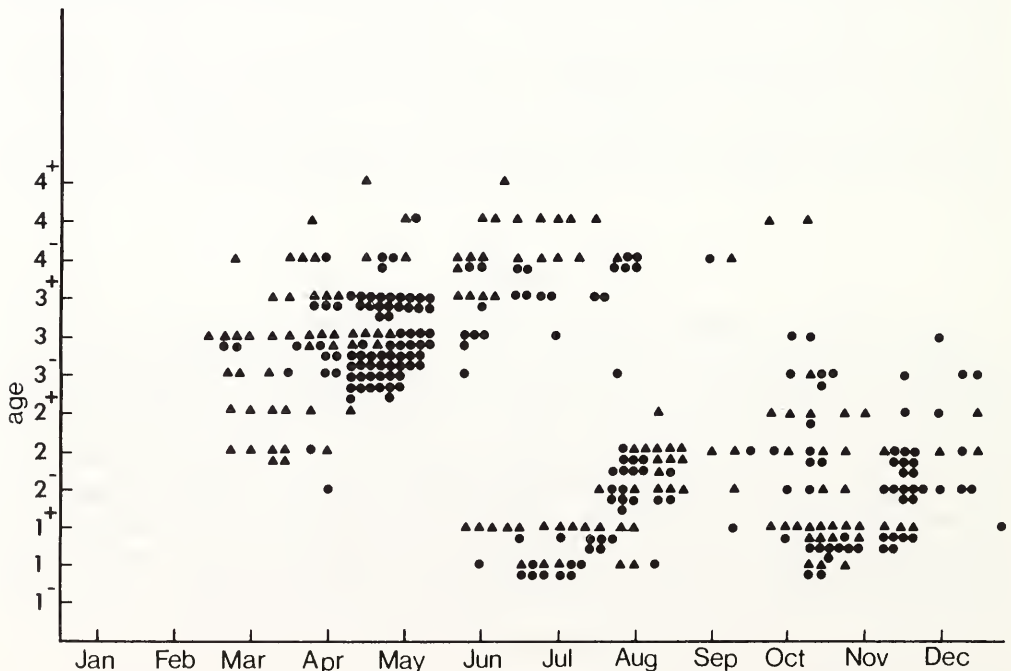
In Indiana, 13 pregnant Southeastern Shrews averaged 4.55 (4 to 6) embryos, 9 pregnant Masked Shrews averaged 6.10 (4 to 7) embryos, and 18 pregnant Short-tailed Shrews averaged 5.39 (2 to 8) embryos. Dates of pregnancy ranged from 8 April to 25 September, 28 April to 23 August, and 29 February to 11 September, respectively (Table 1). Similar earliest dates of pregnancy, and first appearance of young of the year suggested that the onset of breeding probably occurred at about the same time in both species of *Sorex*, with the onset about 3 weeks earlier in *S. longirostris* in this study (Figure 1). The onset of reproduction in *Blarina*, however, was 5 weeks earlier than *S. longirostris* and a full 8 weeks earlier than *S. cinereus* in this study.

*Current Address: Nongame and Endangered Species Program, Massachusetts Division of Fisheries and Wildlife, 100 Cambridge Street, Boston, Massachusetts 02202.

TABLE 1. Monthly distribution of pregnant and lactating individuals of *Sorex longirostris*, *S. cinereus* and *Blarina brevicauda* near Terre Haute, Indiana.

	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
<i>Sorex longirostris</i>												
pregnant	0	0	4	1	2	1	4	1	0	0	0	13
lactating	0	0	0	0	1	1	1	0	1	0	0	4
<i>Sorex cinereus</i>												
pregnant	0	0	2	2	0	4	1	0	0	0	0	9
lactating	0	0	0	1	0	1	0	0	4	0	0	6
<i>Blarina brevicauda</i>												
pregnant	1	1	8	5	1	0	1	1	0	0	0	18
lactating	0	0	2	4	2	3	0	3	4	1	2	21

Previously it has been shown that several species of shrews are capable of reaching sexual maturity and reproducing during their first year of life (Pearson 1945, Conway 1952, Clothier 1955, Short 1961, Clough 1963, Dapson 1968, French 1980a, and others). In this study, two *S. longirostris* in age class 1 were found to be pregnant, three were lactating, and four other females showed signs of sexual maturity. No *S. cinereus* in age class 1 were pregnant or lactating, but 4 females had enlarged uteri, indicating the approach of sexual maturity. At least one *Blarina* in age class 1 had placental scars, one had enlarged teats but a small uterus and 4 had enlarged uteri. Other specimens of each species in age class 2 also showed signs of reproduction in their first year of life. Fifteen females of *S. longirostris* and 20 females of *S. cinereus* in age class 1 were examined, suggesting maturity of female *S. longirostris* in their first year is more common than in *S. cinereus* in Indiana. In Vigo County, *S. longirostris* was trapped consistently with less frequency than *S. cinereus* (1.02 and 5.65 per 100 trap nights in hardwood floodplain habitats, respectively), suggesting lower population densities of *S. longirostris*. These results are consistent with Stein's (1961) sugges-

FIGURE 1. Monthly changes in age class composition of *Sorex longirostris* (triangles) and *S. cinereus* (circles) from Vigo County, Indiana.

tion that reproduction in the first year of life is related to low population densities in *Sorex*. *Blarina* population densities were intermediate with trap results yielding 1.20 per 100 trap nights when taken with *S. longirostris* and 1.16 per 100 trap nights when taken with *S. cinereus* in floodplain hardwoods. Individuals of each of these shrew species have previously been found, simultaneously pregnant and lactating (Hamilton 1949, French 1980a), indicating successive litters in rapid succession during part of the breeding season.

Although most breeding occurs in the spring, Dapson (1968) reports that under certain conditions *Blarina* can produce litters at any time of the year. Several authors (Seton 1909, Hamilton 1929, Lyon 1936, Blair 1940) have suggested that there are two breeding peaks in *Blarina* during the spring and fall with a reduction occurring in mid-summer. In this study, however, there seemed to be only one major peak in *Blarina* reproduction in the spring (late March to early June—Figure 2) which con-

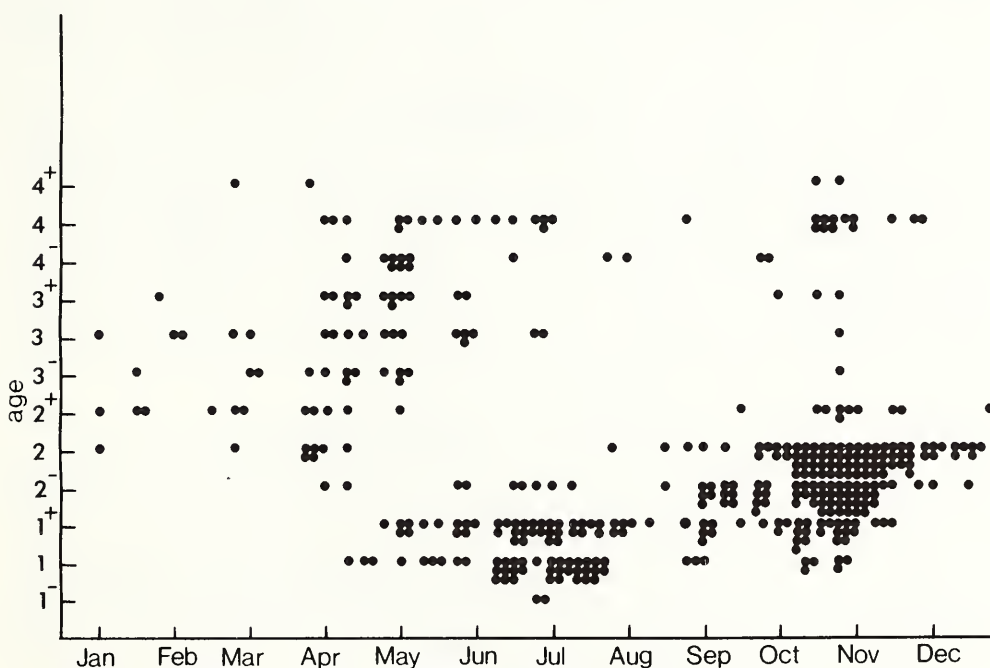


FIGURE 2. Monthly changes in age class composition of *Blarina brevicauda* (circles).

tinued to drop off through the late summer and fall. This is most evident when comparing the proportion of young shrews just entering the trappable population (age class 1) to shrews in age class 2 (Table 2). The proportion of younger shrews is high from April to July and then steadily drops to zero by December. Both species of *Sorex* do appear to have two reproductive peaks, in the spring and again in the fall, with a reduction of reproduction during the mid-summer (Table 2). The major peak in the appearance of young in the population occurs in June and July, with the proportion of younger shrews (age class 1) dropping to zero in August, and a lesser peak appearing in October and November before again dropping to zero in December.

Acknowledgments

Appreciation is extended to G.S. Jones, D.D. Pascal, Jr. and J.O. Whitaker, Jr. for the loan of *Blarina* skulls in their collections. I thank J.O. Whitaker, Jr. for his encouragement and suggestions concerning the manuscript.

TABLE 2. Monthly changes in the proportion of very young (age class 1) and older (age class 2) shrews still in their first year of life from Vigo and Clay counties, Indiana.

	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
<i>Sorex longirostris</i>								
age class 2	0	0	1	13	4	9	1	3
age class 1	1	6	9	0	1	14	3	0
percent in age 1	100	100	90	0	20	61	75	0
<i>Sorex cinereus</i>								
age class 2	0	0	9	8	2	6	16	5
age class 1	0	6	9	0	1	11	6	0
percent in age 1	0	100	50	0	33	65	27	0
<i>Blarina brevicauda</i>								
age class 2	2	3	5	5	23	83	28	10
age class 1	16	34	36	7	7	24	5	0
percent in age 1	89	92	88	58	23	22	15	0

Literature Cited

1. Blair, W.F. 1940. Notes on home ranges and populations of the short-tailed shrew. *Ecology* 21:284-288.
2. Clothier, R.R. 1955. Contribution to the life history of *Sorex vagrans* in Montana. *J. Mammal.* 36:214-221.
3. Clough, G.C. 1963. Biology of the arctic shrew, *Sorex arcticus*. *Am. Midl. Nat.* 69:69-81.
4. Conaway, C.H. 1952. Life history of the water shrew (*Sorex palustris navigator*). *Am. Midl. Nat.* 48:219-248.
5. Dapson, R.W. 1968. Reproduction and age structure in a population of short-tailed shrews (*Blarina brevicauda*). *J. Mammal.* 49:205-214.
6. French, T.W. 1980a. Natural history of the Southeastern Shrew, *Sorex longirostris* Bachman. *Am. Midl. Nat.* 104:13-31.
7. French, T.W. 1980b. Ecological relationships between the southeastern shrew (*Sorex longirostris* Bachman) and the masked shrew (*S. cinereus* Kerr) in Vigo County, Indiana. Unpubl. Ph.D. dissertation, Indiana State Univ., Terre Haute. 54 pp.
8. Hamilton, W.J., Jr. 1929. Breeding habits of the short-tailed shrew, *Blarina brevicauda*. *J. Mammal.* 10:125-134.
9. Hamilton, W.J., Jr. 1940. The biology of the smoky shrew (*Sorex fumeus fumeus* Miller). *Zoologica* 25:473-492.
10. Hamilton, W.J., Jr. 1949. The reproductive rates of some small mammals. *J. Mammal.* 30:257-260.
11. Jameson, E.W., Jr. 1955. Observation on the biology of *Sorex trowbridgei* in the Sierra Nevada, California. *J. Mammal.* 36:339-345.
12. Lyon, M.W., Jr. 1936. Mammals of Indiana. *Am. Midl. Nat.* 17:1-384.
13. Pearson, O.P. 1945. Longevity of the short-tailed shrew. *Am. Midl. Nat.* 34:531-546.
14. Rudd, R.L. 1955. Age, sex and weight comparisons in three species of shrews. *J. Mammal.* 36:323-339.
15. Seton, E.T. 1909. Life histories of northern animals. Charles Schribner's Sons, New York, vol. 1, p. 677-1267.
16. Short, H.L. 1961. Fall breeding activity of a young shrew. *J. Mammal.* 42:95.
17. Stein, G.H.W. 1961. Beziehungen zwischen Bestandsdichte und Vermehrung bei der Waldspitzmaus, *Sorex araneus*, und weiteren Rotzahnspitzmausen. *Z. Saugetierkunde* 26:13-28 (in German).