

*Sylvilagus transitionalis*. By Joseph A. Chapman

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*Sylvilagus transitionalis* (Bangs, 1895)  
New England Cottontail

*Lepus sylvaticus transitionalis* Bangs, 1895:405. Type locality Liberty Hill, New London Co., Connecticut.

*Sylvilagus transitionalis*, Nelson, 1909:195. First use of name combination.

**CONTEXT AND CONTENT.** Order Lagomorpha, Family Leporidae, Genus *Sylvilagus*, Subgenus *Sylvilagus*. There are about 14 recognized species of the genus *Sylvilagus*. No subspecies of *S. transitionalis* are recognized.

**DIAGNOSIS.** This is a medium-sized cottontail (figure 1). The upper parts are pinkish buff to ochreous buff, back is overlain with distinct black wash giving a penciled effect, anterior edges of the ears are covered with distinct black hair. The ears appear short and rounded. There is usually a distinct black spot between the ears and never a white spot or "star" on the forehead. The supraorbital process is obsolete or short; the postorbital process is thin and tapering, and rarely touches the skull (in *S. floridanus*, the postorbital process is broad and flat, frequently touching the skull—see figure 3). Suture between nasals and frontals is jagged and irregular in outline as opposed to the smooth appearance of this suture in *S. floridanus*. Tympanic bullae are smaller than in any subspecies of *S. floridanus* in the United States (see figure 2). Pelage may not be diagnostic throughout the range because of intergradation with members of the *floridanus* group, causing some *floridanus* to take on many of the color and pelage characteristics of *transitionalis* (Chapman and Morgan, 1973). Johnston (1972) described a number of cranial characters that may be used to distinguish *S. transitionalis* from *S. floridanus*.

**GENERAL CHARACTERISTICS.** Descriptions are in Nelson (1909:195-199), Hall (1951:160-161), Hall and Kelson (1959:263-264), and Chapman and Morgan (1973). Females are slightly less than 1% larger than males (Chapman and Morgan, 1973). Dental formula is  $i\ 2/1, c\ 0/0, p\ 3/2, m\ 3/3$ , a total of 28.

Means and ranges of some external measurements (in millimeters) for males and females, respectively, of *S. transitionalis* are (Chapman and Morgan, 1973): total length 405 (386 to 415), 411 (387 to 430); tail length 43 (22 to 57), 47 (30 to 65); hind foot length 93 (89 to 97), 93 (87 to 96); ear length from notch 57 (54 to 59), 58 (54 to 63). Weight of adults varied from 756 to 965 grams in males, and from 802 to 1038 in females (Chapman and Morgan, 1973). Some additional data on weights and measurements can be obtained from Nelson (1909), Hall (1951), Dalke (1942), and Llewellyn and Handley (1945).

Average cranial measurements (in millimeters) of adult *S. transitionalis* (sexes combined) are as follows: basilar length, 54.2; zygomatic breadth, 36.3; postorbital constriction, 14.3; length of nasals, 26.6; width of nasals, 14.3; length of maxillary toothrow, 13.6; diameter of external auditory meatus, 4.4; breadth of braincase, 22.9; length of palatal bridge, 6.0; depth of rostrum, 13.6; parietal breadth, 24.2; length of bulla, 10.1 (Chapman and Morgan, 1973). Additional data on cranial measurements are in Llewellyn and Handley (1945) and Johnston (1972).

**DISTRIBUTION.** The species ranges from southeastern New England south along the southern Appalachians to Alabama. The distribution as described by Hall and Kelson (1959) is shown in Figure 4. However, recent studies have indicated that the range of this rabbit now is much more restricted than originally believed (Chapman and Paradiso, 1972; Chapman and Morgan, 1973; Linkkila, 1971; Goodwin, 1935; Fay and Chandler, 1955; Jackson, 1973; Johnston, 1972). The type locality of *S. transitionalis* (Liberty Hill, Lebanon, New

London Co., Connecticut) no longer has a *transitionalis* population (Johnston, 1972). The species occurs from sea level in New England to above 1300 m (4000 ft.) in the southern Appalachians.

**FOSSIL RECORD.** The fossil evidence of *S. transitionalis* is sketchy throughout the Appalachian area. The only records of subfossils come from sink hole No. 2, New Paris, Bedford Co., Pennsylvania (Guilday and Bender, 1958).

Guilday (personal communication, 1973) reported that all the late Pleistocene deposits he has examined from the Appalachian area contained only *Lepus americanus* Erxleben. He noted that lagomorph remains are known from other cave deposits, but that *S. floridanus* and *S. transitionalis* are so similar osteologically that specific identification has not been possible from the fragmented remains.

Guilday (personal communication, 1973) stated: "During the Wisconsinan glaciation, and up to about 10,000 to 11,000 years ago, only *Lepus americanus* seems to have occupied the Appalachian area at least as far south as Virginia and probably, judging from recent evidence of active glaciers on Grandfather Mountain, North Carolina, the entire Appalachian chain. Both species of *Sylvilagus* invaded, or perhaps reinvaded, the area following the abrupt climatic change that ushered in recent times. Where they occurred during the Wisconsinan Maximum and the particulars of their range adjustments during that time are at present not known." Guilday further pointed out that there is no evidence one way or the other to indicate which of these two species evolved from the other.

**ONTOGENY AND REPRODUCTION.** The gestation period of *transitionalis* is believed to be 28 days; a litter of four was born 28 days after conception (Dalke, 1942). Dalke (1942) described a number of nests but did not indicate whether they were of *transitionalis* or *floridanus*. It is presumed from his account that the nests he described were of both species, because he believed the breeding habits of the two were similar. He reported that all 17 nests he observed were of similar construction, consisting of depressions in the ground about 4 inches deep and 5 inches wide. One nest was located in a hole 18 inches deep. Nests that were in the open were lined with fur and grass. The nest had a cap constructed



FIGURE 1. Photograph of *Sylvilagus transitionalis* from Dolly Sods Scenic Area, Tucker Co., West Virginia (photo by K. B. Fuller).

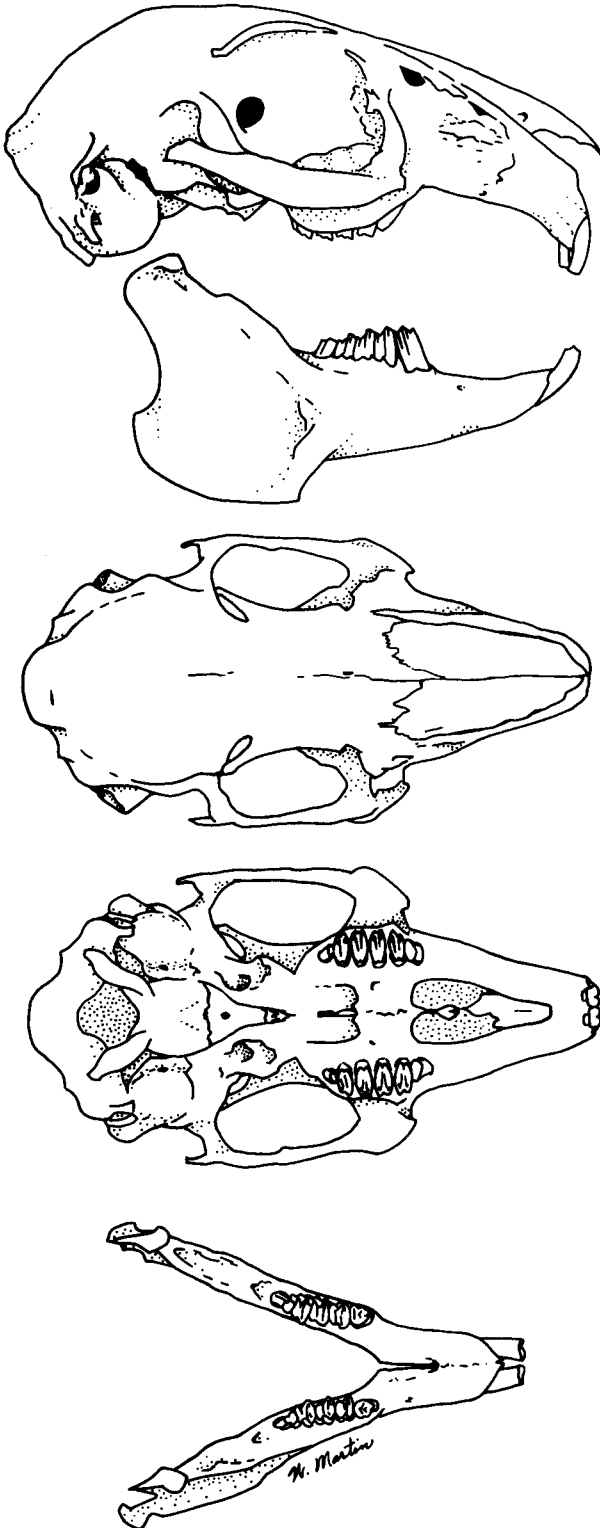


FIGURE 2. Skull of *Sylvilagus transitionalis*. Top, lateral view with mandible; middle, dorsal view; bottom, ventral view with mandible. Drawn from an adult female (USNM 347649) collected in Garrett County, Maryland, on 25 February 1971.

of fur and grass; over the cap was a cover of twigs and leaves. The dry weight of one cap was 6.8 g. Nests were constructed at night and were lined approximately 72 hours before parturition. Dalke (1937:544) reported that of the *transitionalis* nests he found "43 percent were in brush, 25 percent in woods, 16 percent in hayfields, and 16 percent in grass lands other than hayfields."

In Connecticut, enlargement of male testes began the fourth week in December (Dalke, 1937). Between 10 April and

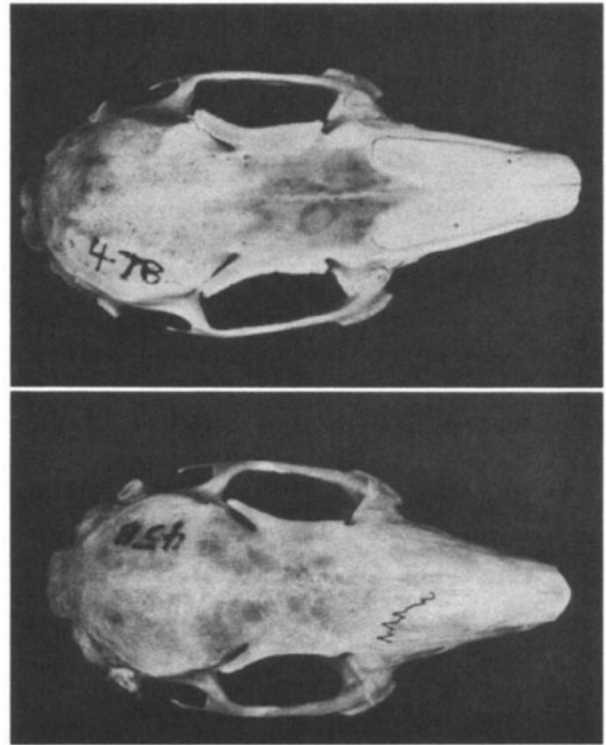


FIGURE 3. Dorsal view of the skulls of two species of *Sylvilagus* collected in western Maryland, at bottom *S. transitionalis* (USNM 349596), at top *S. floridanus* (USNM 349614). The posterior nasal suture is accented on the right side of the *transitionalis*.

10 August 1936, Dalke (1937) examined 19 pregnant females. The litter-size varied from three to eight, the mean was 5.2. A larger litter-size was noted during the period 27 April to 5 June than in the remainder of the breeding season (Dalke, 1937). Based on inadequate data, Dalke believed that two to three litters were common in *transitionalis*.

The lactation period for one female *transitionalis* was 16 days (Dalke, 1942). Dalke (1942) also reported a sex ratio of approximately 1.9 males per female he examined. Chapman and Morgan (1973) found a sex ratio of essentially one to one.

Considerable interest has been raised regarding cross-breeding of *transitionalis* and *floridanus* in the wild. Dalke (1942) reported the birth of one hybrid litter of three in his pens. The male was *floridanus* and the female *transitionalis*. He reported that fighting was the major cause of failure to cross-breed in captivity. Fay and Chandler (1955) believed that cross-breeding occurred in the wild. Chapman and Morgan (1973) obtained an adult female hybrid in western Maryland. Its identity as a hybrid was verified by cranial and biochemical methods. Therefore, it is apparent that hybridization of these two species does occur, but with unknown frequency.

**FORM AND FUNCTION.** Adult New England cottontails undergo one molt per year (Dalke, 1937). Molt takes place during late summer and autumn or during the nonbreeding season. Specimens collected from the third week in December to mid-February had nearly 100% prime fur (Dalke, 1937).

**ECOLOGY.** Relatively little is known about the ecology of the New England cottontail in most parts of its range. For the southern Appalachians, virtually no published data pertaining to this species exist.

The New England cottontail is primarily an inhabitant of dense woodlands and boreal environments (Llewellyn and Handley, 1945; Fay and Chandler, 1955; Carson and Cantner, 1963; McKeever, 1952; Nelson, 1909; Doutt *et al.*, 1966; Linkkila, 1971; Chapman and Morgan, 1973). However, Eabry (1968) found that there were no individual plants, or plant groups, that could be considered indicators of *transitionalis* habitat within the range of the species. It is apparent that in recent years the New England cottontail population throughout the Northeast has been declining (Linkkila, 1971; Chapman and Morgan, 1973; Fay and Chandler, 1955; Jackson, 1973).

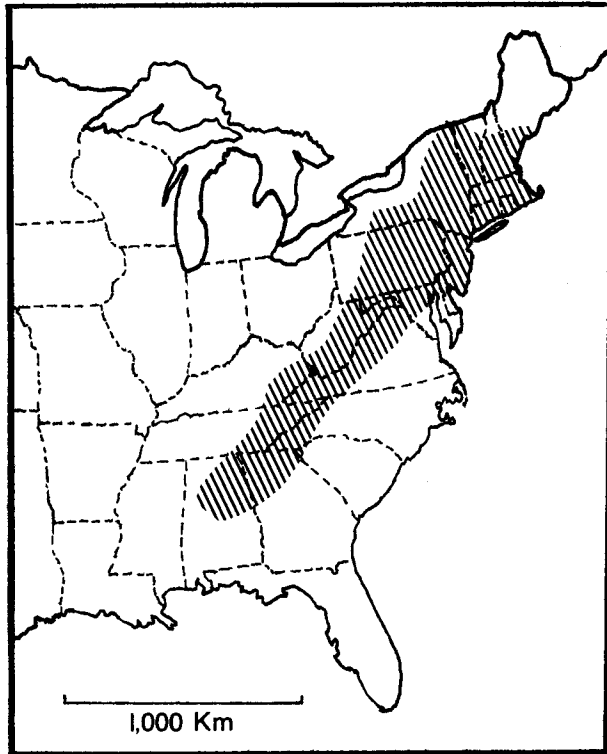


FIGURE 4. Distribution of *Sylvilagus transitionalis* (adapted from Hall, 1951, and Hall and Kelson, 1959).

Chapman and Morgan (1973) believed this decline in abundance of *transitionalis* resulted from habitat change and massive introductions of various species and subspecies of *Sylvilagus* from other localities. Jackson (1973) wrote: "Change in habitat is, to this investigator, the major reason for the decline." According to Fay and Chandler (1955:421): "Once established in this new area, *floridanus* has replaced the native *transitionalis* over some of its former range. The mechanisms by means of which this elimination has been accomplished (It is probably still going on) is not known . . ." Chapman and Morgan (1973) believed the mechanism that has allowed *floridanus* to displace *transitionalis* is introduced genetic variability, which they have termed the *Niche Width-Introduction hypothesis*.

During the autumn, *S. transitionalis* has a home range of 0.2 to 0.7 hectares (0.5 to 1.8 acres) as determined by mark and recapture techniques (Dalke, 1937). The range tended to be linear in some instances. This was apparent along the borders of a marsh and when animals occupied only the shrubby and herbaceous cover around fields and cut-over areas. In January and February, a shifting of rabbits occurred that apparently was associated with the start of the breeding season. Males and females were retrapped up to 530 m (one-third of a mile) from their December ranges (Dalke, 1937). Dalke (1937) also reported a released rabbit that moved slightly over 1.6 km (a mile) from the release site; however, he believed movements of this length were unusual. Nugent (1968) found that male *transitionalis* traveled over greater distances than did females.

The New England cottontail has been reported to make use of holes when pursued by dogs (Palmer, 1944). During the summer, grasses and clovers made up 56% of the New England cottontail's diet (Dalke, 1937); 20% of the food items were herbaceous and shrubby plants, including fruits and seeds; 24% of the stomach contents was not identifiable and consisted of herbage, twigs, buds, seeds, and fruit pulp. Autumn and winter foods include most of the common shrubby and herbaceous plants (Dalke, 1937). Dalke also noted that following the first snow *transitionalis* "fed very freely" on common rush (*Juncus effusus*). It should be pointed out that Dalke and Sime (1941) believed that the food habits of *S. transitionalis* and *S. floridanus* were essentially the same. However, Nottage (1972) believed that *floridanus* is better adapted to a wide variety of diets than is *transitionalis*.

Dalke (1937, 1942), Erickson (1947), and Rankin (1946) reported the following internal parasites in the *transitionalis*

they examined: *Obeliscoides cuniculi*, *Passalurus ambiguus*, *Cittotaenia variabilis*, *Cysticercus pisiformis*, and *Coccidia* (*Eimeria* sp.). Eabry (1968) reported finding filarial worms (*Dirofilaria scapiceps*) in five *transitionalis* he examined. External parasites included the rabbit tick, *Haemaphysalis leporis palustris*, and the dog flea, *Ctenocephalus canis* (Dalke, 1937). Botflies (*Cuterebra* sp.) were found on 5% of the rabbits (Dalke, 1937).

**BEHAVIOR.** Reproductive behavior was successfully induced in *S. transitionalis* by night-lighting caged animals during the winter (Bissonnette and Csech, 1939).

Dalke (1942) reported that he observed no difference in the breeding habits of *S. transitionalis* and *S. floridanus*. A summary of Dalke's (1942) observations on mating habits therefore refers to both species. Fighting often resulted when rabbits of either sex were introduced into pens with another of the opposite sex. However, mating usually took place within a week. Prior to copulation the male would pursue the female around the pen. The male and female would also leap over one another. Sometimes the female would stop when being pursued by the male and then jump over him. In other instances after running around the pen the rabbits would stop and face each other, then one rabbit would leap straight in the air and the other would run underneath. One copulation was observed to occur at 0530. Following copulation both rabbits fed. In every instance, from 24 to 48 hours after copulation the female would chase the male and bite fur from his sides and back (Dalke, 1942).

Reingestion of fecal pellets has been observed in *transitionalis* as reported for other Leporidae (Eabry, 1968). Several behavioral differences have been noted between *S. transitionalis* and *S. floridanus* where they are sympatric. New England cottontails invariably left more droppings and ate more bait in traps than did eastern cottontails. Olmstead (1970) believed that these behavioral differences were caused by different responses of the two species under stress, and indicated that *transitionalis* was less "emotional" than *floridanus*. The New England cottontail often struggled vigorously when handled, whereas the eastern cottontail tended to freeze and remain docile. *Sylvilagus transitionalis* squealed more frequently when handled than did *S. floridanus*. These different behavioral patterns may both be advantageous in the respective habitats of the two rabbits (Olmstead, 1970).

Nugent (1968) found that male *transitionalis* had a greater recapture propensity than females, and that the likelihood of recapturing an *S. transitionalis* was more than twice that of recapturing an *S. floridanus*.

The author also has noted from his observations of these two species in pens and in the wild that *transitionalis* is a secretive rabbit rarely venturing into the open, whereas *floridanus* frequently is seen in the open.

**GENETICS.** The New England cottontail has a diploid chromosome number of 52 (Holden and Eabry, 1970). Karyotype analysis revealed that the autosomes are five nearly metacentric pairs, 17 submetacentric pairs, and three acrocentric pairs. The X and Y chromosomes are a medium-sized submetacentric and the smallest acrocentric chromosome, respectively. No satellites or secondary constrictions (chromosome markers) were found in the New England cottontail (Holden and Eabry, 1970). The New England cottontail has the largest number of chromosomes of any species of *Sylvilagus* thus far karyotyped, and the fundamental number of chromosomal arms is 94 (Holden and Eabry, 1970).

Chapman and Morgan (1973) electrophoretically examined the blood of several species and subspecies of *Sylvilagus* including 14 *S. transitionalis*. They reported that in *transitionalis* albumin was easily recognized in gels as a large, dense, dark-staining protein, which was usually the most anodal in migration pattern. No polymorphism was found in the protein.

A set of proteins similar to the Gc-globins of man was found between the albumin and transferrin (Chapman and Morgan, 1973). These proteins were consistent and showed as four or five bands. The consistency of this pattern was useful for the identification of *transitionalis*.

The transferrin of *transitionalis* was monomorphic (Chapman and Morgan, 1973).

Using the disc electrophoretic technique, 11 post-transferrins could be observed (Chapman and Morgan, 1973). However, with the slab electrophoretic technique, 22 post-transferrins were observed. Chapman and Morgan (1973)

pointed out that with either technique the protein pattern was consistent and species specific for *transitionalis*. No polymorphism was observed in the post-transferrin region.

**REMARKS.** This species is one of the most secretive and least known members of the genus *Sylvilagus*. Much of the confusion regarding *S. transitionalis* results from its resemblance to *S. floridanus* and the fact that the two occur together in many areas. Accordingly, the importance of *S. transitionalis* as a game animal throughout much of its range is poorly known because most hunters and game department officials lump the two species together as "cottontails."

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