Historical Distribution of the New England Cottontail (*Sylvilagus transitionalis*)

Supplemental Document to the New England Cottontail
12-Month Petition Finding, Docket Number FWS–R5–2015–0136

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Introduction

In making listing determinations pursuant to section 4 of the Endangered Species Act (Act), the U.S. Fish and Wildlife Service considers the distribution of a species as one of many aspects of its life history that informs whether or not the species meets the definition of threatened or endangered. Understanding the past and current distribution of a species allows us to better analyze a particular species' risk of extinction by assessing its status (i.e., is it in decline or at risk of decline and at what rate) and determine the likelihood that current and future conditions will promote or threaten a species' persistence. In our previous assessments of the status of the New England cottontail (*Sylvilagus transitionalis*) (71 FR 53756; 72 FR 69034; 73 FR 75176; 74 FR 57804; 75 FR 69222; 76 FR 66370; 77 FR 69993; 77 FR 70103; 79 FR 72449), we described the historical distribution of the species, as following the circa 1960 range delineation presented by Litvaitis *et al.* (2006, entire). This range description included the area east of the Hudson River in New York (excluding Long Island), all of Connecticut, Massachusetts, and Rhode Island, and much of Vermont, New Hampshire, and southwestern Maine (Litvaitis *et al.* 2006, p. 1191). Utilizing previously unassessed information regarding land use changes, predator abundance, and records of New England cottontail occurrence, we have further refined our comprehensive assessment of the species' distribution.

Life History

The New England cottontail, like all cottontails, is primarily an herbivore and feeds on a wide variety of grasses and herbs during spring and summer and the bark, twigs, and buds of woody plants during winter (Mayer *et al.*, *in litt.* 2015; Dalke and Sime 1941, p. 216; Todd 1927, pp. 222–228). Cottontails are short-lived (usually less than 3 years), with avian and mammalian predators being the major contributor in the death of most individuals (Chapman and Litvaitis 2003, p. 118). Reproduction by cottontails begins at an early age with some juveniles breeding in their first season (Chapman *et al.* 1982, p. 96). Litter size typically contains three to five young, which are born in fairly elaborate nests where they receive maternal care (Chapman *et al.* 1982, p. 96). The number of litters per year produced by wild New England cottontails is unknown, but may attain a maximum of seven, based on information for other cottontail species (Chapman *et al.* 1982, p. 96). Young grow rapidly and are weaned by 26 days from birth (Perrotti, *in litt.* 2014). Female New England cottontails have a high incidence of post-partum breeding (ability to mate soon after giving birth) (Chapman *et al.* 1982, p. 96). The reproductive capacity of cottontails remains relatively stable across population densities and is not believed to be a significant contributor to regulating cottontail

populations. Instead, population regulation is influenced by survival, with predation being the primary driver (Edwards *et al.* 1981, pp. 761–798; Chapman and Litvaitis 2003, p. 118). Consequently, habitat that provides abundant shelter from predators is crucial to cottontail abundance (Chapman and Ceballos 1990, p. 96).

The New England cottontail has been reported in historical accounts and early literature under several common names, including the American hare, gray rabbit, coney, conie, and northern coney rabbit.

Habitat

New England cottontails are considered habitat specialists, as they are dependent upon early successional habitats, frequently described as thickets (Litvaitis 2001, p. 466). Suitable habitats for the New England cottontail contain dense (approximately 3,600 woody stems per acre), primarily deciduous understory cover (Litvaitis *et al.* 2003, p. 879), with an affinity for microhabitats containing greater than 20,234 stem-cover units/acre (Barbour and Litvaitis 1993, p. 324; Gottfried 2013, p. 20). New England cottontails are also associated with areas containing average basal area (area occupied by trees) values of 233.6 square feet (ft^2) per acre (ac), which indicates that tree cover is an important habitat component (Gottfried 2013, pp. 20–21). New England cottontails have a strong affinity for habitat patches with heavy cover, and generally do not venture far from these patches (Smith and Litvaitis 2000, p. 2134). Smith and Litvaitis (2000, p. 2136) demonstrated that even when food was not available within the cover of thickets, *New England cottontails* were reluctant to forage in the open and thereby lost a greater proportion of body mass, and succumbed to higher rates of predation compared to eastern cottontails in the same enclosure. Consequently, New England cottontail populations decline as understory habitat thins during the processes of forest stand maturation (Litvaitis 2001, p. 467) and habitat availability plays a key role in the species' abundance and distribution.

Precolonial Distribution

Descriptions of the distribution of the New England cottontail during the early colonial period (1600s to 1700s) are limited to a handful of accounts acknowledging the species' presence and abundance in the region (Brereton 1602, p. 337; Wood 1634, p. 25; Morton 1637, p. 211). Morton (1637, p. 211) described "greate store of Conyes" with those towards the southern portions of the region being very small in comparison to the north where they are "as bigg as the English Cony," a description that likely refers to the snowshoe hare (*Lepus americanus*). This writing suggests that there were distributional differences between New England cottontail and snowshoe hare within the geographic region of the author's travels, which encompassed the area from the mouth of the Kennebec River in Maine to the Cape Cod region in Massachusetts (Morton 1637, entire). Brereton (1602, p. 337) provides insight to the occurrence of the New England cottontail in his account of fur trading for "Conie skinnes, of the colour of our hares, but somewhat lesse" while visiting the Elizabeth Islands, located just south of Cape Cod in Massachusetts. Wood's (1634, p. 25) account briefly mentions the presence of both

rabbits and hares with no description of their distribution within the region he traveled, which extended from along the coast from present day York County in southern Maine to Narragansett Bay, Rhode Island and inland to the interior of New Hampshire.

As a consequence of the lack of precise information, it is difficult to delineate the exact distribution of the New England cottontail during the early colonial periods. However, the geographic distribution of the New England cottontail during this time can be estimated by using existing information of the species' biology and the distribution of suitable habitats.

The amount of shrubland and early successional habitat in the precolonial landscape of the Northeast is not well known, but it is generally accepted that these habitats were probably never naturally abundant prior to European settlement (Brooks 2003, p. 65). Historically, thicket-dependent species like the New England cottontail may have persisted in core habitats associated with frost pockets, barrens, and the shrubby interfaces between wetlands and upland forests (Litvaitis 2003, p. 120). From these more persistent core habitats, thicket-dependent species such as the New England cottontail could have dispersed opportunistically to occupy smaller, disturbance-generated patches of suitable habitat (Litvaitis 2003, p. 120).

Soil conditions, fire, or other disturbances (e.g., ice storms and hurricane damage) naturally limited forest canopy closure in many shrublands (Lorimer and White 2003, p. 41; Latham 2003, p. 34; Brooks 2003, p. 65). Analysis of historical and prehistorical information indicates that the shrublands in the New England landscape were not distributed in a uniform manner (Lorimer 2001, p. 427). For example, glacial moraines and outwash plains that host barrens dominated by pitch pine (*Pinus rigida*) and scrub oak (*Quercus ilicifolia* and *Q. prinoides*), a habitat that is known to be occupied by the New England cottontail, are the dominant geological features of the Cape Cod region in Massachusetts, but are found in only scattered locations in the rest of New England, mostly on the coastal plain (Parshall *et al.* 2003, entire; Bromley 1935, p. 77). Historical data also indicates that hurricane damage to shrub or forest habitat have been minimal in northern New England, while southeastern New England experienced significant effects (Boose *et al.* 2001, p. 44) to habitat that have helped to maintain coastal early successional habitat for the New England cottontail.

In addition to natural disturbances, New England cottontail habitat was most likely influenced by the patterns of human alterations to vegetation. For example, the population of Native Americans in the precolonial period is estimated at 70,000, with three-quarters of all individuals living along the coast and major river valleys in Connecticut, Rhode Island, Massachusetts and southern New Hampshire (Foster *et al.* 2004, p. 64). Their practices of slash-and-burn agriculture, intense consumption of wood for fuel, seasonal movements, and use of fire to maintain habitats promoted a mosaic of forest types in various states of ecological succession (Bromley 1935, pp. 64–65; Cronon 1983, pp. 48–51). Estimates suggest that 10 to 31 percent of coastal, pine-oak forests remained in the seedling-sapling stage (age 1 to 15 years) (Lorimer and White 2003, pp.

45–46), a habitat condition that is known to provide suitable habitat for the New England cottontail.

In comparison to coastal areas, inland disturbances to the forest canopy, either through natural processes or through anthropogenic activities, declined. Fire frequency was low and the collective effects of natural disturbances, such as ice storms, drought, and disease, likely resulted in a diffuse arrangement of shrubland habitats that covered no more than 6 percent of the landscape (Lorimer 2001, p. 429; Litvaitis 2003, p. 117). In addition to the low occurrence of shrublands within the interior portions of New England, these disturbances in mature forest, typically with shade-tolerant understory species, resulted in the rapid recruitment of new forest canopy. Consequently, these shrublands were short-lived and provided little benefit to early successional obligate species (Lorimer 2001, p. 428; Brooks 2003, p. 70), including the New England cottontail. As a result, the abundance and size of shrubland patches decreased progressively with greater distance from coastal regions toward interior New England. This spatial arrangement of early successional habitats within New England likely had a significant effect on the distribution of the New England cottontail, with the species reaching greatest abundance in the coastal regions, but declining rapidly inland as the availability of habitat waned.

In addition to the spatial distribution of habitat, competitive exclusion (absence of one species by another, better adapted one) by the snowshoe hare likely contributed to the scarcity of New England cottontails in interior forests. Cohabitation of habitat patches by the two species occurs infrequently (Stone and Cram 1920, p. 84–85; Litvaitis *et al.* 2006, p. 1194; Litvaitis *et al.* 2003, p. 881), with snowshoe hares occupying landscapes comprising greater forest cover and lower proportion of altered habitat types (Litvaitis *et al.* 2003, p. 883). Climate variability, in the form of increasing snow depth and duration of snow cover with increasing distance from coastal areas, likely enhanced the replacement of New England cottontails by snowshoe hares. This hypothesis is supported by a Wisconsin study that found the 60-day survival rate for eastern cottontails (*Sylvilagus floridanus*), a similar species to the New England cottontail, dropped from 0.89 to 0.18, whereas snowshoe hare survival declined only moderately from 0.84 to 0.63 (Keith *et al.* 1993, p. 1694). This differential survival rate was attributed to the cottontail's greater foot loading, brown coloration, and escape behavior that increases its vulnerability to predation in areas of persistent snow cover (Keith *et al.* 1993, entire).

Based on the strong climatic and vegetation gradients that occurred in precolonial times, along with the presence of the snowshoe hare, the New England cottontail during the early colonial period (circa 1600) reached its greatest abundance in close proximity to coastal regions, where habitat was most abundant, but became scarce with increasing distance inland and eventually becoming absent. Based on this understanding, the most likely distribution of the species approximated the extent of the Central Hardwood and Pitch Pine-Oak forest zones, coinciding with the Coastal Lowland physiographic region and the lower Connecticut River valley (Foster and Aber 2004, pp. 21–25), with additional occurrences found on Nantucket and Martha's Vineyard, Massachusetts and Long Island, New York (Cardoza, *in litt.* 1999; Nelson 1909, pp. 196–199) (see figure 1).

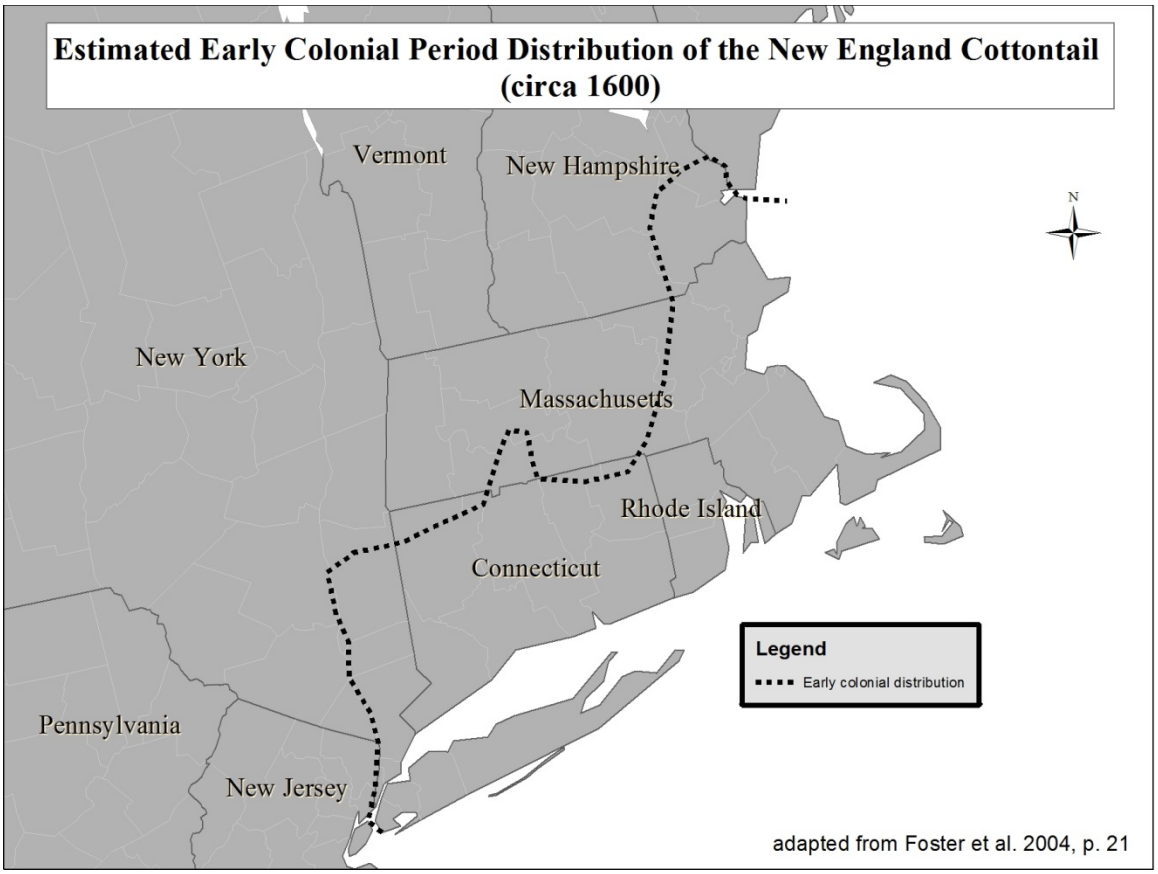

Figure 1. Estimated distribution of the New England cottontail during the early colonial period, circa 1600 (adapted from Foster and Aber 2004, p. 21).

Range Expansion Facilitated by Predator Dynamics

Although the New England cottontail undoubtedly benefitted from human-induced habitat changes, predators (see examples below) of the New England cottontail were not as fortunate, and many of these species became regionally rare or were extirpated (Foster *et al.* 2002, pp. 1337–1357; Bernardos *et al.* 2004, pp. 142–168). Hawks and owls were heavily persecuted and their populations decimated through this same period (Bernardos *et al.* 2004, p. 156). Bounty programs for bobcat (*Felis rufus*), were established in Vermont, Connecticut, New Hampshire, Maine, and Massachusetts and led to declines in some areas (Allen 1876, p. 710; Adams 1896, p. 8; Thompson 1853, p. 37; Foote 1946a, pp. 25–28; Silver 1957, p. 306; Morris 1986, p. 7). Another predator, the grey fox (*Urocyon cinereoargenteus*) was considered rare or absent by the early twentieth century (Allen 1876, pp. 710–713; Kirk 1916, p. 31; Jackson 1922, p. 14). Stone and Cram (1920, p. 275) considered the grey fox "a creature of the forest, incapable of holding his own in a cultivated country." In contrast, the red fox (*Vulpes vulpes*) remained common throughout the region despite the presence of bounty programs and heavy harvest rates (Allen 1876, p 713; Titcomb 1901 pp. 200–202; Jackson 1922, 15; Foote 1946a, pp. 35–38; Foster *et al.* 2002, p. 1345). Red fox population estimates for

New Hampshire were calculated at a minimum of 27,000 animals or three per square mile (mi^2) (one per square kilometer (km^2) (Silver 1957, p. 280).

Although persecution of predators was a contributing factor to their decline, the high commercial value of their pelts also led to significant exploitation. By the early 1900s, the United States was the leading fur producer in the world fur market (Ashbrook 1922, entire). This placed an additional economic incentive, above and beyond that provided by bounties, on the harvest of predators. For example, although habitat destruction contributed to range contraction of the fisher (*Martes pennanti*), harvest played a significant role in the species' status (Krohn 2012, entire). In Vermont, fisher were considered rare in the early 1900s and then "nearly extinct" by 1916 (Perkins 1910 in Foote 1946a, p. 33; Kirk 1916, p. 32; Titcomb 1901, pp. 201–202). This observation is consistent with observation in New Hampshire from the same time period, when the fisher was rarely found in the northern part of the State (Jackson 1922, p. 15; Silver 1957, pp. 254–255). Decreasing predators likely facilitated the New England cottontail's ability to exploit new areas of suitable habitat.

Range Expansion in Historical Times (1600 to 1960)

From the identified early colonial period to the early 1800s, forest clearing in the Northeast progressed at a modest rate, but later intensified throughout the nineteenth century (Foster *et al.* 2004, pp. 74–86). Initially, forest clearing occurred as a result of homesteading practices and the establishment of small-scale farms, but increased as farms increased in size and number. For example, in Maine, the number of farms peaked in 1880 at 64,309 and covered more than 6.5 million ac (approximately 2.6 million hectares (ha)) (Ahn *et al.* 2002, p.5). In the Southern Region of Maine (comprised of York, Cumberland, Androscoggin, and Sagadahoc Counties), agriculture covered 73 percent of the land base in 1870 (Ahn *et al.* 2002, p. 9). The extent of forest conversion to other agricultural uses was similar across New England, covering 50 to 77 percent of the region, with some areas losing 90 percent of the forest (Foster *et. al.* 2004, p. 74). Consequently, remaining forested areas were largely composed of small woodlots used to supply building materials, fuel and other forest products (Foster *et al.* 2004, p 75), and were so heavily cut that the vast majority of forest habitat was harvested at intervals of less than 40 years (Foster *et al.* 2004, p. 89). By 1885 in central Massachusetts, for example, three quarters of the forest was less than 30 years old (Foster *et al.* 1998, p. 106). As a consequence of the conversion of mature forest to open land and young forest, the abundance of suitable habitat for the New England cottontail increased within interior New England and promoted an associated increase in the abundance and distribution of the species (Bernardos *et al.* 2004, p. 157; Foster *et al.* 2002, p. 1345; Ahn *et al.* 2002, pp. 15–16).

By the late 1800s, western expansion of the American frontier and the change from a local agricultural-based economy to an industrial one led to the gradual abandonment of farming in New England (Ahn *et al.* 2002, p. 5). Although this process led to afforestation (e.g., establishing forest where there was no forest previously, as opposed to reforestation), New England's forests continued to experience heavy

utilization for timber products during a "period of forest devastation" that extended from 1880 to 1920 (Foster *et al.* 2004, pp. 86–89; Foote 1946a, p. 6). During this time, household heating accounted for 75 percent of wood consumption (Foster *et al.* 2004, p. 87). Peak extraction for lumber occurred during the period 1905 to 1910, and was reported to reach its peak in 1907, when nearly 2.8 billion board feet of lumber was produced (Steer 1948, pp. 11–18). Fisher (1933, p. 218) writes "Not less than fifteen million of these acres became farm and pasture, of which at least ten million have been abandoned to revert to forest and thus accidentally to produce a supplementary crop of timber, the best of which has now also been cut. There are still about twenty-seven million acres in woodland, but of this more than half is covered in comparatively valueless trees or undesirable species." The result of the heavily utilization of forests created an abundance of young forest "sproutlands" (Graves and Fisher 1903, p. 7; Foster *et al.* 2004, p. 89). Fisher (1933, p. 219) stated that the proliferation of "forest weeds" (undesirable trees and underbrush) had increased in central New England to the extent "that there are at least five hundred acres of forest weeds to one good timber."

As a result of these forest practices, the amount and distribution of shrubland habitat changed substantially within the interior upland landscape, and the New England cottontail responded by expanding its distribution and was aided in this expansion by the aforementioned reduction in predators. By the early 1800s, observers began describing the expanded distribution of the New England cottontail (Bachman 1837, p. 328). This pattern was not exclusive to the New England cottontail; by the early 1900s, changes in the distribution of several species of American hares and rabbits were observed across the eastern half of North America (Nelson 1909, p. 20; Seton 1929, p. 784). For the New England cottontail, the observations can be tracked in three separate geographic areas: (1) North along the Hudson River and continuing up through the Lake Champlain Valley; (2) North through New Hampshire and along the Connecticut River Valley; and (3) North along the coast of Maine (see figure 2). Observations at that time provide abundant descriptions of associated changes in the local declines of snowshoe hares, which can be ascribed to landscape changes resulting in reduced forest cover and extensive alteration of habitat (Hamilton, 1943, p. 389; Litvaitis *et al.* 2003, p. 883).

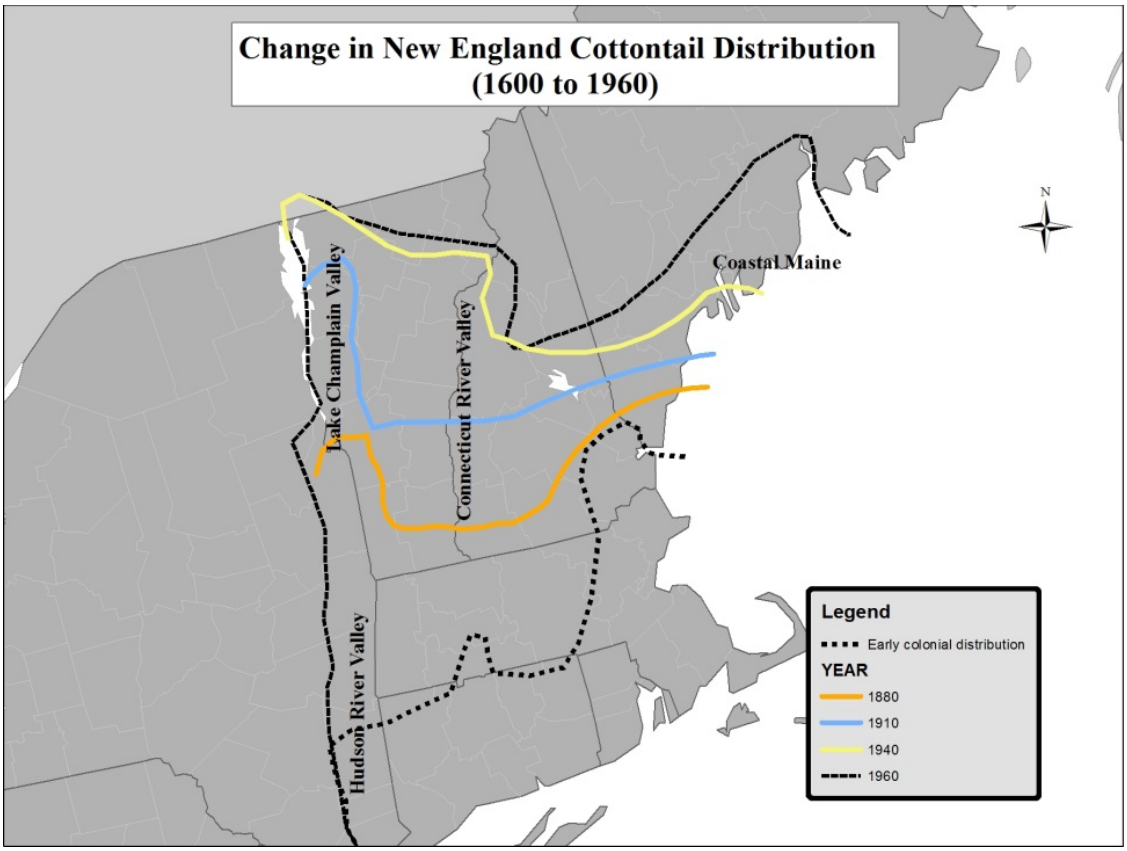

Figure 2. Estimated extent of New England cottontail distribution (1600 to 1960) based on historical accounts presented herein.

Hudson River and Lake Champlain Valleys

The Hudson River Valley extends over 200 mi (322 km)north from New York City, through the Albany, New York region to just north of Lake George, where the watershed divide transitions to the Lake Champlain Valley of New York and Vermont. Within this area, the first written account describing changes in the distribution of the New England cottontail, then known as the American Hare, appears in an 1837 reading prepared by Reverend John Bachman to the Philadelphia Academy of Natural Sciences in which he states that "About 30 years ago the species was not known in the neighborhood of Troy," which is located just east of Albany, but "made its appearance in very small numbers" and became "exceedingly numerous," while the snowshoe hare had become "comparatively scarce" (Bachman 1837, p. 328). By 1884, the New England cottontail had advanced northward by approximately 60 mi (97 km) to the vicinity of Lake George where it had become numerous and, as of the fall of 1907, was continuing its northward spread (Nelson 1909, p. 199).

In nearby Vermont, the snowshoe hare may have been the only lagomorph (e.g, rabbit or hare) found in the State, but the New England cottontail moved in prior to 1840 and expanded its range steadily northward, often replacing the snowshoe hare (Foote 1946a, pp. 39–40). The first reliable account of the presence of cottontails in Vermont is provided by Thompson (1853, p. 48), although no description of the species' distribution

or abundance is provided. The earliest reliable description of abundance appears in Titcomb's (1901, p. 209) writing that the cottontail was "confined to the lowlands in the southern part of the State, and is most plenty in Bennington County." During the same time, Nelson (1909, p. 198) provides a description for southern Vermont when a Mr. G. H. Ross, of Rutland, in 1908 wrote to him that cottontails were rare in 1889, but had become plentiful and had entirely replaced the formerly abundant varying (snowshoe) hare. The species' distribution appears to have changed drastically soon thereafter, based on Kirk's (1916, p. 31) description that the species had "spread northward rapidly in the last 20 years" and had advanced up the Champlain Valley to the Canadian border. The accounts suggest that the New England cottontail probably invaded Vermont shortly after the turn of the nineteenth century, based on the information provided by Bachman (1837, p. 328), and extended its range approximately 160 mi (257 km) northward over the span of 100 years. In contrast to the increase in abundance of the New England cottontail, the snowshoe hare had become much less common (Kirk 1916, p. 31). By 1946, a survey of hunters in Vermont revealed that cottontails were being harvested from every county within the State (Foote 1946b, pp. 17, 35).

New Hampshire and the Connecticut River Valley

Similar to the Hudson River and Lake Champlain Valleys, observations of New England cottontail east of the Green Mountains in Vermont and throughout New Hampshire document the northern expansion of the New England cottontail's range. Stone and Cram (1920, p. 82) considered the species a recent invader of New Hampshire. However, Silver (1957, p. 318) analyzed the available information regarding the species and determined that the species' range likely extended into southern New Hampshire. Additionally, presence of the New England cottontail is confirmed by its appearance in a list of mammals found in the State during the end of the eighteenth century (Belknap 1812, p.153). Although no description of the extent of its distribution is provided, it can be assumed that the species was at least present in the southeast portion of the State.

Little (1888, pp. 31, 52, 110, 263) indicates that the New England cottontail and the snowshoe hare could both be found in Weare, New Hampshire, which is located in Hillsboro County, approximately 25 mi (40 km) north of the Massachusetts border and in the central part of the State. Around the same time, Bangs (1894, p. 412), in his original description of the species, recounts a 1893 visit to the area, in which he states that "In the autumn of 1893 I spent a few weeks collecting in Hillsboro Co., New Hampshire, and was surprised to find the cotton-tail abundant." He goes on to describe a conversation with a resident of the area who told him that "fifteen years before, the cotton-tail was unknown in that part of New Hampshire, but that since then it had year by year become more common, and the hare had decreased in about the same proportion." Changes in the distribution of the two species during the same period are also provided by Stone and Cram (1920, p. 85), in which they reiterate a 1899 written account provided by a Mr. P.C. True of Pittsfield, New Hampshire, who described the disappearance of the snowshoe hare upon the arrival of the "conies" some 30 years prior. By the end of the first quarter of the twentieth century, Jackson (1922, p. 15) considered the "northern coney rabbit" or New England cottontail abundant south of the White Mountains. By the mid-1950s, the

species was reported well into and even north of the White Mountains to at least Lancaster (Silver 1957, p. 321; Stevens 1950 in Jackson 1973, pp. 8, 10). The pattern observed in New Hampshire appears to have been repeated along the Vermont side of the Connecticut River Valley, eventually reaching Essex County in the northeast corner of the Vermont (Allen 1904, pp. 19–20; Kirk 1916, p. 31; Foote 1946b, p. 36). The accounts suggest that the New England cottontail extended its New Hampshire range northward from the vicinity of Weare in the south central region of the State (Little 1888, entire; Bangs 1894, p. 412) to the Lancaster area (Silver 1957, p. 321) during the period spanning the 1880s to 1950, representing a distance of approximately 96 mi (154 km).

Coastal Maine

Norton (1930, p. 81) and Palmer (1944, p. 193) accredit the first written account of the New England cottontail's presence in Maine to the author C.M.H. (possibly Dr. Hart C. Merriam, then Chief of the U.S. Department of Agriculture, Bureau of Biological Survey); however, review of that account reveals that the author was describing a hunting outing in the Mount Diablo area of California, where he happened to procure a cottontail and a jackrabbit with a single shot from his gun (C.M.H. 1893, p. 295). The first credible indication of the species' occurrence in Maine is provided by the species' appearance in a 1862 publication, entitled "Catalogue of the Mammals of Maine" (Hitchcock 1862, p. 66). Norton (1930, p. 81) stated that the rabbit was a "recent" addition to Maine and provides the first clear description of the species status within the State as rather common along the shore to Cape Elizabeth, and crossing the Presumpscot River into the Town of Westbrook, where it was not formerly known to occur. Cottontails apparently came to be common in that area over the next 4 years and had reached the Town of Falmouth in 1917, and then onto Freeport by 1927. Palmer (1937, p. 130) was convinced that the New England cottontail was "gradually enlarging its territory in a northeasterly direction." Palmer (1944, p. 194) described the replacement of snowshoe hares by New England cottontails along the coast in the Town of Brunswick during the early 1930s. By the early 1940s, the species had extended its range along the coast to Topsham, with inland occurrences north to Windham, Standish, and Gray (Palmer 1944, p. 194). This distribution was corroborated by Severaid (1942, p. 11) in a description of the extreme northern range of the New England cottontail extending into Androscoggin County. A little over a decade later, the northern extent of the species' distribution extended slightly farther north, to the Augusta region and along the coast, east of the Kennebec River to the Penobscot Bay area (Coulter and Faulkner 1959, pp. 35–36; Marden, pers. comm., 2015; Cross, pers. comm., 2015). Based on the descriptions provided above, the New England cottontail expanded its range a distance of approximately 90 mi (144 km) from at least the vicinity of the Portland region to the Penobscot Bay area during the period spanning the 1930s to the mid-1950s (Norton 1930, p. 81; Coulter and Faulkner 1959, pp. 35–36; Marden, pers. comm., 2015; Cross, pers. comm., 2015).

Summary of Distribution in the Three Separate Areas

Although there are no systematic studies or comprehensive investigations documenting changes in the distribution of New England cottontail from early colonial

periods to the 1960s, the available accounts provide evidence that the species was dramatically increasing its range throughout this period. The historical accounts provide strong evidence that, as land use changed and predator populations declined and suitable habitat abundance expanded, the species responded. Based on these factors, it can reasonably be concluded that the New England cottontail's 1960s range represented the maximum historical extent of the species' range and was the product of extensive land use changes that substantially increased the abundance and distribution of suitable habitat for the New England cottontail (Bernardos *et al.* 2004, p. 150; Ahn *et al.* 2002, p. 1; Foster *et al.* 2002, p. 1345). Consequently, the reported retraction of the species' range from its 1960 distribution to present provides a valuable geographic reference for understanding recent trends in the species' status and placing the current status of the species in a more accurate historical perspective.

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