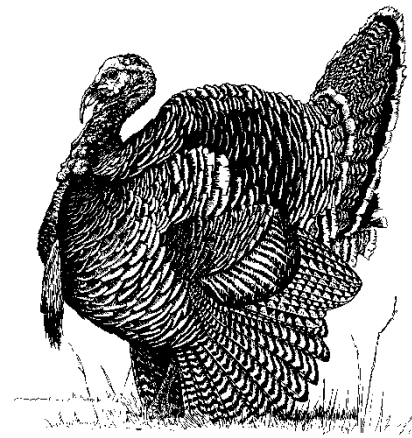


New Hampshire
WILD TURKEY ASSESSMENT
2015



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A. NATURAL HISTORY

The Eastern Wild Turkey (*Meleagris gallapavo sylvestris*) is a relatively short-lived species, but has a high potential reproductive rate. The average life span is 1½ years for males and 2 years for females. The maximum life span is about 8 years.

Male and female turkeys are long-legged and long-necked, and stand 3 to 4 feet tall. Adult male turkeys, called “gobblers” or “toms”, weigh 16-24 pounds, averaging 18 ½ pounds. Juvenile male turkeys, called “jakes” are one year old or less, weighing 12 to 18 pounds, averaging 15 pounds. Adult males have 5 to 12 inch bristle-like “beards” that protrude from their chests, and develop sharp “spurs” on their lower legs, which are useful for aging gobblers. Adult females, called “hens”, weigh 8½ to 13 pounds, averaging 10 pounds. Hens rarely develop spurs, but approximately 6% of adult hens develop “thin” beards similar to that of the gobblers. The chest and back feathers of hens have buffy-brown tips, whereas those of gobblers are black-tipped. The head/neck appendages and their coloration also differ between hens and gobblers.

The average clutch size is twelve eggs. Nesting success is roughly 35%, i.e.: for every three hens attempting to nest, one hen successfully hatches out a brood. Almost all juvenile and adult hens attempt to nest each spring. The preceding year’s hatch of young hens are themselves nesting the following spring, or at eleven months of age. If the initial nest is abandoned from disturbance or destroyed by a predator, most hens will make a second nesting attempt.

Turkeys are polygamous, in that one tom will breed a number of hens. The older, adult gobblers breed most of the hens. Juvenile males, however, are capable of breeding. Weather conditions are often a major factor in determining the yearly productivity of turkey populations. Rainy and cool weather during the late May or early June hatching period can decimate newly-hatched turkey broods.

In early summer, several hens with young often join together to form multiple brood flocks. Hens which are unsuccessful in hatching a brood, or which lose their young, often become foster mothers. Both of the above factors result in added protection for the group of young.

Turkeys have large yearly home ranges of about four to five square miles and long distance movements by some turkeys often to thirty miles are not uncommon.

Turkeys can use a diversity of nesting cover or sites. The nest can be anywhere in the woods or open fields. Often the nest is in clumps of brushy vegetation, such as juniper, blackberry, goldenrod, spirea, or under loose logging slash, or in un-mowed hayfield grass.

The first two to three weeks of life are the most critical, and high mortality can occur during this period. Even though the hen is very protective, chicks can be lost to a variety of predators, bad weather and accidents. It is considered good success if six to seven of twelve poults survive until fall.

Turkeys are true “omnivorous opportunists” in that they feed on almost anything and whatever is in season. Animal matter, mostly insects, is as much as 10% of the diet. Grasses and herbs are well used, particularly at winter “seeps” or wet areas. Large volumes of weed seeds are taken during the summer. In late summer they feed avidly on blueberries, blackberries and cherries. A

staple part of the wild turkey's fall, winter and spring diet is the hard mast or acorns and nuts from oak, beech, hickory, cherry and ash trees.

Because of the presence of long lasting deep snow cover usually present in northern New England, which greatly reduces the access to acorns, corn wastage at dairy farms becomes a very important winter food. Barberry, rose hips and dried apples are very important winter foods. Turkeys are ground-feeders. If deep snow covers the primary foods during the winter, then shrubs which retain fruits or berries over the winter, or some type of grain wastage is needed for at least part of the winter.

Wild turkey flocks cause little conflict with man or his land use and agriculture. Turkeys feed on corn wastage at farms after the ensilage corn is cut in the early fall. While turkeys make good use of dried fruit from "wild" apple trees, the use is during the winter and not in orchards during the fall. Wild berries are plentiful to satisfy turkeys, and flocks can be readily scared away from sites where small fruits are grown.

The wild turkey is in little competition, if any, with other animal species. Historically, it is native to each New England state. Grouse eat buds primarily during winter, and woodcock have migrated. There are no native or established populations of pheasants or quail in northern New England.

Some hunters mistakenly believe that turkeys significantly compete with deer during fall and winter for the available supply of acorns and beechnuts. Turkeys feed on a variety of foods during the fall months. The rodent population of gray and red squirrels, chipmunks and 4 species of mice and voles consume far more nuts per acre or square mile than a flock of turkeys. One 20-inch dbh oak tree can produce 10,000+ acorns. Deer feed on woody browse all winter, and turkeys do not.

Predation on Wild Turkeys

Large ground-nesting game birds such as pheasants, grouse and turkeys are susceptible to considerable nesting losses. Turkeys typically have only a nesting success rate of 33%, or 1 out of every 3 hens successfully hatches a brood. Studies with radioed hen turkeys in New Hampshire have shown that foxes, coyotes and fisher can kill turkeys on nests. Because of their large size, turkeys leave considerable scent when they leave their nest to feed for a short while, and can be tracked to the nest particularly when the ground and vegetation are wet. These larger predators, along with raccoons, skunks and crows also find nests and eat the eggs. Nests are readily abandoned during the first two weeks of the four-week incubation, if disturbed by predators, dogs, humans and farm equipment.

The first 1-2 weeks of life are the most critical period in a turkey's life, because they cannot fly until about the age of 10-14 days, and until then have to be brooded on the ground where they are vulnerable to a range of predators, including hawks and house cats.

Two other predators which readily kill adult turkeys in New Hampshire and throughout their range in the United States, are great-horned owls and bobcats. The owl kills are common in New Hampshire, particularly during April/May when the early nesting owls are quite territorial. Usually only the head and neck area are eaten. Owls usually attack the turkeys when they are

roosting in trees during the night. Bobcat kills have been uncommon because New Hampshire has a relatively low bobcat population.

B. HISTORY OF WILD TURKEYS IN NEW HAMPSHIRE

Most of the seven southern counties of New Hampshire were formerly turkey range. Practically all of this primeval habitat consisted of vast, undisturbed tracts of mixed hardwoods and coniferous forest with many mast-bearing trees (oaks, chestnuts, beech, hickory, cherry, ash) – the primary food source of turkeys. The limiting factors in the North Country were the deep snows and lack of oak trees – the acorns of which can be the “staff of life” for wild turkeys in many states.

The pre-Columbian (or pre-European) population estimate for New Hampshire was approximately 5,500 turkeys at a density of two birds per square mile over an area of 2,760 square miles (30% of the state’s 9,000 square miles) in the southern counties.

Settlement adversely effected turkeys in a variety of ways. Large tracts of forest were cleared for agriculture and the important mast-bearing trees were cut and burned. Nests were destroyed by burning and cattle. There were no seasons or limits. While the American chestnut was a very important food for the wild turkey, the habitat destruction eliminated the turkey long before the “blight” killed off the chestnut. By the end of the Revolutionary War, turkeys were, for all practical purposes, gone from New Hampshire. Between 1830 and 1860, two-thirds or 85% of most towns were cleared and there were over 1 million sheep. The last turkey reported from New Hampshire was in 1854 in Weare.

Land use, logging and different types of farming have changed every square foot of land in New Hampshire many times over during the past 400 years. The original habitat and forest composition cannot be brought back. The numerous and very large specimens of mast-producing tree species such as white oak, red oak, beech, cherry, ash, hickory and basswood are largely gone. One of the most important original turkey foods in New England, the American chestnut, is entirely gone. The extensive “burning” by the Indians to create game habitat, herbaceous and grassy openings and fruiting shrubs is a thing of the past.

Restoration Efforts

The Department’s efforts at wild turkey restoration dates back to the early 1960’s. Numerous states were contacted to see if they would give, trade or sell some wild-trapped turkeys to New Hampshire. There were numerous offers of pen-raised game farm turkeys, which the Department refused on the advice of all states, which had worked with game farm type turkeys. The Department was unable to find a source of pure wild-trapped turkeys until the turkey/fisher swap with West Virginia materialized.

Turkey transplanting was initiated in 1969 when New Hampshire sent 25 fisher to West Virginia and received 26 wild-trapped turkeys in return (11 in 1969 and 15 in 1970). These were released in Pawtuckaway State Park, in the towns of Nottingham and Deerfield in southeastern New Hampshire. This nucleus started reproducing, but one of the most severe winters on record (1970-1971) decimated and/or dispersed this small nucleus. Other limiting factors may have

been the lack of farmland associated foods in the area and relative lack of hardiness in this strain of turkey from a southern state.

The second and successful transplant was with 25 turkeys trapped in the Allegheny Mountains of southwestern New York, bordering Pennsylvania and released during January 1975 in Walpole and Westmoreland in southwestern New Hampshire in the Connecticut River Valley, bordering Vermont. Since then, 15 transplants have been made to other parts of New Hampshire, with turkeys trapped from this original population nucleus.

Justification for the Wild Turkey Program

Wild turkeys had the potential to become a major game species in New Hampshire, in terms of man-hours of recreation. Two hunting seasons per year are possible. The bordering state of Vermont and other states in the Northeast had already reached this goal. It was believed that the potential existed to realize a population of perhaps 5,000 turkeys (it has reached about 40,000 as of 2014) in New Hampshire. There was considerable interest by the sportsmen, landowners and general public to fully restore and manage wild turkeys in the state.

Wild turkey hunting is desirable because it stresses quality hunting, results in little landowner conflict, requires no artificial propagation, produces maximum hunting recreation with minimum expenditure of the resource (low success rate), provides an additional big game species to hunt, and provides more hunting opportunity in southern New Hampshire, where most of the state's hunters live. Turkeys help fill the void created by the loss of farmland and small game habitat. New Hampshire has little or no hunting for quail, pheasants, mourning doves, squirrels or cottontail rabbits. The best habitat for grouse, snowshoe hare and woodcock is in northern New Hampshire, where the human population is far less dense.

Comparison to Other Hunting in the State

Turkey hunting was recognized as having the potential to become a major form of hunting recreation in New Hampshire. While the bag limit for turkeys is minimal, the emphasis is on calling and contact with turkeys, the quality of the hunt and the trophy nature of the turkey. Some compensation for the low bag limit is the liberal season length and man-days of hunting recreation.

It is recognized that a high percentage of New Hampshire's hunters will not become turkey hunters because of the specialized nature of the sport, and the skill and time demanded. During 2003 there were approximately 80,000 hunting licenses sold. There were 16,000 turkey season permit-holders, so that this indicates approximately 20% of the state's hunters are now turkey hunting. If a fall shotgun turkey season is initiated, the number of participants and man-days of hunting has the potential to double.

Past turkey hunter questionnaires show that the average permit-holder spends 5.5 days turkey hunting. Therefore, during the 1989 turkey season the 1,000 hunters equated to 5,500 man-days of hunting recreation. The 16,000 permit-holders from the 2003 spring season meant approximately 880,000 man-days of hunting recreation.

A dramatic increase in turkey population and hunter participation has occurred since the transplant of 25 New York turkeys to New Hampshire in 1975. During the first hunting season in 1980 there were 700 permit-holders and 31 gobblers were harvested from 11 towns. During the 1989 season 1,120 permits were issued, and 142 gobblers taken from 38 towns. During the 2003 season 16,000 permit-holders took 2,600 gobblers from 206 towns. By 2013 20,062 permit holders took 4,500 gobblers from 234 towns, a state record spring harvest.

Enabling Turkey Legislation

During 1977 Senate Bill number 83 (S.B.#83) was introduced and passed, to support restoration work on the new species. The 25 wild-trapped turkeys from New York Fish & Game Department had been released in New Hampshire just two years previous during January 1975. The legislation had two distinct parts – one to give the Fish and Game Department Director the power to set hunting seasons and regulations and the other part to prevent any persons in the state from importing or releasing an undesirable type of non-wild turkey called “game farm turkeys”.

When the first limited hunting season (by permit only) was initiated in 1980, a permit fee of \$5.00 was in place. This produced an ear-marked fund which could only be used for wild turkey restoration, management and research. The thinking was that this would help pay for one biologist’s work time on a Wild Turkey Project, and not use money needed for work on other species such as deer. Federal Aid would subsequently pay a 75% portion of the annual project.

The following outlines the 1977 legislative bill and the responsibility of the Fish & Game Department:

209:12-a Wild Turkey

- I. *The executive director shall adopt rules, pursuant to RSA 541-A, relative to:*
 - a) *Establishing seasons and bag limits and issuing wild turkey permits.*
 - b) *Establishing registration stations and registration agent fees for wild turkeys.*
 - c) *Specifying the methods for taking and registering wild turkeys.*
 - d) *The enhancement, protection and propagation of wild turkeys.*

212:25-a Special Permit to Keep and Propagate Wild Turkeys

No person shall import any species of wild turkey, hybrid wild turkey, or wild turkey/domestic turkey cross or any egg of these species into New Hampshire. Any person in possession of such turkeys when this section takes effect shall be permitted to keep or propagate them by special permit from the executive director. Persons without such a permit shall not sell, give away, or release into the wild a live wild turkey, hybrid or wild turkey/domestic cross, or any fertile egg of any of these species.

Game Farm Turkeys

This type of turkey was developed in the 1930s in various states such as a Pennsylvania, Maryland, etc., as a potential method to produce a source of wild turkeys for restoration work. Domestic hen turkeys were bred by wild male turkeys, and resulting offspring were bred in pens

to try and produce a turkey similar in stream lined form and color of the true wild turkey. However, during years of this breeding and propagation in captivity many of the genetic traits necessary for survival in the wild were lost.

In the New England area, Massachusetts F&G tried game farm turkeys in the Quabbin Reservoir area in the early 1960s. This effort and others like it in other eastern states all failed because this type of domestic/wild cross was not wild enough or hardy enough. The real breakthrough came with the development of the rocket net to capture flocks of wild turkeys, and the willingness of states to trap turkeys and transplant some to states without turkeys.

During the 1960s and 1970s each New England state passed legislation making it illegal for individuals to import, propagate, sell or release game farm turkeys in their respective states. Game farm turkeys have the potential to cross breed with true wild turkeys and ruin restoration efforts. Regardless of the law, some individuals still continue to illegally acquire eggs, chicks or adult turkeys from breeders or game farms in states distant from New Hampshire, where laws pertaining to propagation of wild animals are less strict.

There are three main reasons game farm turkeys are undesirable and illegal. One bad effect is genetic pollution. If the wild turkeys and game farm type interbreed, the wild strain is quickly lost. New Hampshire needs the hardiest strain of wild turkeys to survive its hard winters. Also, game farm turkeys can pass on diseases such as blackhead, fowl pox and cholera to wild turkeys, which have little or no immunity to these diseases. The third bad effect of these turkeys is their relative tameness, with such behavior as roosting on cars and porches and standing along the side of busy highways. These give non-hunters a poor impression of true wild turkey behavior and can result in an over-protectionist attitude. These tame turkeys often come into housing developments and cause damage to plants and gardens and leave excessive droppings, and in so doing, serve to devalue turkeys as a public resource.

There have been several sources or sites of game farm turkeys in New Hampshire, which have been particularly noteworthy. The 23,000-acre Corbin Park Game Preserve in Sullivan County acquired game farm turkeys in the 1960s. Some of them spread into surrounding towns, and still in 2004 off-colored crosses show up at registration stations in the region. A dairy farm in the Lebanon area acquired turkeys from a game farm in Pennsylvania in the 1980s and released them. A game farm in Fairlee, Vermont had game farm turkeys and some of these are believed to have crossed the Connecticut River into New Hampshire. Two additional sources in southwest New Hampshire have spread game farm turkeys to numerous persons around the state for years. All ten counties have had sites with game farm type turkeys.

The potential problems with identifying persons having game farm turkeys, and confiscating or eliminating such turkeys, are numerous. Many hunters, as well as Department personnel cannot readily discern the physical and color differences between true wild turkeys and game farm turkeys. Behavior differences may or may not be obvious. There is as yet no definitive genetic testing which can readily identify a true wild turkey from a game farm turkey. The National Wild Turkey Federation has been sponsoring genetics research in recent years to develop methodology to do this, as well as to distinguish between the five sub-species of wild turkeys. Good proof is necessary in contested court cases. Capturing a flock of obvious game farm turkeys is not easy because they can fly and do not readily go into a trap. Use of rocket nets is costly in terms of man-days. Permission to acquire and use drugs for capturing is difficult.

Regardless of the difficulties in dealing with game farm turkeys, yearly effort should be made by Department staff in the field and regional offices to report and document sites with such turkeys and wherever practical to remove them. Conservation officers should investigate persons with suspected game farm turkeys in captivity. Articles should periodically be written in various magazines to re-emphasize the potential negative impacts and illegal nature of these types of turkeys.

Another on-going or yearly occurrence is persons, when mowing hayfields and flushing turkeys off nests, having the tendency to save the eggs and put them in an incubator or under a laying chicken. These turkeys when hatched are worthless for returning to the wild because they immediately become “imprinted” on humans and lose most of their wildness. These turkeys in essence become “game farm turkeys”, even though their origin is of pure wild stock. It is illegal for anyone to be hatching and raising wild turkeys. The nests or eggs should be left for the crows and mammalian predators to clean up. Periodic reminders not to handle wild turkey eggs should be shared with the public.

C. WILD TURKEY POPULATION ASSESSMENT

1989 Turkey Population

The wild turkey population in New Hampshire, as of April 1990 was estimated at 2,500 (Table 1). All or most of the towns in Cheshire, Sullivan, Hillsboro, Merrimack, Strafford and Rockingham Counties had some wild turkeys in 1989. The southern half of the state’s 9,000 square miles was considered potential turkey range. About 3,000 of 5,000 square miles of potential turkey habitat was occupied by turkeys, most with low densities.

In 1989, it was hoped that by the year 2000, New Hampshire would have a sustaining population of 5,000 wild turkeys (Table 2). Land use, development and degree of remaining farms and winter conditions were expected to be controlling factors. Turkeys existed in eight of New Hampshire’s ten counties at the time. None were expected to survive in Coos County, the White Mountain National Forest region and few in Carroll County. A few had shown up as far north as Monroe and Littleton, and some were expected to live in this portion of Grafton County because of the presence of dairy farms along the Connecticut River Valley. In the central portion of the state, turkeys were not expected to make it far beyond Lake Winnepesaukee. The limit on the eastern or Maine border was thought to be about Ossipee and Wolfeboro.

2004 Turkey Population

The turkey population has spiraled upward since 1990, and substantial range expansion has occurred. As of August 2004, the statewide population was estimated to be 26,900 wild turkeys, compared to 2,500 in 1989, or a ten-fold increase. Table 3 records the estimated turkey population per WMU (see Appendix I for WMU map) and per square mile for 2004, and projected population for 2015.

During 1989, it was felt no turkey population could sustain itself in Coos County, few in Carroll County and only a small population might occupy the western half of Grafton County because of the dairy farms in towns bordering the Connecticut River. There are now turkeys living in every

town of the state's 10 counties. Turkey range of occupation has extended into the towns in northernmost Coos County. Spring gobbler hunting is now allowed in all wildlife management units, except WMU A. Carroll County, bordering Maine, now has a decent turkey population and hunting season, as does the eastern half of Grafton County. Western Grafton County bordering the Connecticut River now has surpassed the original release area in southwestern New Hampshire, as the section of the state having the largest turkey population and the greatest hunting season harvest. This regional increase in the turkey population is due to the greater number of farms and the field brood habitat and winter foods associated with these farms.

Some of the relatively rapid expansion of a turkey population into the northern 3 counties of New Hampshire can be attributed to the turkey transplants made in Maine near the New Hampshire border and from the existing turkey population in northeastern Vermont, which borders New Hampshire along the Connecticut River.

History of Turkey Transplants in New Hampshire

A total of 344 turkeys in 16 transplants have been made during the period 1969-1995. The number in each transplant varied from 10 to 36, with an average of 22 turkeys per transplant. Many more turkeys were trapped during this period, but were banded and/or affixed with radio transmitters for various research studies. Table 4 records the years, release towns and number of turkeys for each transplant, and Figure 1 shows the location of these transplants.

The original 1969-1970 transplant of 26 turkeys from West Virginia to Pawtuckaway State Park in Rockingham County was a failure due to a combination of factors: two of the severest winters of the century (1969-1970 and 1970-1971), lack of foods and brood habitat associated with farmland and these turkeys were perhaps a less hardy strain than the subsequent turkeys obtained from the deep snow country of New York.

Successful restoration began with the release of 25 turkeys trapped in New York during January 1975, and released in the town of Walpole. Primary factors in site selection were a relatively large percent of farmland, and continuity with an adjacent, existing Vermont turkey population. During 1978 and 1979 the process was begun of trapping turkeys from this southwest corner of the state, and transplanting them to more eastern and northern sections of the state. Trap-and-transplant work in New Hampshire was concluded during the winter of 1994-1995, with two transplants to north central New Hampshire, with one release on the east side of Lake Winnepesaukee in Carroll County, and the other release on the west side of Lake Winnepesaukee in Belknap County. No further transplants were needed in northernmost New Hampshire because turkeys had been working up the Connecticut River boundary with Vermont, and because transplants in Maine near the New Hampshire border had expanded into New Hampshire.

Analysis of the potential turkey habitat and tentative transplant sites was for the most part completed in 1978. A minimum of eight major transplants were planned for the southern half of New Hampshire. It was thought that this would be sufficient to start population nuclei in the seven southern counties. As time permitted, and more surplus turkeys became available, additional and smaller transplants could be made to fill some of the gaps in turkey distribution.

The major criterion for selecting each of the transplant sites since 1975 has been the degree of farmland present. The actual release point has always been a farm. The areas with the most remaining dairy farms in each county have been selected. At least during the first winter at the new release site, the flocks would have the opportunity to have corn wastage and other foods around the fields if it was a hard winter.

Degree of Success of Transplants

The majority of the turkey transplants did well, and the population and range expansion increased significantly after several years. The slowest growth and lowest hunter harvest continues to be in southeastern New Hampshire (Rockingham and Strafford Counties). This appears to result from the following characteristics of the region. The region has the highest human density, the most development, the least amount of farmland and fields, and the most posted land. This region of the state has received the most turkey transplants (7 of 16). In addition, the first 2 turkey transplants in Maine were made only several miles from the New Hampshire border in York County.

During 1993, an effort was made to bolster turkey populations in the southeast by making 3 supplemental transplants. This regional turkey population has had many years to multiply and expand. As of 2004 there are turkeys living in every one of the towns in the southeast, and good-sized flocks at the original release site areas. Three transplants to south central New Hampshire (Pittsfield, Lyndeboro, Boscawen) started off well, then stagnated for some years, and now have good populations.

Methods of Estimating the Turkey Population

Assessment of the yearly turkey status and population throughout the various regions of the state is done by a combination of methods: summer brood surveys, winter flock surveys and analysis of sex and age data gathered at registration stations throughout the state during the hunting seasons. The numerous tagged and radio telemetry turkeys from various field studies have also contributed significant information about turkey population dynamics.

It is not difficult to locate broods during the summer because of the tendency of turkeys in 84% forested New Hampshire to seek out hayfields and pastures as brood habitat. It is also not difficult to locate turkey flocks during the winter months because of their tendency to congregate at farms and backyard birdfeeders.

Federal Aid Grant W-89-R-III (Wild Turkey Studies in New Hampshire) has 11 different jobs which are carried out every year. One job, Turkey Brood Surveys, determines regional turkey nesting success and productivity. Brood sighting information is collected from regional biological staff, conservation officers, landowners, and sportsmen during the summer months. Data recorded includes date of observation, number of hens and young, size of young, town and general locality. The periods when most hatching occurs is determined from size of the young. The spring weather conditions are closely followed because this can have a major impact on hatching success and annual productivity.

Another job, Winter Flock Surveys, is a census of regional wintering turkey flock abundance, distribution and survival. Winter flock sighting information is collected from regional biological

staff, conservation officers, landowners, and sportsmen during the winter months. Data recorded includes town, locality and comments on food usage and behavior. Weather conditions and snowfall amounts are recorded throughout the winter.

A third job, Spring Harvest Data Coordination, Collection, Entry and Analysis, uses 50+ registration stations throughout the state to gather harvest information for each turkey taken during the hunting season. Information on the registration form includes license and turkey permit numbers, hunter's name and address, date and time of kill, weapon type, town of kill and turkey biological data: sex and age, weight, beard length, spur length and any abnormalities and tag numbers. Registration form data are entered into a computer data set for analysis.

Estimates of the yearly turkey population per WMU are based on the turkey harvest totals per each WMU during the spring gobbler season in May. In general, in states with established turkey populations, the spring hunting season harvest takes approximately 20% of the male segment of the turkey population. The female turkey population is not hunted in spring seasons. The sex ratio at hatching is 50% males and 50% females. Therefore, the spring season harvest represents approximately 1/10th of the total turkey population, or the estimated statewide turkey population is ten times the number of the spring harvest.

Projected Turkey Populations for the Year 2015

Table 3 gives the estimated turkey populations for 2004 and the projection for the year 2015, or the end of the 10-year management plan currently being formulated. It is not unreasonable to assume a future wild turkey population of 35,000 to 40,000 wild turkeys in New Hampshire, or an average of 4 to 5 turkeys per square mile. The neighboring state of Vermont has attained the population figure of 40,000 wild turkeys, as has the state of Connecticut.

Based on 2004 harvest totals, units H1, H2 and D2 have already attained turkey population estimates of 7.26, 5.09 and 6.19 turkeys per square mile, respectively. Units H1 and H2 in the original turkey release region in southwestern New Hampshire have probably reached carrying capacity. Turkey populations will probably continue to grow in most other units for the next 5 to 10 years. Based on the turkey populations in units H1 and H2 and the relative quality of habitat in the other units, values of 2, 3, 4.5, 5 and 6 turkeys per square mile were projected for the year 2015 for the various units in the state.

Limiting Factors for Maximum Projected Turkey Population

A more realistic maximum projected population level might be more in the order of 30-32,000 wild turkeys. If a fall shotgun season comes about, there will be a significantly greater yearly harvest. During fall seasons hen turkeys will comprise 65% or more of the harvest. While the neighboring state of Vermont has reached a population of 40,000 turkeys, and is about the same size as New Hampshire, there are some significant differences between the two states. Vermont has seven times more dairy farms than New Hampshire. This much greater acreage of farmland in Vermont provides more winter flock carrying capacity and the preferred summer brood habitat of fields.

New Hampshire is one of the most rapidly developing states in the United States. More and more farms and fields are lost to development each year. Yearly productivity of young turkeys can be expected to decrease in towns with high human densities because the favored field habitat for nesting and brood rearing is declining. Increased activity by children, dogs, cats and vehicles leads to increased nest abandonment or destruction.

The “cultural carrying capacity” for turkey flocks in some developed towns in southeastern New Hampshire has probably already been reached. Large turkey flocks living in suburban areas often result in complaints. Turkeys will sample fruits and vegetables in back yards, leave accumulations of droppings and sometimes provide a road hazard. Flocks particularly like to visit birdfeeders during the winter months and can irritate persons trying to feed the songbirds. There is current conflict between some dairy farms and large flocks of wintering turkeys. Turkeys feed on the stored corn ensilage in bunker silos and leave droppings at these food storage sites, which some farmers feel might transmit disease to cattle. The size and numbers of wintering turkey flocks at dairy farms appear to be increasing. A fall gun season for turkeys may be a method used to keep the turkey population from becoming too abundant.

More deer hunters are complaining about large flocks of turkeys eating too many acorns and thereby depriving the favored deer of some of this food supply. Most hunters fail to understand that the numerous species of mice and voles, squirrels and chipmunks consume far more nuts per acre or square mile, and that there is little competition during the critical winter months when deer are on a woody browse diet.

The radio telemetry turkey research studies discussed later in this report show that predation losses of nests, nesting hens and young turkey chicks and poults have been relatively high. There are numerous mammalian and avian predators throughout the state. The hunting and/or trapping of raccoons, foxes and skunks have very significantly declined in the past four decades. Hunting of coyotes and fisher is relatively uncommon. As more of turkey nesting and brood rearing habitat is taken over by development, predation will be more concentrated on the remaining habitat.

Turkeys are still relatively new to the state and most of the WMUs have probably not reached their potential carrying capacity. Setting specific turkey population goals for each WMU might not be realistic at this point in time.

2014 Turkey Population

An annual statewide turkey population estimate is made during the month of August by incorporating numbers and data from: summer brood survey, winter flock survey and spring/fall turkey harvests.

The turkey project biologist based in the Keene Office, acquires a good yearly sample of 100+ turkey broods during the summer, as well as the number and size of flocks during winter field work. However, the majority of these observations are from towns in southwestern New Hampshire. To obtain more comprehensive data from throughout the state two on-line public surveys were initiated.

There have been six years of the Public Internet Winter Flock Survey (Table 5). The average number of flock reports statewide have been 1,467 reports. The total number of turkeys from these reports has averaged 23,500 turkeys, and average number per flock report was 15.7 turkeys. The survey for the first two years recorded the locality, usually the road name. In subsequent years locality was omitted and only the town recorded. Many reports are of the same flock of turkeys in a town. It is also apparent that the greater number of flock reports come from WMUs in southeastern NH towns which have the greater human density and number of backyard birdfeeders and hence many more reports to enter in the survey.

The Public Internet Summer Brood Survey (Table 6) has been conducted for four years. The average number of brood reports received per year has been 1,033 reports. The poults per hen average state-wide was 3.74 poults for the month of August, and 4.00 poults per hen for the 4-month summer recording period.

During development of the previous 10 year Turkey Management Plan and Turkey Assessment in 2004, the turkey population was projected to be 30,000 to 32,000 turkeys by the year 2015. This goal has been reached or surpassed by the end of year 2014, during which the population is estimated at about 40,000 wild turkeys. Some states have estimated that the spring season turkey hunting harvest takes approximately one-tenth of the total turkey population and 20 percent of the male segment. Hence a spring gobbler season harvest of 4,000 gobblers would equate to a statewide population of 40,000 turkeys.

By the end of year 2014 the carrying capacity of turkeys has probably been reached in most of the state. There are at least some turkeys in every town in the state, from Portsmouth to Pittsburg. The current estimated population of 40,000 turkeys is probably going to be the average annual population for about the next ten years. Perhaps an annual population of 50,000 turkeys might be reached some year(s) when there is an above average summer hatch and survival of young.

The majority of the turkey population increase during the past 4-5 years appears to have come from towns in southeastern NH, or wildlife management units J2, L and M (Tables 3 and 7). This was not initially expected because these units have the most human development and the least amount of farmland. The 2014 estimate of 40,000 wild turkeys equates to a state-wide average of 4.55 turkeys per square mile, with WMUs in the southern half of the state having significantly higher turkey densities than this.

D. WILD TURKEY HABITAT ASSESSMENT

Limiting Factors for Turkeys

The following text was originally written in 1989. Updates are offered where necessary in order to provide an accurate perspective of turkey habitat conditions today. The most important factor limiting turkey numbers and their range expansion in New Hampshire is access to winter food. Snowfall is extensive over most of the region. Snowfall occurs from October through April in the northern sections. Even in the more favorable regions, during some winters, turkeys will have to withstand 100 or more days with from one to three feet of snow cover. In some cases there will be no access at all to foods on the ground, and seep areas will remain frozen over due to prolonged periods of zero range and lower temperatures. Deep, long-lasting snow cover

prevents turkeys from reaching foods on the ground, and turkeys cannot subsist on buds as do partridge. It is a bad sign when turkeys are reported “budding”. When found dead from starvation, their crops may be full of pine or hemlock needles or beech buds, which are of little nutritional value. Turkeys will sometimes stay in roost trees and starve when deep powder snow conditions persist because turkeys cannot walk around well and are susceptible to predators. It is better when crusts form as it will increase their mobility and encourage them to look for food above the snow.

The second most limiting factor is the lack of open or non-forested land. The winter foods, which turkeys need to survive are not found in dense woodland when deep snow cover persists for a long time. Turkeys need to rely on dried fruits and berries when acorns and nuts are unavailable. Apple trees, rose, sumac, juniper and other fruiting shrubs only grow well in non-forested sites where competition is minimal and where they receive maximum sunlight. Next to Maine, New Hampshire is the second most heavily forested state.

A third limiting factor is lack of numbers and variety of nut-bearing trees and other winter foods. While acorns are a primary food of wild turkeys over most of their range in North America, turkeys in some regions get along without the presence of any oak species if other mast species act as substitutes. The pits from cherry tree fruits, nuts from hickory trees and seeds from ash trees can be very important foods in other eastern states, but these three tree species are relatively scarce in northern New England. Beechnuts are a favorite turkey food, but the yearly crop is unreliable, and the trees are subject to disease. The seeds from hop hornbeam trees are a favorite, but this species is relatively scarce.

The number of species of oak trees is limited. The acorns from the more palatable “sweet” white oak species are the favorite of turkeys and other wildlife, but white oak is relatively scarce in most of New Hampshire. Northern red oak is the main species on which turkeys have to rely for acorns. Even its numbers are few compared to the numbers of birches, maples and white pines, prevalent in most forest stands. Roughly the northern halves of Vermont, New Hampshire and Maine have few oaks at all. Connecticut, Massachusetts and Rhode Island on the other hand, have an abundance of oak, particularly white oak, as well as other nut-bearing trees.

Besides lack of numbers of fruit-bearing shrubs and trees, variety of species is lacking. Our native winterberry, sumac, high-bush cranberry, juniper and wild apples are relatively scarce because the state has become so heavily forested. The fruits from green briar, bittersweet and flowering dogwood are important in other states, but hardly grow in New Hampshire. Important European species, which have escaped, such as barberry, buckthorn and Tartarian honeysuckle are also relatively scarce in New Hampshire.

A fourth important limiting factor, and perhaps the most limiting factor, is the relative scarcity of farmland. New Hampshire has very little farmland, and it is not evenly distributed throughout the state.

Scarcity of Farmlands

Since the initial restoration efforts with turkeys in the northernmost states, the great importance of farmland, particularly dairy farming, has been well documented. Without farmland and especially corn growing, turkeys could hardly exist in Michigan, Wisconsin and Minnesota.

Turkeys have taken hold and expanded rapidly in southeastern Minnesota, for example, almost entirely due to the fact that a major wildlife conservation practice for wild turkeys and deer is to leave blocks of standing corn for their wintering use. In northern New England, farmland is even more important to turkeys because the region is heavily forested and human development excludes turkeys from some of the best historic range in the coastal and river valley areas.

The land use practice that has done the most for turkeys is manure spreading during the winter months. Since most of the corn grown is chopped for ensilage to feed the dairy cows, there is an abundance of corn kernels left in the manure. In most cases, this has been a primary food source of turkeys during the critical winter period when there is maximum snow depth and when the acorn crop is scarce or non-existent.

Dairy farming is the primary reason Vermont had 12,000 to 15,000 wild turkeys in 1989, both a spring and fall hunting season, and why turkeys are as far north as the Canadian border in the Champlain Valley. Vermont supplies forty percent of the milk of the six New England states. It is common to see winter flocks of fifty to one-hundred feeding on manure spreading and around silage pits.

New Hampshire has relatively little farmland compared to other states. During 1986, the state lost 68 dairy farms, or 13% of its remaining farms to the federal dairy farm buy-out program. Most of those were lost in the southern counties or the turkey range. There were only 285 dairy farms left in New Hampshire in 1989.

Vermont has far more wild turkeys because it has many more dairy farms. Vermont had seven times the number in New Hampshire in 1989. Even though both states are approximately the same size, there are some significant differences. Vermont is less forested, with far more farms. Its soils are generally better, particularly in the counties bordering New York, where the majority of farms exist. Vermont has more hardwood forest, whereas New Hampshire is extensively covered with white pine, which has little value to turkeys and which acts to shade out the desirable fruiting shrubs and apple trees. Southwestern Vermont has considerably milder winter conditions and less snow depth. Turkeys even do well in northwestern Vermont on the Canadian border, due to the warming influence of Lake Champlain, and the extensive dairy farming in this large lake area. Vermont is subject to less development pressure. It is further away from East Coast and the Boston area. Also the hilly topography of eastern Vermont, with the narrow stream valleys, makes it less susceptible to development as compared to the relatively flat topography of southern New Hampshire.

Another reason the relatively few dairy farms are so important in New England is because there are few other types of farming, and there is little growing of grains other than corn. In other states, turkeys make good use of oats, wheat, sorghum, millet and buckwheat. Most of New Hampshire's remaining dairy farms are along the narrow Connecticut River Valley, bordering Vermont. The majority of farms in the southeast coastal plain and Merrimack River Valley have been eliminated due to industrial development, suburban growth and high taxes. Those farms in the Lakes Region have succumbed to summer resorts and second home development.

There is little former or abandoned farmland in early successional stages, which would produce an abundance of fruiting shrubs. Mature tree growth or housing has taken over most of these sites. Since forest openings are scarce, the pastures and hayfields make the best turkey brood

habitat where young turkeys can obtain the high protein diet of insects and seeds. More importantly, turkey winter foods are most associated with this remaining farmland. Without the existence of these dairy farms, it is probable that significant starvation and turkey losses would have occurred during some of the hard winters, such as those of 1975, 1977, 1978, 1981 and 1986.

Another important type of feeding behavior at dairy farms is turkey use of the bunker, trench or pit silos, which are filled with corn ensilage for feeding the cattle. Flocks frequently walk into those trench silos to feed on the corn kernels in the ensilage. During hard winter conditions, use is often on a daily basis. Trench silos at some farms are never used because the farm and buildings sit in an exposed open area, with no tree cover close by.

Dairy cows and wild turkeys are “synonymous” with one another. Wherever there is a town with some turkeys, the turkeys seek out the nearest farms. Dairy farms also represent a good percentage of the remaining field or open land left in the state. The pastures and field borders seem to be where the majority of the remaining barberry and rose bushes exist, as well as many of the wild apple trees. Grassy seeps and agricultural weeds such as burdock are also present in these fields. Therefore, turkeys gravitate to these farm sites to obtain the important winter foods.

Corn Plots for Turkey Winter Food

During 1995 approximately 30 dairy farms were selected throughout 5 counties, to pay them to leave blocks of standing corn for turkey winter use. The money for this initiative came from the earmarked turkey fund from the sale of the \$5.00 turkey hunting permits. The payment rate was \$500 per acre, and the size of the plots varied from ¼ to 1 acre.

During the winter of 1995-1996 turkeys made little use of this corn because of a mild winter. Deer ate most of the corn because of lack of mast, and because they did not yard up due to minimal snow-cover.

For the second successive year farmers were paid to leave standing blocks of corn for the winter of 1996-1997. It was hoped this winter would be a more accurate test of turkey use. However, turkey use of standing corn was quite minimal at 25 plots at farms in 13 towns from 3 counties in southwestern New Hampshire. The unusually good beechnut crop and little snowcover kept turkeys in the woods. Deer eventually made significant use of most plots, and eliminated the corn at some plots, even if one acre in size.

For the winter of 1997-1998 five corn plots of ½ acre in size were paid for in 3 towns in upper Grafton County in the Connecticut River Valley. These plots received turkey use during most of the winter. There were no corn plots in southwestern New Hampshire. Due to the cost of standing corn, the heavy use by deer, and the uncertainty of winter conditions, and the uncertainty of turkey usage, the use of the Department ear-marked turkey fund to pay for standing corn was dropped. The emphasis shifted to buying crabapple trees, which retain their fruit over the winter, as a method of addressing the lack of winter food sources for turkeys.

Crabapple Mini-Orchards

Since the re-introduction of wild turkeys to New Hampshire in 1975, turkey use of dried apples left on trees over the winter has been well noted during deep snow periods. Crabapple trees have been planted in recent years to beautify the landscape at schools, banks and MacDonalDs. These trees are hardy, produce apples in 2-3 years, and often are loaded with ½ bushels of fruit through the winter. The idea was to establish some mini-orchards of crabapple varieties for turkey winter food.

With the help of Charlie Williams, who was president of the New Hampshire Wild Turkey Federation, and a Horticulture Professor at UNH, a list of 30 varieties of crabapples was compiled, which retained fruit over winter and were winter hardy and disease resistant. Bailey Nurseries in Minnesota shipped 270 trees of 12 varieties at a cost of \$2,200. Newark Nurseries in Michigan shipped 75 trees of two varieties at a cost of \$525, and 19 trees of 3 varieties came from a nursery in Maine. The average price per tree was approximately \$6.50.

A total of 18 crabapple plots were planted at 14 sites in 13 towns, half on public land and half on private land. A 4-foot high piece of wire fencing and a 2-foot plastic guard for the base of the trunk, were put around each tree to prevent damage by deer and voles/mice. The number of trees varied from 12 to 33, spacing in rows was 7 paces or 21 feet between trees, and virtually all plots were in old fields or field edges, where there would be no competition from forest trees, and tractor mowing could be done between trees.

Landowners were selected who had a high interest in wild turkeys and habitat management, had suitable land and had turkeys using their land or living in the general area. The shipment of trees comes in early May to the regional office in Keene. The trees are bare root stock in bundles of 5 or 10 trees.

The material cost of each mini-orchard has been approximately \$250. About half is for the actual cost of the trees, and half for the cost of the fencing and mouse guards. The landowner has not had to pay anything. After several years of experimenting, the project settled on 20 trees per plot, which includes 5 trees each of 4 varieties. During the past several years the one nursery from Michigan has been the sole provider. The year 2003 was the sixth year that crabapple plots have been disseminated by the four regional biologists. A total of 640 trees have been purchased for approximately \$10,000 annually to do 32 mini-orchard crabapple plots each year.

Turkeys have used the majority of the plots, although time to assess tree survival, fruit production and turkey use during the winter months has been limited. Grouse have shown a marked liking for the fruits in winter with as many as 9 grouse congregated together at several sites. Late winter use by flocks of robins and waxwings has been noted. Crabapple trees that have been well cared for by the landowner have grown fast, and produced an abundance of fruit in several years.

Various problems have been noted over the six years. Major damage to the trees by deer and mice has occurred during some deep snow winters. Better fencing and mouse guards are needed. The logistics of moving these trees around the state has to be improved. The landowner recipient should be expected to do the planting, fencing and some annual maintenance and asked to help monitor the growth and wildlife use.

Further Decline in Dairy Farms

During 1989 there were only 285 dairy farms left in all 10 counties of New Hampshire. Now in 2004 there are less than 200 dairy farms left in the state, while neighboring Vermont has less than 1,800 farms left (see Figures 2 and 3). The number of dairy farms appears to decline further each year. There are now only 24 farms left in the original turkey release region of southwest New Hampshire – 12 farms in the 23 towns in Cheshire County and 12 farms in the 15 towns in Sullivan County. The southeast region of Rockingham/Strafford Counties has only a handful of dairy farms left. The south/central region of Hillsboro and Merrimack Counties has perhaps 6 farms left in each county. The area of most dairy farms left in New Hampshire is in western Grafton County in a tier of 10 towns directly bordering the Connecticut River. This county now has the highest turkey harvest, and the most turkeys. As a whole the largest turkey harvests and highest turkey densities are from the towns in the 3 counties directly bordering the Connecticut River, because of the prevalence of farms and fields for winter food and good summer brood habitat. As of January 2005, State Department of Agriculture data indicate there are only 137 dairy farms left in New Hampshire.

Another significant change during the past 15 years has been the decline of manure spreading during the winter months. Many farms have built concrete bins to store the manure over the winter. Less nitrates are lost as opposed to spreading the manure on the snow-cover in the fields.

There are increasing numbers of wintering turkey farm sites with 100 or more turkeys. This is creating friction with some of the dairy farms. There is not enough natural food available for this many turkeys congregated together, particularly during the deep snow-cover periods. Farmers do not like turkeys in grain storage bins, or large numbers of turkeys eating the corn ensilage out of the bunker and pit silos. There is also a concern by some farmers that turkeys could transmit disease through their droppings. Beginning during winter 2004-2005 the University of New Hampshire in cooperation with The Fish and Game Department and USDA Wildlife Services will study this issue, with funding from USDA.

Turkey Flock Use of Backyard Birdfeeders

The main winter food source of all turkey flocks in New Hampshire in all towns in the state, during periods of deeper snow-cover has become the sunflower seeds, cracked corn and other seeds at the countless backyard birdfeeders. This feeding behavior developed gradually over the past 15-20 years. Birdfeeders have become very popular. The building of new houses along all roads in all towns has greatly increased the opportunity for turkeys to increase their range into northern New Hampshire towns, into towns with little or no farmlands, and into heavily forested portions of towns with little natural winter turkey foods available.

The sunflower seeds are a large component to the birdseed mixtures. Sunflower seeds are considerably more nutritious than corn or acorns. Sunflower seeds have become a favorite turkey food. More and more residents now feed flocks of 20 to 60 turkeys all winter.

Another significant change just during the past several years is the rapidly increasing number of houses feeding wintering deer in their backyards. During the past two winters of doing winter deer yard survey in towns from four counties the turkey project biologist noted that 85% of the deer groups were going to backyards for corn and grain piles. More and more flocks of turkeys are taking advantage of these deer feeding sites.

The Public Internet Winter flock Survey shows that a high percent of winter flocks are at birdfeeders (Table 10). This is probably a major reason for the turkey population increase in southeastern NH. During winter 2013, 400 flocks used birdfeeders or 22.7% of the total flocks, compared to 432 flocks or 47.6% of flocks during winter 2014. Birdfeeder use was low during winter 2013 since snow cover was relatively low because seven thaws created a lot of bare ground sites.

During winter 2014 the greatest food usage was 432 flock reports (59.4%) at backyard birdfeeders. The second highest category was 135 flock reports (18.6%) of turkeys using corn/grain put out by people. The two categories combined become 78.0% of the flock observations, of turkeys getting birdseed and grain provided at people's houses.

The next highest category of food usage was of 77 flocks (10.6%) using apples/crabapples, followed by 41 reports (5.6%) of acorn or beechnut use. When use of corn in manure, corn in ensilage and standing corn were combined, the total of 26 flock reports was (3.5%) of corn use from agriculture. Another 181 flock reports were recorded with the type of food usage listed as "unknown".

Distribution of Turkey Habitat in the State

Table 8 provides a summary of turkey habitat by WMU, as formulated in 2001. Table 9 provides a summary of important turkey habitat types by WMU. Since fields and farmland are so important to turkeys in New Hampshire for summer brood habitat and a source of winter foods and oaks/beechnut are an important mast food source for turkeys, the square miles of these habitats were tabulated. The land or units in western New Hampshire or along the Connecticut River Valley (D2, H1, H2) stand out as having the best remaining acreage of fields and crops, and also some of the best turkey population densities as a result of this.

The square miles of beech/oak forest type show a significant difference from northern to southern New Hampshire. The units in the North Country (A, B, C, D1) have a relatively small percent of potential turkey habitat in the oak/beechnut forest type, as compared to the rest of the units in the state.

The square miles of developed land per unit is also noteworthy. Southeastern New Hampshire (units M, L and K) has significantly more developed land than elsewhere, as well as the highest human densities. Since 2001, habitat loss has continued to occur as additional agricultural land is put to other uses and both the human population and development increase.

Regional Severity of Winter Weather Conditions

Winter weather conditions can have a significant affect on wild turkey population growth throughout various regions of the state. A severe winter can result in significant turkey starvation losses and set back population growth for several years. In general, total inches of snowfall are greater in the northern half than in the southern half of New Hampshire, and snow-cover lasts longer in the northern half. Once snow-cover reaches a depth of 6 inches or more, turkeys cannot get to foods on the ground. Seep or wet areas are visited a lot by turkeys when snow-cover increases, but if a period of days of very low temperatures results, even the seep

areas become frozen. It is important to turkeys if one or more thawing periods occur during the winter. Also, formation of crusts on the snow is good. This enables turkeys to walk around and seek foods without burning a lot of energy. Turkeys flounder in deep loose snow and are more susceptible to predators.

During the early years of turkey restoration, total snowfall was recorded for each winter month of December, January, February and March. Also recorded were the number of winter days with 6 inches or more, and 12 inches or more of snow-cover. The snowfall data was obtained from weather stations in Surry, Concord and Durham. The data from these three stations was then averaged to represent the snowfall data for the southern half of New Hampshire. At that point in time turkeys had not progressed much into the northern half of the state.

Three severe winters occurred over the time span 1969-1986. The winter of 1970-71 had 85 inches of snowfall with 107 days of over 6 inches of snow-cover. The winter of 1971-72 had 82 inches of snowfall during the December – March period. These two severe winters helped eliminate the transplant of turkeys to Pawtuckaway State Park in Rockingham County and decimated the statewide deer population. The worst winter for turkeys, which caused some starvation, was 1981-82. While there was only 62 inches of total snowfall, the snow-cover came early and stayed late. There were no thawing periods and 96 continuous days of 1 to 3 feet of snow-cover.

A 10-year average (1969-1979) was made of total snowfall for the southern half of New Hampshire and the snowfall for each subsequent year was compared to this. The 10-year winter snowfall average by month was: December – 20 inches, January - 18 inches, February - 17 inches and March - 14 inches, for a total winter snowfall average of 69 inches.

Winter snowfall data should be monitored in northern New Hampshire, such as it is for deer. The winter snowfall amounts will no doubt be significantly greater than from southern New Hampshire. Potential turkey winter starvation losses will be much greater in northern New Hampshire.

The most important limiting factor to turkey numbers and range expansion in New Hampshire is access to winter food, because of deep snow-cover. However, during the past ten years or more the winters “appear” to be getting milder, with more winter thawing periods, early spring green-ups and less long-lasting snow cover.

The second most limiting factor is the lack of open or non-forested land. The edges of the open field land is what produces most of the wild apple, barberry, rosehips, sumac, etc., which are important turkey foods above the deep snow cover. The fields and pastures associated with the dairy farms produced much of the turkey winter foods and also were the best turkey summer brood habitat, since turkey restoration began in the state. More dairy farms have been lost during the past ten years. As of 2014, there were only 130 dairy farms left in the state, compared to 435 during 1984. Most of the remaining dairy farms are in towns from the three counties (Grafton, Sullivan, Cheshire) bordering the Connecticut River and Vermont. Thankfully there are still 1,500 horse farms in New Hampshire, and many small fields continue to be mowed throughout the state, to provide hay bales to feed horses. These fields are good turkey brood habitat.

Winter turkey starvation losses do not appear to be significant in the northern one-third of NH (Coos County and the northern portions of Grafton and Carroll Counties) even though farmland is minimal and the density of human residences is relatively low. There appears to be enough backyard feeders to help turkey flocks through the winter months. Another factor is the deer-feeding stations, where turkeys can get corn and grain, along with the deer.

E. HUNTING SEASONS ASSESSMENT

Types of Hunting Seasons and Methods

Of the two periods of hunting seasons for turkeys each year, the spring gobbler season is by far the most popular and traditional in most states. Calling in gobblers with various calling devices is a large part of the sport and tradition of turkey hunting. Only the male turkeys gobble and display during the several spring months. This is the major reason spring turkey hunting is so much more popular. Gobblers respond very little to calling during the fall months as it is not the breeding season. Most fall flocks consist of one or more hens and their young, and the general hunting technique usually involves trying to break up a flock and then trying to call some of these in where the flock is re-assembling.

Turkeys have a high reproductive potential in that they hatch and average clutch of 10-12 eggs and the great majority of all hens nest each year. Re-nesting is also the norm with turkeys whereby if the first nest is lost to predation or abandoned due to disturbance, most hens will make another nest. The young hens hatched during the early summer are themselves nesting the following spring when they are less than one year old.

Initiating turkey hunting can start relatively soon after restoration or transplanting of turkeys to a new region because of the high reproductive potential, the ability of turkeys to expand rapidly because of their large home ranges, and the relative difficulty of hunting wild turkeys. Success rates are typically in the order of 12%, i.e. only 12 out of every 100 hunters is going to successfully harvest a gobbler during the spring season.

The great majority of hens have been bred before hunting begins in the spring. In almost all states in the northeast the season begins in late April or early May, and ends in late May or early June, depending on latitude. The hunting season does not begin earlier in the spring so as not to interfere with the initial breeding activity. The season usually terminates by the end of May so as not to interfere with the rearing of young after the peak of hatching in early June.

Time of day when turkeys can be hunted is also a factor in the regulations. During the spring season the hunting hours are ½ hour before sunrise until 12:00 noon. Allowing only morning hunting is thought to help reduce disturbance of hens which typically come off their nests to feed for an hour or less in the afternoons, and also may mean less disturbance to other turkeys when they go to roost in trees during the early evening at sunset. In any case, analysis of hunting season data has shown that 80% or more of the spring gobbler season harvest occurs between the hours of 5:00 and 8:00 AM.

The typical scenario for starting turkey hunting in a new state or region of a state is to start with a limited spring season first. After the turkey population increases and expands its range, the spring season may be lengthened, a fall archery only season started, and then a fall shotgun

season allowed when and if a stable turkey population develops, which has a spring gobbler harvest of 0.5 to 1.0+ gobbler kill per square mile of turkey habitat. Bag limits are often later liberalized by allowing 2 gobblers in the spring and/or 2 turkeys during a fall season.

A special permit is required to hunt turkeys in New Hampshire. This is one method of regulating hunting pressure. Other methods include the possible use of lotteries, having different season lengths in various wildlife management units, and allocation of the numbers of permits per WMUs. In some states, permit-holders are allocated to hunt during specific weekly segments of the month-long season.

During the past ten year segment the spring gobbler season has had the same season dates of May 3 – 31st. The starting day of the regular season was whatever day of the week was May 3rd. The 2-day weekend or Saturday & Sunday Youth Hunt has been the weekend preceding the May 3rd regular season start. The fall archery turkey season has remained the same 3-month period as the September 15 – December 15 deer archery season. The 5-day fall turkey shotgun season was initiated during fall 2006, and has been the five week days starting on the Monday of Columbus Day during October.

Early Turkey Hunting Seasons

The first ten years (1980-1989) of limited spring gobbler hunting is summarized in Table 11. A fall gun season for turkeys was not originally planned unless or until there was a significant increase in turkey numbers and distribution. During fall turkey hunting, both toms and hens are allowed to be hunted. New Hampshire did not have a turkey population large enough to accommodate the harvest of hens from a fall gun season during preceding decades. However, fall archery season for turkeys was allowed because it facilitates increased man-days of hunting recreation with little or no impact on the resource. During the fall archery seasons of 1985 through 1989, 5, 3, 4, 2 and 12 turkeys, respectively, were harvested. The season length was liberal and currently is three months in length. It runs concurrently with the fall archery season for deer, or from September 15th to December 15th. The number of permit holders participating was estimated at about 300 in 1989.

Current Spring Turkey Hunting Seasons

From the first limited spring season in 1980 with 31 gobblers harvested, it took ten years to reach a harvest of 100 gobblers, with 142 harvested during the May 1989 season. With eastern transplant areas soon open to hunting and the turkey population increasing in numbers in various regions, the turkey season harvests began to increase rapidly. The increasing numbers of new turkey hunters also contributed to this greater harvest. It took until 1989 to reach 1,000 permit holders, and the number has increased significantly to where there were 16,000 permit holders in 2003.

Table 12 shows the total yearly spring harvest from 199 to 2014. From the 1994 to the 1995 season the harvest went from 334 to 536 gobblers, or about a 60% increase. Increases since then have typically varied from 20 to 30%, except for the years 2002, 2003 and 2004 where the harvest stayed at approximately 2,600 gobblers, due to two successive summers of below long-term average hatching success due to poor spring weather. It took a period of 19 seasons (1980-1998) to reach a harvest of 1,000 gobblers (1,015 in 1998). It then took only three more seasons

to reach a harvest of 2,000 gobblers (2,266 in 2001). Kill again increased from 2005 through 2008, while varying from year to year it has averaged about 3,900 per year.

As of the May 2003 season, the original release area of the state (unit H2 = 388 gobblers) still recorded the largest number of turkeys harvested, followed by two other units in the southwest region of the state: (unit K = 339 gobblers), and (unit H1 = 317 gobblers). Units B, C1, C2 were opened to hunting during the May 2003 season and 59 gobblers were taken in this northern region. Only units A1 and A2 near the Quebec border remain closed.

Only Cheshire and Sullivan Counties have perhaps reached their carrying capacity for turkeys, after a period of 29 years since the original release in 1975. The other 8 counties still appear to have expanding turkey populations. While northernmost Coos County (harvest = 139 gobblers) is large, its potential is not great because it is the most forested county, with perhaps the hardest winter conditions. The north central region of Carroll/Belknap Counties (harvest = 318 gobblers) in the Lake Winnepesaukee/Maine border area appears to have a significantly increasing turkey population, even though few dairy farms remain in this region.

The southeastern region of Rockingham/Strafford Counties (harvest = 196 gobblers), has produced a relatively low season harvest for years, even though the most turkey transplants were made to this region. This is now the most developed region of the state, with the least farmland and the most posted land. During the past two years, turkey harvest in the northern half of Strafford County has been increasing.

Table 13 gives the 2005-2014 spring turkey kill by WMU. Statewide, the kill seems to be leveling off at approximately 4,000 gobblers. It varied from 3,042 gobblers during May 2005, to 4,550 gobblers during May 2013. The average harvest during this 10-year segment was 3,807 gobblers. The Youth Hunt harvest varied from 389 during May 2005, to a high of 590 during May 2013, and the 10-year average has been 503 gobblers or 13.2% of the regular season spring harvest.

Turkey Harvest Densities

Figure 4 shows the 1980 through 2014 spring turkey harvest for each wildlife management unit and statewide. It also shows the corresponding harvest per square mile of habitat for each unit. These graphs include a threshold harvest rate of 0.5 per sq. mile which is considered a general goal representing a threshold for considering allowing additional fall harvest during a limited fall shotgun season. The harvest in recent years has shifted from southwestern to southeastern New Hampshire. For years the highest harvests were in the western units of H1, H2, K and D2. For approximately the past four years the southeastern units of J2, L and M have had the higher harvest. Average kill per sq. mile in southeastern units are J2 (0.76), L (0.89) and M (0.74) while in western units they are D2 (0.57), H1 (0.87), H2 (0.65) and K (0.91). It probably took longer for the later turkey transplants to southeastern NH to grow and expand. The southeastern region also has a much greater human density, and hence more turkey hunters. While farmland in southeastern NH is greatly diminished, there is sufficient brood habitat, and an abundance of birdfeeders for winter food.

Trends in Turkey Harvest and Kill Per Square Mile in WMU's

The spring season harvest shows a leveling off for the past several years at an average of about 4,000 (Table 12). Further upward trends may be unlikely but if the turkey population continues to increase in the units in the eastern and northern section of the state, the statewide yearly harvest total should also increase. The hunter success rate may be leveling off. Since turkey hunting was new to the state the success rate was only 3 to 5% the first few years, then increased to about 10 to 12% after ten years, and is currently at about 16-17% for the past several years. The number of permit-holders rose each year, but has now leveled off at between 18,000 and 20,000 hunters (Table 12). Currently, there are approximately 60,000 hunting license holders in NH. During year 2013 there were 18,663 resident turkey hunters and 1,399 non-resident persons who purchased a turkey permit. Therefore, about 1 out of 3 hunters hunts turkeys.

Age Classes of Turkeys in Harvest

Over the course of 35 hunting seasons in New Hampshire, there have almost always been more juvenile gobblers (jakes) registered than adult gobblers (toms). This is understandable since turkey hens produce an average of 12 young each year, of which half or 6 are going to be juvenile males. Turkeys are not long-lived, having a maximum life span of approximately 8 years, and an average life span of only 1½ years for males. New Hampshire typically has approximately 55% jakes and 45% toms in the spring gobbler harvest, or a juvenile:adult harvest ratio of 1.30 to 1.0. Table 11 lists the harvest ratio for 1980-1989.

Table 14 has the juvenile/adult harvest ratios for the past ten years, and the breakdown of age classes in the harvest each year. For years prior to this there were usually more jakes than toms in the spring harvest. This was still the case during May 2005 when the harvest ratio was 1.11 jakes to 1.00 toms. Ever since then or for the past nine years there have been more toms in the harvest than jakes, with the 9-year average being 0.58 jakes to 1.00 toms. With the growth of the turkey population statewide there are now more adult gobblers living longer in the turkey population, and hunters can be more selective in harvesting a tom rather than a jake.

Every turkey brought to a registration station since the first season has had spur, beard and weight measurements taken, and there is a volume of data to follow any trends in harvest. The following are the averages for the past ten years for each of the five gobbler age categories: 36% 1-year olds, 39.0% 2-year olds, 19.4% 3-year olds, 4.9% 4-year olds and 0.73% 5+ year olds. It is apparent that the one and two year old gobblers comprise approximately 75% of the annual harvest and that four and five year olds are relatively scarce. The small number of long, sharp spurs from registration stations confirms there are relatively few old toms in the state turkey population, and that the turkey population is hunted relatively hard.

Fall Archery Seasons

The first limited spring shotgun season was in 1980, and the first fall archery season was initiated five years later in 1985. It was quite feasible to allow archery hunting because the low hunter success rate by bow and arrow would not impact on the growth of turkey populations. For the first three years the season opened the same day as the opener for the fall deer archery season and went to late October, for a season length of approximately 5 ½ weeks. For the first four seasons the number of participating hunters varied from 200 to 285 archery hunters. There was an archery hunter questionnaire for these first four seasons. The harvests were quite low,

being only 5, 3, 4 and 2 turkeys respectively. Archery hunting was only just beginning to gain in popularity and it took some time to learn about hunting this new species.

The number of participants and number of turkeys registered began to grow after the 1989 season. At this time the season was lengthened to be concurrent with the fall deer archery season, or a 3-month season of September 15 – December 15. The fall harvest reached 100 turkeys, with 132 turkeys taken in 1995. During the 2003 questionnaire it was indicated that 36% of those hunting during the spring season also participated during the fall archery season. It is therefore estimated that 5,400 hunters spent some time archery hunting for turkeys during the fall 2003 season. During the fall 2003 archery season a record 270 turkeys were taken, and another record was set during the 2004 fall season with 341 turkeys registered. Table 15 records the archery harvest from 1993-2004.

Table 16 has the fall shotgun and fall archery turkey harvests for the past ten years (2005-2014). The 5-day shotgun fall season was initiated during 2006. During 2006 this shotgun harvest was 122 turkeys, there was a high of 719 turkeys taken during fall 2010. The main reason for this spike in harvest was due to eastern units J1, J2, L and M being open for this first time. The 9-year average was 433 turkeys during the 5-day October season or 62.4% of the fall harvest.

A few hunters have suggested that the fall shotgun season be lengthen by adding a weekend. A cautious approach has been taken because experience in other states has shown that too liberal a fall season can negatively impact upon the turkey population for the following spring season. During the NH fall turkey seasons the highest percent of the harvest has been of the adult hen segment. Taking too many hens in the fall harvest could slow turkey population growth in areas. An experienced turkey biologist from the NWTf has advised that the fall season turkey harvest not be more than 20% of the spring harvest total.

The 3-month fall turkey archery season has varied from a harvest of 189 during fall 2014, to a high of 418 turkeys during fall 2007, with a 9-year average of 261 turkeys or an average of 37.6% of the total fall harvest. Since the advent of the fall shotgun season, the percentage taken by archery has declined, probably because it is easier to take a fall turkey by shotgun than by archery.

Status of northern WMUs

The six poorer quality habitat units of A, B, C1, C2, E and F in northern NH, which have more severe winter conditions, little farmland and low human density, have not shown significant growth in the past ten years, which was not unexpected. During the spring 2014 season their combined harvest of 196 turkeys, was only 5.6% of the statewide season total.

A criterion that has been used for when to open a unit to allow some fall shotgun season, has been when a unit has reached a spring season harvest of ≥ 0.5 gobbler kill per square mile. These units are a considerable distance from this goal. These units do not have turkey populations or spring harvests high enough to safely support a fall shotgun season. A liberal spring gobbler season length and a fall archery season are sufficient.

Season Regulation Changes

As the turkey population increased in range expansion and numbers, various hunting regulations became more liberal. The first two seasons were 9 days long, then went from 18 to 20 days for four years and settled at a season length of 29 days since 1989 to the present in 2004. The starting date varied during the first ten seasons, ranging from May 4th to as late as May 16th. Radio telemetry research in neighboring Vermont indicated that the majority of hens began incubation between May 4th and May 8th, and that state had a May 3rd opening day for the hunting season for many years. Field studies in New Hampshire indicated a similar time pattern for breeding, nesting and hatching. For years the starting date was selected so that it was not on a Saturday or Sunday, so as to lessen hunting pressure on opening day. As the turkey population multiplied and turkey hunting opportunity became available in most regions of the state, the switch was made to May 3rd.

For the first two seasons in 1980 and 1981, the number of permit-holders were drawn by a lottery, and assigned to one of several zones in which they had to hunt. This lottery and zone system was discarded after these two years because it was shown that hunting success rate was quite low, the number of permit applicants was not large and the rapid increase in turkey distribution could tolerate the hunting pressure.

Several changes over the years helped increase hunter satisfaction. Hunters were allowed to use one or more decoys. The end of the daily hunting period went from 11:00 AM to 12:00 noon. A separate small turkey permit or stamp had to be printed and distributed around the state to license agents for many years. During 2001, the permit became a “tag” on the hunting license, similar to the deer and bear season tags. “Companion hunting” was finally allowed in 1994. This was a very popular change for hunters. After a hunter registered a turkey, he could still assist another hunter by calling turkeys.

During the first ten seasons a hunter questionnaire had been mailed to permit-holders in order to determine such things as towns or areas hunted, number of man-days of hunting, hunting pressure, hunter interference, number of turkeys heard and seen, etc. No hunter questionnaire was sent out for years until 2002 when the Turkey/Small Game Committee of 5 biologists sent out a 2-page questionnaire to 1,000 permit-holders, in order to assess hunter opinions about a possible youth hunt, a possible fall shotgun season and degree of hunting pressure.

The questionnaire indicated that 36% of those hunting during the spring season also participate during the fall archery season; that 84% support a spring youth hunt; that 67% rate turkey hunting in the state as good or excellent; that 88% judged hunting pressure as light or moderate, and would not welcome restrictions to when or where they could hunt in the state.

Over the years, additional units have been opened to various seasons as the turkey population has increased and provided additional harvest opportunity. In recent years, additional consideration was given to several means to liberalize the turkey hunting seasons. The best turkey population units could perhaps have a 2-gobbler bag limit during the spring gobbler season, and the fall shotgun season could have a weekend added to the five weekdays. However, this possible liberalization was put on hold the past several years because of: the advent of the two turkey pox viruses the past three years and the unknown losses to the viruses, the below average hatching success several years, and the slowed growth in annual turkey harvests.

F. RESEARCH FINDINGS AND NEEDS

A substantial number of turkey research projects have been conducted in New Hampshire since successful turkey restoration began in 1975. There have been 5 field studies with radio telemetry turkeys, and 3 studies with imprinted captive turkeys to study nutrition and metabolism aspects. The field work monitored turkeys in 6 of the states' 10 counties. The University of New Hampshire was a partner, and a Master of Science thesis resulted from each study. Appendix II provides citations for New Hampshire studies.

The main source of funding for these research studies was from dedicated turkey permit revenue and Federal Aid funds. Additional monies came from the University of New Hampshire. Its' research facility in Brentwood, site of the former Department pheasant farm, was used to house the captive turkeys for the several nutritional studies. For several studies some monies were contributed from the New Hampshire Turkey Federation and from the National Wild Turkey Federation. The Blue Mountain Forest Association, a preserve of 23,000 acres, allowed the use of their land and provided lodging for one study.

1980 - 1981 Study of Two Turkey Transplants to Strafford/Rockingham County Area

The objective of this study was to document the winter range use and requirements of turkeys with emphasis on winter food usage. This was the first major radio telemetry study of turkeys in the state since the initial release of 25 wild turkeys in 1975. Size of winter home ranges of 5 flocks were 1,860, 879, 521, 1,502 and 455 acres, for an average of 1,042 acres. In square miles this was 3.0, 1.42, 0.84, 2.42 and 0.73, for an average of 1.68 square miles. A total of 806 winter feeding sites were inspected over 43.4 miles of trails. Over 80% of feeding sites were in woodlands, 13.3% along edges of fields, pastures and power-lines, and 5.1% were in fields. Of the 806 sites, 218 (27%) were in some type of wetland. Scratching for acorns occurred at 227 of the feeding sites and accounted for 31.4% of the total feeding activity. Feeding on acorns decreased markedly as depth of snow-cover increased. Next to mast, wetland plants were the most important constituents of the turkeys' winter diet. Most of this activity was at spring seep sites, which have less snow-cover than surrounding habitats. Intensive use of sensitive fern was responsible for most of the wetland feeding, and accounted for 20.7% of the total winter-feeding activity. The spore heads have a high protein value. Other wetland foods used to a much lesser extent were seeds from sedges and the fruits of winterberry bushes. A wide variety of other foods were used, such as standing corn, beggar-tick, burdock, rose hips, wild apples and fruits from barberry bushes. Scratching beneath white pine and hemlock trees occupied an estimated 15.6% of the feeding activity. Examination of droppings indicated that white pine seeds made up some portion of the diet. Scratching for blue beech seeds accounted for 6.0% of feeding activity when snow-cover was minimal.

1987 - 1988 Radio Telemetry Study of Nesting Hen Turkeys in Sullivan/Cheshire County and Rockingham/Strafford County

Predation was very high both years of this study. Ten of 21 hens (48%) were killed in 1987, and 11 of 29 hens (39%) in 1988. The combined total for the two years was 21 of 50 hens (42%) killed by predators. While predation of hens was a high 42%, predation of nests was even higher. Of 40 nests monitored over the 2-year period, 18 of 40 nests (45%) were destroyed. Coyotes and fisher appeared to be the major predators on adult hens. Fisher have the ability to

knock turkeys out of a roost trees at night. Coyotes can be particularly destructive during the nesting period because they are very active near the same farm and field areas where turkey hens nest and raise their young. Evidence indicated that coyotes and fisher killed 18 radio hens. The following were the causes of mortality of radioed hen turkeys during the 1987-1988 study: 11 coyotes, 7 fisher, 2 predators unknown, 1 great-horned owl, 2 road-kills and 1 natural injury.

Fourteen radioed hens left over from the summer of 1988 were monitored through the 1989 nesting season. Five of these 14 hens or 36% were lost to predation and one was killed by a car. Evidence indicated that coyotes killed 3 hens and fisher killed 2 hens. The 1987-1988 telemetry study confirmed the affinity of hen turkeys to nest near fields and then to use them as brood habitat. The great majority of hens both years nested close to hay fields, pastures or overgrown fields. During the summer of 1987 all nests were quite close to fields. The distance of nests to fields varied from 10 to 200 feet and averaged 80 feet. Seven of 12 nest sites (58%) were within 30 feet of the edge of a field. Of the 3 re-nesting hens, 2 of their nests were in hayfields and one on the brushy edge of a field. During the summer of 1988, 17 of 20 nests (85%) were within 100 feet of hayfields or pastures. Of these 17 nests, 6 nests were only 10 feet from a field edge. Two nests were greater than 100 feet, but still close to fields. One nest was 150 feet and one nest 500 feet away from a field edge.

Several years after turkeys were introduced into southwestern New Hampshire in 1975, turkey nests began to be reported in hayfields. By 1985 this was a common phenomenon throughout the turkey range in the state. It became obvious that virtually all of these nests were second nest attempts. There is not sufficient grass growth for cover in fields when hens establish their first nests during early to middle April. During most years active dairy farms do their first hay cutting the first week of June. Since approximately 1995 the great majority of dairy farms destroy turkey nests each year when hay-mowing. Some farms report 4 to 6 nests mowed over, and more hens are now being chopped up by mowers, rather than being flushed. The newer tractors are larger with closed-in cabs and move faster. Many turkey nests are also lost from mowing in fields other than dairy farms. There appears to be little solution to this increasing loss in numbers of turkey nests and hens. While flushing bars on tractors have been used for years in the mid-western states to flush pheasants and ducks, they have never been a tradition in New England states. During summer 1987 the distance of nest sites N=13 from winter capture sites varied from 14 mile to 2 $\frac{3}{4}$ miles. Six nests from western New Hampshire averaged 1.77 miles and 7 nests from eastern New Hampshire averaged 1.00 miles. The combined average was 1.81 miles. Several hens traveled long distances of 24, 18 and 9 miles. This tendency of wild turkeys to rapidly expand their range into new habitat is confirmation of why a small New England state needs relatively few turkey transplants to develop a statewide turkey population. During summer 1988 distance of nest sites from the capture/wintering sites of 22 radioed hens was an average of 2.38 miles. The eastern New Hampshire hens moved significantly lesser distances or an average of 1.24 miles, as compared to 2.06 miles for the western New Hampshire hens. Long distance movements were 3 hens crossing the Connecticut River into Vermont to nest, moving 17, 6 and 6 miles respectively. Another hen moved 15 miles north.

2001 - 2002 Winter Radio Telemetry Study of Hen Turkeys in Sullivan County

The major objective of this study was to determine the influence of food availability and supplemental feeding on winter survival and population dynamics of northern wild turkeys. The following is a brief summary of the two years of research: During winter 2001 a total of 235

turkeys were trapped, of which 25 hens were radioed. During winter 2002 a total of 182 turkeys were trapped, and another 25 hens radioed. Different amounts of grain were given to various groups of these turkeys in order to measure and compare their energy expenditure, weight loss, activity and winter home ranges. The radioed hens were injected with double-labeled water. Four distinct flocks were trapped and re-trapped after a 15-22 day period, and the energy expenditures calculated. During winter 2001, 19 of 25 (76%) were recaptured, and 13 of 25 (52%) during winter 2002. Turkeys were exposed to a hard winter 2001, with frequent snowstorms and snow depths of 43-85 cm, which limited ground forage and turkey mobility. The winter of 2002 had minimal snow, which resulted in much bare ground conditions and reduced use of feeding sites. As a result, winter home ranges were 6-33 ha in 2001, versus 22-283 ha in 2002. Most turkeys maintained weight to ± 0.1 kg during the trial period. Body weight of both juveniles and adult hens were about 5% less in 2001 than 2002. Mean body fat was similar across treatment groups. Mean body fat was about 417 gm in juvenile hens, and 657 gm in adult hens. Fat deposits represented 12 and 17 days of their required energy demands or FMR (Field Metabolic Rate), respectively. Despite dramatic differences in environmental conditions between the hard and easy winter, energy expenditure was similar both years and among the treatment groups. In hard winter 2001, turkeys adapted to severe conditions by restricting distances moved and activity, and by remaining close to the feeding sites.

Bio-energetic measurements during the two different winters point to several key factors concerning the winter ecology of wild turkeys: The FMR of juvenile and adult hens was remarkably similar and relatively low during two disparate winters, indicating that they seem adapted for low energy expenditure regardless of winter conditions. Most hens maintained their energy balance during the severe winter, indicating that the supplemental grain provided maintenance energy when natural foods were not available. The only treatment group that experienced an energy deficit had only minimal food available in the corn kernels found in some old manure piles. Although turkeys have appreciable fat deposits, extended periods (two weeks) without access to food will probably result in mortality, with juveniles succumbing first. Food availability is the key habitat factor influencing winter survival of northern wild turkeys.

The two years of metabolic research on free-ranging flocks of wild turkeys in various towns in northern Sullivan County was successfully concluded. Turkeys lower their daily energy expenditure and behave similar to wintering deer by: 1) using their body fat reserves, 2) reducing distances moved, and 3) staying (roosting) near the food source. Without the abundance of backyard birdfeeders, severe winters with long-lasting deep snow cover could be devastating to turkey flocks in New Hampshire, with significant starvation losses.

2001 – 2002 Study of Home Range, Nesting Ecology and Survival

A 2-year study in northern New Hampshire during 2001 and 2002 monitored 45 radioed hens in several towns in western Grafton County along the Connecticut River Valley and some adjacent towns on the Vermont side of the Connecticut River. Survival of hens was similar to rates reported in other northern states. Survival was lowest during spring (76%) when hens were highly vulnerable, as most mortality (89%) was associated with incubation and brood rearing during spring and summer. Twelve of 44 hens survived > one year, yielding a sample of 56 hens to calculate survival rates. Nineteen known mortalities occurred during the study. Two died during the winter, 12 during the spring and 5 during summer. Twelve or 63% of hen mortality

occurred during reproductive efforts (May-July). Most were from predation: 3 hens killed during laying, 6 hens during incubation on nests and 3 hens during brood rearing. Predation included 5 by coyotes, 2 by red fox, 2 by bobcats, 1 by great-horned owl, and 4 were unknown. Other deaths were 2 from car kills, 1 from hay mowing, 1 from fence entanglement and 1 unknown. Overall productivity of nesting hens in this study was lower than expected. The nesting rates of adult hens (88%) and juvenile hens (58%) were lower than that in other northern states. The average clutch size of 10 eggs was similar to that from other states, as was nesting success (52%), degree of re-nesting (63%), and the hatching success rate (60%) from re-nests. The survival rate of poults at 0 to 14 days post-hatch was 38%, and at 0 to 21 days post-hatch was 32%. Poult survival was 39% lower in 2002 when spring rainfall was abnormally high, than in 2001 when spring weather was normal.

Annual home ranges of radioed hens averaged 5,745 acres (9.3 sq. mi.), similar to that for hens reported in other studies. Winter home ranges in 2001 of 14.8 acres, and in 2002 of 143.3 acres were among the lowest reported in from other states. These small home ranges are a result of the severe winter conditions in northern New England, and the turkey dependence and use of agricultural food on dairy farms in northern New Hampshire. Essentially, these home ranges represented the small area of flocks moved from the trench silos and/or manure piles to roost sites. The average dispersal distance from wintering site to nesting site of radioed hens was 2.48 miles for adult hens and 6.57 miles for juvenile hens, and both were similar to the distances measured in other northern states.

2004 – 2005 Winter Agricultural Damage by Wild Turkeys in New Hampshire

This research study was started during spring/summer 2004 and will continue during winter 2005. It was proposed by the Fish & Game Department and Wildlife Services, funded with a grant from the Wildlife Services Agency of the United States Department of Agriculture (USDA) based in Concord, and implemented by the University of New Hampshire. The Research objectives are: identify those farms experiencing winter congregations of wild turkeys; identify specific concerns of those farmers; test for the presence of Salmonella in turkey fecal samples collected at a sample of farms during winter 2004-2005; and describe and contrast the adjacent forest habitat at farms.

Large flocks of turkeys at dairy farms from four counties along the Connecticut River Valley have raised concerns about the local and seasonal density of wild turkeys. Some farmers have reported damage to or use of corn ensilage in bunker silos during the winter months by flocks of 100 or more turkeys. Some dairy farmers have expressed concerns about the potential spread of disease to cows from turkey feces, particularly Salmonellosis. Some dairy farmers from other states in the Northeast have similar concerns.

Farms with large wintering flocks of wild turkeys were identified by the Fish & Game Department. The study area was divided into two regions, the Northern Region (north of Lebanon) with 12 farms, and the Southern Region (south of Lebanon) with 10 farms. During July 2004 research technicians met farm managers and gave them a survey of 22 questions that included trends and observations about turkeys and other wildlife, damage and concerns. The technicians also mapped turkey feeding and roosting sites.

Of the 22 farms surveyed, size of winter flocks was: 25 to 50 turkeys (23%), 51 to 100 (23%), and greater than 100 turkeys (32%). Forty-five percent of the farms fed spoiled ensilage to

turkey flocks, left some standing corn and spread manure in fields in order to help wintering turkeys and to help keep turkeys from feeding in the bunker silos. The majority of farmers (82%) had a positive or neutral attitude toward wild turkeys, but 25% of Northern farms had a negative attitude compared to 10% of Southern farms. The two main concerns of dairy farmers were disease (55%), and feed contamination (41%). The most popular response by farmers for methods to control winter flock congregations was increased hunting opportunity and bag limits. Other avian species identified as threats on farms included pigeons, blackbirds, starlings, waterfowl and geese. When asked which wildlife species pose threats on their property, bear was the most in the north (58%), and blackbirds and starlings in the south (70%).

2004 New Hampshire Residents' and Hunters' Opinions on the Status and Management of Big Game Populations, (416 pp.)

This survey was conducted for the Fish & Game Department by Responsive Management of Harrisonburg, Virginia, to determine public opinions on and attitudes toward populations and management of the following big game species: deer, bear, moose and turkey. The study entailed a telephone survey of 519 New Hampshire residents, which included 109 hunters.

Responses were favorable toward the Department, with a majority (63%) rating the Department's performance at 8 or higher, on a scale of 0 to 10. A majority (53%) of respondents rated their interest in wildlife as high, 38% as medium, and 7% low. A majority (74%) knew a moderate or great deal about wildlife in general. A majority (87%) approved of legal, regulated hunting as a way to manage game populations: 64% strongly approved and 23% moderately approved, while only 7% disapproved.

There is a 52-page segment of the report addressing the public attitudes toward wild turkey management. The following is a brief summary of the survey findings. The following ratings were given to the Department's wild turkey program: 24% excellent, 28% good, 8% fair, 2% poor and 38% didn't know.

A majority (77%) of the hunter segment of respondents rated the turkey program in their county as excellent or good because they thought the turkey population is at the right size. Only 10% of hunters rated the program as fair or poor. A majority (61%) of respondents think the wild turkey population in their county should remain the same; 12% think the population should be increased, and 9% think it should be decreased. Of the hunter segment (109 hunters), 60% of these hunters think the wild turkey population in their county should remain the same. Note: It should be remembered that answers and attitudes from this type of survey might be somewhat different if a significant portion of the 16,000 turkey hunters in New Hampshire were sampled. The great majority of hunting license holders are not turkey hunters. Approximately 22 of the 109 hunters (20%) in the total of 519 respondents in the survey are estimated to have been turkey hunters.

Each of these research studies has contributed significantly in learning about the ecology and population dynamics of turkeys throughout the different regions of New Hampshire. Each has led to a better understanding of how to protect and develop a sustainable turkey population throughout the state, how to best manage turkey hunting seasons and how to reduce potential conflict of turkeys with agricultural interests. New Hampshire, as well as neighboring Maine and Vermont, has hard winter conditions, with long-lasting deep snow-cover. Since turkeys are primarily ground feeders, lack of winter food sources has always been a primary concern. The

studies with captive turkeys contributed greatly to better understanding how turkeys can survive hard winter conditions, how various winter foods contribute to energy needs, and what conditions will likely result in mortality. The field research during the winters of 2000-2001 and 2001-2002 in Sullivan County measured turkey weight gain or loss and energy needs under actual winter conditions with groups of free-ranging radioed turkeys. It was found that turkeys had some winter survival behavior similar to deer, in that to conserve energy and weight loss turkeys reduced their daily movements and roosted very close to the primary food source.

Several Viruses Present in Wild Turkeys in Northeastern States – Ted Walski

During November 3, 2011 was the first official record of the avian pox virus and/or lymphoproliferative disease virus (LPDV) in New Hampshire, with two toms collected in the town of North Haverhill (Grafton County). During the next three years the two viruses have killed turkeys throughout NH, as well as the neighboring states. The turkey project biologist has monitored and recorded cases each year. The hunting registration forms during the spring and fall hunting seasons have helped in determining towns and sites with pox turkeys, as have reports from the Public Internet Summer Brood Survey and the Public Internet Winter Flock Survey. During October 2012 six turkey specimens were sent to the Veterinary Lab at UNH, and were diagnosed as having both viruses. During the May 2013 hunting season 100+ turkey feet donated by hunters from NH and Vermont were sent to the SCWDS Lab in Athens, Georgia. A relatively high 71% tested positive for the LPDV virus. Appendix III provides additional background information on the viruses in New Hampshire and the northeast.

2013 Evaluating a Monitoring Survey as a Management Tool for Eastern Wild Turkeys in NH (78 pgs.)

The 2012 Public Internet Summer Brood Survey and the 2012 Public Internet Winter Flock Survey added a new section or questionnaire to help assess public attitudes about wild turkeys in the state. Data from these two surveys were compiled and analyzed as part of an M.S. Thesis by a University of NH graduate student/Department employee. The public overwhelmingly liked wild turkeys and supported the F&G Dept.'s efforts to census the number and distribution of turkeys in the state. The opinion results were: strongly dislike (0.002%), dislike (0.003%), neutral (8.45%), like (23.37%) and strongly like (71.70%).

2005 Winter Agricultural Damage by Wild Turkeys in New Hampshire (35 pgs.)

Summary: During July 2004 University research technicians met farm managers and gave them a survey of 22 questions, and mapped turkey feeding and roosting sites at the farms. During the winter of 2005 a university graduate student and the Department turkey project biologist collected turkey droppings four times at these farms. These droppings were tested at the UNH Veterinary Diagnostic Lab. No salmonella was found in droppings from these farms. The university submitted a 35-page progress report: Winter Agricultural Damage by Wild Turkeys in New Hampshire. The majority (82%) of farmers had a positive or neutral attitude towards wild turkeys. The species posing the most threat to their property were bears in the north (58%), and blackbirds/starlings in the south (70%).

Procedures: A formal study proposal was submitted during spring 2004. It was proposed by the Fish & Game Department and Wildlife Services (former Animal Damage Control), and

implemented by the University of New Hampshire. Farms with large wintering flocks of wild turkeys were identified by several biologists from the Fish & Game Department. The study area was divided into two regions, the Northern Region (north of Lebanon) with 12 farms, and the Southern Region (south of Lebanon) with 10 farms. During July 2004 research technicians met farm managers and gave them a survey of 22 questions that included trends and observations about turkeys and other wildlife, damage and concerns. The technicians also mapped turkey feeding and roosting sites.

Droppings were collected at the sample of dairy farms during the 4 winter months of winter 2005, by a university graduate student, assisted by the F&G Dept. turkey project biologist. The droppings were examined at the UNH Veterinary Diagnostic Lab at Durham, New Hampshire.

Results: Of the 22 farms surveyed, size of winter flocks was: 25 to 50 turkeys (23%), 51 to 100 (23%), and greater than 100 turkeys (32%). Forty-five percent of the farms fed spoiled ensilage to turkey flocks, left some standing corn and spread manure in fields in order to help wintering turkeys and to help keep turkeys from feeding in the bunker silos. The majority of farmers (82%) had a positive or neutral attitude toward wild turkeys, but 25% of northern farms had a negative attitude compared to 10% of southern farms. The two main concerns of dairy farmers were disease (55%), and feed contamination (41%). The most popular response by farmers for methods to control winter flock congregations was increased hunting opportunity and bag limits. Other avian species identified as threats on farms included pigeons, blackbirds, starlings, waterfowl and geese. When asked which wildlife species pose threats on their property, bear was the most in the north (58%), and blackbirds and starlings in the south (70%).

Conclusions: The majority of dairy farmers had a positive or neutral attitude toward wild turkeys. This research study should help greatly in reducing the fears of dairy farmers about disease transmission and feed contamination from wild turkeys.

G. SUMMARY AND CONCLUSIONS

The pre-settlement population in New Hampshire was estimated to have been approximately 5,000 wild turkeys, mostly in the southern half of the state. The range pretty much followed that of the oak/chestnut forest. Settlement caused most towns to become about 85% cleared. There were no resource agencies to protect and manage wildlife, and most wild turkeys were extirpated by the end of the Revolutionary War.

Effective restoration did not begin until the 1960s when the waterfowl cannon net was adapted for capturing wild turkeys and the Northeast Wild Turkey Technical Committee was formed to yearly meet and discuss turkey research and management findings and needs. The two member states of New York and West Virginia trapped wild turkeys and sent them to various New England states. The 1969-1970 transplant of 27 West Virginia turkeys to New Hampshire failed because of a combination of reasons: these turkeys came from a state with less severe winter conditions, there was no farmland at the release area, and New Hampshire experienced two of the severest winters of the century. The 1975 release of 25 New York turkeys was quite successful because the release was in good farmland and these turkeys were used to deep snow winters in the Allegheny Mountains. Most of the subsequent 15 transplants within New Hampshire did well. Transplanting turkeys within the state was completed in 1995. There are now some turkeys in every town in all 10 counties.

Legislation was passed in 1977 to give the Fish and Game Department Director the authority to set seasons and hunting regulations, and to prohibit the importation, propagation, sale or release of undesirable game farm turkeys. A biologist was assigned to spend a major portion of his yearly work effort on turkey restoration, management and research. A turkey hunting permit fee was established to help pay for this work. A limited turkey season was initiated in 1980 with the first spring gobbler season by a lottery drawing. Hunters were allocated to hunt in four different zones in southwestern New Hampshire. A first fall archery season was allowed in 1985 because archery allowed numerous man-days of hunting recreation with little impact on the turkey population. As the turkey population expanded in range and numbers from turkey transplants, more of the state was open to hunting. The need for a lottery and allocation of hunters to zones was not needed after only several years. It took the first ten hunting seasons to reach a level of 1,000 permit-holders and a harvest of 100 gobblers harvested. After that the turkey population, the number of hunters participating, the turkey harvest and the popularity of turkeys grew rapidly. The spring 2004 season harvest was 2,700 gobblers and there were an estimated 16,000 permit-holders. A limited one-week fall shotgun season could soon be considered for various management units in western New Hampshire.

During 1989 a 31-page draft of a Wild Turkey Assessment report was prepared, but never finalized, because the Chief of the Wildlife Division retired and there were Department budget problems. This report was to be a management plan for the years 1990-1995. This report dealt with all the population, habitat, harvest and other concerns in the current assessment for the next 10 years. Several major objectives were: To develop a wild turkey population in all regions of the state with suitable habitat; to provide hunting opportunity with both a spring and fall hunting season; to reach a statewide population of 4,000 to 5,000 wild turkeys; to have 5,000 permit-holders per year, resulting in 55,000 man-days of hunting recreation per year. Other objectives were: to educate the general public and landowners about turkey ecology and habitat needs; to determine the yearly progress of turkeys at transplant sites; to determine the general status of the statewide population by winter flock census and summer brood survey; to annually monitor the spring and fall season by use of permit and registration stations and analyze the results; to utilize the ear-marked turkey fund derived from the sale of turkey hunting permits for habitat work, management and research; to educate the hunters about turkey hunting methods; to increase the numbers of wild turkeys until the carrying capacity is reached; to allow a fall shotgun season when and if regional turkey populations are high enough to absorb a fall gun season. All the above objectives were reached except for the last two. However, a fall shotgun season is now possible for wildlife units in western New Hampshire and the carrying capacity for turkeys in all parts of the state may soon be reached by the year 2010.

In 1989, or 15 years following the initial successful release of 25 New York turkeys, the statewide population was estimated at 2,500 wild turkeys and the maximum "projected" wild turkey population for the year 2000 was 8,125 turkeys. However, by 1996 the population was already 8,000 turkeys and 18,000 turkeys in year 2000. The current 2004 population was estimated to be 26,000 wild turkeys. The "projected" statewide population by the year 2015 or the end of the new 10-year Turkey Management Plan is 38 to 40,000 wild turkeys. The neighboring states of Vermont and Connecticut are now at estimated populations of 40,000. It is not unreasonable to assume New Hampshire could reach this figure, with the density of turkeys per management units varying from 2 or 3 in the northern and 5 to 7 turkeys per square mile in the southern half to two-thirds of the state.

All counties or management units of New Hampshire have some turkey habitat, some much more than others. Large Coos County in the north has the least habitat because it has very little field or farmland and little oak type forest. The White Mountain National Forest area in the north-central regions will also have low turkey numbers because it is very mountainous with deep snow-cover and little winter food. The most limiting factor for turkey numbers throughout the state is access to winter food. Plants that can provide foods above the deep snow-cover, such as wild apple trees and sumac, are relatively limited because most towns are approximately 84% forested. Dairy farms are synonymous with large turkey flocks because the corn wastage in the manure spreading and manure piles, and the corn ensilage in the bunker and pit silos have provided winter food and the fields associated with farmland have provided the best summer turkey brood habitat. However, since the 1980s the state has lost the majority of its dairy farms. There are now less than 200 dairy farms remaining in the state. The big factor in recent years, which has allowed the turkey population to grow and expand is the proliferation of backyard birdfeeders.

Seven turkey research studies have been coordinated between the Fish and Game Department and the University of New Hampshire between 1980 and 2003. Much has been learned about nesting habitat and degree of reproductive success, home range size and movements, winter range use, causes of mortality and food usage. Numerous radioed hen turkeys have been monitored and numerous other turkeys banded. This work with tagged turkeys has taken place in all ten counties in the state.

Hunting season lengths and bag limits can readily be adjusted by wildlife management units, and serve to control large turkey populations if problems develop with agricultural interests and in developed or urban areas. The big limiting factor of winter food scarcity seems to have been removed by the behavior of every turkey flock going to backyard birdfeeders during the critical period of deep snow-cover. The Department will continue to educate the public about wild turkey ecology and population dynamics and to stress the importance of fields and open land for wild turkey habitat.

Summary and Conclusions for 2005-2014:

1. One goal was to reach a statewide population of 40,000 turkeys. There was an estimated population of 26,900 turkeys in 2004. The projected population for 2015 was 40,449 turkeys. The estimated population as of 2014 was 39,060 turkeys. Therefore, the goal has been reached.
2. It was predicted that the turkey carrying capacity throughout the state would be reached by 2014. The current estimated turkey population of 40,000 may be about maximum. However, after an above reproductive summer, the population might reach 50,000 turkeys. Likewise, after a poor hatching year(s) the population could drop to 30,000 turkeys.
3. Another goal was to provide some fall shotgun season in WMUs with the better turkey population densities and spring harvests. Since 2006 12 of the 18 WMUs have had a 5-day fall shotgun season. The six northern WMUs may continue without a fall shotgun season because of poorer habitat and a lower turkey population.

4. Another goal was to have a special season for young turkey hunters. During 2004 the popular Youth Hunt was initiated, it takes place during the weekend before the start of the regular season, and has an average harvest of 13.2% of the total spring harvest.
5. In recent years the spring gobbler season harvest seems to have leveled off at approximately 4,000 gobblers and 20,000 turkey permit-holders.
6. The major limiting factor for turkeys in New Hampshire was winter food scarcity. This obstacle seems to have been significantly reduced because it has been observed that all turkey flocks go to backyard birdfeeders during critical periods of deep snowcover. During 1984 there were 435 dairy farms throughout the state, and only 130 during 2014. Backyard birdfeeders are now the major winter food source.

Table 1. Wild turkey range and projected population density in New Hampshire as of 1990.

County	County Size (sq. mi.)	Occupied Turkey Range (sq. mil)	Percent of County Occupied	Estimated Turkey Population	Turkey Density Per Square Mile
Cheshire	720	612	85%	800	1.11
Sullivan	540	459	85%	500	0.92
Hillsboro	890	596	66%	355	0.4
Merrimack	930	623	66%	150	0.16
Belknap	400	120	30%	90	0.23
Strafford	380	190	50%	120	0.32
Rockingham	690	276	40%	300	0.44
Grafton (1)	595	242	15%	200	0.83
Carroll	---	---	---	---	---
Coos	---	---	---	---	---
Total	5,145	3,118	NA	2,515	Mean=0.81

(1) Acreage only includes the western one-third of the county. The eastern two thirds were not considered to constitute turkey habitat.

Table 2. Maximum projected supportable wild turkey population for New Hampshire, projected in 1989 for the year 2000.

County	Square Miles of Land Area	% of Areas Constituting Habitat	Square Miles of Turkey Habitat	Maximum Expected Turk Population	Turkeys per Square Mile
Cheshire	720	100%	720	1440	2
Sullivan	540	100%	540	810	1.5
Hillsboro	890	100%	890	1335	1.5
Merrimack	930	100%	930	1395	1.5
Belknap	400	100%	400	400	1
Strafford	380	100%	380	760	2
Rockingham	690	100%	690	1035	1.5
Grafton	1616	33%	535	800	1.5
Carroll	944	33%	310	150	0.5
Coos	1673	0%	---	---	---
Total	9000	60%	5395	8125	Mean=1.5

This table was prepared in 1989. It provides insight into our turkey status and expectations at that time. The estimated pre-colonization turkey population estimate was 5,550 turkeys over 30% of the state (2,760 miles) in southern portions of the state. Density on occupied ranges was 2.0 birds per square mile.

Table 3. Estimated 2004 wild turkey population per wildlife management unit and projected wild turkey population for 2015, in New Hampshire.

Wildlife Management Unit (WMU)	Square Miles of Turkey Habitat*	Estimated Turkey Population for 2004	Turkey Density per Square Mile 2004	Projected 2015 Turkey Population	Projected Turkey Density Per Sq. Mi. 2015
A	534	150	0.28	1068	2
B	342	160	0.47	684	2
C1	205	100	0.49	615	3
C2	245	260	1.06	735	3
D1	234	1070	4.57	1404	6
D2	475	2940	6.19	3325	7
E	780	420	0.54	1560	2
F	479	770	1.61	1437	3
G	650	2360	3.63	3250	5
H1	402	2920	7.26	2814	7
H2	697	3550	5.09	4182	6
I1	358	1710	4.78	2148	6
I2	378	1570	4.15	2268	6
J1	472	1530	3.24	2124	4.5
J2	819	2380	2.91	3685	4.5
K	637	3000	4.71	3822	6
L	494	1060	2.15	2223	4.5
M	690	950	1.38	3105	4.5
Total	8891	26900	3.03	40449	Mean=4.55

*Total land area

Table 4. A history of turkey transplants/releases in New Hampshire.

Figure 1 Map Reference Number	Year of Transplant	Town Of Release	Number of Turkeys Released	County of Release
1	1969	Nottingham/Deerfield	26*	Rockingham
1	1970			
2	1975	Walpole	27	Cheshire
3	1978	Lyndeboro	16	Hillsborough
4	1980	New Boston	7	Hillsborough
5	1979	Pittsfield/Gilmanton	25	Merrimack/Belknap
6	1979	Lee/Durham	21	Strafford
7	1979	Brentwood/Exeter	25	Rockingham
8	1979	Boscawen/Webster	17	Merrimack
9	1984	Chester/Derry	12	Rockingham
10	1986	Weare/Dunbarton	25	Hillsborough/Merrimack
11	1992	Canterbury	25	Merrimack
12	1993	Chester	20	Rockingham
13	1993	Kensington	10	Rockingham
	1983	Kensington	5	Rockingham
14	1993	Strafford	13	Strafford
15	1994	Moultonboro	35	Carroll
16	1995	Sanbornton	36	Belknap
Total			344	

* This release failed

The 1969-1970 transplant was from West Virginia and the 1975 transplant was from New York. The remainder of transplants consisted of birds trapped and relocated within New Hampshire.

Table 5. Data from Public Internet Winter Flock Survey (6 years)

Year	# of Flock Reports Statewide	Total Turkeys Reported	Average Number Per Flock
2009	1528	10414	15.66
2010	1291	19050	14.89
2011	1497	27521	18.38
2012	1180	20295	17.45
2013	1787	28389	15.89
2014	1520	21352	14.05
6 yr. Averages	Avg. = 1,467	23,500	Avg. = 15.7

Table 6. Data from Public Internet Summer Turkey Brood Survey (4 years)

Year	# of Brood Reports Statewide	Aug. poults per hen Average - Statewide	All Summer, poults per hen Avg. Statewide
2011	808	4.38	4.79
2012	924	3.84	4.06
2013	1676	3.33	3.32
2014	724	3.40	3.81
4 year Averages =	Avg. = 1,033	Avg. = 3.74	Avg. = 4.00

Table 7. Estimated 2014 Wild Turkey Population per WMUs

Unit	Sq. miles of turkey Habitat	Estimated turkey Population	Turkey population Per square mile
A	534	480	0.90
B	342	250	0.71
C1	205	220	1.07
C2	245	280	1.14
D1	234	1,020	4.36
D2	475	2,340	4.93
E	780	340	0.44
F	479	640	1.34
G	650	2,570	3.95
H1	402	2,950	7.34
H2	697	3,610	5.18
I1	358	1,590	4.44
I2	378	1,760	4.66
J1	472	1,660	3.52
J2	809	5,990	7.31
K	637	4,900	7.69
L	494	4,060	8.22
M	690	4,400	6.38
TOTALS	8,891	39,060	4.39 average

Table 8. Turkey habitat* by Wildlife Management Unit (WMU) in New Hampshire.

WMU	Total Sq Miles	Land Sq Miles	% of WMU That is Land	Sq. Miles of Land That Met Turkey Guidelines	% of Land That Met Turkey Habitat Guidelines
A	584.6	569.9	97.5	465.8	81.7
B	346.2	342.2	98.8	281.8	82.3
C1	205.7	204.9	99.6	174.4	85.1
C2	257.4	244.5	95.0	179.6	73.5
D1	241.2	234.4	97.2	193.1	82.4
D2	483.9	475.4	98.2	425.1	89.4
E	782.8	779.9	99.6	574.5	73.7
F	483.4	479.0	99.1	403.6	84.3
G	672.3	649.6	96.6	556.3	85.6
H1	409.8	401.8	98.1	354.8	88.3
H2	719.7	697.3	96.9	626.6	89.9
I1	368.0	358.0	97.3	317.9	88.8
I2	396.9	377.7	95.2	328.0	86.8
J1	507.2	471.8	93.0	428.2	90.8
J2	929.3	818.8	88.1	733.2	89.5
K	657.2	637.1	96.9	569.9	89.5
L	513.9	494.0	96.1	412.2	83.4
M	722.4	690.2	95.5	530.7	76.9
STATE	9282.1	8926.4	96.2	7555.6	84.6

*Habitat data were generated in 2001. Habitat features included agricultural lands, all forest classes except spruce/fir, other/cleared lands, bedrock/vegetated, and forested wetlands.

Table 9. Square miles of cover type by wildlife management unit (WMU). Estimates derived using 2001, GRANIT Land Cover data based on classification of Landstat Thematic Mapper Imagery.

WMU	Sq. Mi. Land Area*	Sq. Mi. Crops	Sq. Mi. Hay/Pasture	Sq. Mi. Beech/Oak	Sq. Mi. Other Hardwoods	Sq. Mi. Conifers	Sq. Mi. Developed Land
A	534	0.2	6.2	36.8	182.9	90.6	0.5
B	342	0.7	3.9	24.3	114.1	52.4	0.4
C1	205	0	1.2	19.4	78.4	28.5	0.1
C2	244	0.1	1.3	16.4	61.6	54.8	0.3
D1	234	1.7	5.2	9.1	35.4	41.9	0.4
D2	475	2.9	14.6	38.8	82.8	75.6	0.5
E	780	0.3	4.1	83.3	164.9	189.1	1.2
F	479	1.2	4.3	79.9	95.5	90.8	0.8
G	650	0.9	15.4	110.9	95.3	126	2.1
H1	402	2.5	14.1	52.1	39.5	76.1	2.1
H2	697	2.8	18	118.7	44.1	102.1	2.3
I1	358	2.8	10.4	68.4	20.9	63	1.4
I2	378	0.4	6.7	67	36.7	70.3	0.8
J1	472	0.1	4.9	68.1	50.5	77	1.6
J2	819	1.6	17.6	132.4	55.3	93.3	3
K	637	2.7	16.6	98.6	14.8	103.2	3.4
L	494	1.6	11.9	52.6	25.8	39.1	4.4
M	690	2.4	16.9	53.1	28	41.3	11.4

Table 10. Food Usage Categories by Turkey Flocks Statewide – Winter 2014

Food category	Number of Observations	Percentage of Total Observations	
Acorns/beechnuts	41	5.6%	
Apples/crabapples	77	10.6%	
Birdfeeder	432	59.4%	78.0% fed by people
Corn/grain	135	18.6%	
Corn in manure	11	1.5%	3.5% corn from agriculture
Corn in ensilage	10	1.4%	
Standing corn	5	0.6%	
Dried berries/ Fruits on shrubs	2	0.2%	
TOTAL	727	100.0%	
(unknown foods)	(181)		

Table 11. A comparison of season results in New Hampshire from 1980 through 1989.

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
	May 10-18	May 16-24	May 5-23	May 5-22	May 8-27	May 8-27	May 7-31	May 6-31	May 4-31	May 3-31
# of Days	9	9	19	18	20	20	25	26	28	28
Turkey Kill	31	27	40	72	51	61	89	86	91	142
Permits Sold	708	1,272	1,203	1,128	871	758	862	857	875	1,121
Est. Persons Hunting	637	1,090	1,022	918	740	644	776	771	787	1,009
% Success Rate	5.0	2.5	3.8	7.8	6.9	9.5	11.5	11.0	11.6	14.1
Juvenile:Adult Harvest	0.45	0.69	0.86	0.72	1.32	1.26	1.23	1.40	1.62	1.58
Percent Kill Opening Day	29	30	35	16	43	25	43	26	26	26
Avg. Man- Days Hunting	4.2	3.6	4.8	5.0	5.6	5.4	5.7	6.8	5.7	---
Towns with Turkeys Taken	11	9	17	21	17	19	25	25	35	38
Towns Visited By Hunters	24	34	23	21	29	41	41	52	55	---

Table 12. Spring Season Harvests 1990-2014

Year	Youth Hunt Kill (% of Total)	Number of Permits Sold	Total Spring Harvest
1994	N/A	3,654	334
1995	N/A	4,935	539
1996	N/A	6,096	690
1997	N/A	6,797	757
1998	N/A	7,949	1,015
1999	N/A	10,024	1,378
2000	N/A	11,662	1,883
2001	N/A	13,936	2,260
2002	N/A	16,065	2,631
2003	N/A	16,485	2,599
2004	321 (11.9%)	17,653	2,706
2005	389 (13.0%)	18,626	3,042
2006	437 (12.4%)	19,641	3,559
2006	454 (12.4%)	19,388	3,651
2008	579 (14.1%)	18,683	4,107
2009	570 (14.1%)	18,520	4,056
2010	541 (14.7%)	18,380	3,669
2011	521 (14.2%)	18,643	3,672
2012	480 (12.4%)	18,694	3,876
2013	590 (13.1%)	20,062	4,550
2014	471 (12.1%)	N/A	3,885
Total	5032		38,067
10 yr average	503		3,807
Percent	13.2		

Table 13. New Hampshire Spring Turkey Harvest by WMU for 2005-2014

Unit	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	10 year average
A	Closed	Closed	23	14	34	22	30	47	62	48	47.7
B	17	36	23	39	37	26	19	34	41	25	29.7
C1	28	23	11	12	16	14	13	13	18	22	17.0
C2	14	41	25	28	29	23	19	26	33	28	26.6
D1	120	129	110	123	101	82	83	99	114	102	106.3
D2	337	399	351	378	352	308	236	213	270	234	307.8
E	48	48	44	47	35	37	37	23	47	34	40.0
F	83	83	98	101	94	82	64	78	83	64	83.0
G	269	288	281	307	301	279	244	265	324	257	281.5
H1	336	320	351	353	337	340	299	274	337	295	324.2
H2	370	407	428	467	505	409	431	371	449	361	419.8
I1	174	194	204	212	242	188	181	196	199	159	174.9
I2	193	228	187	224	192	174	172	182	202	176	193.0
J1	180	208	196	206	199	181	152	165	212	166	186.5
J2	295	356	429	500	530	471	512	532	676	599	490.0
K	343	412	461	486	487	472	529	535	571	490	478.6
L	131	184	204	285	289	261	311	393	455	406	291.9
M	114	176	206	308	264	296	338	425	456	440	302.3
Totals	3042	3559	3651	4107	4044	3669	3672	3876	4550	3906	3808

Table 14. Age Classes of Spring Gobbler Harvest (2005-2014)

Year	1 yr old	2 yr old	3 yr old	4 yr old	5+ yr old	Juvenile to tom ratio
2005	52.6%	30.5%	13.1%	2.9%	0.9%	1.11 to 1.00
2006	36.4%	40.4%	19.4%	3.7%	0.005%	0.53 to 1.00
2007	32.6%	40.9%	19.7%	5.7%	1.1%	0.48 to 1.00
2008	38.4%	37.7%	17.9%	5.1%	0.70%	0.63 to 1.00
2009	35.5%	40.4%	18.5%	4.9%	0.67%	0.55 to 1.00
2010	25.0%	49.8%	19.9%	4.7%	0.60%	0.33 to 1.00
2011	44.1%	32.0%	17.5%	5.7%	0.70%	0.79 to 1.00
2012	31.7%	39.0%	23.3%	5.3%	0.78%	0.46 to 1.00
2013	32.8%	39.0%	22.4%	5.4%	0.84%	0.49 to 1.00
2014	30.8%	38.6%	22.5%	5.6%	1.00%	0.45 to 1.00
10 yr avg.	36.0%	40.3%	19.4%	4.9%	0.73%	0.58 to 1.00

Table 15. Fall Archery Turkey Harvest in New Hampshire 1993-2004.

Year	Total Turkeys	# Females	# Males	# Unknown	# of Towns Registering Turkeys
1993	22	18	4	--	17
1994	43	32	10	1	31
1995	132	87	41	4	62
1996	48	34	14	--	34
1997	115	84	31	--	69
1998	76	45	30	1	45
1999	244	164	76	4	108
2000	81	53	25	3	55
2001	256	175	81	--	130
2002	202	133	69	--	107
2003	270	168	102	--	145
2004	342	205	139	--	150
Total	1,831	1,198	620	13	

Season dates are September 15 – December 15 (concurrent with the fall deer archery season).

Table 16. Fall Archery and Fall Shotgun Turkey Season Harvests 2005 - 2014

Year	Archery Harvest	% of Total	Shotgun Harvest	% of Total	Total Fall Harvest
2005	296	--	--	--	296
2006	208	53.3%	122	31.3	390
2007	418	54.9%	343	45.1	761
2008	207	41.1%	297	58.9	504
2009	198	40.2%	294	59.8	492
*2010	291	28.8%	719	71.2	1010
2011	211	32.8%	432	67.2	643
2012	350	33.1%	706	66.9	4056
2013	313	36.6%	542	63.4	855
2014	189	29.9%	443	70.1	632
Total	2681		3898		6343
9 yr avg.	261		433		634
	37.6%		62.4%		

*Opened J1, J2, L and M

Figure 1.
Turkey Transplant Sites in
New Hampshire 1969 to 1995

YEAR	TURKEYS	TOWNS
1	1969	26 Nottingham/Deerfield
2	1975	27 Walpole
3	1978	16 Lyndeborough
4	1980	7 New Boston
5	1979	25 Pittsfield/Gilmanton
6	1979	21 Lee/Durham
7	1979	25 Brentwood/Exeter
8	1979	17 Boscaawen/Webster
9	1984	12 Chester/Derry
10	1986	25 Weare/Dunbarton
11	1992	25 Canterbury
12	1993	20 Chester
13	1993	10 Kensington
14	1993	13 Strafford
15	1994	35 Moultonborough
16	1995	36 Sanbornton

- Turkey transplant sites outside of NH (approx. locations):
 5 Vermont
 2 Massachusetts
 3 Maine

- ~ State
- ~ County
- ~ Town
- Urban area
- ~ Rivers and Streams
- ~ Lakes and Ponds



NHFGD GIS Program, December 2004

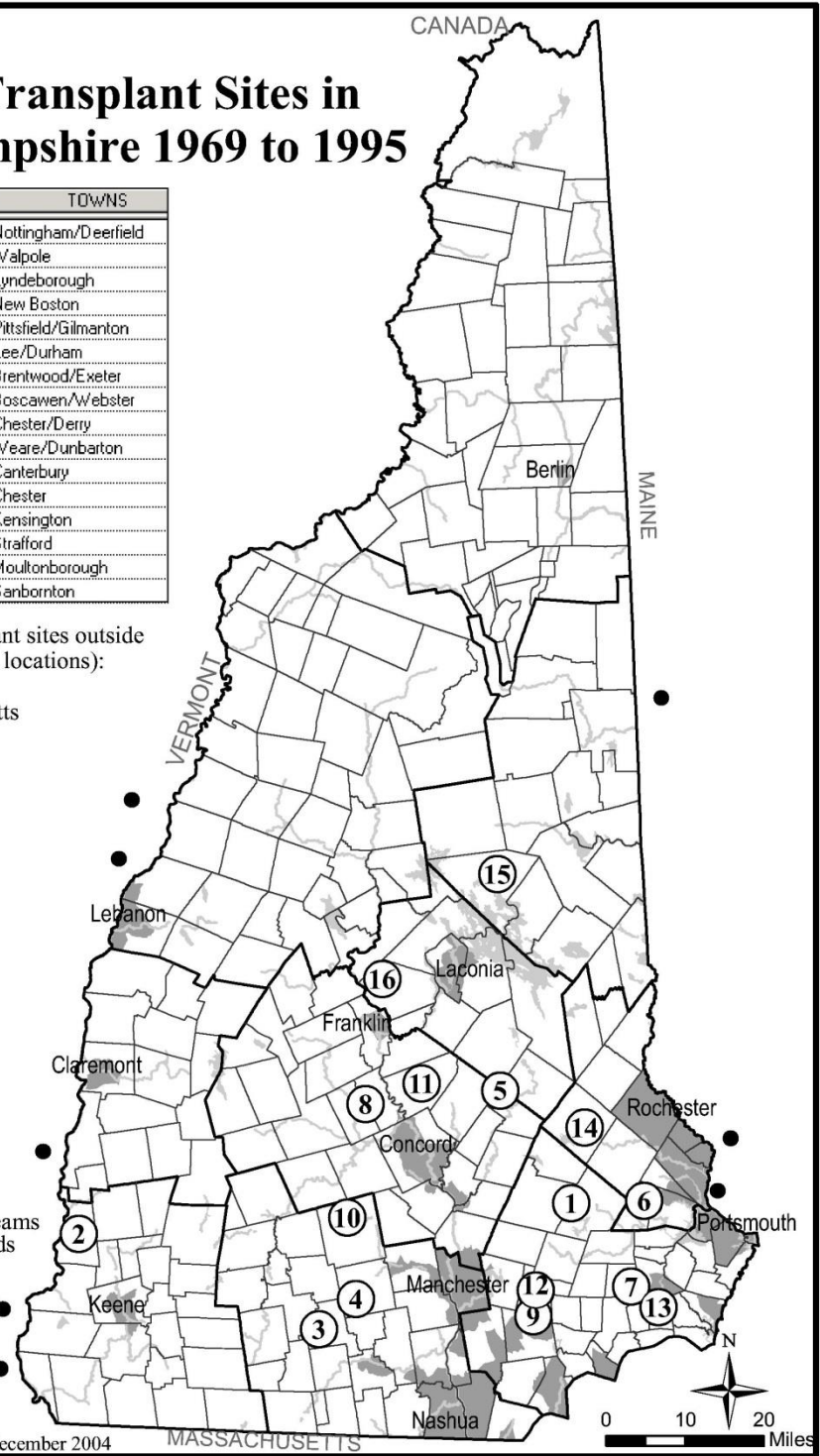
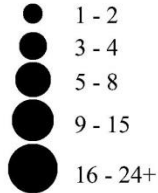


Figure 2.
Dairy Farms in
New Hampshire
1984

COUNTY	FARMS
Belknap	15
Carroll	8
Cheshire	43
Coos	72
Grafton	102
Hillsborough	42
Merrimack	62
Rockingham	30
Strafford	26
Sullivan	35
State Total	435

Number of Farms

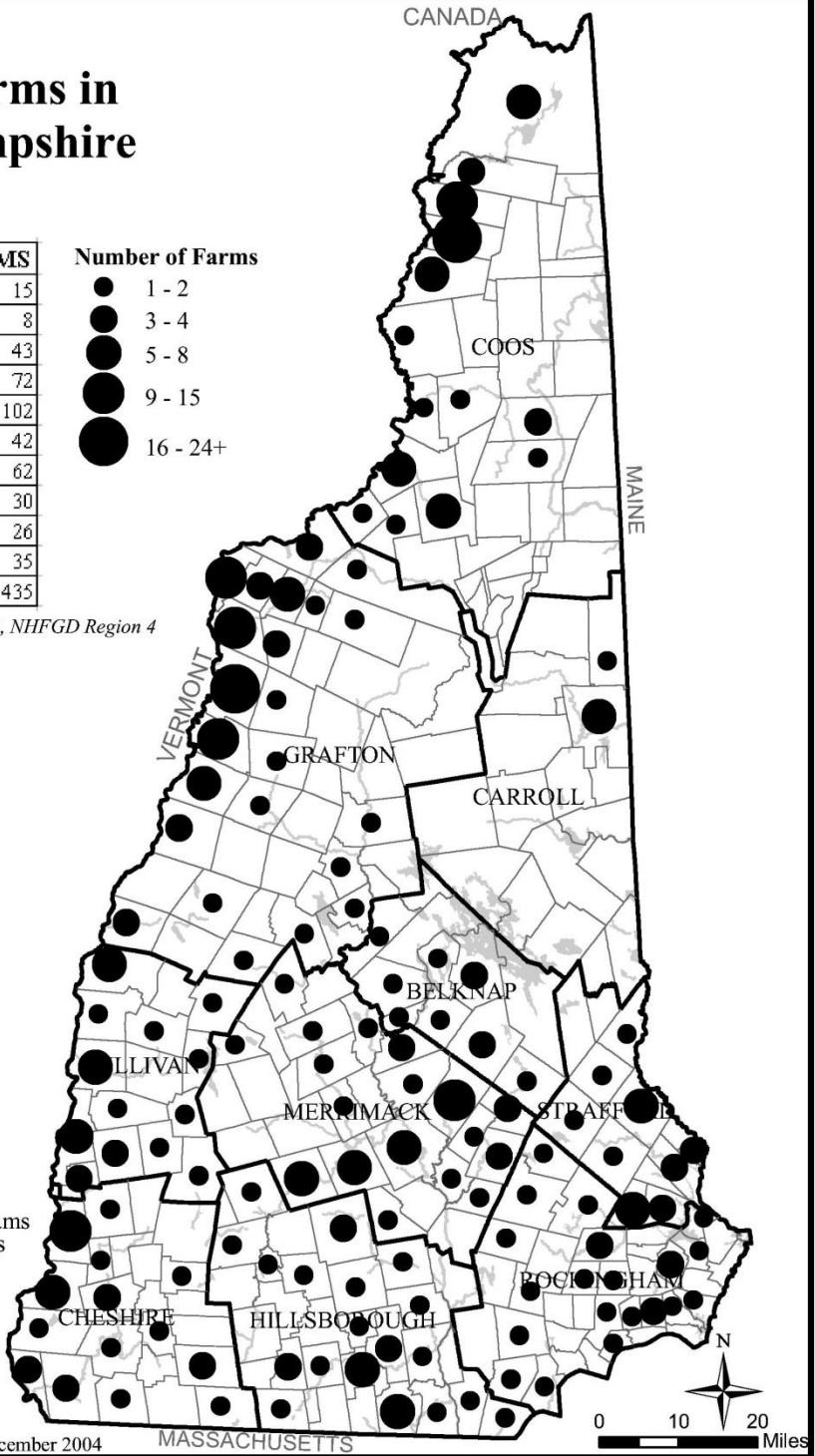


Data Source: T. Walski, NHFGD Region 4

- ~ State
- ~ County
- ~ Town
- ~ Rivers and Streams
- Lakes and Ponds

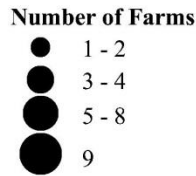


NHFGD GIS Program, December 2004



**Figure 3.
Dairy Farms in
New Hampshire
2004**

COUNTY	FARMS
Belknap	6
Carroll	2
Cheshire	15
Coos	17
Grafton	39
Hillsborough	6
Merrimack	19
Rockingham	9
Strafford	5
Sullivan	19
State Total	137



Data Source: T. Walski, NHFGD Region 4
obtained from NH Dept of Agriculture,
Markets & Food Jan 11, 2005

- ~ State
- ~ County
- ~ Town
- ~ Rivers and Streams
- Lakes and Ponds



NHFGD GIS Program, January 2005

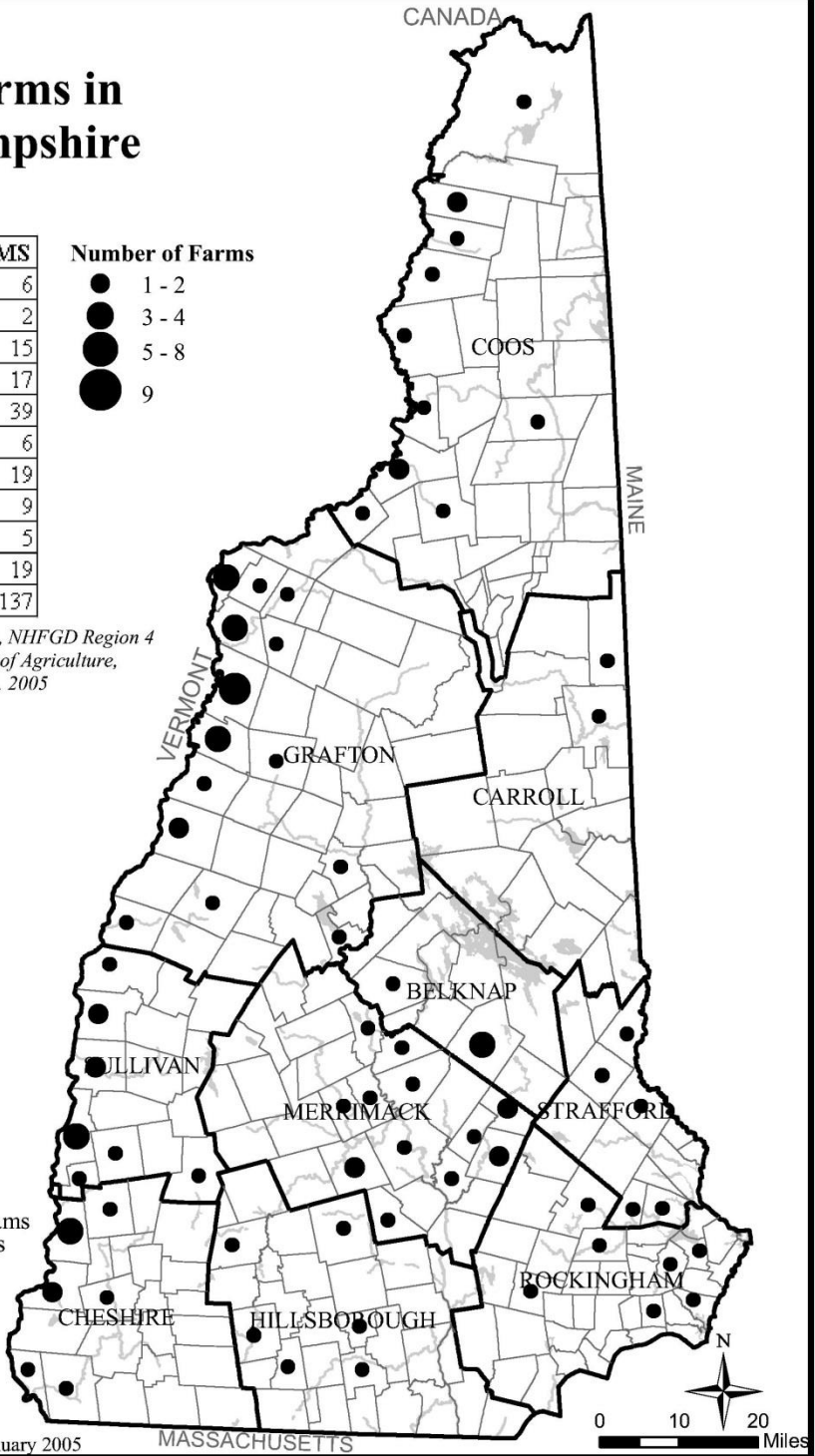
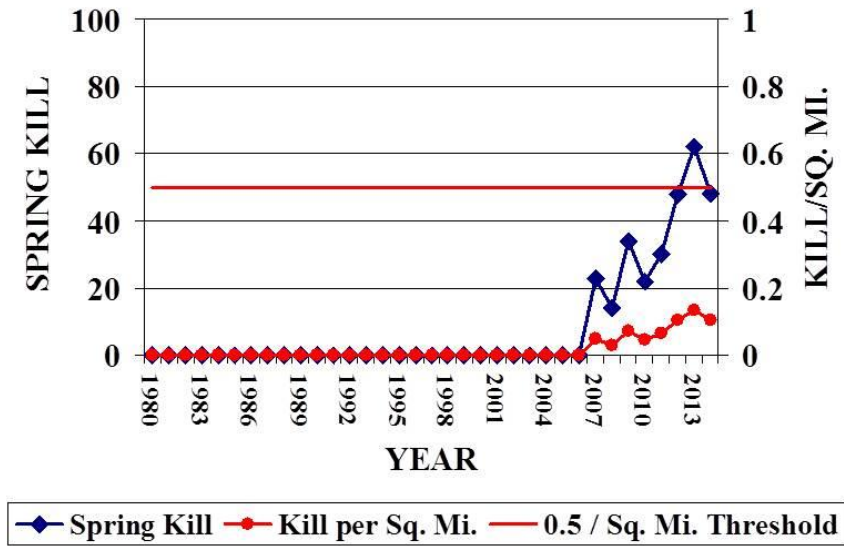


Figure 4. 1980-2014 Spring Turkey Kill and Kill per Square Mile By Wildlife Management Unit and Statewide.

WMU-A Spring Turkey Kill and Kill / Sq. Mile of Habitat (1980-2014)



WMU-B Spring Turkey Kill and Kill / Sq. Mile of Habitat (1980-2014)

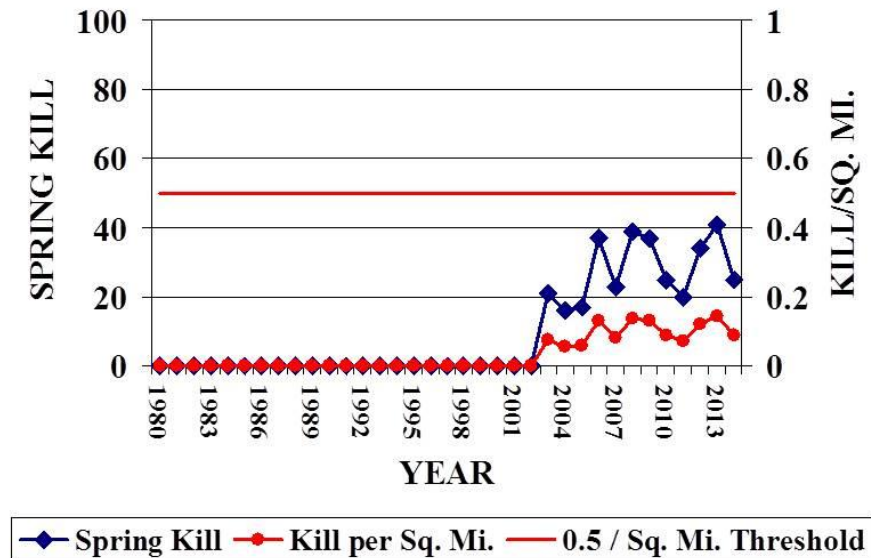
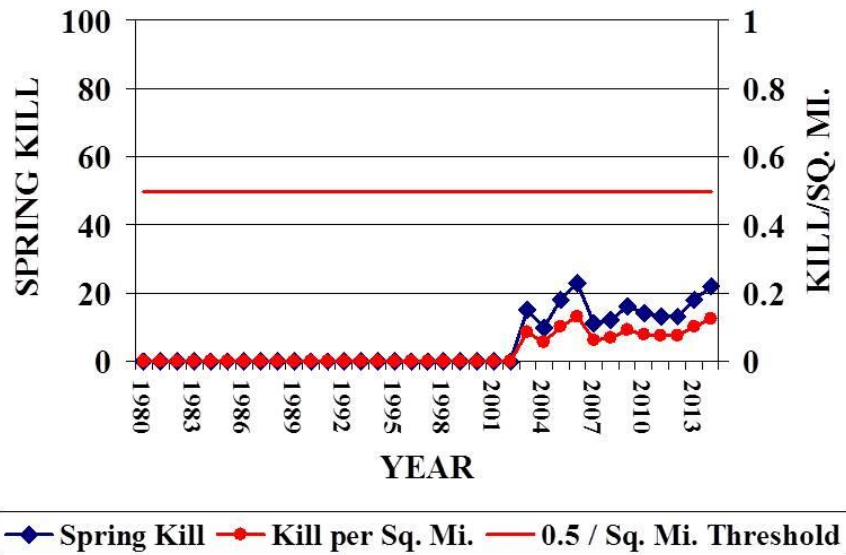


Figure 4. 1980-2014 Spring Turkey Kill and Kill per Square Mile By Wildlife Management Unit and Statewide (cont.).

WMU-C1 Spring Turkey Kill and Kill / Sq. Mile of Habitat (1980-2014)



WMU-C2 Spring Turkey Kill and Kill / Sq. Mile of Habitat (1980-2014)

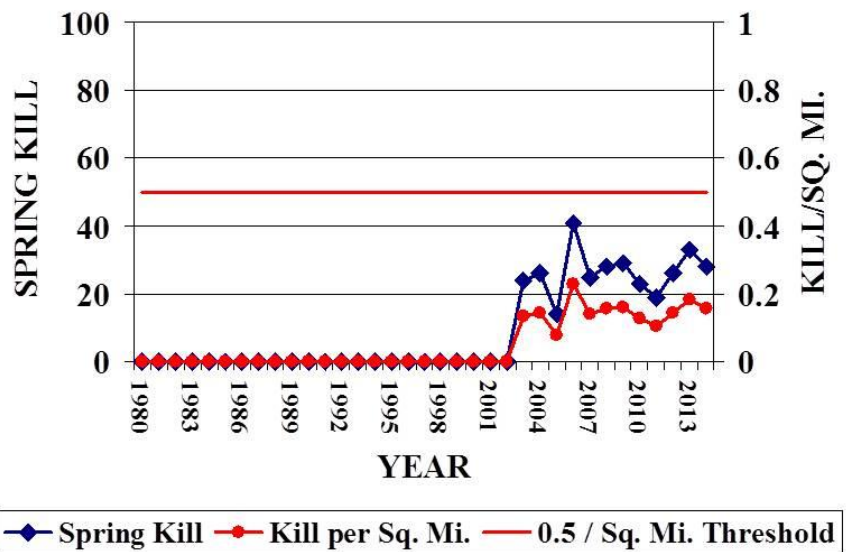
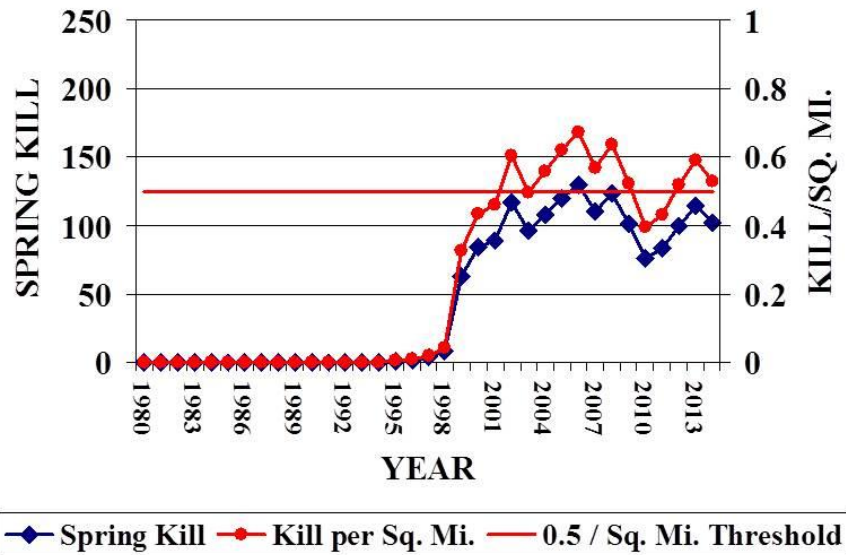


Figure 4. 1980-2014 Spring Turkey Kill and Kill per Square Mile By Wildlife Management Unit and Statewide (cont.).

WMU-D1 Spring Turkey Kill and Kill / Sq. Mile of Habitat (1980-2014)



WMU-D2 Spring Turkey Kill and Kill / Sq. Mile of Habitat (1980-2014)

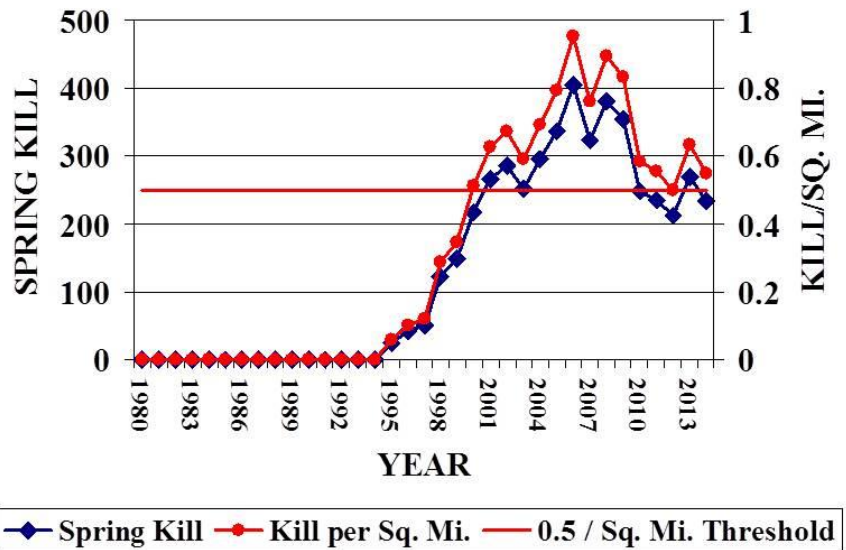
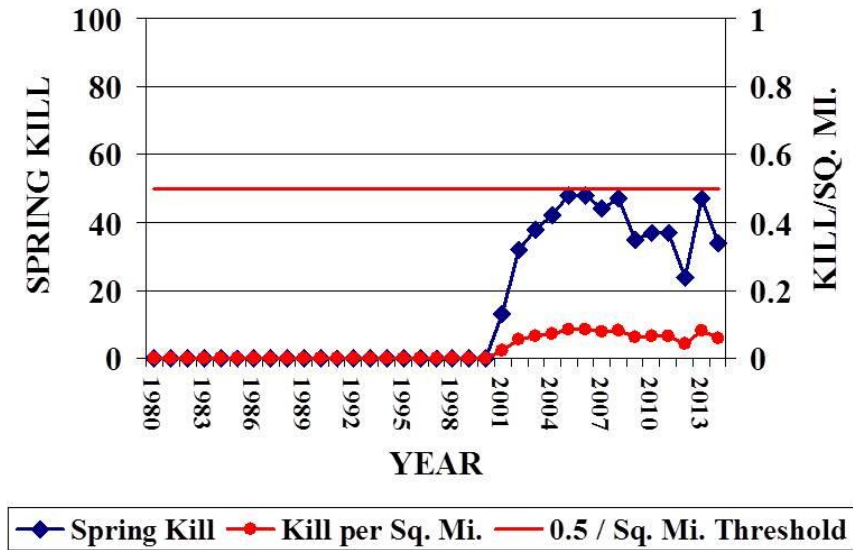


Figure 4. 1980-2014 Spring Turkey Kill and Kill per Square Mile By Wildlife Management Unit and Statewide (cont.).

WMU-E Spring Turkey Kill and Kill / Sq. Mile of Habitat (1980-2014)



WMU-F Spring Turkey Kill and Kill / Sq. Mile of Habitat (1980-2014)

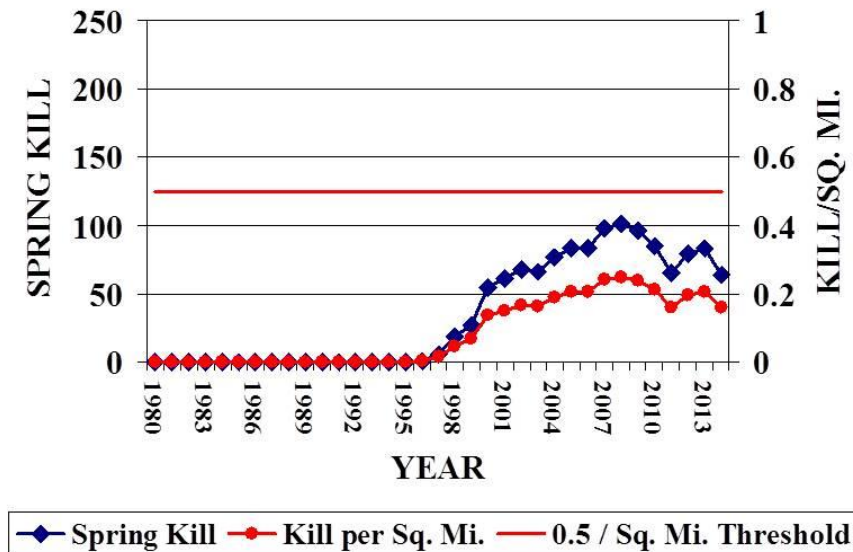
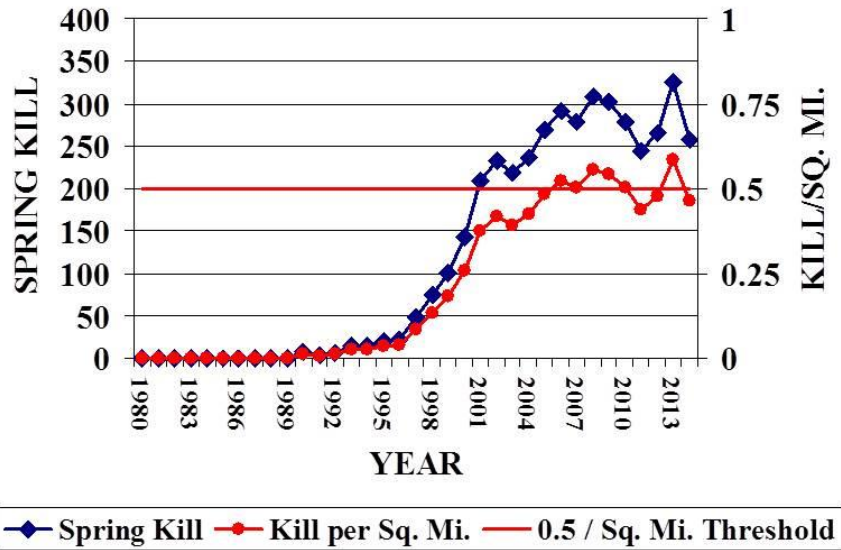


Figure 4. 1980-2014 Spring Turkey Kill and Kill per Square Mile By Wildlife Management Unit and Statewide (cont.).

WMU-G Spring Turkey Kill and Kill / Sq. Mile of Habitat (1980-2014)



WMU-H1 Spring Turkey Kill and Kill / Sq. Mile of Habitat (1980-2014)

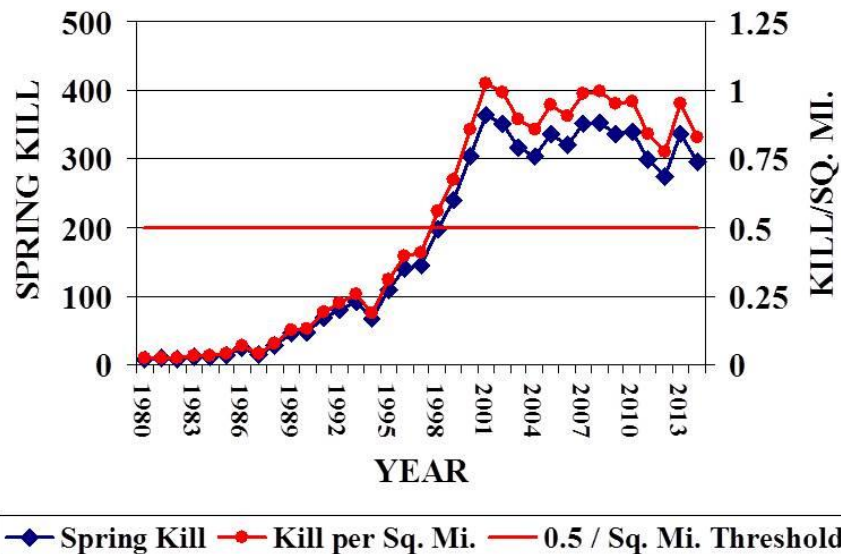
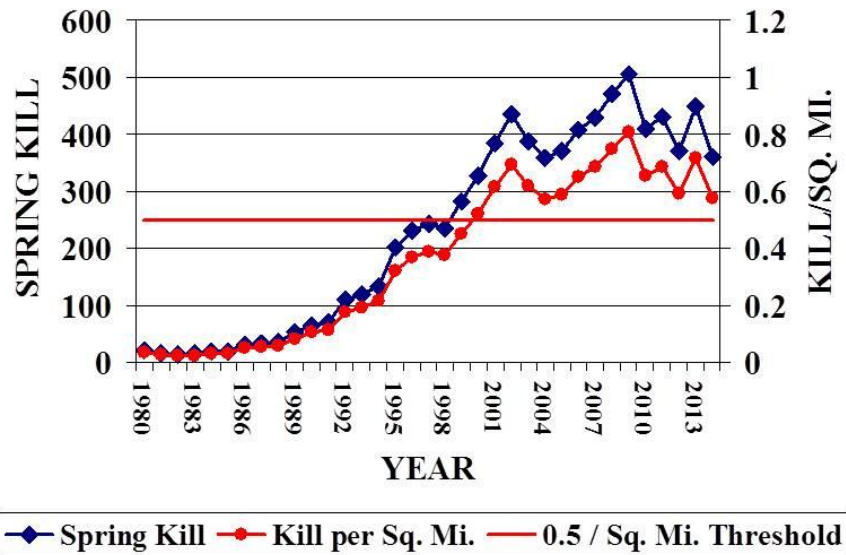


Figure 4. 1980-2014 Spring Turkey Kill and Kill per Square Mile By Wildlife Management Unit and Statewide (cont.).

WMU-H2 Spring Turkey Kill and Kill / Sq. Mile of Habitat (1980-2014)



WMU-I1 Spring Turkey Kill and Kill / Sq. Mile of Habitat (1980-2014)

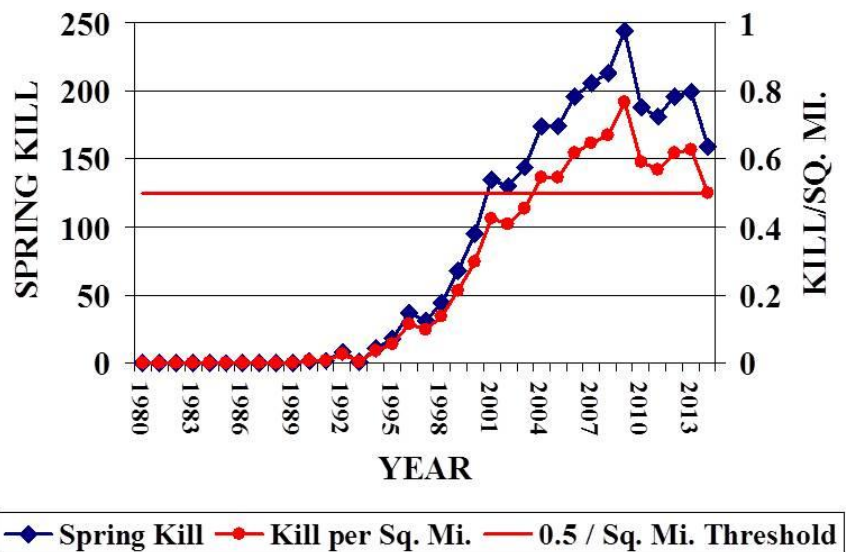
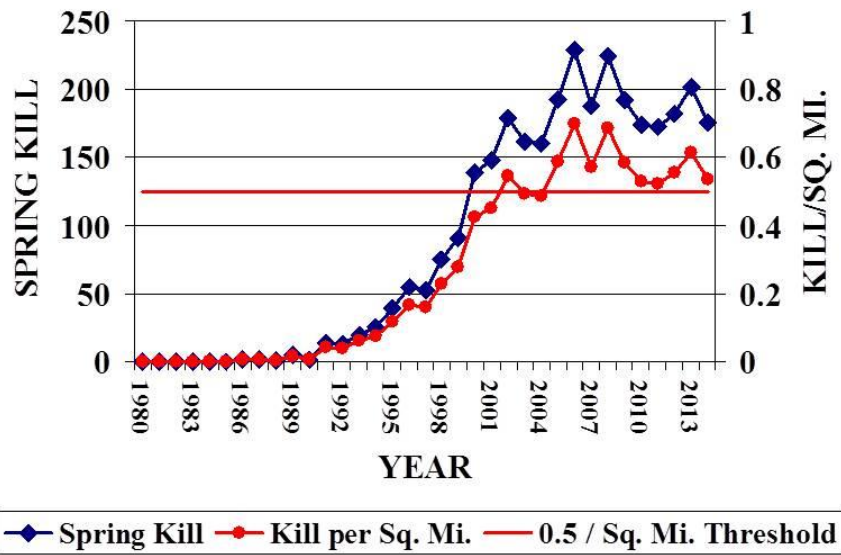


Figure 4. 1980-2014 Spring Turkey Kill and Kill per Square Mile By Wildlife Management Unit and Statewide (cont.).

WMU-I2 Spring Turkey Kill and Kill / Sq. Mile of Habitat (1980-2014)



WMU-J1 Spring Turkey Kill and Kill / Sq. Mile of Habitat (1980-2014)

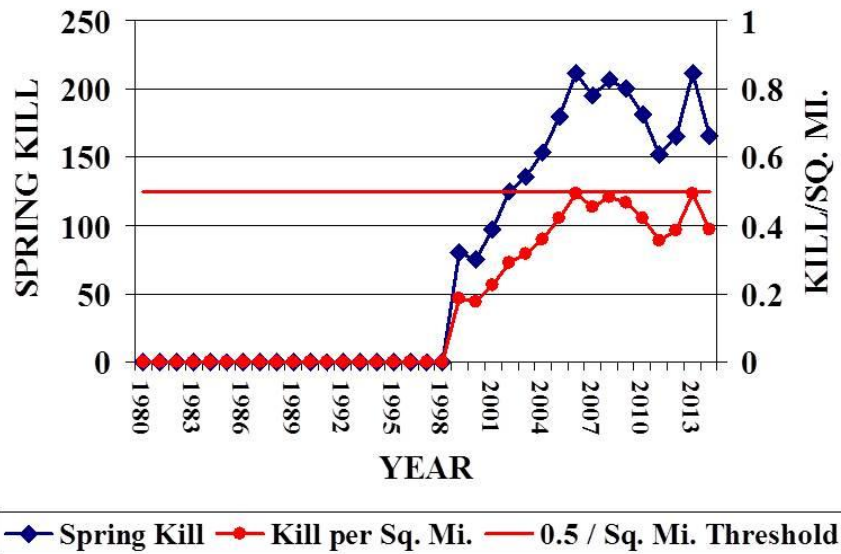
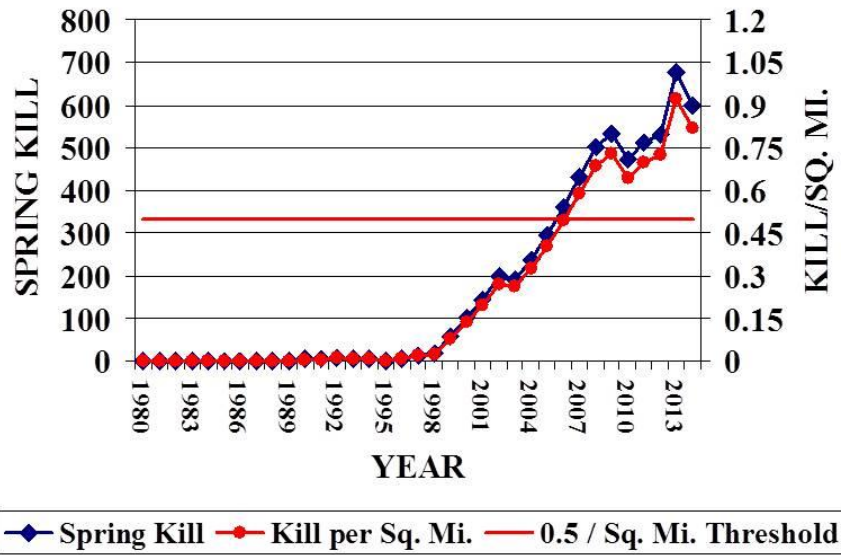


Figure 4. 1980-2014 Spring Turkey Kill and Kill per Square Mile By Wildlife Management Unit and Statewide (cont.).

WMU-J2 Spring Turkey Kill and Kill / Sq. Mile of Habitat (1980-2014)



WMU-K Spring Turkey Kill and Kill / Sq. Mile of Habitat (1980-2014)

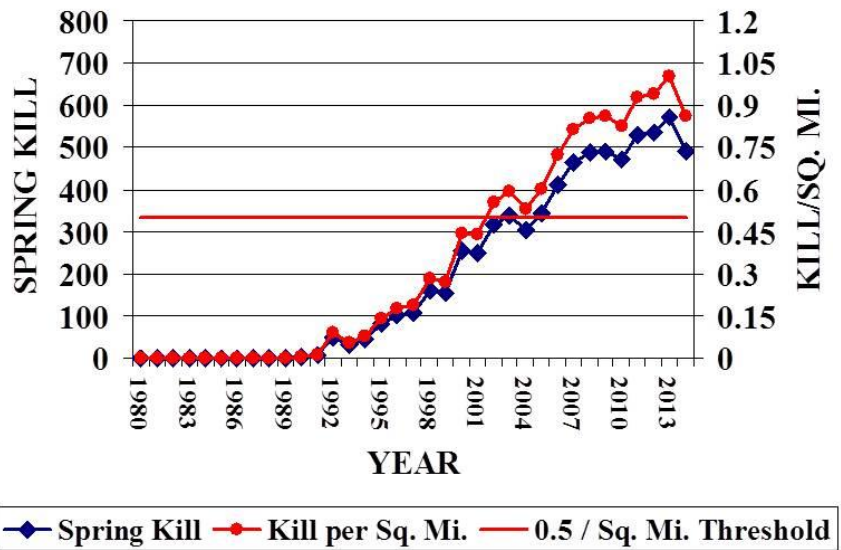
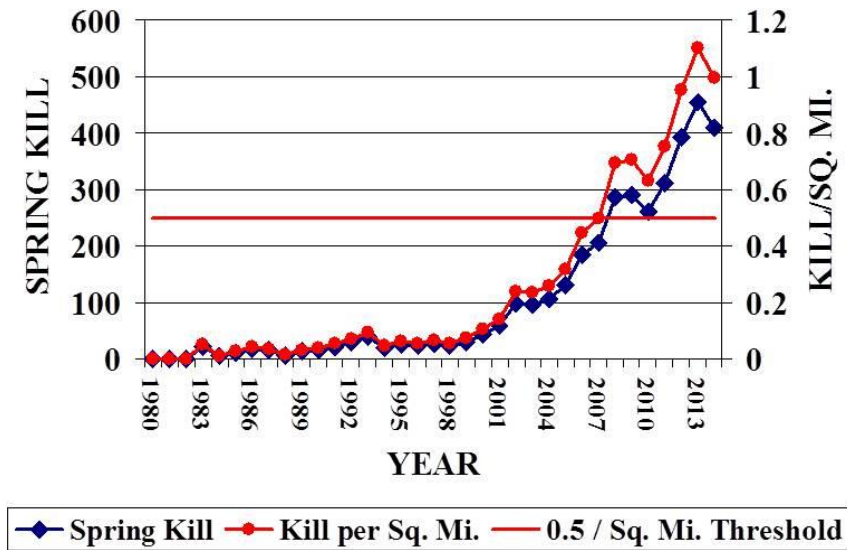


Figure 4. 1980-2014 Spring Turkey Kill and Kill per Square Mile By Wildlife Management Unit and Statewide (cont.).

WMU-L Spring Turkey Kill and Kill / Sq. Mile of Habitat (1980-2014)



WMU-M Spring Turkey Kill and Kill / Sq. Mile of Habitat (1980-2014)

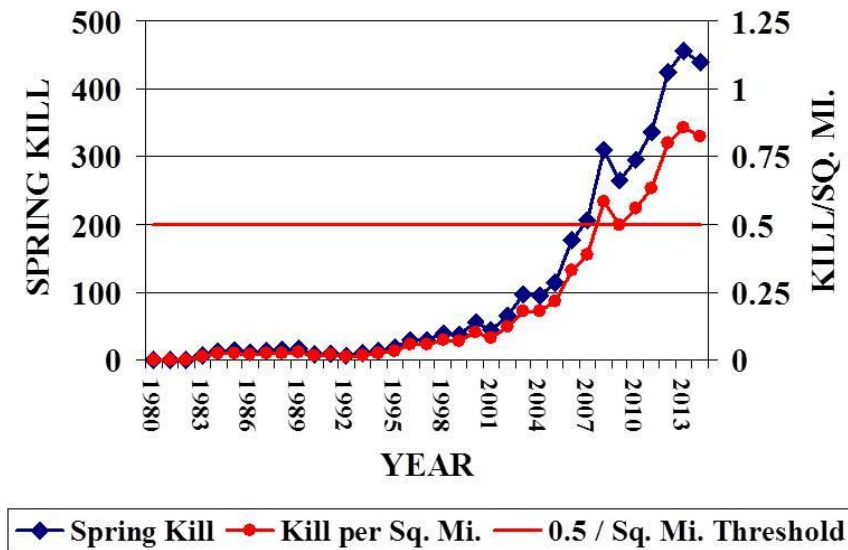
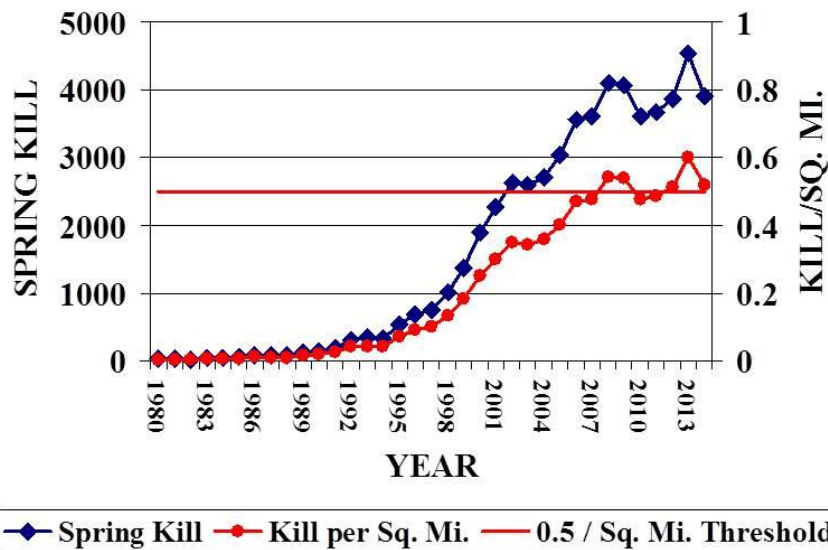
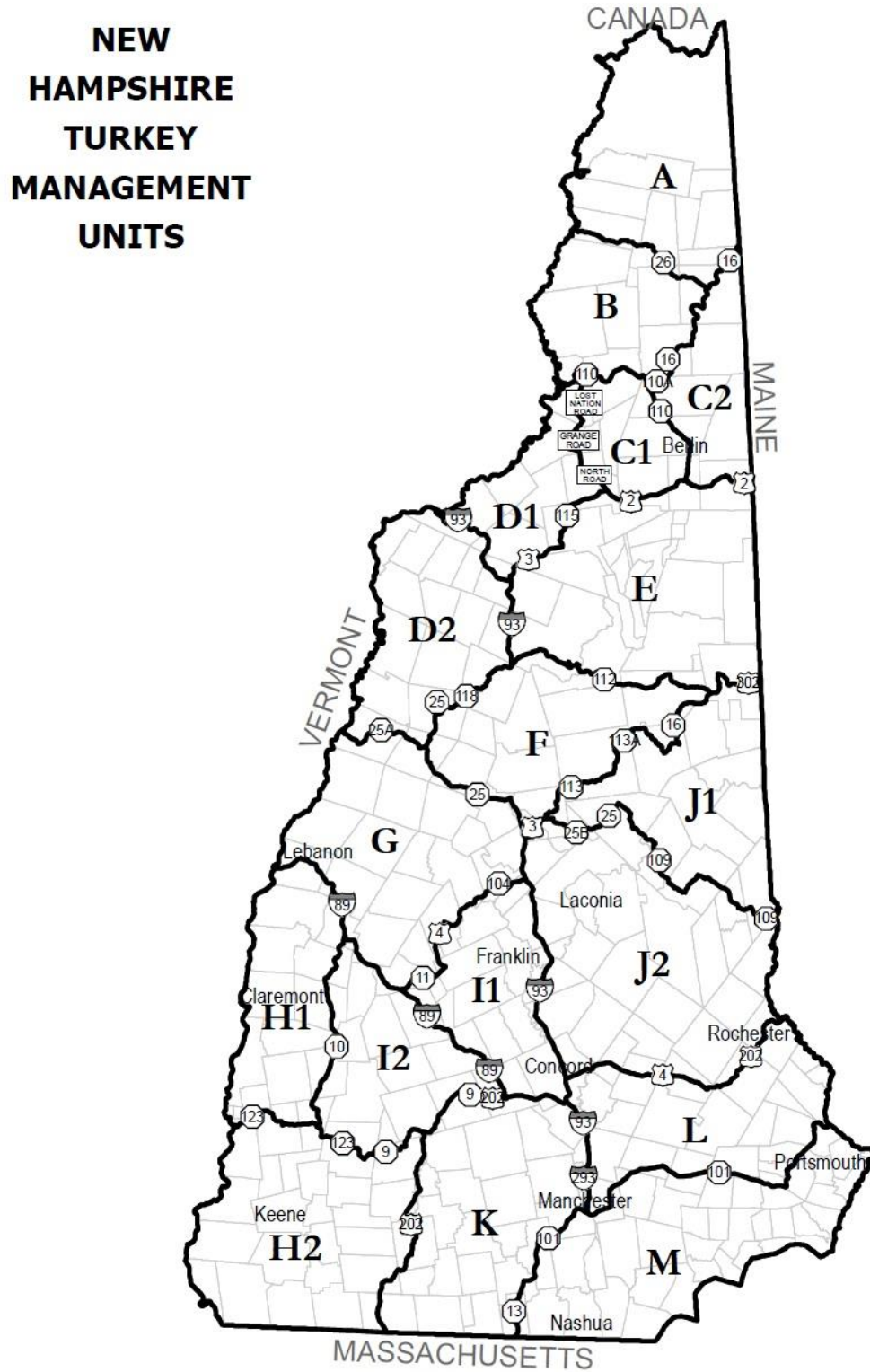


Figure 4. 1980-2014 Spring Turkey Kill and Kill per Square Mile By Wildlife Management Unit and Statewide (cont.).

Statewide Spring Turkey Kill and Kill / Sq. Mile of Habitat (1980-2014)



Appendix I. New Hampshire Turkey Wildlife Management Units.



APPENDIX II. New Hampshire Wild Turkey Studies.

Good, P.L. 1982. Winter habitat of the wild turkey in southeastern New Hampshire. M.S. Thesis, Univ. of New Hampshire, Durham. 61 pp.

Thomas, G.E. 1989. Nesting ecology and survival of hen and poult eastern wild turkeys in southern New Hampshire, M.S. Thesis, Univ. of New Hampshire, Durham. 67 pp.

Decker, S.R. 1988. Nutritive quality and metabolizable energy of eight wild turkey winter foods in New Hampshire. M.S. Thesis, Univ. of New Hampshire, Durham. 37 pp.

Oberlag, D.F. 1989. The influence of season and temperature on metabolism of eastern wild turkeys in New Hampshire. M.S. Thesis, Univ. of New Hampshire, Durham. 57 pp.

Coup, R.N. 1996. Winter field metabolic rate of wild turkeys in New Hampshire. M.S. Thesis, Univ. of New Hampshire, Durham. 66 pp.

Hamel, J.P. 2002. Influence of winter supplemental feeding on the winter bioenergetics and reproduction of eastern wild turkeys in New Hampshire. M.S. Thesis, Univ. of New Hampshire, Durham. 105 pp.

Timmins, A.A. 2003. Seasonal home range, nesting ecology and survival of eastern wild turkeys in northern New Hampshire. M.S. Thesis, Univ. of New Hampshire, Durham. 87 pp.

Pekins, P., Heubner J., Beane L. 2004. Winter agricultural damage by wild turkeys in New Hampshire. Progress Report, Univ. of New Hampshire.

Appendix III. Several Viruses Present in Wild Turkeys in Northeastern States

Ted Walski
Turkey Project Biologist
Feb. 20, 2013

In New Hampshire, as well as in the other New England states, New York, New Jersey and Pennsylvania, sick turkeys have been noted and specimens collected and sent to state veterinary labs. One virus is Avian Pox Virus which has been present in more southern states for decades, and the second virus is Lymphoproliferative Disease Virus (LPDV), which has only been detected in wild turkeys during the past several years.

The symptoms are similar for both viruses. Lesions or wart-like, yellow, pussy protruberances develop around the neck/head area. The growths may accumulate around the eyes, making it difficult for the turkey to see, and hence become more vulnerable to predators. The growth may also get into the throat, making it more difficult to ingest food. Some of the turkeys picked up had lost considerable weight, to as much as one-third or more of normal weight. They can become relatively easy to catch because of a weakened condition.

Avian pox is an infectious viral disease of numerous bird species. The old term “fowl pox” was used for turkeys and chickens. This virus does not appear to be one of the more lethal diseases or marked die-offs would have occurred in the past in more established southern turkey states. Among wild turkeys mosquitoes are probably the most important transmission route. The wet year of 2011 in New Hampshire was notable for numerous hatches of mosquitoes.

The first case of the new LPDV was reported only in 2009 in the United States. It was previously reported in domestic turkeys in the United Kingdom and the Middle East. This virus is now also present in New England. The six turkey specimens sent during October 2012 to the veterinary lab at UNH in Durham were diagnosed as having both viruses. The head/neck lesions are symptomatic of both viruses; however LPDV often has lumpy growths on the toes of the turkey’s feet.

The “potential” impact of these two viruses on wild turkeys in New Hampshire and other states is currently unknown. The first two sick turkeys were collected in N. Haverhill, NH during October 2011. Then a scattering of turkeys were noted or collected having the virus from 21 towns throughout NH during the year 2012. During the 2012 fall hunting season 1,000+ turkeys were registered. There is a section on the form where any abnormalities are to be recorded. Forms from seven towns reported turkeys with the avian pox lesions.

During the start of the May 2013 spring gobbler season, biologists will be present at perhaps 10-12 registration stations throughout the state to ask hunters to donate the feet of their turkey or a 4-inch section above the spur up to the leg joint. The goal is to collect 50 turkey feet, 5 feet from each of the 10 counties. These samples will be sent to the disease center in Georgia. Analysis of bone marrow will help to determine the prevalence of the virus in a region’s or state’s wild turkey population. Hunters are urged to cooperate with this study. They are also encouraged to report to one of the 4 regional Fish & Game Dept. offices (Keene, Durham, New Hampton, Lancaster) any sick-looking turkeys they see or hear of during the hunting season, scouting or anytime of the year.

Note: These viruses and the turkey’s meat pose no threat to humans.

Incidence of Pox Viruses in Turkeys During Year 2014

From January 2014 through December 2014 the turkey project biologist recorded 25 towns throughout NH, which had sites with pox turkeys. Age of the sick turkeys was usually an adult, and somewhat more

hens than toms. Multiple individuals in a flock were rarely reported with pox lesions, but rather one individual in a flock.

The 2014 Winter Public Internet Flock Survey was another source from which to record pox turkeys from around the state. There were only 18 towns with pox reports. Most of these reports came from southeastern NH – 9 sites in Rockingham County and 6 sites in Strafford County.

The hunting season turkey registration forms are another source from which to detect pox incidence around the state. The May 2014 Spring Gobbler Season had five pox turkeys recorded in the harvest.

The 2014 Summer Public Internet Brood Survey was another source of pox incidence. Only 5 of 724 respondents 0.007%, or less than 1% reported virus lesions in the head/neck area. Three of these towns were from southeastern New Hampshire, and two towns from southwestern NH.

It appears the prognosis of turkeys with the lesions on the head is not good. The majority of the turkeys reported already have substantial blockage of the vision in one or both eyes, and can often be captured by humans. Predators may remove a percentage of these turkeys at an earlier stage. It is not known if any of these turkeys ever recover. Monitoring of specific individual turkeys at various sites would take a significant amount of time.