

New Hampshire

Ruffed Grouse Assessment

2015



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Introduction

The ruffed grouse is North America's most widely distributed grouse species and is the most popular resident game bird throughout much of the eastern United States and Canada (Dessecker et al. 2007). The ruffed grouse since the pioneer days has been the most popular, as well as the most abundant, upland game bird in New Hampshire (Silver 1957). Ruffed grouse are abundant only where young forests, those from 5 to 20 years of age, are common. Historically, young forest habitats were sustained throughout the ruffed grouse range primarily by fires caused by lightning or by Native Americans (Dessecker et al. 2007). Today, sustainable forestry practices that remove all or most of the trees at one time from an area are the best tools to establish and sustain quality ruffed grouse habitat. Aspen forests can support many more ruffed grouse than other types of forests (Williamson 1993). Young aspen forests provide excellent year-round habitat for ruffed grouse, especially since the flower bud found on mature male aspen trees is an important source of winter food (Dessecker et al. 2007). In New Hampshire we are not blessed with large tracts of aspen forest types; therefore northeastern forest types can be managed for grouse. The same young-forest and shrub dominated habitats preferred by ruffed grouse are preferred by various other wildlife species of conservation concern (Dessecker et al. 2007). State wildlife action plans collectively identify 58 species in conservation need that are dependent upon young-forest and shrubland habitats similar to those preferred by ruffed grouse.

Today, commercial timber harvests and other habitat management practices must be implemented at regular intervals (approximately every 10 years) to ensure a continuous supply of quality ruffed grouse habitat. The American Woodcock Conservation Plan (Kelley et al. 2008) and Ruffed Grouse Conservation Plan (Dessecker et al. 2007) call for the creation of over 600,000 acres of young forest habitat annually in the Northeast to restore populations of both ruffed grouse and American woodcock. The Ruffed Grouse Conservation Plan is an effort to establish conservation strategies to guide on the ground habitat management initiatives. The Conservation Plan utilizes the Bird Conservation Region (BCR) as the geographic assessment unit to focus habitat efforts. The Conservation Plan compares ruffed grouse habitat conditions and populations between the base year 1980 and 2005. In the Plan, the objective is to have 406,500 acres of small-diameter forest to sustain grouse populations at, or restore populations to 1980 levels. The Conservation Plan recommends 20,300 acres of even-aged management in New Hampshire to meet this objective.

Description

The ruffed grouse or "partridge" as it is commonly called is a year round resident in New Hampshire. The bird's technical name is *Bonasa umbellus*, which renders out as "bison umbrella". The first name refers to the grouse's drumming sound, which has been compared to the bellowing of a bison bull, and the second name is taken from the umbrella – like ruff on the bird's neck (Edminster 1954). The ruffed grouse has 3 common color phases: a reddish phase more common in southern and especially coastal New Hampshire, a gray phase more common in the north, and an intermediate reddish gray phase which occurs statewide (Silver 1957). The sexes have similar plumage, but the male's black ruffs are more conspicuous than the female's, and the male has a small orange-red comb above the eye. The neck ruffs are usually black with green and purple reflections, but may be reddish-brown. Its wing span is 25 inches, the tail is from 4 ½ to 7 ½ inches long and birds can weigh 17-25 oz; males are slightly larger than females (Madson 1969).

Across most of its range, a fully grown tail feather over 5-7/8 in in length is usually a male; less than 5 ½ inches to a hen – but birds with intermediate measurements can be either male or female. When this occurs, the feathers on the bird’s rump can be examined; if there are 2 or 3 spots, the bird is probably a male, if none or one spot, a female (Gullion 1989). The dark terminal band on the characteristic fan tail is interrupted on the female.

Fleshy pectinations grow along the sides of the toes in fall and winter, and are shed during the spring; these are thought to aid in walking on snow (Madson 1969). Without such structures, a grouse could not walk on snow and reach such foods that grow on twigs too slender to support the bird’s weight.

Distribution

The ruffed grouse is North America’s most widely distributed grouse species and is the most popular resident game bird throughout much of the eastern United States and Canada (Dessecker et al. 2007). This species has been New Hampshire’s most popular game bird since colonial times, and no doubt was an important staple for indigenous human populations (Robinson 1994). Ruffed grouse populations experience irregularly cyclical booms and crashes, which vary geographically (Edminster 1947). Silver (1957) presents historical evidence of population fluctuations in New Hampshire.

The following information is largely derived from Atlas of Breeding Birds in New Hampshire (1994 Audubon Society of NH) unless otherwise noted. Information on breeding birds in New Hampshire was scarce between 1623 and 1792, when Jeremy Belknap produced his famous History of New Hampshire (Belknap 1812), containing the first published list of New Hampshire birds. As for the woodland birds, he describes the “Partridge” (ruffed grouse) as “very common”. Relatively, few priority blocks lacked grouse records in the Breeding Bird Atlas of New Hampshire

Reproduction and Dispersal

Ruffed grouse are normally solitary in their social behavior (Gullion 1984), although they may form loose flocks in fall and winter. With the onset of spring, male ruffed grouse become territorial and defend an area of woodland approximately 4- 8 acres in size (Archibald 1975, Rusch et al. 2000). The home ranges of females are 5- 25 acres; two to three times larger than males’ and may overlap, thus, a female may visit more than one male, and one male may fertilize several females (Maxson 1989, Rusch et al. 2000).

The ruffed grouse breeds at 10 months of age. In early March, the male establishes a “drumming territory” where he displays for receptive females. A typical drumming log is moss covered, approximately 20 in in diameter, about 10 ft. long and almost always located near an edge or opening in the forest. Drumming takes place on one spot on the log, which becomes worn; droppings accumulate nearby (Edminster 1947). When suitable logs are unavailable, moss covered mounds, boulders, or stone walls serve the same purpose (Robinson 1994). A male grouse may drum in every month of the year and any hour of the day and night, but the most intense drumming occurs in early morning and evenings in late March through April, tapering off in May (Edminster 1947).

The ruffed grouse is a ground nesting bird. The nest is a shallow hollow in dead leaves, usually located at the base of a tree, near a log, or under a shrub or brush pile, typically in a middle-aged stand of hardwood or mixed forest (Robinson 1994). The average clutch of 11 eggs is completed in about 17 days (Madson 1969). The hen incubates for 24-25 days and raises only one brood per year, but may

renest should the first clutch fail (Johnsgard 1975). Young grouse are “precocial”, capable of following the hen and feeding themselves within a few hours of hatch. During the first three weeks post hatch, the hen will brood the chicks beneath her wings and body to keep them warm and dry at night and in wet weather. It is common for a hen to imitate the broken-wing trick by which the hen leads an intruder away from her motionless brood. At the age of 16 to 18 weeks old, the young grouse disperses from its brood to find a home range of its own. Dispersal among grouse serves to fill unoccupied habitat and promote genetic mixing.

Food Habits

The following information is largely derived from Silver (1957) unless otherwise noted. In 1939, (Knowlton et al. 1940) crops and gizzards, collected by New Hampshire conservation officers and sportsmen cooperators, were analyzed at the University of New Hampshire to determine what foods are utilized and the degree to which each is available at specific times of the year. Vegetable matter made up over 90 percent of all food taken except during the last half of July, when insects made up 16.6 percent of crop and gizzard contents. Insect species were not identified. From mid-June to mid-July grouse lived mostly on strawberries and during the latter part of July sedge was the favored food. Through August and September, raspberries, blackberries and blueberries predominated, with slugs as the dominant animal food. In October, the birds ate mostly fruits of apple and thorn apple, apple leaves, and fruits of the Canada mayflower. In November, apples shared top place with grapes, and sheep sorrel was important. Since specimens were taken only from the middle of June through November, no information was gained on winter food habits.

The growing chicks need a great deal of animal protein early in life, they feed on insects for the first few weeks, gradually shifting to a diet of green plant materials and fruits. The most frequently taken insects are ants, beetles, and caterpillars (Bump et al. 1947).

In fall and winter grouse switch their diet to buds and catkins of various shrubs and trees such as willow, hazelnut, birch, maple, cherry and apple, hop hornbeam, alders, dogwoods, and witch hazel, but the staminate flower buds of male quaking aspens are thought to be the most preferred winter food (Vt. Fish and Wildlife Dept. 1986). Favorite herbaceous species include; clover, partridge berry, and wintergreen.

Mortality

Ruffed grouse normally have a short life span. From a brood of 10 or 12 hatched in late May or early June, usually 5 or 6 will have died by mid-August. Among those living to disperse in the fall, about 45% will be lost by early winter. Another 10% die over winter and during early spring, so that only about 45% of the young grouse alive in mid-September live to their first breeding season (Guillon 1972).

Silver (1957) presents historical evidence of population fluctuations in New Hampshire from the era of market hunting in the summaries in her publication *A History New Hampshire Game and Furbearers*. The factors responsible for these periodic fluctuations in ruffed grouse abundance remain poorly understood. Edminster (1954) and others believe that grouse cycles results from a complex interplay between a multitude of natural forces (Madson 1969). Bump (1947) noted that populations can fluctuate widely from year to year, the primary cause of short-term fluctuations appear to be related to weather trends and variations in the quantity and quality of food resources.

In much of their range, ruffed grouse populations go through 8-to-11-year cycles of increasing and decreasing numbers. Biologists for decades have tried to figure out what causes the cycle to fluctuate in such predictable 10-year intervals. In one of the most extensive studies to date Zimmerman et al. (2008) concluded that several factors likely work in concert to influence the cycle, but the exact mechanism (s) remain unknown. Zimmerman's study in northern Minnesota examined grouse populations in an area near Grand Rapids, looking at everything from weather data to the abundance of raptors such as hawks that prey on grouse. Among the findings were that cold winters with little snow tended to result in lower populations the next year, while warm winters with lots of snow generally meant more birds the next year. Winter weather explained the most variation among the hypotheses they considered. Winter weather can influence thermoregulation, cover from predators, and condition of females at the start of the breeding cycle. The best set of predictors they could pull together explained 17 percent of the variability in the cycle. The other 83 percent remains unexplained. Still the predictability of ruffed grouse cycles largely remains unexplained (at least in northern Minnesota).

Habitat

Although, ruffed grouse can be found in many different types of forest, deciduous forests, such as aspen, birch, maple or oak are preferred; they are abundant where young forests habitats are common (DeGraaf et al. 1992). Historically, young-forest habitats were sustained throughout the ruffed grouse range primarily by fires caused by lightning or by Native Americans, wind, and flooding caused by beaver (*Castor canadensis*) (DeGraaf and Rudis 1986).

Grouse also occupy other forest types but require three different age classes of habitat to meet their year round requirements: 1-15 year- old stands are needed for brood habitat, 6-25 year-old stands are needed for fall feeding and spring breeding cover, and stands of mature trees are needed for winter feeding and nesting sites (Williamson 1993). Grouse use habitat intermixed with grassy openings, apple trees and scattered patches of softwoods with hardwood forest (VT Fish & Wildlife Dept. 1986).

Ruffed grouse require logs or stone walls located in dense hardwood saplings for drumming sites. Hardwood sapling and pole sized stands with little understory allow grouse to detect land based predators while, at the same, prevent avian predators from flying through the dense overhead canopy (Williamson 1993). During winter, more mature woodlands, especially coniferous forests, are used for roosting and over. When snow is deep and soft, birds will roost in the snow, otherwise they will roost on the ground or in trees.

Historical Background, Regulations and Early Research

The following information is largely derived from Silver (1957) unless otherwise noted. Around 1850 more of the total area of the state was cleared than at any other time. Just over one-half had been stripped of trees, and 38 percent was in improved farm land. The amount of cleared land in New Hampshire in 1850 was more than double what it had been in 1780. Grouse had thrived on civilization and had apparently become generally very numerous. They seemed to have reached their greatest abundance when nearly all other species were at their lowest.

Regulation of grouse hunting received no attention for a long period. The first act protecting birds was passed in 1842, affording a breeding and rearing season free from molestation. They could be legally taken between September 1 and April 1, and permission of the landowner was required for hunting.

The regulation was repealed after four years, and grouse remained unprotected until 1862. The second law protecting grouse, passed in 1862, established a shorter season – September 1-February 28 – and four years later hunting was further curtailed by closing the season on January 31. Snaring had been a popular method of capture, and in 1885, was forbidden. By 1929, grouse were so rare all over the state that the Legislature completely closed the season in Coos County on the Canadian border, and in Cheshire County bordering Massachusetts.

A number of early research investigations intended to increase the general knowledge of grouse populations. Two NH Fish and Game Federal Aid projects; 2-R and 3-D began in 1939. The first was a research project designed to study methods of increasing ruffed grouse in selected coverts. The second was a demonstration project to develop areas where habitat experiments could be carried out, and results observed.

Wild apple trees, native fruit bearing trees and shrubs were released and pruned on the two study areas, called refuges. Additional shrubs and vines were planted and small openings were created to improve brood cover. Brood censuses were run on both study areas and check areas at two-week intervals through the summer. Results showed the greatest loss of chicks came in June immediately after hatching. Both of these grouse projects, as well as Project No. 5-D which had continued work begun under 3-D, were dropped during the war, so that research did not carry through an entire cycle, and no follow-up or inspection of the areas after a lapse of time was undertaken.

After the war, a state-wide survey of ruffed grouse population trends was conducted under Project No. 9-R in 1948 and '49, and No. 14-R in 1950. The objectives of the projects were comprehensive and one of the aims was to develop a practical technique to census grouse over wide areas. It was hoped that a combination of a wing and tail study with a brood census would provide information regarding population fluctuations to help set seasons. Silver (1957) stated that a statistical analysis of several years' data seems to indicate that the technique is reliable.

Past Populations

Silver (1957) reveals that ruffed grouse were noted by all historians who attempted to deal with local fauna, but the fact that some recorded them plentiful, while others considered them nearly extirpated, supports the theory that populations have fluctuated since earliest historical times (Silver 1957).

In 1881, the newly-established Fish and Game Department reported grouse virtually exterminated as a result of marketing and the destruction of the forests (Silver 1957). By 1884, the birds were evidently beginning to come back and in 1902 were very plentiful (Silver 1957). Between the years 1896 -1915 rapid swings in populations were reported. Through these years the Commission blamed the ups and downs on a number of reported events; an invasions of hawks and owls driven down from Canada by a shortage of hare, predation from foxes and bobcats, destruction of eggs by red squirrels, cold and wet hatching periods, disease, ticks, telephone and telegraph wires, which killed many birds, and automobiles, which permitted hunters to cover 10 times their previous range (Silver 1957).

Silver (1957) summarized from the N.H. Fish and Game Biennial Report of 1926 that an acute shortage of grouse extending into Canada and some of the Western states, "no doubt this is one of the low periods of the cycle". Department records do not show any general improvement in grouse status

earlier than 1934, although the New England Ruffed Grouse Investigation (Anon. 1930) showed an improvement for New Hampshire grouse in 1929 (Silver 1957).

Current Populations

New Hampshire's fall grouse populations vary from year to year, depending on the size of the breeding population in the spring, and hatching and survival of eggs and chicks during the summer. Five small game management regions (Fig 1) are used to assess distribution, abundance and trends of our small game species. Ruffed grouse are the most sought after species of small game in New Hampshire and the majority of ruffed grouse hunting effort occurs in northern New Hampshire. The only index to fall grouse populations in New Hampshire currently available (number of grouse seen per 100 hours of hunting) is provided by the annual Small Game Survey and Figure 2 illustrates small game hunter effort per species and region for 2013-2014. This survey has been conducted since 1999 and allows the Fish and Game Department to quantify hunter activity and observations to generate indices for key small game species. This method is viewed as a reliable index to species abundance and allows N.H. Fish and Game to compare grouse observations within and between years. The variability in grouse observation rates by region for dog hunters (2009-2013) is illustrated in Figure 3.

A ruffed grouse drumming survey to assess regional grouse breeding populations began in 1999 and continues today (Table 1 and Figure 4). Ruffed grouse breeding populations are surveyed by counting the number of male ruffed grouse drumming events heard per stop on established routes throughout the state. Results from randomly stratified grouse drumming routes run in New Hampshire during the last 5-years (2010-2014) are illustrated in Figure 5.

For the past 10 years, 6-8 select drumming routes have been surveyed in the North Country. These routes track changes in grouse abundance on our premier grouse range. In 2014 the survey results show an average of 0.84 drumming events per stop, this is a decrease from the reported 1.03 drumming events per stop in 2013. The North Country continues to have the most abundant grouse habitat in the state and Figure 6 depicts results from select ruffed grouse drumming routes run in New Hampshire's North Country (2005-2014).

In 2005, a ruffed grouse wing and tail survey in northern New Hampshire was introduced to increase our knowledge on ruffed grouse. In 2009 the survey was introduced statewide. The samples provide the department with age and sex composition, distribution data and a juvenile to adult female ratio. This ratio is an indication of hatching and rearing success. The juvenile to adult female ratio calculated from the wing and tail survey data is shown in Table 2.

Regulations

The ruffed grouse is managed through season setting and bag limits. The current hunting season for ruffed grouse is from October 1-December 31, statewide, with a daily bag limit of 4. Hunting seasons are established on a biennial basis through the administrative rule-making process. Short and long-term survey trends are evaluated and season recommendations are made by the project leader, reviewed by the Department Game Management Team as well as law enforcement staff and then presented at public hearings to develop the final recommendation for approval by the Commission and Executive Director.

Conservation and Management Needs

Ruffed grouse can survive and maintain populations in a variety of forest habitats. However, ruffed grouse are abundant where young forest habitats are common. Optimal habitat for ruffed grouse include young (6-15 year old) even-aged deciduous stands typically supporting 20-25,000 woody stems/ha (Gullion 1984). These habitats are available to grouse for approximately 1 decade because stem densities decrease rapidly through natural thinning as succession proceeds (Dessecker and McAuley 2001). Commercial timber harvests and other proactive habitat management practices must be implemented at regular intervals to ensure a continuous supply of quality ruffed grouse habitat on the landscape.

The most recent land cover assessment data and Forest Inventory data were summarized by Catherine Callahan, NHFG's GIS Coordinator to compare current grouse habitat (2011) to the previous ten years (2001 (Appendix 1)). In the ten year period there was a loss of 151,369 acres of ruffed grouse habitat statewide; this represents a -2.8 percent change in habitat (Appendix 2). The southeast small game region showed a higher loss of habitat than other small game regions.

In 1999, the Society for the Protection of New Hampshire Forests released New Hampshire's Changing Landscape, a report that explored the relationships between population growth, land use change, and the loss of the state's natural resource base. The 2010 executive summary highlights key findings from the latest analysis of the state's natural resources. New Hampshire remains the second-most forested state in the nation, after neighboring Maine, but the forest lands continue to decline from a high of 87% in 1960 to about 82% today. Based on current trends and predictive models, New Hampshire's forested lands will continue to decline. Forest loss linked to population growth indicates the conversion of another 225,000 acres in the years out to 2030, dropping New Hampshire forest land to 78.5% of total land area (Sunquist 2010). The ruffed grouse species profile in New Hampshire's Wildlife Action Plan list development and loss of open space as a direct impact to wildlife habitats including early successional forests.

Habitat conditions suitable for grouse are difficult to map using existing data because of the succession of the young forest. Permanently protecting large blocks of forest suitable for forest management and the creation of young forest stands will provide an opportunity to manage for ruffed grouse and other wildlife species that depend on these habitats. While harvest regulations have a role to play in grouse management, they play little role in regulating grouse abundance. Population numbers are primarily influenced by various environmental factors and establishing specific population objectives would contribute little to grouse management. Habitat is the most critical factor and grouse management goals and objectives should focus on ensuring the continued availability of suitable grouse habitat.

Summary

Ruffed grouse are abundant where young forest habitat is common. Many of the species in conservation need in the state wildlife action plan are dependent upon young forest and shrubland habitats similar to those preferred by ruffed grouse. Responsive Management (2014) conducted a scientific telephone survey of New Hampshire residents' opinion on the status and management of big game populations for planning purposes. In the survey, New Hampshire residents were asked if they approved or disapproved of forestry practices designed to create and maintain young forest to improve habitat for game species and other wildlife. The overwhelming majority of residents (91%) approve of

forestry practices to create young forests for wildlife habitat; only 2% disapprove. Ruffed grouse management should focus on habitat management practices that create and maintain young forests. Proposed goals and objectives should be examined closely in the context of the habitat requirements for other species to ensure the greatest benefit to other big game species management programs and species with the greatest conservation need in New Hampshire.

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Table 1. 1999-2014 Grouse drumming index by regions.

YEAR	NORTH	WHITE MOUNTAINS	CENTRAL	SOUTHWEST	SOUTHEAST
1999	0.7	0.63	0.24	0.21	0.15
2000	0.7	0.62	0.36	0.1	0.18
2001	0.84	0.84	0.54	0.44	0.03
2002	0.95	0.79	0.57	0.3	0.08
2003	0.43	0.58	0.48	0.45	0.14
2004	0.56	0.58	0.23	0.18	0
2005	0.675	0.85	0.42	0.5	0
2006	0.45	0.46	0.4	0.25	0.06
2007	0.54	0.8	0.35	0.3	0.12
2008	0.62	0.37	0.38	0.23	0.08
2009	0.65	0.68	0.43	0.35	0.1
2010	0.86	0.36	0.43	0.26	0.22
2011	0.82	0.56	0.4	0.3	0.08
2012	1.51	0.86	0.3	0.43	0.06
2013	1.01	0.4	0.4	0.13	0.04
2014	1	0.46	0.41	0.19	0

Table 2. Juvenile to adult female ratio for 2005-2013.

Year	Sample Size	Juvenile/Adult Female Ratio	Comments
2005	54	0.58	Pilot study
2006	112	0.78	Expanded study
2007	108	1.90	Expanded study
2008	162	1.71	Expanded study
2009	194	1.72	Statewide
2010	168	1.81	Statewide
2011	157	1.67	Statewide
2012	242	1.90	Statewide
2013	234	1.10	Statewide

Fig 2. New Hampshire small game hunter effort per species and region (2013-2014).

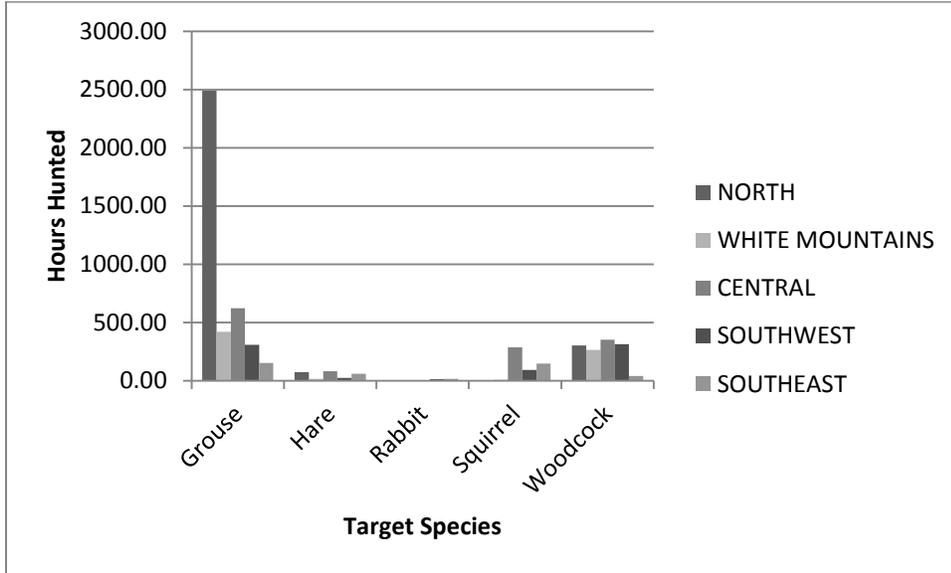


Fig 3. New Hampshire grouse observation rates by region for dog hunters (2009-2013).

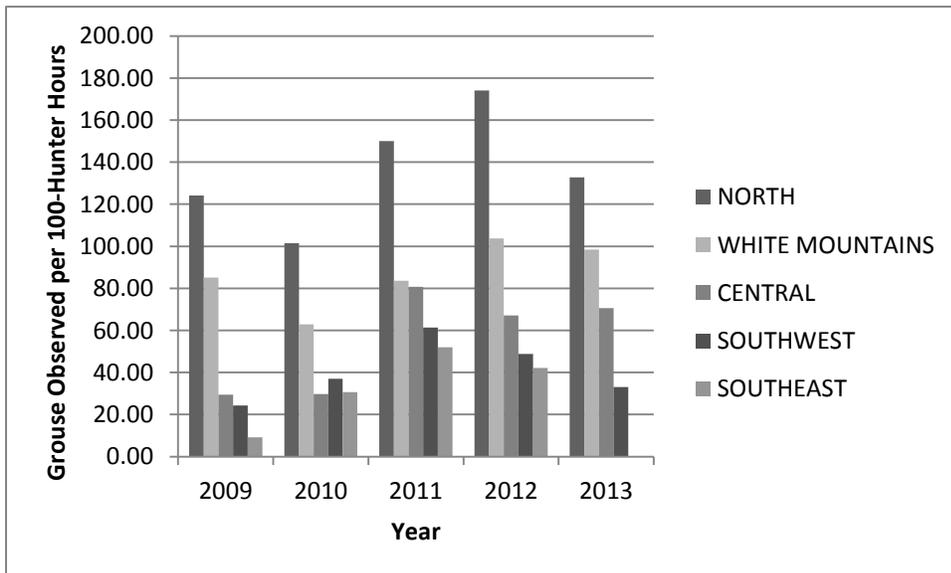


Fig 4. Grouse Drumming Index for 1999-2014.

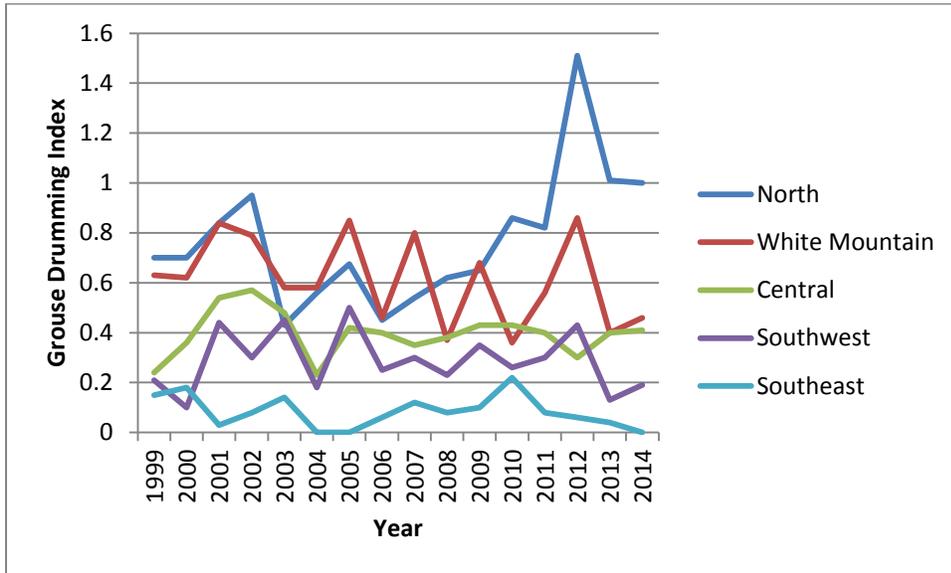


Fig 5. Results from randomly stratified grouse drumming routes run in New Hampshire during the last 5 year's (2010-2014).

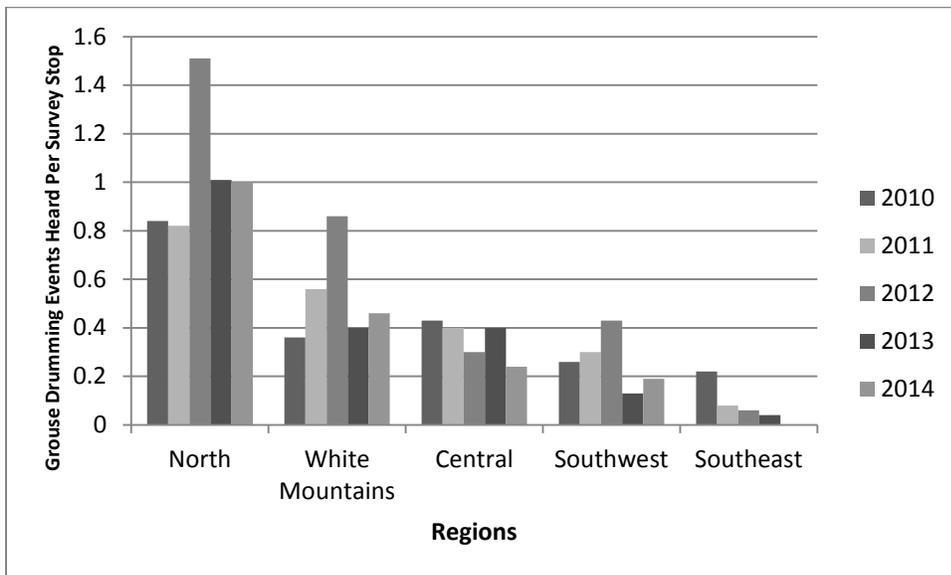
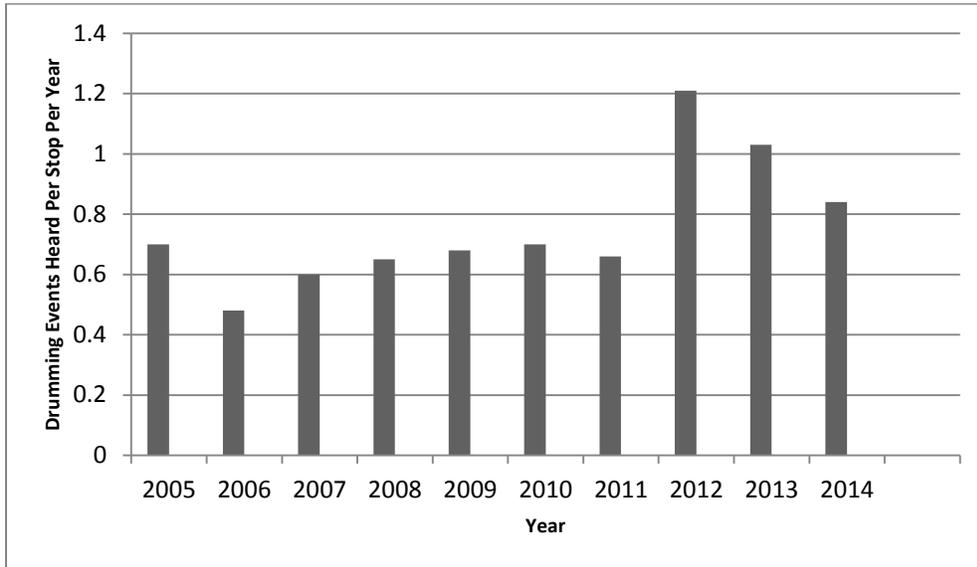


Fig 6. Results from select ruffed grouse drumming routes run in New Hampshire's North Country (2005-2014) depicting the number of grouse drumming events heard per stop per year.



Appendix 1. Landcover habitat assessment for ruffed grouse.

GROUSE HABITAT

Developed

- 110 Residential, commercial, or industrial (NON-HABITAT)
- 140 Transportation (NON-HABITAT)

Active Agricultural Land

- 211 Row crops (HABITAT)
- 212 Hay/rotation/permanent pasture (HABITAT)
- 221 Fruit orchards (HABITAT)

Forested

- 412 Beech/oak (HABITAT)
- 414 Paper birch/aspen (HABITAT)
- 419 Other Hardwoods (HABITAT)
- 421 White/red pine (HABITAT)
- 422 Spruce/fir (HABITAT)
- 423 Hemlock (HABITAT)
- 424 Pitch pine (HABITAT)
- 430 Mixed forest (HABITAT)
- 440 Alpine (Krumholz) (NON-HABITAT)

Water

- 500 Open water (NON-HABITAT)

Wetlands

- 610 Forested wetlands (HABITAT)
- 620 Non-forested wetlands (HABITAT)
- 630 Tidal wetlands (NON-HABITAT)

Barren Land

- 710 Disturbed (NON-HABITAT)
- 720 Bedrock/vegetated (HABITAT)
- 730 Sand dunes (NON-HABITAT)
- 790 Cleared/other open (HABITAT)

Tundra

- 800 Tundra (NON-HABITAT)

Land Cover within the road buffer (300 ft buffer of Class I-V roads) is reported.

Appendix 1 continued

New Hampshire Land Cover Assessment

Developed

- 110 Residential, commercial, or industrial
- 140 Transportation

Active agricultural land

- 211 Row crops
- 212 Hay/rotation/permanent pasture
- 221 Fruit orchards

Forested

- 412 Beech/oak
- 414 Paper birch/aspen
- 419 Other hardwoods
- 421 White/red pine
- 422 Spruce/fir
- 423 Hemlock
- 424 Pitch pine
- 430 Mixed forest
- 440 Alpine (Krumholz)

Water

- 500 Open water

Wetlands

- 610 Forested wetlands
- 620 Non-forested wetlands
- 630 Tidal wetlands

Barren Land

- 710 Disturbed
- 720 Bedrock/vegetated
- 730 Sand dunes
- 790 Cleared/other open

Tundra

- 800 Tundra

The following rules were used to determine forest type:

Deciduous stands (41x) are forested stands comprising less than 25% coniferous basal area per acre. Coniferous stands (42x) are forested stands comprising greater than 65% coniferous basal area per acre. Mixed stands (430) are forested stands comprising greater than 25% and less than 65% coniferous basal area per acre. Alpine areas (440) contain stunted vegetation, either hardwood or softwood (usually paper birch or spruce/fir), and occur just below tree line in the White Mountains.

Beech/oak stands (412) are deciduous stands comprising at least 30% beech and oak. Paper birch/aspen stands (414) are deciduous stands comprising at least 20% paper birch and aspen.

Appendix 1 continued

Other deciduous stands (419) are deciduous stands not meeting either the beech/oak or paper birch/aspens criteria.

White/red pine stands (421) are coniferous stands in which white and red pine constitute a plurality of the coniferous basal area. Spruce/fir stands (422) are coniferous stands in which spruce and fir constitute a plurality of the coniferous basal area. Hemlock stands (423) are coniferous stands in which hemlock constitutes a plurality of the coniferous basal area. Pitch pine stands (424) are coniferous stands in which pitch pine constitutes a plurality of the coniferous basal area.

Other class definitions are as follows:

Developed (110) - built-up areas.

Active agriculture (200) - hay fields, row crops, plowed fields, etc.

Water (500) - lakes, ponds, some rivers or any other open water feature. Wetlands (600) - areas dominated by wetland characteristics defined by the U. S. Fish and Wildlife Service National Wetlands Inventory. Basically hydric soils, hydrophytic vegetation and the hydrologic conditions that result in water at or near the surface for extended periods of the growing season.

Disturbed (710) - gravel pits, quarries or other areas where the earth and vegetation have been altered or exposed.

Bedrock/vegetated (720) - exposed bedrock or ledge (usually in the mountains) that may have some forms of stunted vegetation growing in cracks or lichens growing on the surface rock.

Sand dunes (730) - areas along the seacoast that are dominated by sand.

Cleared/other open (790) - clear cut forest, old agricultural fields that are reverting to forest, etc.

Tundra (800) - areas dominated by short vegetation that occurs above tree line in the White Mountains (only mapped on Mt Washington).

10-Year Update to the NH Land Cover Assessment Data:

The 2001 New Hampshire land cover was updated by establishing a crosswalk with the 2011 National Land Cover Data (combined the raster layers in ArcGIS 10 software) as follows:

2001 NH Land Cover	2011 National Land Cover	2011 NH Habitat Assessment
All classes	Developed	Developed
Developed or Transportation	All classes	Developed or Transportation
Agriculture	Agriculture or herbaceous	Retained 2001 ag class
Forest, Undeveloped classes	Wetland	Wetland
Forest, Undeveloped classes	Barren	Disturbed
Forest, Undeveloped classes	Scrub/Shrub	Cleared/Other open
Forest classes	Forest	Retained 2001 forest class

Appendix 2. Percent change in ruffed grouse habitat for 2001-2011.

Appendix 2 Ruffed Grouse														
Grouse REGION	ACRES	SQMI	LAND ACRES	2001 Percent of Region's Land area that is habitat	2001 Habitat Acres total	2001 Percent of Habitat within road buffer	2001 Acres of Habitat Within 300ft Road Buffer	2011 Percent of Region's Land area that is habitat	2011 Habitat Acres total	2011 Percent of Habitat within road buffer	2011 Acres of Habitat Within 300ft Road Buffer	2011 Habitat Acres outside the road buffer	2011 Percent of region that is habitat and is outside the road buffer	Percent Change in Habitat
North	914863	1429.4	890250	97.9	871649	4.8	42273	96.7	861146	5.7	48702	812445	91.3	-1.2
White Mountains	1251719	1955.8	1239732	96.8	1199663	6.2	73952	95.7	1186625	7.1	83919	1102706	88.9	-1.1
Central	1585215	2476.9	1470996	94.2	1385169	14.8	205422	92.0	1353186	16.1	218402	1134784	77.1	-2.3
Southwest	1397530	2183.6	1352890	94.6	1280220	16.1	205871	92.9	1257107	17.0	213438	1043669	77.1	-1.8
Southeast	791220	1236.3	757870	82.0	621664	25.2	156853	72.4	548931	25.3	138775	410156	54.1	-11.7
State	5940547	9282.0	5711739	93.8	5358365	12.8	684371	91.2	5206996	13.5	703236	4503760	78.9	-2.8
1 acre = 0.0015625 square mile														
			LAND SQMI		2001 Habitat SQMI				2011 Habitat SQMI			2011 Habitat SQMI outside road buffer		
North			1391.0		1362.0				1345.5			1269.4		
White Mountains			1937.1		1874.5				1854.1			1723.0		
Central			2298.4		2164.3				2114.4			1773.1		
Southwest			2113.9		2000.3				1964.2			1630.7		
Southeast			1184.2		971.3				857.7			640.9		
State			8924.6		8372.4				8135.9			7037.1		