REPORT OF THE

DEPARTMENT OF INLAND FISHERIES AND WILDLIFE

BEFORE THE JOINT STANDING COMMITTEE ON INLAND FISHERIES AND WILDLIFE

REFERENCE: WILD TURKEY WORKING GROUP RECOMMENDATIONS

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DATE OF PRESENTATION: March 26, 2013

Good afternoon Senator Dutremble, Representative Shaw and Members of the Inland Fisheries and Wildlife Committee. I am Judy Camuso, Special Projects Coordinator at the Department of Inland Fisheries and Wildlife (MDIFW), and I'm here to give you an overview of the 2013 Wild Turkey Working Group meeting and recommendations. In your packet I have included: a copy of this report and the corresponding WMD maps, the 2010 report to the Joint Standing Committee on Inland Fisheries and Wildlife on the Turkey Working Group's findings and recommendations, the 2013 report from the Turkey Working Group, the minutes from the 2013 meeting, and two studies on the interaction between ticks and wild turkeys.

In 2010 the Wild Turkey Working Group made a number of recommendations to the legislature and committed to reviewing those recommendations in three years. This year, many of the same members met on February 15 with a goal to provide the MDIFW with recommendations to increase wild turkey hunting opportunities and decrease nuisance wild turkey complaints. The Wildlife Division took the Group's recommendations and condensed them into the following sections:

Recommendations for General Hunting Seasons

- Open the entire state (all WMD's) to a spring wild turkey hunt.
- WMD's 1-6 and 8 will have a one bearded bird limit in spring.
- Maintain the current spring bag limit of two bearded birds in WMD's 7, and 9-29; retaining the additional fee for a second bird.

- Bag limits for the fall season are as follows:
  WMD's 15-17 and 20-25 have a two bird (either sex) bag limit.
  WMD's 12-14, 18, 26-29 have a one bird (either sex) bag limit.
  WMD's 1-11, and 19 are closed to fall hunting.
- Any zones open to a fall harvest are open to both shotgun and archery.
- Re-evaluate the hunting seasons and bag limits in no less than two years.

This approach will substantially increase the opportunity to hunt wild turkeys and should encourage hunters to participate in the fall hunt, particularly in areas experiencing the majority of nuisance turkey complaints. An expanded fall hunt plan (where female turkeys can be taken) is recommended to reduce targeted wild turkey populations.

Recommendations for Timing of the Seasons

- Maintain the current spring wild turkey season timing (approximately the month of May and the first week of June) with a youth hunt on the Saturday preceding opening day.
- The hours for the spring wild turkey hunting season will remain ½ hour before sunrise until 12:00 p.m. (noon) local time.
- The fall wild turkey hunting season dates will coincide with the fall archery season for white-tailed deer.
- Maintain the fall hunt shooting period of ½ hour before sunrise to ½ hour after sunset.

In Virginia, only 6% of hunters hunt in the afternoon, and those hunters accounted for only 3% of the total spring turkey harvest. Further, it is believed that many landowners do not support an all-day turkey hunt in the spring. In addition, there are many non-consumptive users in the field in the spring. These users are not used to, nor do they support having hunters in the field in the afternoon. Given the low participation rate and the lack of support from landowners, the group did not recommend a change to the spring hunting hours.

Recommendations Involving Registration

- Maintain the current system of registration of turkeys as a big game species.
- MDIFW staff will ensure that all tagging stations are equipped to register wild turkeys.
- MDIFW will also remind tagging stations that they do not have to collect additional biological information for wild turkey, but accurate tagging, sexing and aging remains important.

In states with electronic tagging, registration compliance drops to approximately 30%. Our current wild turkey management system is based on accurate data from the harvest and these data are an essential component of a responsible wild turkey management program. The group did not recommend moving to an electronic tagging system at this time.

Recommendations Regarding Fees

- Maintain the current resident wild turkey permit at $20; which would include one bird in the spring two birds in the fall.
- Reduce the fee for the non-resident wild turkey permit. The group did not specify what that fee should be.

- Reduce the cost of a second turkey permit in the spring to $10.
- Reduce the fee to register a wild turkey to $2, all of which would be retained by the tagging station.

Recommendations Regarding Outreach

- The working group developed a sub-committee to develop a nuisance turkey policy, based on the Department's Animal Damage Control Policy. This document will include preventative measures as well as lethal and non-lethal options available to landowners by season.
- The Department will work with the Farm Bureau and use social media, web sites, and printed outlets to publicize and educate landowners regarding issues involving wild turkeys.
- The Department will work with its Information and Education staff, SAM, the Farm Bureau, the Department of Tourism, and local rod and gun clubs to actively promote fall wild turkey hunting.
- The group believed that increasing the fall harvest is a major component to reduce wild turkey populations in problem areas. Currently the fall harvest makes up approximately 10% of the total annual harvest. The increased bag limit, the expansion of the shotgun season, and the outreach campaign are all designed to increase the fall wild turkey harvest.

Other issues discussed

Ticks

Based on two studies (attached) and consultation with Maine Medical Center's vector borne disease staff, wild turkeys are not known to be a viable host for black-legged ticks (deer, or dog ticks among others) and thus are not believed to have a significant role in the transmission of Lyme disease.

Permit sales

The group acknowledged the interest in turkey hunting has dropped off some; however there have been many changes in the permit system that may exaggerate that drop off. In 2005, close to 24,000 permits were sold however, those were in a lottery system which is completely different from the current permit system. After the lottery was eliminated certain landowners no longer needed to purchase a permit, and in 2010 youth hunters were not required to purchase a permit. The youth hunters and landowners account for approximately 2,400 hunters. In more recent years when the permit system has been open to everyone, the permit numbers have been stable. The number of permits sold in the past three years is: 15,858 in 2012, 15, 171 in 2011, and 16,834 in 2010. The number of non-resident permit sales has been very consistent with 714 permits sold in 2012, 737 in 2011, and 782 in 2010. The group felt that the increased opportunity for hunting in

both seasons, as well as the increased bag limit will likely generate increased permit sales.

Extension of the youth day to a youth week

Although the group enthusiastically encourages youth wild turkey hunting, they did not support a week of youth hunting in mid or late April. The current season is timed to allow the majority of the female turkeys to be bred and incubating eggs at the onset of the hunting season. Having hunters pursuing turkeys in the middle of the breeding cycle has the potential to disrupt and reduce successful breeding. All New England states have a spring turkey hunting season with opening days of May 1 or the weekend preceding May 1. Lastly, the group encourages rod and gun clubs and other organizations to offer workshops specifically for youth turkey hunting.

Thank you for the opportunity to present these recommendations.

A Report to the Joint Standing Committee on Inland Fisheries & Wildlife

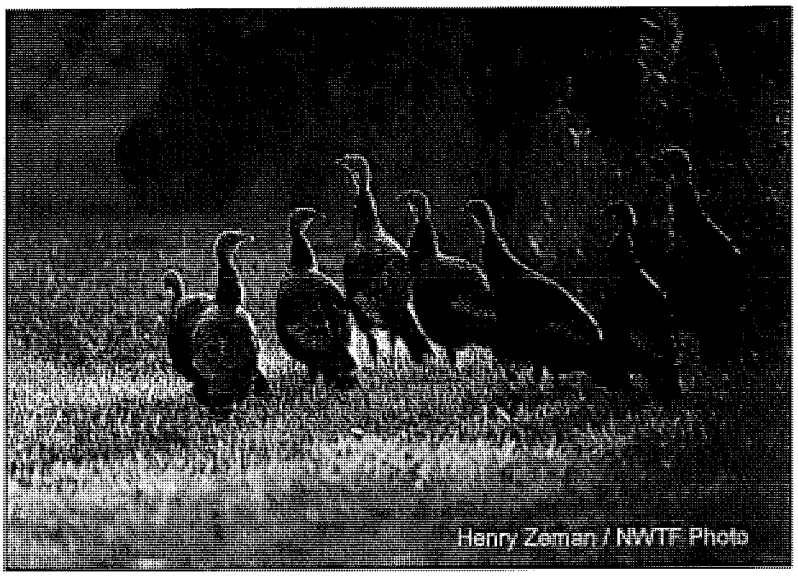
L.D. 256 -- Resolve, To Direct the Commissioner of Inland Fisheries and Wildlife to Explore Opportunities and Issues Surrounding Wild Turkey Hunting

The working group's findings, recommendations, and recommended legislation

Submitted by:
Roland D. Martin, Commissioner
January, 2010

INTRODUCTION

For anyone who has travelled along Maine's roads recently, it is hard to imagine that not so long ago turkeys were virtually non-existent in the state. Once common in southern Maine - York, Cumberland, and Oxford Counties, and perhaps in reduced densities eastward along the coast to Mt. Desert Island - the wild turkey was eliminated from the State in the early 1880s. This was likely the result of intensive land clearing and unrestricted hunting.



Attempts to reintroduce wild turkeys to Maine failed in the1940s and1960s; the turkeys were game farm or pen-reared birds and were ill-equipped to survive on their own. Responding to requests from fish and game clubs and Maine sportsmen, and encouraged by successful reintroduction programs in neighboring states, the Maine Department of Inland Fisheries and Wildlife (MDIFW or Department) began planning a wild turkey reintroduction program in earnest in the mid-1970s. The goals of the program were twofold: to establish wild turkeys in the coastal part of the state where they historically occurred, and to provide a new game bird for sportsmen.

As a result of the combined efforts of MDIFW, the Maine Chapter of the National Wild Turkey Federation (NWTF), and sportsmen, more recent reintroduction attempts have been successful using wild-trapped birds from Vermont (1970s) and Connecticut in the late 1980's. A small number of trap-and-transfer efforts of resident birds occur annually in areas where the Department continues to try to increase the population.

Maine's wild turkey population continues to grow and expand into habitat beyond initial expectations; wild turkeys now occupy all of Maine's 16 counties. The current population may be as high as 50,000 birds. The population fluctuates based on spring weather and winter snows, which affect production, recruitment, and survival. The return of the wild turkey to Maine is a wildlife management success story.

Today, in areas where the Department has released wild turkeys and birds have expanded naturally, the wild turkey population provides both consumptive (hunting) and non-consumptive (bird feeding and bird watching) uses. There has been, and continues to be, demand for reintroductions of wild turkeys into additional areas of the state by sportsmen's groups and others. Decisions as to where trapped birds are to be released are generally left up to the Department with input from the Maine Chapter NWTF, landowners, and agricultural interests.

Interest in wild turkey hunting has grown significantly since the first spring gobbler season in 1986. Although interest in Maine's spring wild turkey hunt remains strong with the most recent season's permit sales at 16,600, there has been a steady decline from the 23,963 permits

issued in 2005. That year marked the first year that all spring wild turkey permit lottery applicants were issued a permit. With the elimination of the lottery system, permit sales decreased by 19% in 2006 and have been steadily declining since, with a 6.5% decrease in 2007, 3.0% in 2008, and a 5.6% decline in 2009. The initial decline of 19% in 2006 is thought to be related to the elimination of the lottery system where the excitement of a lottery was no longer a draw. When there was a lottery for the spring wild turkey hunting season, the cost to participate was $5 (a nominal fee for a chance at being drawn for a permit). If drawn, a hunter could choose whether he or she wanted to purchase a permit. There were likely some hunters who applied for and were drawn to receive a permit, but for whatever reason decided not to purchase the permit. Currently, there is no lottery; the opportunity to hunt wild turkeys costs a Maine resident $20.

The Department has adopted a conservative approach to harvest management to distribute hunting pressure, promote landowner relations, provide for hunter safety, and maintain a quality hunting experience. As a result of concerted Department efforts, Maine has become known for its high quality spring hunt, a hunt that biologists and sportsmen are proud of. As the turkey population has expanded, both numerically and geographically, so too has the opportunity to hunt them [Table 1]. Over the last several years, the Department has expanded turkey hunting opportunity by elimination of the spring turkey lottery and the A:B split spring season [Table 2]. In addition, the Department has expanded fall turkey hunting opportunity adding additional wildlife management districts, lengthening the season, and allowing the use of shotguns in selected areas [Table 3].

The spring 2010 wild turkey hunting season will include two significant changes adopted from proposed legislation initiated by the Sportsman's Alliance of Maine in the 124th legislature. The first change is a combined spring/fall permit available to residents for $20.00 and nonresidents for $54.00. Holders of these permits may obtain a second spring male turkey for an additional $20.00. The second significant change allows resident junior hunters a spring/fall turkey permit and a second spring turkey permit at no cost. These are significant season changes that may expand participation in both the spring and fall hunts and were a compelling reason behind the working group's hunting recommendations discussed later in the report [see pages 32-33].

Table 1. Wild Turkey Management Accomplishments Highlighting Efforts to Increase Hunting Opportunity (1977 – present).

Year	Accomplishments
1977	Reintroduction of 41 wild turkeys from Vermont
1982	In-state trap and transfer activities began
1985	*Wild Turkey Assessment* written; goals and objectives established for 1985-2000
1985	In-state trap and transfer protocol established
1985-87	Wild turkey reproductive ecology study conducted by B. Treiterer, U. of Maine
1986	First spring wild turkey hunting season established, 500 permits available
1987	70 additional wild turkey transported from Connecticut to Maine
1988	Memorandum of Understanding between the Maine Department of Inland Fisheries (MDIFW) and the National Wild Turkey Federation signed
1989	U. of Maine survey of Maine turkey hunters conducted
1991	Began rule-making efforts to deal with pen-raised turkey issue
1992	Expanded spring hunting zone from York County to include Cumberland County
1995	Number of spring hunting permits increased from 500 to 750
1996	Number of spring hunting permits increased from 750 to 1,250; north/south hunting zones established
1997	Number of spring hunting permits increased from 1,250 to 1,750
1998	Number of spring hunting permits increased from 1,750 to 2,250
1999	Number of spring hunting permits increased from 2,250 to 3,000; hunting by Wildlife Management Districts (WMDs), spring hunting zone expanded
2000	Number of spring hunting permits increased from 3,000 to 4,000
2000	*Wild Turkey Assessment* updated
2000-01	Wild turkey management goals and objectives established by a public working group and adopted by the Commissioner's Fish and Wildlife Advisory Council for the period 2000-2015
2001	Number of spring hunting permits increased from 4,000 to 7,000; A and B spring seasons established
2002	Number of spring hunting permits increased from 7,000 to 9,000; 2 week fall archery season established (taking males and females both legal)

Year	Accomplishments
2002	MDIFW Nuisance Wildlife Policy adapted to specifically address wild turkeys
2003	Number of spring hunting permits increased from 9,000 to 12,000; electronic calls became legal; landowner permit program established
2004	Number of spring hunting permits increased from 12,000 to 15,600; 5-week spring season established; spring hunting zone expanded; Youth Hunt Day established
2005	Number of spring hunting permits = number of applicants (23,963)
2006	Unlimited spring hunt (lottery discontinued, permits available over-the-counter); spring hunting zone expanded; 4 week fall archery season in some WMDs
2006	Southern Aroostook County Wild Turkey Working Group established
2007	6-day fall shotgun wild turkey hunting season conducted in specific WMDs
2008-09	Wild turkey / blueberry depredation study conducted by J. Huebner, U. of Maine
2009	A/B spring hunting season structure discontinued (full 5 weeks open to all hunters); fall archery zone expanded
2010	Bag limits changed: 1 bird in the spring and 1 bird in the fall, additional spring bird $20

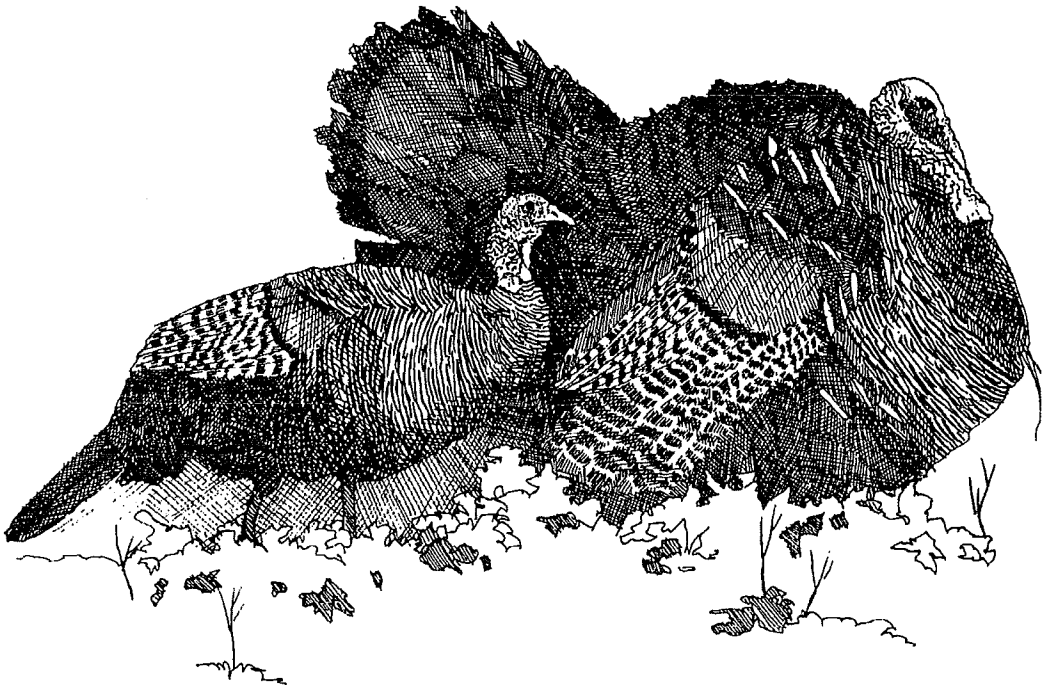


Table 2. Spring Wild Turkey Hunting Effort, Harvests, and Hunting Zones.

Year	Number of Applicants	Number of Permits	Harvest	Status, Regulation, and Seasons
Pre 1955	0	0	0	No regulations
1955-59	0	0	0	No open season
1960	0	0	0	Season provision repealed in 1959
1961-71	0	0	0	No regulations
1972-84	0	0	0	Commissioner given regulatory authority – No open season
1985	0	0	0	Commissioner given authority to institute a spring hunting season
1986	605	500	9	8 May to 24 May, York County
1987	536	500	8	8 May to 23 May, York County
1988	355	355	16	9 May to 28 May, York County
1989	464	463	19	8 May to 27 May, York County
1990	500	499	15	8 May to 28 May, York County
1991	508	500	21	8 May to 28 May, York County
1992	886	500	53	4 May to 30 May, York & Cumberland Counties
1993	1,079	500	46	3 May to 31 May, York & Cumberland Counties
1994	1,185	500	62	2 May to 30 May, York & Cumberland Counties
1995	1,712	750	117	1 May to 29 May, York & Cumberland Counties
1996	3,952	1,250	288	1 May to 31 May, North & South Hunting Zones
1997	5,091	1,750	417	1 May to 31 May, North & South Hunting Zones
1998	6,449	2,250	594	1 May to 30 May, North & South Hunting Zones
1999	9,294	3,000	890	3 May to 31 May, 1 Zone: WMDs 15-17, 20-26
2000	14,909	4,000	1,559	1 May to 31 May, 1 Zone: WMDs 15-17, 20-26
2001	18,685	7,000	2,544	Season A: May 1-5 and May 21-28 Season B: May 7-19 1 Zone: WMDs 12,15-17, 20-27

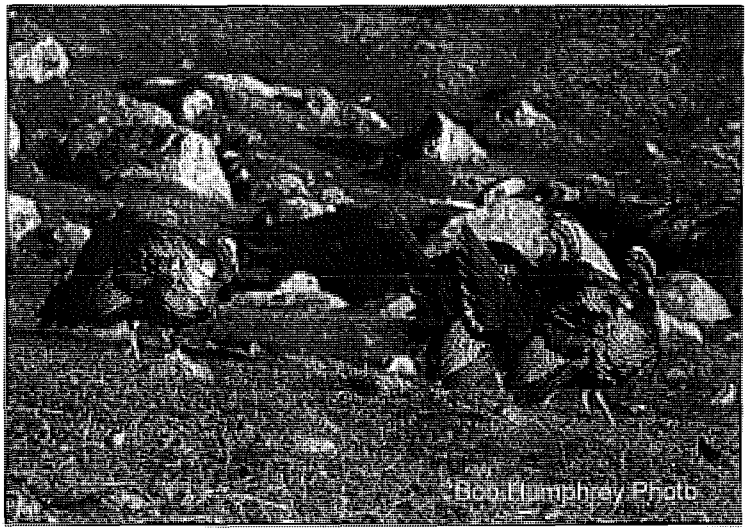
Year	Number of Applicants	Number of Permits	Harvest	Status, Regulation, and Seasons
2002	25,954	9,000	3,391	Season A: April 29-May 4 and May 20-June 1 Season B: May 6-18 and May 27-June 11 Zone: WMDs 12, 15-18, 20-27 2-week fall archery season established
2003	26,505	12,000	3,994	Season A: April 28-May 3 and May 19-31 Season B: May 5-17 and May 26-31 1 Zone: WMDs 12, 15-18, 20-27
2004	24,039	15,600	4,839	Season A: May 3-8 and May 24-June 5 Season B: May 10-22 and May 31-June 5 Youth Hunt: May 1 1 Zone: WMDs 12,13,15-18, 20-27
2005	23,963	23,963	6,236	Season A: May 2-7 and May 23-June 4 Season B: May 9-21 and May 30-June 4 Youth Hunt: April 30 1 Zone: WMDs 12-18, 20-27 All lottery participants given a permit
2006	N/A	19,393	5,931	Season A: May 1-6 and May 22-June 3 Season B: May 8-20 and May 29-June 3 Youth Hunt: April 29 1 Zone: WMDs 10-18, 20-26 Lottery discontinued, permits available over-the-counter
2007	N/A	18,132	5,984	Season A: April 30-May 5 and May 21-June 2 Season B: May 7-19 and May 28-June 2 Youth Hunt: April 28 1 Zone: WMDs 7, 10-18, 20-26 Permits available over-the-counter
2008	N/A	17,587	6,348	Season A: April 28-May 3 and May 19-May 31 Season B: May 5-17 and May 26-May 31 Youth Hunt: April 26 1 Zone: WMDs 7, 10-18, 20-26 Permits available over-the-counter
2009	N/A	16,600	5,766 Preliminary	May 4-June 6 (5 weeks open to all hunters) Youth Hunt: May 2 1 Zone: WMDs 7, 10-18, 20-26 Permits available over-the-counter

Table 3. Fall (Either Sex) Wild Turkey Hunting Effort, Harvests, and Hunting Zones.

Year	Number of Permits	Harvest	Status, Regulation, and Seasons
2002	2,022	151	October 21 through November 1 Archery only 1 Zone: WMDs 15, 16, 20-26
2003	2,882	246	October 20 through October 31 Archery only 1 Zone: WMDs 15, 16, 20-26
2004	2,923	204	October 18 through October 29 Archery only 1 Zone: WMDs 15, 16, 20-26
2005	2,913	157	October 17 through October 28 Archery only 1 Zone: WMDs 15, 16, 20-26
2006	2,639	198	Zone 1: WMDs 15-17, 20, 24-26; Oct 7-Oct 21 Zone 2: WMDs 21-23; Sept 28-Oct 27 Archery only
2007	5,357	1,843	Zone 1 (archery only): WMDs 15-17, 20, 24-26; Oct 6-Oct 20 Zone 2 (archery only): WMDs 21-23; Sept 27-Oct 26 Zone 3 (archery and shotgun): WMDs 15-17, 20-25; October 13-Oct 19
2008	4,966	685	Zone 1 (archery only): WMDs 15-17, 20, 24-26, Oct 11-Oct 25 Zone 2 (archery only): WMDs 21-23, Oct 2-Oct 31 Zone 3 (archery and shotgun): WMDs 15-17, 20-25, Oct 18-24
2009	3,300	Not Available Yet	Zone 1 (archery only): WMDs 15-17, 20, 24-26, Oct 10-Oct 24 Zone 2 (archery only): WMDs 21-23, Oct 1-Oct 30 Zone 3 (archery and shotgun): WMDs 15-17, 20-25, Oct 17-23

While many consider the return of the wild turkey to Maine a resounding success, some in the agricultural community are experiencing economic losses and other effects of an existing and expanding turkey population. The desire to reduce nuisance turkey complaints was the impetus behind an amended version of LD 256, 'Resolve, To Direct the Commissioner of Inland Fisheries and Wildlife to Explore Opportunities and Issues Surrounding Wild Turkey Hunting.'

BACKGROUND



Wild Turkey Management Planning: In 1985 MDIFW prepared its first *Wild Turkey Assessment,* an exhaustive review and analysis of all that was known about wild turkeys in Maine. The assessment outlined the history of wild turkey management in the state and the current status of the population, habitat, and biological knowledge. The assessment was used by a public stakeholder group having diverse interests in wild turkeys as a guide to develop a goal and objectives that would direct wild turkey management for the period 1985-2000. The goal was a broad statement of management direction, but the objectives established timelines and were specific and measurable.

In 1999, the Department refined its *Wild Turkey Assessment* [Appendix 1A] and convened another Wild Turkey Working Group to develop goals and objectives that would guide wild turkey management for the period 2000–2015. Goals and objectives were developed within the following broad sideboards: wild turkey may not be put in jeopardy of extirpation, and they may not be managed in a manner that degrades habitat. The group considered wild turkey management issues for several months and recommended a management goal and a series of objectives that were adopted by the Department's Fish and Wildlife Advisory Council in May 2001. The following goal and five objectives have directed MDIFW's management actions since [Appendix 1D].

Goal: Increase the size and distribution of the wild turkey population within all suitable habitats in Maine.

Objective 1: By 2010, increase the size and distribution of the wild turkey population within all suitable habitats in Maine via trap and transfer activities and habitat improvements.

Objective 2: By 2010, provide unlimited spring hunting opportunity (everyone who applies for a permit receives a permit) as long as the wild turkey population can support it and 2001 hunt quality is maintained. *(The working group defined quality hunting as hearing, seeing, working, and hopefully harvesting a turkey without interference from others.)*

Objective 3: By 2002, develop a component to the Department's Nuisance Wildlife Policy that addresses wild turkeys.

Objective 4: By 2003, implement a limited fall hunting season in areas where the wild turkey population can support it, and without adversely affecting Objective 2.

Objective 5: Develop a cooperative habitat improvement program between landowners, the Maine Chapter National Wild Turkey Federation, and the Department.

Based on the wild turkey management goal and objectives established by the public working group, the Department prepared the *Wild Turkey Management System*, which outlines how it will determine if it is meeting management objectives and what management actions it will take if the objectives are not being met [Appendix 1G].

CREATION OF THE 2009 WILD TURKEY WORKING GROUP

In response to an increasing turkey population and concerns about the perceived increase in the number of nuisance turkey complaints particularly among agricultural interests, the 124th Legislature passed an amended version of LD 256 to read 'Resolve, To Direct the Commissioner of Inland Fisheries and Wildlife to Explore Opportunities and Issues Surrounding Wild Turkey Hunting' [Appendices 2A and 2B].

Sec. 1 Study opportunities and issues regarding wild turkeys. Resolved: That the Commissioner of Inland Fisheries and Wildlife shall work with interested parties to explore the opportunities and issues surrounding the wild turkey hunt in the State and the problem of nuisance wild turkeys in farming areas, including, but not limited to, electronic tagging or registration, telephone registration and expanded hunting opportunities to reduce the agricultural damage caused by wild turkeys; and be it further

Sec. 2 Report. Resolved: That the Commissioner of Inland Fisheries and Wildlife shall report the findings and recommendations based on the study in section 1 to the Joint Standing Committee on Inland Fisheries and Wildlife by January 5, 2010. The Joint Standing Committee on Inland Fisheries and Wildlife may submit legislation to the Second Regular Session of the 124th Legislature regarding matters presented in that report.

The 2009 Wild Turkey Working Group consisted of 17 members [Appendix 2D]:

Brad Allen	MDIFW Bird Group Leader
Jeff Bellmore	Maine Professional Guides Association
Mark Caron	MDIFW Regional Wildlife Biologist, Region F
Mike Dann	Small Woodland Owners Association of Maine
Frank Dunbar	MDIFW's Fish and Wildlife Advisory Council
Chris Dyer	Maine Warden Service
Bob Humphrey	Outdoor Writer, Turkey Hunter
Patricia Kontur	Maine Wild Blueberry Commission
Galen Larrabee	Dairy Farmer
Doug Little	NWTF Regional Biologist (New York and New England)
Jon Olson	Maine Farm Bureau
Jerome Richard	Maine Bowhunters Association

Kirk Shively	Wildlife Disease Biologist, USDA APHIS, Wildlife Services
Brian Smith	NWTF, Maine Chapter President
George Smith	Executive Director, Sportsman's Alliance of Maine
Kelsey Sullivan	MDIFW, Wildlife Biologist, Bird Group
Jim Wescott	NWTF State Chapter Board Member, turkey hunter

Maine Audubon was invited to participate but did not.

With the unanimous agreement of the Working Group, Sandy Ritchie, Habitat Conservation and Special Projects Biologist, Inland Fisheries & Wildlife, facilitated Working Group meetings and Mark Ostermann, Data Management Leader, Inland Fisheries & Wildlife provided technical support to the group during the electronic tagging discussions. A summary of each working group meeting and a list of those who attended can be found in Appendices 3-5.

The report that follows constitutes the working group's findings and recommendations [see pages 30-33].

SUMMARY OF WILD TURKEY WORKING GROUP MEETINGS

The working group met three times during August and September 2009, investing more than 15 hours in discussing wild turkey issues and opportunities and developing a series of recommended strategies to address human / wild turkey conflicts and expand hunting opportunity.

Prior to the first meeting the Department distributed a number of background materials for the Working Group to review. These were not discussed in any great detail; rather they were provided as background and reference material [Appendix 1].

- *Wild Turkey Assessment* prepared by Phillip Bozenhard in 1985 and updated by R. Bradford Allen in 2000.
- *Wild Turkey Management Issues and Concerns* raised by the 2000 Wild Turkey Working Group.
- *Wild Turkey Management Goal and Objectives 2000-2015* developed by the 2000 Wild Turkey Working Group and adopted by the MDIFW Commissioner and Fish and Wildlife Advisory Council in May 2001.
- *Feasibility Statements for the Wild Turkey Goals and Objectives* prepared by Andrew Weik, April 2001.
- *Problems and Strategies for Wild Turkey Management in Maine* prepared by Andrew Weik, April 2001.

To fully appreciate and understand the Working Group's recommended strategies, a brief overview of each meeting is presented below [see also Appendices 3-5].

Meeting #1 – August 5, 2009

The first meeting of the 2009 Wild Turkey Working Group was devoted to a discussion of the Department's Species Planning Process, status of wild turkeys in Maine, review of the legislative resolve, and identification of wild turkey issues associated with dairy farming and the blueberry industry.

1. Welcome / Introductions / Review Agenda

   Sandy Ritchie had a family emergency and was unavailable to attend the first meeting. Mark Stadler, Wildlife Division Director, facilitated the meeting in Sandy's absence. Mark welcomed members of the Wild Turkey Working Group (Working Group) and thanked them for participating. Working Group members, Department staff, and guests introduced themselves.

   Mark asked "Is the group a good cross section of interested parties?" The group indicated that it was although the Warden Service representative had a prior commitment.

2. Ground Rules

   Mark led the group in developing the following ground rules:

   - One conversation at a time / be as concise as possible
   - Maximize participation / respect others' perspectives / seek to address all perspectives
   - Decision making by consensus
   - All have the responsibility to move the process forward

3. Background and Charge

Mark discussed the requirements of L.D. 256. He indicated that they appeared to revolve around three broad areas, which are:

A. Wild Turkey Hunting in Maine:

1) Issues

2) Opportunities

B. Agricultural Issues Concerning Wild Turkeys

1) The Problem of Nuisance Wild Turkeys in Farming Areas: Identification of the Problem. Once we have identified and described the problem, then consider the...

2) Expanded Hunting Opportunities to Reduce the Agricultural Damage Caused by Wild Turkeys

C. Electronic Tagging / Registration; Telephone Registration

The working group concurred with this categorization. It decided to begin its deliberations by undertaking a review and discussion of B 1) The Problem of Nuisance Wild Turkeys in Farming Areas: Identification of the problem.

4. Species Planning, the Status of Wild Turkeys in Maine, and Animal Damage Control

Mark Stadler presented an overview of the Department's Species Planning Process, including the development of: a Species Assessment, management goals and objectives for a 15 year planning period by a public working group, and Species Management Systems [Appendix 3B].

He reiterated the point that how the fall hunt affects the quality of the spring hunt is an important issue to remember and will be critical to future discussions. Doug Little (NWTF) indicated that the use of spring harvest data to increase or reduce fall hunting opportunity (as Maine does) is a widely accepted practice used in other states. He stated there are instances where some states are considering reducing fall hunting opportunity because of reduced spring hunt quality.

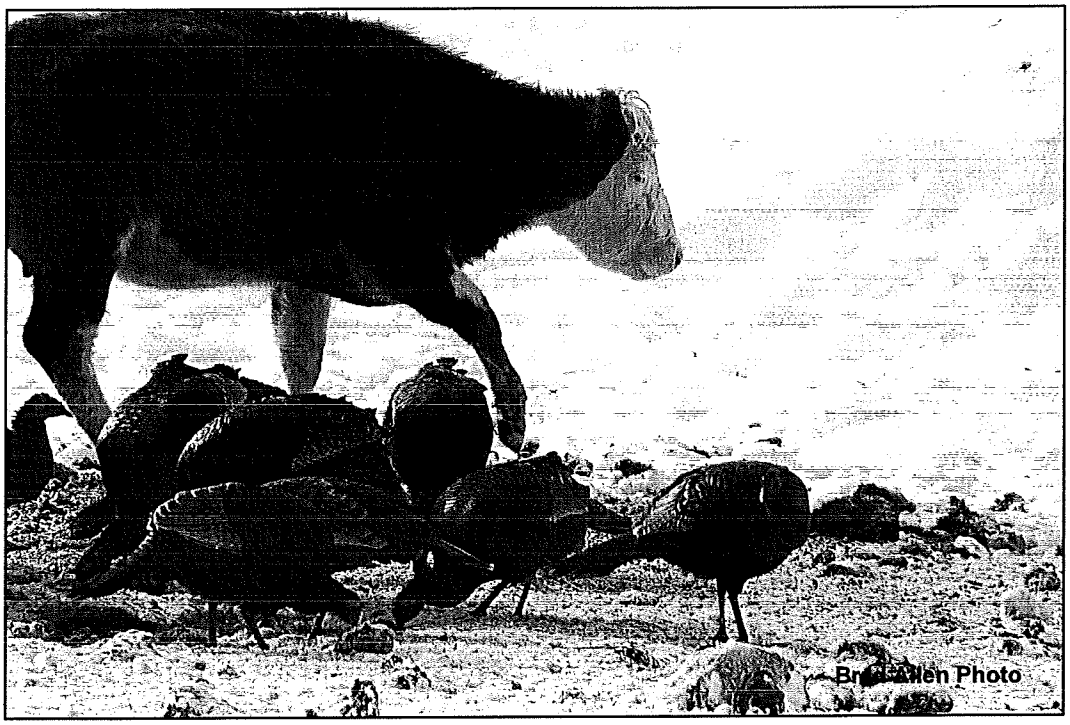
Kelsey Sullivan provided a presentation on the Status of Wild Turkeys in Maine and emphasized where we are in terms of populations status, goal and objectives, and harvests [Appendix 3C].

Mark described MDIFW's Animal Damage Control (ADC) policy and nuisance issues specific to wild turkeys and provided opportunity for discussion [Appendix 3D]. The question was asked of farmers in general "How long have the birds bothered them"? Mr. Larrabee indicated that it really depends on the winter (snow conditions). If you get one storm of 18 inches, they come around quickly. If snows are intermittent, the birds generally forage in the woods.

5. The Problem with Nuisance Wild Turkeys in Farming Areas: Identification of the Problem

Dairy Farming

Galen Larrabee, representing the Maine dairy industry, provided the working group with his assessment of the affect of turkeys on his dairy operation. He indicated that problems with turkeys on his farm began in the late 1990s, and he has had as many as 160 turkeys living on his farm during winters. He also noted that farmers using haylege bunkers face different problems than those using wrapped bales. Below is a summary of the problems Mr. Larrabee identified; in addition, he and other members of the working group provided comments and possible solutions to the problems listed.



Problem	Potential Strategies / Comments
Dairy farmers don't receive any of the economic benefits from wild turkey presence in Maine but must absorb costs associated with wild turkey conflicts.	• Education and outreach to dairy farmers, the public, and IFW. • IFW allowing farmers to address problems as conflicts arise. • IFW outreach to dairy farmers w/ problems. • Recognize the contribution of farmers.
Turkeys frequent dairy farms for food when wild food gets scarce. As long as turkeys	• Carry excess food out back for turkeys to peck thru.

Problem	Potential Strategies / Comments
can scavenge in the woods they are not a problem.	• Leave several rows of silage corn. • Place excess silage corn away from dairy operations.
Farmers don't like turkeys in corn or haylege bunkers because they eat a lot.	• Keep turkeys out of feed bunkers non-lethal (preferred) and lethal means if necessary.
Turkey feces in feed: effect on palatability and milk productivity?	• Several hundred samples of turkey defecation in silage and barnyards were collected and tested in New Hampshire. No incidence of Salmonella was found. • USDA-Wildlife Services Maine will be collecting samples and swabbing birds looking for Campylobacter and other fecal borne pathogens with regards to abortion in cattle and sheep. • Study of starling feces in feed and declining milk production – starlings may be a bigger issue than turkeys.
Destruction of wrapped bales; food spoiled; serious problem	• Better storage sites for wrapped bales away from depredation and damage. • Some studies suggest other wildlife might be causing the damage rather than turkeys. Need camera evidence because mitigation will be different if we don't determine who is causing the problem. • APHIS Wildlife Services recommends that studies be conducted to investigate the issue of damage to wrapped bales and silage bags to determine the role that turkeys may or may not play in the damage. Kirk Shively indicated Wildlife Services is well qualified to undertake a study.

Mr. Larrabee concluded his remarks stating he has worked with MDIFW since 2000 to prevent and resolve issues with wild turkeys on his farm. He indicated there is much better cooperation between the Department and dairy farmers today than in the past, but there is room for improvement and additional tools. He believes most farmers want to coexist with

wild turkeys, are learning to live with them, and prefer not to shoot them. When asked if turkeys were a huge problem and MDIFW's Animal Damage Control program ineffective, Mr. Larrabee stated that may have been the case 8-10 years ago, but it would be an overstatement today. He has a good relationship with the Department and encouraged MDIFW and dairy farmers to continue to work cooperatively and for the Department to direct assistance to farmers who request it.

Wild Turkeys and Wild Blueberry Agriculture

Wild blueberry growers have expressed concerns that wild turkeys commonly use their farms and may cause significant crop damage. The wild turkey's conspicuous and gregarious diurnal behavior makes them highly visible, which can result in farmers attributing crop damage from other wildlife species to wild turkeys.

Until now, impacts of wild turkeys on wild blueberry agriculture have not been studied. Janice Huebner, M.S. candidate at the University of Maine Department of Plant, Soil, and Environmental Sciences completed her study titled "***Wild Turkey Foraging Behavior and Crop Depredation on Wild Blueberry Farms in Maine***" in December 2009 in an effort to understand the impact of wild turkey foraging and activity on wild blueberry farms. Because Ms. Huebner's work is germane to the deliberations of the Wild Turkey Working Group, we provided a direct copy of the abstract of the thesis below as well as other results, annotated conclusions, and management recommendations (with literature citations removed) taken directly from the thesis. These points further highlight some of the more important findings in Janice Huebner's work.

Thesis Abstract

A highly successful reintroduction program has restored wild turkeys (Meleagris gallopavo) to Maine in large numbers and wild blueberry (low sweet blueberry [Vaccinium angustfolium]) growers have increasingly expressed concern about wild turkeys inhabiting their farms. The objectives of the present study were to determine the concerns and perceptions of wild blueberry growers about wild turkeys, describe wild turkey activity and diet while using blueberry fields, and estimate blueberry crop loss. In 2008 I sent a mail-in questionnaire about wild turkey and wildlife damage to all wild blueberry growers in Maine. I studied wild turkey activity on four wild blueberry farms in Knox County, ME from mid-May through July 2008 and 2009. I used an activity budget to describe behavior, and used fecal analysis and video recording to document food items consumed. To estimate crop loss from wildlife I compared proportion of blueberry loss rates between open or enclosed plots. I modeled blueberry crop loss by wild turkey using results from the present study and the literature. Forty-two percent of growers responded (n = 225) to the questionnaire, and most (76%) reported no or few benefits from wild turkeys on their farms. Most (60%) growers were concerned with damage from wild turkeys. Deer (66%) was the species most commonly indicated as causing damage. Growers were most concerned with wild turkeys eating blueberries (54%) and knocking blueberries off stems (44%). In general, concerns were shared by respondents in regions of the state both with and without high wild turkey densities. Wild turkeys were present on blueberry fields 29% of total survey time (820 hours). Wild turkeys used blueberry farms and spent greater proportions of survey time on fields during the pre-fruiting compared to the fruiting season (2008: $P = 0.01$, 2009: $P < 0.001$).

Overall, wild turkeys spent approximately 50% of time in foraging behaviors. On two sites, feeding behaviors were not different between seasons (Marrs Hill: P = 0.468, Clarry Hill: P = 0.861) or field types (Marrs Hill: P = 0.256), but there were yearly differences (Marrs Hill: P = 0.005, Clarry Hill: P < 0.001). Before blueberries ripened, other foods such as weedy vegetation comprised most (90%) of the foods used while in blueberry fields. During the fruiting season, wild blueberries were 46% of the food items used. In both years the rate of blueberry loss on plants did not differ between open and enclosed plots (2008: P = 0.693, 2009: P = 0.498). Based on mean estimates for model inputs from the present study and the observed mean flock size (n = 4), the "average" scenario for our study sites resulted in a loss of 18.7 kg ($33.39) of wild blueberries by wild turkeys. This loss represented 0.05% of the total crop for a 20 ha field. Experimental (enclosure) and modeling results were consistent. My results indicate that wild blueberry crop losses by wild turkeys are relatively low. Better information on actual crop loss will be helpful to both wild blueberry growers and wildlife managers.

Below are other results, annotated conclusions and management recommendations (with literature citations removed) taken directly from the thesis. These points further highlight some of the more important findings in Janice Huebner's work.

Perceptions of Wild Blueberry Growers to Wild Turkey Damage in Maine: Many wild blueberry growers are concerned that wild turkeys cause damage to their crop and despite the difference in wild turkey numbers between the regions, these concerns were generally consistent in both the mid-coast counties and Washington County. Growers likely perceive wild turkeys as causing damage because they are highly visible on blueberry farms, and growers do not have reliable information on the amount of crop loss caused by wild turkeys and other wildlife. Crop losses to wild turkeys and wildlife needs to be quantified.

Additionally, many growers had other important concerns for which little information is available, such as wild turkeys eating blueberry buds in the autumn and depositing feces on plants. This information will also be beneficial to agencies outside Maine weighing the costs and benefits of wild turkey introductions where wild blueberry agriculture is regionally significant.

Wild Turkey Foraging Behavior and Crop Loss on Wild Blueberry Farms in Maine: Wild turkey activity on farms unexpectedly decreased from pre-fruiting season to the fruiting season in both 2008 and 2009, despite the high abundance of wild blueberries that came available. Wild turkeys also spent roughly equal proportions of time in prune fields and fruit fields during the fruit season [at one study site] in 2008 and 2009. Several factors may explain the lack of a positive relationship between fruit availability and wild turkey use of wild blueberry fields. Wild blueberry farms likely only comprise a portion of total wild turkey habitat [home ranges in spring and summer between 105 ha-833 ha], and wild turkeys exhibit seasonal preferences for habitats types. In the spring (pre-fruiting season), wild blueberry fields may have been used more for breeding activities. While hens with broods may prefer field habitats, my anecdotal observations suggest wild blueberry fields provided very little cover from predation and young poults had difficulty maneuvering through dense blueberry stems. I observed little use of fields by hens with broods. A second contributing factor is that preferred food sources may have been abundant in adjacent habitats during the fruiting seasons, which resulted in wild turkeys spending less time on blueberry fields. However, complicating factors include fruit field types that had greater amounts of weedy vegetation because herbicide 41 applications were only applied to prune fields. Also, fruit

fields often received early July insecticide applications which may have deterred wild turkeys from eating treated blueberries or decreased in insect abundance.

Management Implications: Most wild blueberry growers in Maine are concerned about damage from wild turkeys to their crop. These concerns are not unfounded because wild turkeys are active on farms and do eat blueberries. Yet, crop loss from wild turkey is relatively low for most growers. However, in rare cases, small blueberry farms (<5 ha) with high wild turkey populations may consider the amount and value of blueberry loss unacceptable. For growers using or considering the use of hazing and scare devices targeted specifically at wild turkeys, it is likely not worth the cost. An effort should be made to distribute information on crop loss estimates to wild blueberry growers. For the majority of wild blueberry growers, wild turkey damage is not a source of significant damage. Cumulative damage from other wildlife may be more of concern for Maine's blueberry growers. This information will be especially helpful to inform growers in eastern Maine where wild turkeys are expanding and increasing and to inform organizations that are weighing the costs and benefits of wild turkey introduction.

Patricia Kontur, representing the Maine blueberry industry, outlined the problems that blueberry growers contend with; in addition, she and other members of the working group provided comments and possible solutions regarding the problems discussed.

Problem	**Potential Strategies / Comments**
Blueberry growers don't receive any of the economic benefits from wild turkey presence in Maine but must absorb costs associated with wild turkey conflicts.	• Education and outreach to blueberry growers, the public, and IFW. • IFW allowing blueberry growers to address conflicts. • IFW outreach to blueberry growers with problems. • Recognize the contribution of blueberry growers.
Wild turkey foraging damages berries; feces in berries. From the grower's perspective as soon as turkeys walk into the field damage increases with each day.	• Wild turkeys eat bugs thereby providing a potential benefit of blueberry pest control. • What do blueberry growers use to scare off/get rid of wild turkeys? A discussion ensued about scare tactics, deterrents, limited utility, and that birds get conditioned to these. Consider rotating deterrents on the landscape and allowing periodic lethal take. • Need to seek a balance between the

Problem	Potential Strategies / Comments
Wild turkey foraging damages berries; feces in berries. From the grower's perspective as soon as turkeys walk into the field damage increases with each day.	numbers of wild turkeys in blueberry fields and the financial loss associated with their presence. • Like dairy farming, education and outreach to blueberry growers will be helpful to assess the problem and develop a better understanding of the complete picture (i.e. Janice Huebner, University of Maine graduate student studying wild turkey/blueberry interactions). • Janice Huebner's study will hopefully shed light on the degree of turkey damage (direct and indirect) and what role other species play in damage to blueberry fields (bears, deer, raccoons)

Time expired before turkey damage to other berry crops, farm stand and back yard gardens, and apple orchards could be fully vetted. These topics were deferred to the next meeting.

The minutes of the first meeting and all of the documents provided to the working group are found in Appendix 3.

Meeting #2 – August 25, 2009

The second meeting of the 2009 Wild Turkey Working Group was devoted to a continued discussion of wild turkey conflicts in agricultural areas and identification of hunting issues and opportunities.

1. The Problem of Nuisance Wild Turkeys in Farming Areas: Identification of the Problem

   Dairy and blueberry problems were discussed at the first meeting. Problems associated with other berry crops and farm stand produce were addressed at the second meeting.

Problem	Potential Strategies / Comments
Strawberries	
To protect strawberry plants in the late fall farmers cover them with straw; in some cases after spreading the straw, wild turkeys scratch up the straw damaging the plants and agricultural cloth.	• Need to determine the number of wild turkeys being killed in relation to nuisance (whether by permit or not). • Use fencing, repellants (mylar tape, cracker shells, fish scent sprays). • A 3-D coyote goose repeller sold in Forestry Suppliers is very effective though it needs to be moved around in the fields. • Timing of the hunting seasons is not effective to take out enough wild turkeys and to reduce the wild turkey numbers. Hunting generally doesn't occur when damage is occurring. MDIFW stated that hunting has never been used or promoted to control the wild turkey population.
Raspberries	
During the fruiting cycle, wild turkeys are in the berry patches searching for insects and inadvertently knocking raspberries off the plants when they flap their wings. This damage can increase product loss and cost. It's a numbers game. For example, 10 birds are tolerable but when you get higher	• Strategies for small fruits and vegetables are all similar (fencing, various repellants, education and outreach, etc.). • Smaller operations may have a more difficult time financing nuisance control strategies than larger operations.

Problem	Potential Strategies / Comments
numbers (i.e. 100 birds) the problem becomes a major issue.	• Education and outreach is important for all nuisance categories (berries, dairy, orchards, etc.). Need to think "out of the box" about delivering the information. • The Living with Wildlife link on IFW website will be available shortly. This site will describe methods for preventing or resolving conflicts with wildlife and who to turn to for help if needed. • Websites are good but we also need to provide landowners with the opportunity to talk to a "real person" and not feel they are being put off.
Small Farms and Back Yard Gardens	
Problems are similar to those of berry growers.	• Some strategies are similar – small operations may have a more difficult time financing control strategies.
Apple orchards	
Wild turkeys eat apple drops and knock apples off the trees. They also cause limb damage and damage to buds in the spring.	• Some strategies are similar – small operations may have a more difficult time financing control strategies.
Turkey Problems in General	
Trapping and transferring wild turkeys – growers would like to know where birds are relocated.	• MDIFW always seeks landowner permission when birds are released, but the regional offices should be encouraged to think beyond the actual release site as to where birds could move to. • Post releases sites on IF&W's website. • IFW should be more proactive in distributing a "plan" for wild turkey releases. • Need a landowner relations coordinator. Can we tap into Hunter Education instructors as an education

Problem	Potential Strategies / Comments
	and outreach vehicle? • Continue with trap and transfer efforts.
GAP – Good Agriculture Practices (Food Safety for agricultural fields) - GAP is a USDA certification program to allow growers to market food to the retail outlets while ensuring safety (i.e., home growers selling fresh pack to supermarkets). Growers are looking to USDA to find out what is required to comply with the program. GAP identifies 200 items in total and 2 items speak to wildlife. 1. Monitor wildlife activities on the property. 2. Take measures to reduce the amount of wild animals entering the property.	• Need to monitor GAP to ensure "reasonableness" in dealing with wildlife. • Inform regional biologists about GAP. • Need to coordinate where trapped wild turkeys are released especially if they are released near GAP areas.
It is an urban vs. rural problem.	• Need to determine how to get the message out in a better fashion - a compiled package covering all species and information and the steps to go through to resolve conflicts.

A general discussion of nuisance wild turkey issues ensued. According to Warden Chris Dyer, 111 calls related to problem wild turkeys were reported between January 1 and August 24, 2009 and recorded in the Warden Service's Records Management System. The calls ran the gamut from wild turkeys bothering bird feeders, to a dead wild turkey in a driveway, to farming complaints. One grower commented that reports are probably under representative of the number of ongoing problems, citing most farmers don't report problems with wild turkeys, they simply deal with them.

Working Group members agreed it was important to compile USDA's reports with MDIFW's to get as accurate a picture of the problem as possible and to try to assess how many birds were being removed by lethal means.

2. Wild Turkey Hunting Issues and Opportunities

The remainder of the meeting was devoted to a brainstorming session of various hunting issues and opportunities. Sandy Ritchie told the working group the field was wide open and encouraged members to raise any issue, comment, or opportunity they wanted the broader working group to consider. The following is a summary of topics discussed.

Turkey demand could exceed supply in some areas of the state – some working group members expressed concern that a series of wet springs and poor poult production in

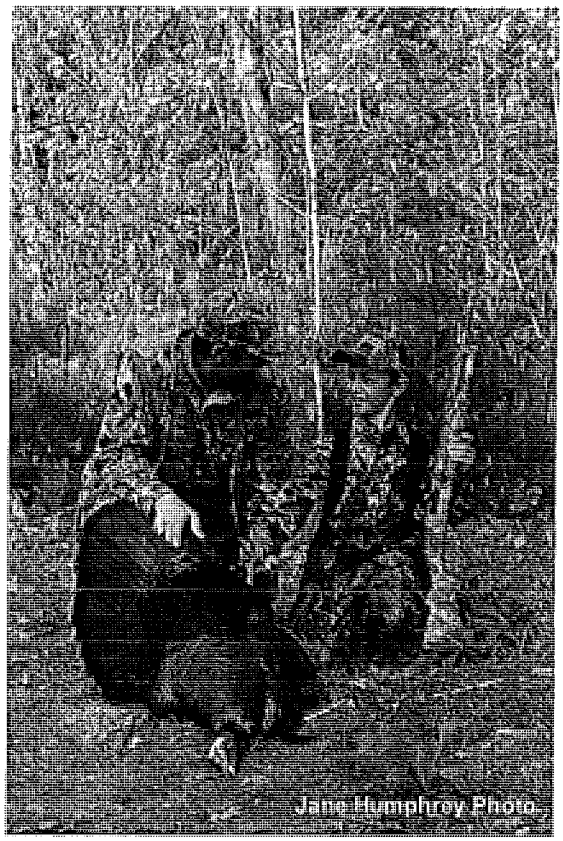
conjunction with hunters gaining experience and expertise during the fall hunt could result in an increased harvest of hens and begin affecting population growth.

Fall season triggers – the Department uses the metric of spring harvest of wild turkey gobblers/mi^2 of forested habitat as a means to assess the wild turkey population within a Wildlife Management District (WMD). The Wild Turkey Management System calls for specific values of gobblers harvested/mi^2 forested habitat to be met in the spring before opening a WMD to fall hunting. Three variations of a fall harvest, when met, can trigger a fall season opening. A WMD that realizes:

- 0.5 gobblers/square mile of forested would open up a 2 week bow hunt.
- 0.75 gobblers/square mile of forested habitat would open a 2 week bow season, as well as a 1 week shotgun season.
- 1.0 gobblers/square mile of forested habitat would open a 4 week bow season, as well as a 1 week shotgun season.

Season and weaponry changes – a list of suggested changes is presented below.

- Provide similar seasons for bow hunters and shotgun hunters. [Some members were concerned about the potential for an increased harvest of hens by lengthening the shotgun season.]
- Expand the youth hunt during the spring and fall seasons.
- Reduce the spring season from 5 weeks to 4 weeks.
- Allow the use of crossbows.
- Institute an early spring bow only season [mid April for 2 weeks] – Bob Humphrey thought an early spring bow season might increase nonresident participation in wild turkey hunting as it has in other states. Others believed an early season wouldn't attract hunters; they preferred to focus on a season where hunters could see success. Jerome Richard of the Maine Bowhunters Association did not support an early spring bow only season.



- May 1st vs. an earlier April spring season opening – Doug Little, Northeast Regional Biologist with NWTF reported that May 1st is the ideal start date. Based on radio telemetry studies, May 1st is the peak onset of incubation when hens are closely tied to the nests. An earlier season opening increases the mistaken identity and illegal

take of hens in the harvest and "educates" gobblers that won't respond to calling anyway.

- Extend the spring noon closure to all day hunting - Brad Allen provided the group with a number of reasons why all day spring wild turkey hunting is not advised.

  - All day hunting diminishes the tradition of spring wild turkey hunting which is an early morning hunt.

  - All day hunting may diminish the current quality of the spring hunt, risking the high level of success and credibility our wild turkey program enjoys.

  - Extending hunting hours has the potential to decrease the acreage open to hunting as landowners may not welcome all day hunting on their land.

  - Research has shown that additional hunting pressure from all day hunting will depress turkey gobbling activity.

  - Further, the wild turkey is the only game bird that wildlife agencies allow to be hunted during the nesting phase of its reproductive cycle. Caution should be exercised to ensure that hunting is as benign as possible.

  - All day hunting increases the potential for disturbance to nesting hens and nest abandonment.

  - All day hunting would likely increase the male harvest and enhances the opportunity for illegal hen losses when nesting hens leave their nests and feed in the afternoon.

  - All day hunting might increase more "road hunting" and stalking turkey spotted in fields in the afternoon. This raises safety and ethical concerns.

  - No other state in the northeast has all day hunting. Conditions are likely very different in the southern states that do have all day spring hunts. The most obvious difference is that our turkeys experience severe winter conditions.

  - Lastly, the hunting community has not expressed a strong desire for all day hunting.

Making too many season changes too quickly makes it difficult to measure cause and effect in regards to hunt quality – it was suggested that once a major change is made to a season framework (increasing bag limits, providing additional weaponry opportunity), MDIFW should not make an additional change for a period of 3 years. This timeframe is intended to allow the Department to review and evaluate harvest and survey trend data to assess the effect of the change on the population or the quality of the hunt.

Need to preserve the quality of the spring hunt – MDIFW needs to monitor the effect of increased opportunity in the fall in relation to the quality of the hunt in the spring. Maine's spring hunt is its premier hunt; preserving its quality is of utmost importance. A quality hunt

means more than harvesting a bird; it also includes seeing, hearing, and working a bird without interference from others.

How can we attract more people to the sport of turkey hunting – we don't seem to be attracting more residents to the sport despite expanded seasons, a greater area open to hunting, increased bag limits, and reasonable permit fees. The opportunity to attract residents is limited; the opportunity to attract nonresidents is better and should be promoted.

Landowner issues – the fall season occurs when farmers are harvesting their fall crops. Farmers are concerned about expanding shotgun opportunity in the fall. They want to ensure a safe and quality hunting experience while minimizing interference with their farming activities.

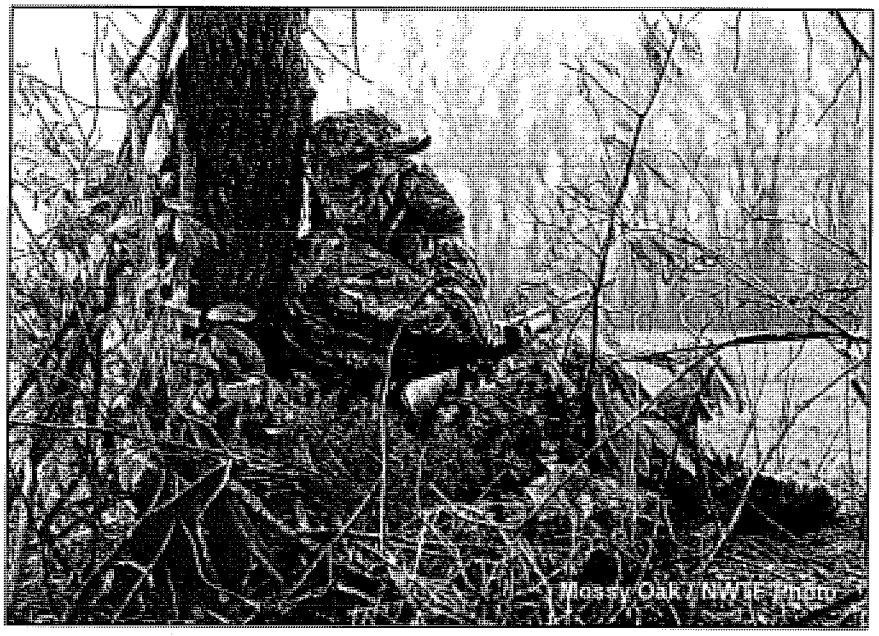
3. Proposed Spring Season Framework

The Working Group agreed to the following structure for the spring season:

- Season opening – maintain current opening (around May 1)
- Season length - 5 weeks, no split seasons
- Daily closure – noon time, though the group was divided on a ½ day vs. full day hunting (3 supported an all day season, 11 were opposed, Doug Little representing the NWTF abstained from voting).

Once major changes are made to a season framework (i.e., increasing bag limits, expanding weaponry), the group recommended not making additional changes for a period of 3 years to allow the Department to review and evaluate harvest and survey trend data.

The minutes of the second meeting and all of the documents provided to the working group are found in Appendix 4.



Meeting #3 – September 15, 2009

The third meeting of the 2009 Wild Turkey Working Group was devoted to a continued discussion of hunting issues and opportunities, including the use of crossbows; electronic tagging; identification of strategies to address conflicts with turkeys; and a review and affirmation of wild turkey goals and objectives developed by the 2000 Wild Turkey Working Group. A summary of items discussed is provided below.

1. Hunting Issues and Opportunities

   At the previous meeting the Working Group discussed a spring season framework. A fall season structure and the use of crossbows were the focus of the third meeting.

   An objective of the 2000 Wild Turkey Working Group was to implement a limited fall hunting season by 2003 in areas where the Wild Turkey population could support it and without adversely affecting the quality of the spring hunt. The Department implemented its first fall season (a two-week archery only season in selected WMDs) in 2002. Since the inaugural fall season, the Department has expanded fall turkey hunting opportunity adding additional wildlife management districts, lengthening the season, and allowing the use of shotguns. Hens comprise about 60% of Maine's fall turkey harvest.

   When determining a fall season the Department considers:

   - Season triggers - spring harvest of wild turkey gobblers/mi^2 of forested habitat (see page 22)
   - Productivity estimates from August brood surveys
   - MDIFW regional biologists' perspectives

   Doug Little provided a regional and national perspective of fall turkey seasons. Most states use a 2-3 year spring harvest trend to determine fall opportunity; Maine uses 1 year data and is the only state to do so. When setting fall seasons, Maine has been liberal despite being at the northern limit of wild turkey range where year to year changes can be exacerbated. We are also one of the more recent states to implement a fall gun season. States with longer fall gun seasons have longer histories of fall hunting and are not on the northern limit of the range. Arkansas, a state with a long history of turkeys and turkey hunting, is proposing an emergency closure of their fall season after several years of poor production.

   Most states manage their fall hunts to assure that even with the harshest of winters and the wettest of springs, the fall harvest will not negatively impact the population and the spring hunt. Given season timing and the need to publish hunting regulations in advance of a season, it is very difficult for states to respond to poor winters and wet springs by reducing the fall season framework. Hunters want to have some expectation as to what a season will be.

   Working Group members urged caution when expanding and evaluating seasons to ensure we maintain the safety net of the fall season triggers. Some wondered whether a 2-bird take in the spring (allowable beginning in 2010 with an additional fee) will require a change to the

season triggers, and others expressed concern that as hunters continue to become more experienced we could achieve our fall season triggers quicker thereby expanding fall hunting opportunity sooner than biologically warranted. To date the Department has been conservative in its approach to harvest management and has not seen the need to limit the fall hen harvest because it is likely less than 8%-10% of the hen population.

The group briefly discussed using recreational turkey hunting to reduce the turkey population and, as a result, reduce the number of nuisance wild turkey complaints. They agreed that there are more direct and focused ways to address wild turkey conflicts rather than recreational hunting, particularly if that hunting might jeopardize the quality of Maine's spring turkey hunt and diminish hunter satisfaction. Provisions for dealing with nuisance wildlife exist in law, and the Department's Animal Damage Control Policy has provisions to address and remedy nuisance wild turkey complaints.

The Working Group agreed to the following structure for the fall season:

- Maintain the current [2009] fall season structure for 2010.
- Don't consider any changes until at least 2011. [Note: as a result of Working Group recommendations on pages 32-33, no season changes will be considered until 2013.]
- Use 3-year trend data when establishing future seasons to allow the Department adequate time to review and evaluate harvest trend data.
- Investigate the opportunity to expand the fall shotgun season beginning no earlier than 2011. [Note: as a result of Working Group recommendations on pages 32-33, no season changes will be considered until 2013.] If fall shotgun opportunity is expanded, we may need to reconsider fall season triggers, which by most states' standards are already very liberal.

2. Use of Crossbows

The group considered arguments for and against the use of crossbows while turkey hunting. [Appendices 5B-5D]. Doug Little surveyed all state wild turkey program leaders on the use of crossbows and received 32 responses. Crossbows are legal in 13 states and illegal in 19. Of the 6 New England states surveyed, crossbows are illegal for spring and fall wild turkey hunting in Maine, Massachusetts, New Hampshire, and Rhode Island [Connecticut and Vermont did not respond].

In states where crossbows are allowed, less than 2% – 9% of the harvest is attributable to crossbows. The Maine Chapter of the NWTF opposes the use of crossbows at this time because it would be another variable on top of other season changes. The Maine Bowhunters Association [MBA] opposes the use of crossbows, especially during the fall turkey season because it overlaps the archery season on deer and MBA fears it could lead to the illegal harvest of deer by crossbow users.

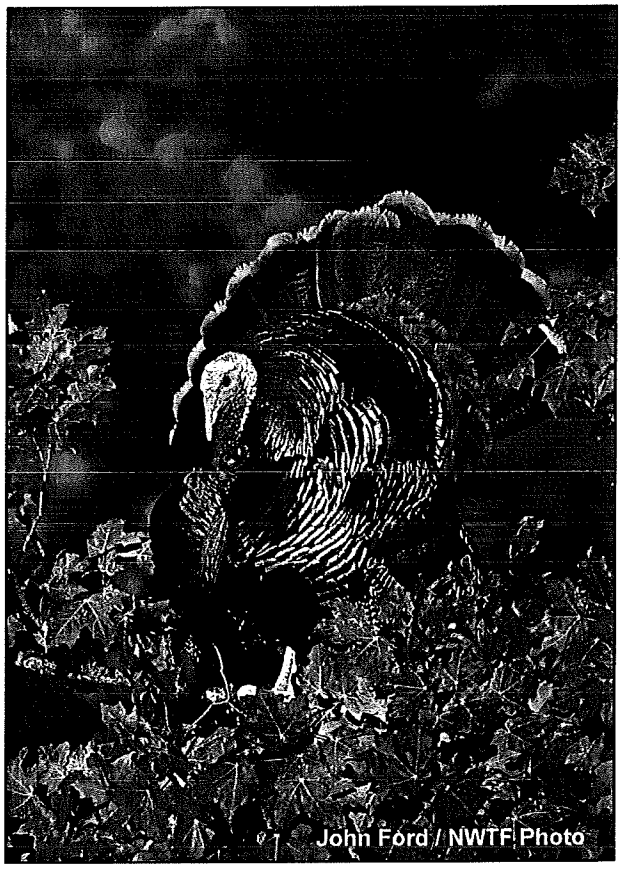
The Working Group agreed that MDIFW should investigate the use of crossbows beginning with the 2011 turkey seasons and suggested the Department use its 2010 Spring Turkey Hunter Questionnaire as one way to gauge hunter interest in the use of crossbows while turkey hunting. [Note: as a result of Working Group recommendations on pages 32-33, no

season changes will be considered until 2013.] Agricultural interests urged caution, expressing concern for lost arrows in farmers hay fields and the potential of ingestion of arrow heads by livestock. [Using crossbows to hunt wild turkey would require legislation.]

3. Strategies to Address Farmers' Conflicts with Wild Turkeys

The Working Group discussed a number of potential strategies to address farmers' conflicts with turkeys.

- Use of repellants – fencing, mylar tape, cracker shells, coyote decoys, etc.
- Directed efforts at lethal removal of offending turkeys.
- Trapping and relocating wild turkeys.
- Education and outreach efforts.
- Directing recreational hunters into problem areas – ultimately the group decided not to recommend this strategy because landowners are getting plenty of requests from hunters to hunt on their properties.
- Trap, euthanize, and donate turkeys to soup kitchens – ultimately the group decided not to recommend this strategy.
- Allow the use of depredation permits by "agents" of the busy farmer (friends, family, ADC agents) – this strategy was strongly discouraged by Warden Service because it makes a hunt out of a nuisance problem and opens up a "can of worms".
- Payment to farmers for damage.



4. Electronic Tagging

The Sportsman Alliance of Maine continues to advocate for website and telephone options for tagging wild turkeys.

The group briefly discussed the advantages and disadvantages of moving forward with electronic registration of wild turkeys. The Department has met several times to discuss electronic tagging and has identified advantages and disadvantages of 1) maintaining the current registration process, 2) implementing self-registration where the hunter would register the animal online or by phone, or 3) implementing a tagging station online registration process [Appendix 5E].

The consensus of the Working Group was not to proceed with electronic tagging at this time. The group expressed concerns about non compliance and data reliability. They were also worried about adding another layer of change and responsibility to the tagging stations in light of the registration fee increase passed in the last legislative session and the dissension it has caused. [Registration fees for big game were increased from $1 to $5 with the additional $4 earmarked to MDIFW to support two data entry positions]. A final concern expressed by Warden Chris Dyer was overburdening the Kennebec County court system. If the electronic server is located in Augusta, all tagging violations would potentially have to go through the Kennebec County court system.

5. Affirmation of 2000 Wild Turkey Working Group's Goal and Objectives

The remainder of the meeting was devoted to a review of the Wild Turkey Goal and Objectives for the period 2000-2015 developed by the 2000 Wild Turkey Working Group and adopted by the Department's Fish and Wildlife Advisory Council on May 1, 2001. They are as follows:

Goal: Increase the size and distribution of the Wild Turkey population within all suitable habitats in Maine.

The 2009 Wild Turkey Working Group affirmed this goal.

Objective 1: By 2010, increase the size and distribution of the Wild Turkey population within all suitable habitats in Maine via trap and transfer activities and habitat improvements.

The 2009 Wild Turkey Working Group affirmed this objective.

Objective 2: By 2010, provide unlimited spring hunting opportunity (everyone who applies for a permit receives a permit) as long as the Wild Turkey population can support it and 2001 hunt quality is maintained. (The working group defined quality hunting as hearing, seeing, working, and hopefully harvesting a turkey without interference from others.)

We achieved an unlimited spring hunt in 2005 when all applicants were given a permit. The 2009 Wild Turkey Working Group affirmed continuing to provide unlimited spring hunting opportunity as long as the turkey population can support it and spring hunt quality is maintained.

Objective 3: By 2002, develop a component to the Department's Nuisance Wildlife Policy that addresses Wild Turkeys.

A component to the Department's Nuisance Wildlife Policy that addresses wild turkeys is found in Title 12: Chapter 921; section 12401, pages 910-916 and in the Department's Administrative Policy Regarding Human/Wildlife Conflicts (Policy J1.6, last revised 7/31/2008).

Objective 4: By 2003, implement a limited fall hunting season in areas where the Wild Turkey population can support it, and without adversely affecting Objective 2.

The Department implemented Maine's first limited fall hunting season in 2002. The 2009 Wild Turkey Working Group affirmed continuing to provide a limited fall hunting season in areas where the population can support it and without adversely affecting spring hunt quality.

Objective 5: Develop a cooperative habitat improvement program between landowners, the Maine Chapter National Wild Turkey Federation, and the Department.

The 2009 Wild Turkey Working Group recommended modifying this objective to read as follows: Develop a cooperative turkey management program between landowners; the Maine Chapter National Wild Turkey Federation; sportsmen (i.e. SAM), landowner (i.e. SWOAM), and agricultural (Farm Bureau) groups; and the Department.

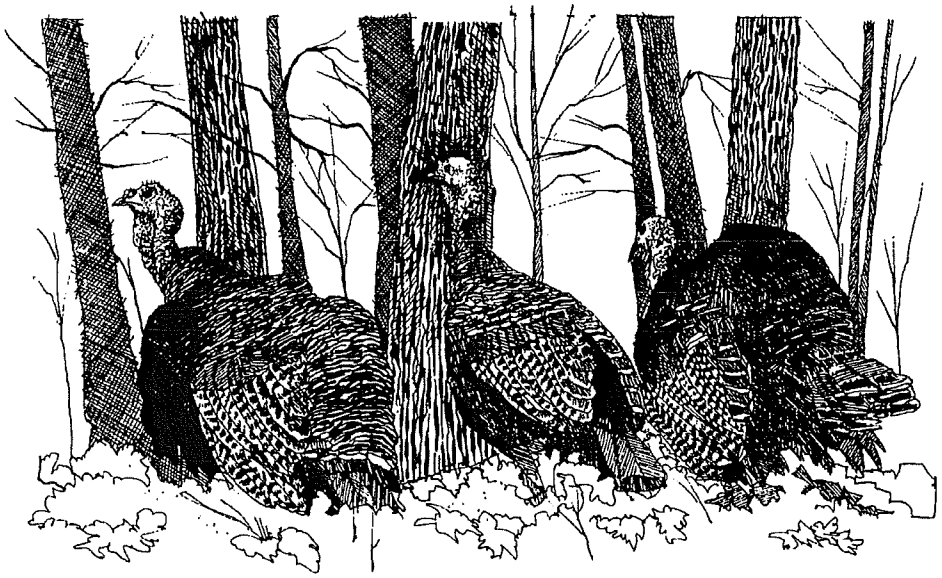
The group also proposed two additional recommendations that were not fully articulated into measurable objectives.

Objective 6: Reduce landowner / turkey conflicts.

Objective 7: Evaluate all of the turkey seasons and bag limits and investigate options for additional hunting opportunity.

The minutes of the third meeting and all of the documents provided to the working group are found in Appendix 5.

Following the meeting, MDIFW developed a draft report outlining the deliberations and recommendations of the Wild Turkey Working Group and forwarded the draft to Working Group members for review and the opportunity to provide any additional comments or thoughts. The Department requested that it receive these by December 9, 2009 but accepted all comments that came in, even after the deadline. Working Group comments are presented in Appendix 6.



Recommendations to the Joint Standing Committee on Inland Fisheries and Wildlife for Expanding Wild Turkey Hunting in Maine and Alleviating Farmers' Conflicts with Wild Turkeys.

Developed by the 2009 Wild Turkey Working Group

Recommended Strategies to Address Farmers' Conflicts with Turkeys

The Working Group unanimously makes the following recommendations to address farmers' conflicts with Wild Turkeys:

1. MDIFW should post *Living with Wildlife* on the Department's website informing landowners how to prevent and reduce problems caused by wild turkeys and where to turn for additional assistance if needed.

2. MDIFW and the Maine chapter of the National Wild Turkey Federation should:

    a. develop extension materials addressing how farmers can respond to conflicts with wild turkeys and

    b. disseminate these through agricultural and landowner groups, publications, and trade shows (i.e., Maine Farm Bureau, Maine Organic Farmers and Growers Association, commodity groups, Small Woodland Owners Association of Maine, etc.).

3. As part of its efforts to respond to landowner / wild turkey conflicts and to augment the pool of Animal Damage Control agents currently registered in its ADC program, MDIFW should enroll qualified members of the Maine Chapter of the National Wild Turkey Federation and other sportsmen's groups, and other interested individuals, as Animal Damage Control agents, who will provide their services at no charge to the landowner. Response to landowner / wild turkey conflicts will follow the stepped-down approach (prevention and extension, regulation, non-lethal control, and lethal control) described in the Department's *Administrative Policy Regarding Human/Wildlife Conflicts (Policy J1.6, last revised 7/31/2008*).

   To be successful, participants must commit to:

   a. participate in the program and be available to farmers;

   b. cooperate and coordinate with Department biologists and game wardens; and

   c. comply with standards and protocols outlined in the Department's ADC policy.

4. MDIFW and the Maine Chapter of the National Wild Turkey Federation should pursue funding from the National Wild Turkey Federation's Superfund, and other sources, to purchase and maintain a supply of materials (fencing, mylar tape, cracker shells, coyote decoys, etc.) necessary for appropriate and timely response to landowner / wild turkey conflicts.

5. Availability of volunteers [Maine Chapter NWTF members and other sportsmen's groups and interested individuals] to address issues a landowner may have will depend on the location and time of the complaint. MDIFW, the Maine Chapter NWTF, and other interested parties should develop a process that assures farmers that their complaints will be addressed as promptly as possible. [See 3 above.]

6. MDIFW should:

   a. emphasize, within the Department, the value and utility of wild turkey trapping and relocation;

   b. continue its current wild turkey trapping and relocation efforts; and

   c. publicize wild turkey release sites on the Department's website.

   [Efforts beyond current levels will require additional staff and funding.]

7. MDIFW, with assistance from other interested stakeholders including, but not limited to the Maine Chapter National Wild Turkey Federation, Sportsman's Alliance of Maine, Small Woodland Owners Association of Maine, and the Maine Farm Bureau should develop and implement a cooperative turkey management program.

The Working Group discussed using recreational wild turkey hunting as a means to reduce the turkey population and, as a result, reduce the number of nuisance wild turkey complaints. They agreed that there are more direct and focused ways to address wild turkey conflicts rather than recreational hunting, particularly if that hunting might jeopardize the quality of Maine's spring wild turkey hunt and diminish hunter satisfaction.

Recommendations to Expand Wild Turkey Hunting Opportunity in Maine

Maine's spring hunt is its premier hunt; preserving its quality is of utmost importance.

The general wild turkey hunting recommendations are intended to protect and enhance spring gobbler hunting opportunities and, as appropriate, provide additional recreational hunting by allowing limited fall hunting. The emphasis is on quality spring gobbler hunting. Expanded fall hunting should be carefully considered because fall seasons, where the harvest of hens is legal, may negatively influence the population's growth rate more than spring hunting seasons.

The Working Group unanimously makes the following recommendations concerning wild turkey hunting opportunities in Maine.

1. MDIFW should continue to provide unlimited spring hunting opportunity, as long as the turkey population can support it and spring hunt quality is maintained. A quality hunt means more than harvesting a bird; it also includes seeing, hearing, and working a bird without interference from others. Whether or not hunt quality is maintained is measured by the interference information collected with the Department's Spring Wild Turkey Hunter Questionnaire.

2. MDIFW should continue to evaluate population, harvest, and survey data to investigate providing additional hunting opportunity during the fall season, as long as the population is not negatively affected and spring hunt quality is maintained.

3. Once a major change is made to a season framework (increasing bag limits, providing additional weaponry opportunity), MDIFW should not make an additional change for a period of 3 years. This timeframe is intended to allow the Department to review and evaluate harvest and survey trend data to assess the effect of the change on the population or the quality of the hunt.

4. MDIFW should structure the spring wild turkey season as follows.

    - Maintain the current spring season opening (around May 1)
    - Season length - 5 weeks, no split seasons.
    - Daily closure – noon time.

5. MDIFW should structure the fall wild turkey season as follows.

    - Maintain the current (2009) fall season structure; only consider season changes after 2013.
    - Investigate the opportunity to expand the fall shotgun season beginning no earlier than 2013. If fall shotgun opportunity is expanded, MDIFW should review the metrics it uses for determining fall seasons.

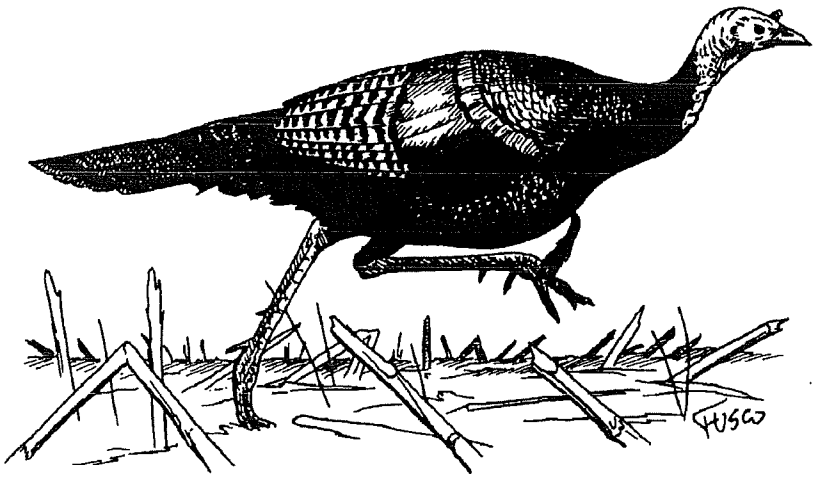
6. MDIFW should investigate the use of crossbows beginning with the 2013 turkey seasons. [Using crossbows to hunt wild turkey would require legislation.]

7. MDIFW and the Maine Chapter NWTF should promote opportunities to attract more people to the sport of wild turkey hunting, especially among nonresidents. [Resident interest seems to have stabilized despite expanded seasons, greater areas open to hunting, increased bag limits, and reasonable permit fees.] [Efforts beyond current levels would require additional staff and funding.]

Recommendation Concerning Electronic Registration of Wild Turkeys

The consensus of the Working Group was not to proceed with electronic tagging for the following reasons:

- concerns about non-compliance and data reliability;
- apprehension about adding another layer of change and responsibility to the tagging stations in light of the big game registration fee increase passed in the last legislative session and the dissension it has caused[1]; and
- concerns expressed by Warden Service about overburdening the Kennebec County Court system. If the electronic server is located in Augusta, all tagging violations would potentially have to go through the Kennebec County court system. [This will require Warden Service consultation with the Attorneys General Office and with district attorneys in Maine's 16 counties.]



[1] Registration fees for big game were increased from $1 to $5 with the additional $4 earmarked to MDIFW to support two data entry positions.

Wild Turkey Working Group Report

The working group was convened in Augusta on February 15, 2013. The committee was made up of representatives from several stakeholder groups.

Jeff Bellmore	Maine Professional Guides Association
Rick LaFlamme	Maine Warden Service
Jon Olson	Maine Farm Bureau
Adam Vashon	USDA, APHIS, Wildlife Services
Jerry Lavigne	Sportsman's Alliance of Maine
Kelsey Sullivan	MDIFW, Wildlife Biologist, Bird Group
Jim Wescott	NWTF, State Chapter Board Member, turkey hunter
Mike Windsor	Maine Audubon
Jane Eberle	Private citizen
Mark Caron	MDIFW, Regional Biologist
Judy Camuso	MDIFW, Meeting facilitator

Overview/Discussion of existing conditions

The meeting began with brief introductions and an overview of the goals for the committee which are to increase opportunity for turkey hunting in Maine, and reduce nuisance turkey complaints and damage caused by turkeys The group established ground rules for the day and a decision making process. Kelsey Sullivan and Jim Wescott gave an overview of turkeys in Maine, from their extirpation to one of the best wild turkey programs in the east.

I. Increasing hunting opportunity and harvest during the fall

After discussing the spring and fall turkey hunting season and nuisance turkey issues, the committee agreed that the best way to both increase hunting opportunities and decrease nuisance issues in targeted areas is to increase the fall harvest. Kelsey Sullivan explained that since the fall turkey hunting season allows for the take of females, the fall harvest really is the best way to reduce turkey populations in specific areas. Currently the turkey management system has triggers, based on the spring season, that inform the "allowable harvest" for the fall turkey hunting season. To date, that is how the Department determined which WMD's had fall harvests, and the length of those seasons. In order to reduce the turkey population in an area, hunters will need to harvest 10% or more of the population before we start to see a population decline. We consider this 10% to be the allowable harvest, or the amount of harvest that the population can sustain without decreasing the population. Currently, we are well under our allowable harvest. Based on our data, MDIFW could increase the number of weeks of bow, and increase the shotgun season. On average we are currently harvesting less than 20% of the 10% allowable harvest in many of our Wildlife Management Districts. In other words we are currently harvesting approximately 2% of the total population. The group noted that it will be

challenging to get the effort needed to achieve the 10% threshold without changes in the fee structure and additional promotional efforts.

Recommendations

- The Committee recognized that the Department needs to maintain a turkey management system that uses the WMD system to apply appropriate management actions across the state.

- Expand the fall wild turkey hunting season from October 1 until Youth Day for the regular firearms season for white-tailed deer, in all WMDs open to fall turkey hunting.

- A turkey permit would include 1 bird in the spring and up to 2 birds in the fall, for the $20 permit fee, and maintain the $20 for the additional permit in the spring. The group agreed the fee for non-residents should be lowered, but did not determine that fee.

Expand areas currently open for a fall harvest of one week season to a four week season; both shotgun and archery.

- WMD's 15-17, 20-25: open to four weeks of shotgun and bow and arrow, with a 2 bird limit.
- WMD's 26 and 28: open to four weeks of shotgun and bow and arrow, with a 1 bird limit.

Expand areas currently open or previously closed to a fall harvest, to four weeks of archery.

- WMD's 7, 10-14, 19: open to 4 weeks of bow and arrow with 1 bird limit.

Expand areas currently open or previously closed to a fall harvest, to one week of shotgun and four weeks of archery.

- WMD 18: open 1 week of shotgun and 4 weeks of bow and arrow, with a 1 bird limit.

Other considerations

- WMD 29 will be open to the spring hunt 2013 or 2014 and will be re-evaluated in three years for a fall hunt.

- The Department will work with their Information and Education staff, SAM, and the Maine Tourism Bureau to actively market and promote fall turkey hunting in Maine.

II. Spring All Day Hunting

There was a lengthy discussion on the pro's and con's of all-day hunting during the spring season. The group also discussed an increased bag limit in the spring. The group recognized there would be benefits to opening the season to an all-day hunt particularly for young hunters and working folks who can't hunt before work. Biologically, an all-day spring hunt will not significantly affect the turkey population. In other states, only about 6% of the hunters participated in the extended day (afternoon) and accounted for 3% of the total harvest. Many landowners have expressed opposition to having hunters on their property in the afternoon, in the spring in particular. Warden Service also expressed concern about having hunters out all afternoon in the spring, when many non-consumptive users are out and about and not used to having hunters out in the afternoon. The current framework is supported by the Warden Service.

The group discussed the option of maintaining a morning hunt only for the first two weeks of the season, and opening it up to an all-day hunt the last three weeks. This was not generally supported.

Recommendation:

- Maintain the current spring hunt program of 2 birds and the noon closure.
- Increase opportunity and harvest with fall hunting frameworks.
- Re-evaluate the spring season in four years, given that fact that it make take people a while to become aware of the changes to the fall season. The Working Group should re-evaluate this issue after the spring season of 2016. As with the previous Working Group recommendations, it did not want to make too many changes at one time, which would make it difficult to evaluate the effectiveness of any changes made.

The group also discussed the option to open all the remaining WMD's for spring turkey hunting. There are several benefits to opening additional WMD's to a spring harvest. Since the spring harvest does not have a significant effect on the turkey population, it could be possible to open up areas where turkey populations are still expanding. This would increase opportunity for hunters and this may be a good way to get more young hunters to participate in the sport. This spring hunt also may appease the farmers in those areas where turkeys are being reintroduced.

Recommendation:

- Kelsey will discuss opening additional areas to turkey hunting in the spring at the MDIFW regional staff meeting in May. If the group agrees we will open additional areas in 2014 based on that meeting the additions will be consider through the regular rule-making process. The remaining WMDs to consider are 1-6, 8, and 29.

III. Nuisance issues with turkeys

The group discussed the primary nuisance issues with turkeys, particularly in agricultural area and methods available to minimize damage caused by turkeys. Warden Rick LaFlamme gave and overview of the number of complaints over the past several years, and Jon Olson from the Farm Bureau discussed the complaints he hears from farmers across the state. Both individuals indicated that complaints have been consistent over the past three years, but they really have not gone down. The group recognized there will always be some level of complaints but that we should work to reduce the complaints from their current average of 65 per year (as monitored by the Warden Service).

Recommendations:

- Increase fall hunting opportunities in an effort to increase the fall harvest and potentially reduce turkey populations in areas of high turkey densities and high incidence of nuisance complaints.

- Warden Service will attend appropriate farm bureau meetings to establish relationships so IFW can better assist farmers with wildlife issues before they are at their wits end.

- Develop a document based on the Departments Animal Damage Control policy to outline an integrated approach for managing turkey damage and nuisance complaints. Include contact info for resources, as well as web sites where people can access this material. A complete document to address issues year-round that we can distribute information seasonally to farmers. Mark Caron will facilitate a subcommittee to establish this document with the assistance of Adam, Rick, Kelsey, Jon. The subcommittee will develop a schedule of press releases with messaging and directing folks to web sites. The group will develop a clear, concise product.

- Increase I & E efforts and develop social media outlets for getting the message out about how to manage turkeys. Farm Bureau has an active email list/ opportunities to communicate with 6,000 members and friends.

IV. Electronic Tagging

The group also discussed the benefits and pitfalls of electronic tagging. Other states that have electronic tagging have poor (30%) compliance with registration. Given the group is proposing several significant changes to the harvest potential they felt the data from the tagging stations is vital to our ability to manage turkeys. Tagging stations have also expressed interest in maintaining the current registration process.

Recommendations:

- Maintain the current registration system of tagging stations for wild turkeys.
- Simplify turkey registration by removing the requirement to take biological measurements.
- MDIFW will look at the current distribution of turkey tagging stations around the state and make efforts to increase the number of tagging stations in areas where stations are limited.
- Investigate the potential to reduce the registration fee from the current $5 fee to $2 per bird, with these dollars retained by the tagging agent.

The group also discussed the potential to increase the big game hunting license fee and do away with the registration fee for all big game all together. IFW would pay the registration fees ahead of time. If that is not palatable we could keep the registration fee to $2 for turkey only. The tagging stations would keep the $2.

V. Trap and Transfer

The group discussed MDIFW's current trap and transfer program.

Recommendation:

- Maintain the current trap and transfer program as a mechanism to handle nuisance issues within the regions and continue to address expansion of turkeys within the state and including Aroostook County.

Wild Turkey Working Group Meeting Minutes

February 15, 2013, 9-3

Jeff Bellmore	Maine Professional Guides Association
Rick LaFlamme	Maine Warden Service
Jon Olson	Maine Farm Bureau
Adam Vashon	USDA, APHIS, Wildlife Services
Jerry Lavigne	Sportsman's Alliance of Maine
Kelsey Sullivan	MDIFW, Wildlife Biologist, Bird Group
Jim Wescott	NWTF, State Chapter Board Member, turkey hunter
Mike Windsor	Maine Audubon
Jane Eberle	Private citizen
Mark Caron	MDIFW, Regional Biologist
Judy Camuso	MDIFW, meeting facilitator

Introductions

Judy Camuso welcomed the group and thanked everyone for their participation. The group spent a few minutes introducing themselves and their affiliation, and their interest or history with wild turkeys. The group then came up with some ground rules for conducting the meeting, and how decisions would be made. Everyone agreed it is paramount to listen to learn, and consider perspectives other than their own. The group agreed that the goal was to come to consensus on any recommendations and if consensus can't be reached, we will note where we varied. Judy outlined that the overall goal for the day was to find ways to increase wild turkey hunting opportunity and decrease nuisance turkey complaints and damage.

Judy explained that she would compile the notes and any recommendations from the meeting and bring to the Commissioner and the Division Director, and they would review them and bring any appropriate recommendations, and any modifications to the recommendations to the Fish and Wildlife Committee.

Overview/Discussion of existing conditions

Kelsey began the meeting with a brief overview of Wild Turkeys in Maine:

Maine has had a very successful restoration effort of wild turkeys. Birds were originally brought into Maine in the 1970-80's. Populations were established in York County, and then a trap and transfer program was initiated and populations expanded. The original reintroductions included 163 birds from Vermont and Connecticut and which was the same subspecies, the eastern wild turkey (*Meleagris gallapovo silvestris*) that was

originally extirpated. Jim explained that both Connecticut and Vermont birds had been reestablished with birds from PA, so technically, most of the birds actually originated in PA. Initially it was a farmer who gave permission to release turkeys on his farm. They were released in York, and immediately moved to Elliot and that is where they first established. We now have a population of approximately 60,000 birds.

Kelsey explained that the population estimate is a conservative estimate of 10 times the spring harvest (Healy and Powell 1999). This method is not corrected for hunter effort although the number of hunters has been relatively stable in the last three years. That is the method that we've used since 2006/07 and allows us to track trends. It is also used by other states that have good registration stations. IFW does conduct an August productivity count, but we have not been doing that long enough to incorporate the data.

The core population is in southern and central Maine, specifically WMD's 15, 16, 17, and 20-25. There are currently turkeys in every county including Aroostook County.

Based on our knowledge wild turkeys were historically limited to southern Maine to mid-Maine in the coastal areas, and into Hancock County. Snow depth is a thought to be a limiting factor in the original range of the species in Maine.

Currently, we have a spring hunt in 20 WMD's. After this spring, we will open up a 21st WMD to spring hunting (WMD 27). Currently, we have approximately 16,000 active turkey hunters. This includes an estimate of 2,400 youth hunters (in 2010 we stopped the requirement for youth to buy turkey permits). Also in 2010 IFW added the option to allow hunter to purchase a second turkey permit. There has been some misrepresentation of the decline of turkey hunting. Currently we sell approximately 16,000 permits to 13,000 individuals.

Costs for resident to hunt wild turkey: a big game hunting license plus a $20/permit. That permit includes a bearded bird in the spring and one bird, which can be either sex, in the fall. You can purchase a second permit (bearded bird only) in spring for an additional $20. So you can get three turkeys for $40. In 2012 we had 714 non-resident hunters. Non-residents also need a big game hunting license and the turkey permit fee is $54.

Our turkey hunters are relatively successful with about 30% of the hunters taking a turkey. Other states have a success rate closer to 14%. We have a robust, healthy population and now we are dealing with nuisance issues.

There was a question regarding how naïve Maine turkeys are? Jim Wescott explained that we don't have the same hunting pressure here in Maine, so turkeys that are hunted less are more naïve. In other states they are harder to see and attract. The hunting pressure in other area cause more reclusive behavior.

The group discussed the idea that Maine has to be more aggressive in promoting our turkey hunt. Access is not a limiting factor for additional hunting opportunities. We

discussed if the $40 permit too high. Most participants felt the fees were maybe a bit high for the resident hunter.

Another issue with attracting hunters from out of state that the group discussed was the half day hunt. What do the guides do with the clients in the afternoon? Nap, fish. Go roosting in the evening. When folks come from out of state, they are amazed at the area we have to hunt and the number of turkeys we hunt. For out of state hunters, the fees are very comparable to other states.

Of the 13,000 hunters that buy a turkey permit, only 2988 purchased a second spring permit in 2010. The first two weeks of the season, everyone is out. The last three weeks are quieter. Enforcement is more intense in the first two weeks.

Questions as to why there are not more permits being sold for spring:
Is it possible that we don't have Sunday hunting is a contributing factor? Are hunters going to other state because they can't hunt on Sunday? Farmers are very opposed to Sunday hunting, along with other groups. Many folks don't want hunters on their property on the weekends at all.

Need to continue to promote turkey hunting to youths. Maybe we need to reduce the fee for hunters to encourage more hunters. It's not necessarily the fee, it's the fee associated with the only half day hunt that is a combining factor with residents.

Nuisance issues with turkeys:

Kelsey started this discussion by explaining that there are certainly issues with turkeys causing damage, however turkeys are one of the few species of wildlife that we see. Most wildlife does damage at night and we don't see them, but the turkeys are more visible so we associate them with the damage even if another animal has actually done the damage. Nuisance wildlife is a big issue: bigger than just turkeys. Certainly there are issues with turkey damage in silage, gardens etc., but likely damage associated with wild turkeys is largely perception based.

Kelsey also gave a brief overview of the diseases associated with turkeys: again there is more than meets the eye. Turkeys don't seem to contribute to disease as much as we think. Often the problem is another reason, and the turkeys just happen to be there. The state of NH conducted a study and did not detect salmonella in over 400 turkey fecal samples. Last year MDIFW sampled 65 birds, 5 showed signs of being exposed to salmonella, but were not actively infected. There are issues no doubt, but turkeys are not the smoking gun.

The diseases we worry about most with turkeys is salmonella, EEE, and Lyme disease. MDIW had a message into Maine Medical Vector Borne Disease lab to check on their knowledge of tick/turkey issue. EEE and salmonella are two viruses that have the potential for cross over from turkeys to humans through mosquitos (EEE) and consumption if not properly processed (salmonella).

Adam Vashon has a reference on ticks/turkeys will share. Study shows that turkeys are unlikely to carry/spread ticks.

Turkeys can carry disease like avian pox, which we have seen in the state but not at high levels. This past year we had 4 dozen documented reports of birds with pox like symptoms with characteristic lesions/warts. LPDV was the actual disease. Several cases were confirmed through lab testing. LPDV is not new, and has been in the United States for a while but was not documented until 2011. As far as we know, it is not transferrable to humans but possibly communicable to poultry. Last year, we had a very mild winter (warm temperatures) and high winter survival of turkeys, which we think accounts for the higher incidence of the LPDV. Many of the reports were from harvested birds. Our policy is that if a hunter kills one, we can issue them a new permit if requested although the meat can be consumed if handled and cooked thoroughly.

Competition between deer and turkeys? There has not been anything to document that turkeys are limiting deer populations. In southern Maine we have robust populations of both turkeys and deer. If turkeys were outcompeting deer for food, deer would have smaller body size, and overall health would deteriorate, which we have not seen. Bob Humphrey has written a good article on this subject.

Warden LaFlamme gave an overview of MDIFW's procedure when we get a turkey complaint. When IFW gets a nuisance complaint (68 nuisance complaints in 2012 with Warden Service - WS) the game warden does a site visit to come up with a number of different options to resolve the issue. The goal is to accommodate the land owner either by destroying the turkeys, moving the turkeys, or harassing them to the point that they leave the area. Often when we conduct a site visit, we see damage from other wildlife as well; both deer and coyotes. IFW recognizes that biologists also get complaints that are not tracked by the Warden Service, so using a conservative estimate, given the permits/recommendations from biologists we probably see more like 120-130 complaints per year. Farmers can shoot up to three birds if they are causing damage to crops. The farmer has to notify WS. We also recognize that many farmers are just dealing with the issue on their own, without contacting the Department.

What sort of proof do they have to show damage? Tracks, pictures or other evidence of turkeys in crops etc are fine for documentation.

How are the complaints trending? According to both the Warden Service, and Jon Olson of the Farm Bureau, the number of complaints has been about the same for the past three years.

What are the natural predators for turkeys? Hawks feed on the young, along with coyote, fox, and fisher. Incubating hens and poults are the most vulnerable. Fox and coyote also prey on young and adults.

Distribution of nuisance problems? Do silage pits attract turkeys? Turkeys tend to move into silage when winter/snow conditions are tough. The birds seem to be coming from a large overall range and take advantage of this food source.

For strawberry growers the biggest problem with turkeys is when you are putting straw down on the crop to protect it during winter months. Turkeys are raking the straw off and getting at the greenery of the strawberry plant, and damage the actual. In the process they also uncover the crop and expose the plant to the winter conditions.

Most of the recorded complaints actually come in the spring (May-July), followed by fall complaints, then winter ones.

Adam Vashon commented that when you don't incorporate lethal methods, the other management tools become less effective. There are ways to control the damage but often the best time to do that is when the damage is actually occurring, and that's hard to predict and most farmers don't have a lot of spare time to monitor turkeys. Full integration of all methods available is effective, but lethal methods should be part of the package

Does chasing or killing them in one area just push them to a neighbor's farm to cause damage somewhere else? They tend to have a negative association with the negative memory of where their counterpart turkeys were killed or harassed.

There is also a need to consider the human safety issues. Wildlife droppings can be a real issue with human health standards for farmers selling their crops.

Currently, we do not have a good estimate of the crop loss due to wild turkeys.

One of the goals of the last Turkey Working Group was to decrease nuisance turkey complaints; which does not seem to have happened. What can we do or recommend? Can we encourage more lethal methods? Make it easier for farmers to reduce their damage? What is an acceptable level of complaint? Complaints are growing in Downeast and Northern Maine. In southern/central Maine complaints have stabilized.

Try to encourage more hunters in the spring on the farm. We should be encouraging folks to hunt in the fall as well. We would need a substantial increase in fall harvest to see a decrease in the wild turkey population.

Do we worry about the increased harvest impacting the non-consumptive users? Most people like turkeys but non-residents don't come to Maine to see turkeys specifically.

The group discussed the need for a technical document to help land owners manage nuisance wild turkeys. Mark Stadler was working on such a document to be incorporated into the Department's Animal Damage Complaint policy. We discussed the efficacy of a coyote decoy? They typically cost about $60-70 but are often very effective. Usually by the time the farmer calls the Warden Service they are at their wits end. They need help

fixing the problem. We don't want turkeys becoming a nuisance for the folks who are housing them. The fall season may be the best option for reducing the nuisance. NWTF estimates the population at closer to 80,000 because they feel the registration numbers are inaccurate.

Fall considerations: Increase the fall bow season (fall season to 90 days?), increase the shotgun season, and increase the fall bag limit.

We have a very valuable game species but we do not want it to become so abundant that it is considered a "trash" wildlife species.

We need to respect the opinions of the new generation farmers in southern Maine. They might be less inclined to allow hunting/killing so we may need to develop additional methods to assist many of these farmers.

There is an assumption that there is a direct relationship between the turkey population level and damage. They are probably not as closely linked as we think. There is always going to be damage and we need innovative methods to reduce turkey damage and nuisance.

Do turkeys in high numbers stress the populations biologically? Now that we have areas in the State with high densities this is becoming more of a factor in population dynamics. This is evident with the recent occurrences of the LPDV virus.

Annual wild turkey harvest is about 7,000. An accepted assumption if you harvest more than ten percent of your total population in the fall is that the population will start to start to decline. Wild turkeys have a huge capacity to reproduce and rebound. Traditionally our realized harvest has been very conservative.

The last working group (2009) set very specific goals, most of which we have achieved, but the outreach goals were a bit vague.

Recommendations:

- Increase fall harvest to attempt a reduction in turkey populations in targeted areas.

- Warden Service staff and our Landowner Relations Coordinator will attend farm bureau meetings to establish relationships so IFW can better assist farmers with issues before they are at their wits end.

- Develop a document to outline an integrated approach for managing turkey damage and nuisance complaints. Include contact info for resources, as well as web sites, where people can access this material. A complete document to address issues year round that we can distribute information seasonally with farmers. Include what farmers can do legally. Mark will facilitate a

subcommittee to establish this document with the assistance of Adam, Rick, Kelsey and Jon. Perhaps a press release, with messaging and directing folks to web sites, as well as possible mailing. Goal – produce a clear, concise product.

- Increase social media outlets for getting the message out about how to manage turkeys. The Farm Bureau has an active email list with an opportunity to communicate with 6,000 members and friends.

Trap and Transfer:

The Department is currently only releasing turkeys into Aroostook County. We put a hold on the trap and transfer this year due to the occurrence of the LPDV virus, and trying to prevent the spread of it.

In New Brunswick, they are looking to reestablish wild turkeys. They are as close as they have ever been. They've had an Environmental Assessment (EA) done and are considering a transfer program. They are looking at moving birds from Ontario, rather than from Maine, but may possibly request assistance from Maine if Ontario cannot provide enough birds. There could be an announcement of a final decision in the next few months. Initially we were approached to by NB, to provide some of our wild turkeys but now it seems they will get birds from Canada.

When MDIFW introduces turkeys into a new area, we contact all commercial farms within 20 miles of a release site and secure permission before any birds are released.

Recommendation: Maintain the trap and transfer tool to be able to deal with nuisance issues within the regions.

Spring All day Hunting

There has been a lot of support/talk about opening up the spring hunt to the whole day. An earlier recommendation was to open the last three weeks to all day hunting. Jim Westcott explained that in Virginia, about 6% of the hunters participated in the extended day (afternoon) which accounted for only 3% of the total harvest.

Biologically, MDIFW does not think an all-day hunt will have an effect on the population, and it likely will not have a realized effect on the harvest. It would allow youths and adults who can't hunt in the morning an opportunity to hunt in the afternoon. Originally, when establishing the spring hunting season, folks were apprehensive about hunting during the spring season so they opted for the half day hunt. As a result over the years, extending the spring hunting hours could have signficant social impacts. All day spring turkey hunting in Maine likely will create a number of issues for enforcement with

other conflicting outdoor activities. An afternoon hunt is more of a stop and stalk. Hunting incidents may increase. Some hunters have requested an all-day hunt. What will the pushback from the non-consumptive users be? Will folks even know?

How much effort will this actually affect? It's not an issue biologically, but are we creating a social issue to satisfy a small percentage of hunters?

Additional accidents: currently hunters are going out early morning. They often find the birds on the roosts the night before the hunt and, get land owner permission for access. Last year we had 4 incidents of turkey hunters getting shot. The likelihood of folks who are in the woods in the afternoon, who are not used to hunters being in the woods in the afternoon, increases the potential for conflict with consumptive users and non-consumptive users.

Jon Olson commented that farmers likely would rather not have hunters on their property in the afternoons.

Currently we have an 8 hour hunting day. If we extend that, birds are being hunted for 16 hours. An all-day hunt may impact the quality of the hunt, and the group could see where the extended hours could also increase the possibility of hunting accidents.

In the past the Maine Chapter of the NWTF was willing to compromise and try and go with an all-day hunt the last half of the season.

We should be increasing the opportunity for fall turkey hunting. The fall hunt has greater opportunity to address the nuisance problems.

The hunting community has not expressed a strong desire for an all-day spring hunt.

A low percentage of hunters in other states participate in the afternoon portion of the hunt.

Could we increase the bag limit in the spring to increase opportunity? Potentially could increase the opportunity for hunters without any additional impact on other users. Possibly if you increase the bag limit, you will reduce the availability of mature males (Toms) and the quality of the spring hunt in subsequent years.

The spring harvest is 86% of the annual turkey harvest throughout the northeast. The fall hunt does not have the same participation anywhere in the northeast. To attract hunters to the fall hunt, we will have to market it.

Jeff inquired if it would be possible to harvest a turkey in the fall under the small game license? Too expensive for nonresidents to buy the big game license and the permit fee= $154. Can we go to small game and still require registration? Could we develop a three day big game turkey? We could shoot more turkeys in the fall if we could provide more

opportunity to the upland bird and small game hunters with an inexpensive three day turkey permit for non-residents

Recommendation

- Leave the hunting season hours, length and bag limit the same in the spring (2 birds, ½ day) and make significant changes to the harvest and opportunity in the fall.
- Maintain the current turkey registration system.
- Re-evaluate the seasons and dates in four years, given that fact that it may take people a while to be aware of the changes in the fall season. After the changes this fall we will re-evaluate after the spring season in 2016.

Increasing hunting opportunity in the fall

Kelsey explained that currently we have triggers in the Department's Wild Turkey Management System to allow for hunting in the fall, and those numbers are based on metrics derived from the spring harvest. Any changes we make will be outside the current management system. We will still use the same triggers but change what that means (ie expanded hunting season).

Currently we have some WMDs with bow hunting only and some with bow hunting and one week of shotgun.

To curb wild turkey population growth we will need to harvest 10% of the population. We are well under our allowable harvest in all WMD's where we have a turkey season.

Based on our data we could increase the number of weeks of bow, and shotgun seasons. On average we are currently harvesting less than 20% of the potential allowable harvest.

If we want to be conservative, we would not go beyond the maximum sustained yield, but if we want to impact/decrease the population in certain areas we should try to exceed the maximum allowable harvest.

Kelsey stated that we hope to have WMD 27 open for a spring season this year for the first time.

We have potential conflict with opening the fall dates up for the entire month of October with the opening day of youth hunting for White-tailed deer.

From an enforcement perspective, the only folks who should be hunting on youth day are youths.

The group recommended we expand the hunting season to the entire month of October (with the exception of youth day). If we need or want to expand into November, we

could consider that in three years. There is strong resistance to having turkey hunters in the woods with deer hunters for many reasons.

Recommendations

- Permit would include 1 bird in the spring and 2 in the fall for the $20 permit fee, and maintain the $20 for the additional permit in the spring. The spring hunt is a premier hunt and we don't think the additional bag limit/opportunity in the fall will impact the additional revenue from the second permit.

- WMD's 15,16,17, 20-25 we will open to one month shotgun and bow and arrow with a 2 bird limit.
- WMD's 26 and 28 we will open to one month shotgun and bow and arrow with a 1 bird limit.
- WMD 18, we will open to 4 weeks of bow and arrow, 1 week shotgun with a 1 bird limit.
- WMD's 7, 10-14, 19 we will open to 4 weeks of bow and arrow with 1 bird limit.
- WMD 29 will be open to the spring hunt 2013 or 2014 and will be re-evaluated in three years for a fall hunt.

The group discussed if we should recommend that MDIFW open the WMD's in all the districts where turkeys are for a spring hunt? There are several benefits: in addition to the population issues, we are trying to get young people out into the woods and work on habitat management issues. The spring hunt may appease the farmers in those areas where turkeys are being reintroduced and will increase opportunity for hunters in new areas.

Recommendation: Kelsey will discuss opening new areas to hunt in the spring at the IFW regional staff meeting to discuss turkey and furbearers in May. If the group agrees we will open new areas in 2014 based on that meeting and will go through the regular rule making process.

Electronic tagging: compliance with electronic tagging in New York state is about 30% for turkeys. Most everyone agrees that we still need the complete registration system data, particularly given the potential changes in the harvest. There are both biological reasons and enforcement reasons to continue to register turkey with the Department's current system.

The Department needs to communicate the message to the registration stations that info on spur, weight etc. is not necessary. The last iteration of the tagging books did not include those fields. IFW will look at turkey tagging stations around the WMD's with a harvest, and try to get more tagging stations that can tag turkeys.

The group discussed the prospect of eliminating the registration fee all together and increasing the permit fee? We would pay the tagging stations ahead of time, a nominal

fee. Perhaps this would encourage more folks to register. We shouldn't penalize the successful hunter.

The group also discussed the potential to increase the big game hunting license fee and do away with the registration fee for all big game all together. IFW would pay the registration stations ahead of time. If that is not palatable we could keep the registration fee to $2 for turkey only. The tagging stations would keep the $2.

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Experimental Studies of Interactions Between Wild Turkeys and Black-Legged Ticks

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ABSTRACT: Wild turkeys are increasing in abundance and distribution in eastern North America, but their potential role as hosts for ticks, or as predators on ticks, is unknown. We performed two experiments, one to determine whether juvenile black-legged ticks (*Ixodes scapularis*) feed successfully on turkeys, and the other to determine if turkeys depredate adult black-legged ticks in forest habitats. Of 550 larval ticks placed directly on 5 captive wild turkeys, none engorged and only 7 (1.3%) were recovered; the remainder apparently were consumed during preening. Of 165 nymphal ticks placed on the turkeys, 5 engorged and 8 unengorged ticks were collected; 152 (93.3%) were apparently consumed. Of 250 adult ticks introduced into forest enclosures exposed to turkey foraging, 89.5% were recaptured, which was not significantly different from the 92.2% recaptured in control enclosures from which turkeys were excluded. We conclude that wild turkeys are unlikely to host juvenile black-legged ticks in nature, and that turkey foraging is unlikely to reduce local density of adult ticks.

Keyword Index: Host, Lyme disease, parasite-host interactions, vector.

INTRODUCTION

Historically, the wild turkey (*Meleagris gallopavo*) was an abundant member of vertebrate communities within forests and grasslands of eastern and central North America (Healy 1992). However, this species was decimated throughout its historical range during the 18th through early 20th centuries as a result of hunting and habitat destruction (Kennamer et al. 1992). Regrowth of forests following deforestation, combined with reintroductions, transplantations, and subsequent population growth and dispersal of the birds, has resulted in rapid increases in both density and range of this species. Between about 1930 and 1990, the turkey population in the eastern United States and southeastern Canada increased from extreme scarcity to more than 2.5×10^6 individuals, which may equal or exceed the abundance they maintained in precolonial times (Kennamer et al. 1992).

Regrowth of eastern forests and the consequent expansion of populations of other vertebrates, most notably white-tailed deer (*Odocoileus virgianus*) and white-footed mice (*Peromyscus leucopus*), have resulted in the emergence of Lyme disease, a zoonotic disease transmitted by tick vectors (*Ixodes* spp.) (Barbour and Fish 1993, Ostfeld 1997). Forest floor vertebrates play key roles in the Lyme-disease epizootic both as hosts for ticks and as sources from which feeding ticks obtain the bacterium (*Borrelia burgdorferi*) that causes the disease (Lane et al. 1991, Piesman and Gray 1994). Because wild turkeys are abundant, large, and active on the forest floor where ticks seek hosts, this species may interact strongly with *Ixodes* ticks. If turkeys serve as hosts for ticks or as reservoirs of Lyme-disease bacteria, they may enhance the density and infection prevalence of the ticks, thus increasing risk of human exposure to Lyme disease. Alternatively, if turkeys consume the ticks they encounter while foraging, they may reduce tick density and hence disease risk. We are not aware of any studies on trophic interactions between turkeys and *Ixodes* ticks. To evaluate the possibility that turkeys may influence the abundance or infection prevalence of ticks, we undertook a study to determine experimentally whether and how these species interact.

In summer and autumn 1998, we conducted two experiments on trophic interactions between turkeys

and black-legged ticks (*Ixodes scapularis*—formerly *I. dammini*), the primary vector of Lyme disease in eastern and central North America. In the first experiment, we sought to determine whether turkeys are suitable hosts for juvenile ticks. If so, our intention was to determine whether turkeys are a competent reservoir for *Borrelia burgdorferi*. In the second experiment, we asked whether turkeys depredate unfed adult ticks and consequently reduce their abundance within local areas.

MATERIALS AND METHODS

Experimental Animals

Five yearling female eastern wild turkeys were obtained in June 1998 from Quattro's Game Birds in Pleasant Valley, NY. The breeding stock consisted of 10th generation turkeys originating from wild-caught birds native to Wisconsin, and was bred periodically with wild stock captured in Massachusetts. These birds were hatched in incubators and raised in large groups. We housed the five birds together in a 2m wide by 5m long by 2m high coop made of welded wire on a wood frame and containing a wooden perch and rain shelter. The coop was placed in a native old-field at the Institute of Ecosystem Studies in Millbrook, NY, ~500m from the experimental forest plots (see below). Turkeys were supplied with commercial turkey feed, scratch grain, and water ad lib.

Host-seeking ticks (*Ixodes scapularis*) were obtained for both experiments by dragging a 1 m^2 piece of white corduroy cloth in a forested site ~3 km from the experimental site. Ticks were placed in glass vials with moistened plaster of paris, and were used within five days of collection. The same collection and maintenance procedure in prior experiments resulted in high feeding success of larval ticks on two species of *Peromyscus* mice (Hazler and Ostfeld 1995).

Experiment I - Turkeys as Hosts for Ticks

The primary purpose of this experiment was to determine whether juvenile (larval and nymphal) black-legged ticks can feed successfully on turkeys. In the initial phase, we used nymphal ticks known from our prior studies at this site to have a 30-40% infection prevalence with Lyme-disease bacteria (R. S. Ostfeld, unpublished data). If nymphal ticks fed successfully, our secondary purpose was to determine using xenodiagnosis the probability that uninfected larval ticks feeding two weeks later would acquire the bacteria.

In August 1998, we placed 27 nymphal *I. scapularis* ticks on each of the five turkeys. While the birds were restrained, ticks were placed on the nape of the turkeys' necks with a fine brush. The nape of the neck was used to reduce the possibility that turkeys would immediately remove ticks by preening. The turkeys were then held individually for five days (125 hours) in wire-mesh cages (40 cm wide by 56 cm long by 80 cm high) that were suspended over tubs of water. Cages were covered by plastic tarps for protection and shading. The turkeys had ad lib access to food and water through a 10 cm by 15 cm opening in the front of each cage. The tubs of water beneath cages were examined for fed or unfed ticks once each day for five days. We used a five-day criterion because juvenile ticks may require up to a day to attach and typically remain attached to hosts for about three days (Lane et al. 1991, Ostfeld 1997). After a two-week resting period, we placed 110 larval and 6 nymphal *I. scapularis* on each turkey (again, on the nape of the neck), returned the turkeys to their individual cages, and repeated the daily collection procedure for seven days (168 hours).

Experiment II - Turkeys as Predators on Ticks

The purpose of this experiment was to evaluate the effectiveness of turkeys as predators on adult *I. scapularis* in a natural forest habitat. We used adult ticks because this largest life stage (ca 2 mm long in *I. scapularis*) is the most likely to be visible and attractive to turkeys as food. To this end, we established six 10 m by 10 m enclosures in a mature oak forest site about 500 m from the turkey coop. The oak forest sites are described thoroughly in Ostfeld et al. (1995, 1996a). Enclosures were arranged as three blocks with 30-100 m between blocks and 15 m between the two enclosures within each block. Enclosures were constructed of plastic snow-fencing 2.5 m high that was supported at the corners by stapling the fence to tree trunks. For each pair of enclosures within a block, we used a coin toss to determine which would be the experimental (with turkeys) and control (no turkeys) unit.

We performed a pilot experiment in October 1998, in which we introduced 50 adult ticks (1:1 sex ratio) into the center of one of the experimental enclosures and allowed them to acclimate for 15 hours. We then introduced two turkeys into the enclosure and left them undisturbed for eight hours. The turkeys were then placed individually in cages suspended over water for 48 hours (see methods for Experiment 1) to determine whether any of the ticks had parasitized the turkeys. We then estimated the number of ticks that remained in the forest plots using a standard drag-sampling technique (e.g., Falco and Fish 1992). We exhaustively sampled the forest floor of both experimental and control enclosures by dragging a 1 m^2 corduroy cloth in concentric circles, checking the cloth for ticks every 10 paces. Because recovery rates were low, we followed

the pilot experiment with an additional experiment using carbon dioxide-baited tick traps (Falco and Fish 1992) in addition to drag-sampling.

We performed the full experiment in early to mid November, 1998, which is the time of peak activity of adult ticks at our sites (Ostfeld et al. 1996a,b). We placed 100 adult ticks (1:1 sex ratio) in the center of each of the six enclosures and allowed them to acclimate for 15 hours. We then released two turkeys into each of the three experimental enclosures and left them undisturbed for 8 hours per day for the following two days (16 hours total). Immediately following the 16 hours of foraging, the birds were placed in individual cages suspended over water for 48 hours to collect any ticks having parasitized the turkeys. The morning after turkey removal, three CO_2-baited tick traps were placed 2.5 m from the center of each enclosure, with at least 4.5 m between adjacent traps. Each trap was charged with ~1 kg of dry ice and was checked after seven hours. Immediately after the traps were checked, we drag-sampled the entire plots to collect any remaining ticks. We also drag-sampled the outer perimeter of the enclosures to determine whether any ticks had escaped. The following day the tick traps were recharged and the trapping and dragging procedures were repeated. We repeated this entire process in all six enclosures one week later. To be conservative in our analysis, we did not consider the repetitions of the tick introductions to be experimental replicates. Instead, we used a paired t-test with the presence or absence of turkeys as the independent variable, the experimental and control enclosure within a block comprising the pairs (N = 3 pairs), and the total number of ticks recovered in the two introductions as the dependent variable.

RESULTS

Experiment I - Turkeys as Hosts for Ticks

Very few larval or nymphal *Ixodes scapularis* ticks were recovered from the turkeys. Of the initial 27 nymphs placed on each of the five turkeys (135 ticks altogether), only six (4.4%) were recovered. On average, 1.20 (0.74 (SE; range 0-4) ticks per bird were recovered after 125 hours. Of the six nymphs that were recovered, four were engorged and two were unfed; the four engorged nymphs all came from one of the birds.

Of the 110 larvae and six nymphs placed on each turkey in phase two (580 ticks altogether), only 15 ticks (2.6%) were recovered after 168 hours. None of the 550 larvae engorged; all seven of the larvae recovered were unfed (mean = 1.40 ± 1.17 larvae per bird). Of the eight nymphs that were recovered, only one was engorged (TABLE 1). A thorough visual examination of one of the turkeys immediately following the seven days over water pans revealed no ticks. Because of the low success rate in feeding nymphs to repletion on the birds, and because no engorged larvae were recovered, we could not conduct a xenodiagnosis to test for the reservoir competence of wild turkeys.

Experiment II - Turkeys as Predators on Ticks

Turkeys were ineffective predators on adult *I. scapularis* ticks. On average, 179 adult ticks were recovered from the three forest enclosures in which turkeys foraged, compared to 184 ticks in the control enclosures (paired t-test, $t = -0.23$, $P = 0.84$; Fig. 1). The proportion of introduced ticks recovered after 16 hours of access by turkeys was 89.5% in experimental enclosures (with turkeys) and 92.2% in the turkey-free controls. No ticks were recovered from the turkeys during the 48 hours they were held over water immediately following the experiments.

DISCUSSION

Results of Experiment I suggest that wild turkeys are a poor host for juvenile *Ixodes scapularis* ticks, and are likely to be parasitized only rarely in nature. In the first phase, only four (3.0%) of 135 nymphs placed on turkeys fed to repletion, and in the second phase, only

TABLE 1. Recovery of juvenile *Ixodes scapularis* ticks placed on five captive wild turkeys held individually over collecting pans of water.

Tick Life Stage	Number of Ticks Introduced	Number (%) of Engorged Ticks Recovered	Number (%) of Unengorged Ticks Recovered	Total Number (%) of Ticks Recovered
Larval	550	0 (0)	7 (1.3)	7 (1.3)
Nymphal	30	1 (3.3)	7 (23.3)	8 (26.7)

one (3.3%) of 30 nymphs and none of 550 larvae fed to repletion. The low recovery rates for ticks in either an engorged or unengorged state strongly suggest that the ticks we placed on turkeys were preened off and swallowed by the hosts. The ticks had no other route of escape. Casual observations revealed that the turkeys commonly autopreened and allopreened while housed in the coop; however, observations of the birds while they were held in individual cages were prevented by protective tarps surrounding the cages. Grooming behavior is known or suspected to be responsible for reductions in infestation rates by ixodid ticks on other hosts (Ostfeld et al. 1993, Sonenshine 1993).

Ixodes scapularis ticks are known to parasitize dozens of species of vertebrate hosts, including several species of ground-dwelling songbirds (reviewed by Lane et al. 1991, Fish 1993, Tälleklint 1996). However, we are not aware of any studies reporting *I. scapularis* parasitizing *M. gallopavo*. Davidson and Wentworth (1992) reviewed studies of ectoparasites on turkeys, and reported the occurrence of three species of other ixodid ticks and one species of argasid on wild turkeys in the southeastern United States. The poor performance of these ticks on turkeys, and the likelihood that they were consumed during autopreening, suggests that continued range expansion and population growth of wild turkeys will not increase the number of feeding opportunities for questing *I. scapularis*.

Captive wild turkeys in our forest enclosures did not reduce abundance of adult *I. scapularis*, nor did the ticks parasitize the turkeys during their foraging bouts. Prior studies with the same individual turkeys in the same forest enclosures revealed that the turkeys spent much of their time in the enclosures feeding, and that they consumed substantial numbers of tree seeds experimentally introduced into the enclosures (F. Keesing, E. Brownold, and R. Ostfeld, unpublished data). In both prior and current studies, turkeys began pecking and scratching at the forest floor within several minutes of being introduced into enclosures (D. Lewis and R. Ostfeld, pers. obs.). Therefore, the lack of removal of adult ticks was not caused by a lack of foraging effort. We tentatively conclude that natural populations of turkeys are unlikely to reduce population size of questing adult *I. scapularis* through predation. Because both turkeys and ticks occur naturally in aggregations (Ostfeld et al. 1996a, Lewis and Ostfeld, pers. obs.), it remains possible that turkey flocks may encounter and depredate clumps of ticks.

Natural enemies of ticks appear to be common (Carroll 1995, Hu et al. 1993, Samish and Rehacek 1999, Zhioua et al. 1995), although their impacts on tick populations are poorly understood. Duffy et al. (1992) found that helmeted guineafowl (*Numida meleagris*) reduced abundance of adult *I. scapularis* ticks on grass lawns. However, this species of tick is substantially more abundant in forests than on lawns (Adler et al. 1992, Maupin et al. 1991, Ostfeld et al. 1995). Although >40 species of birds are reported to feed on ticks, evidence suggesting regulation of tick populations by birds is scarce (Samish and Rehacek 1999). Further studies of the regulatory capacity of birds and other predators and pathogens on ticks are warranted.

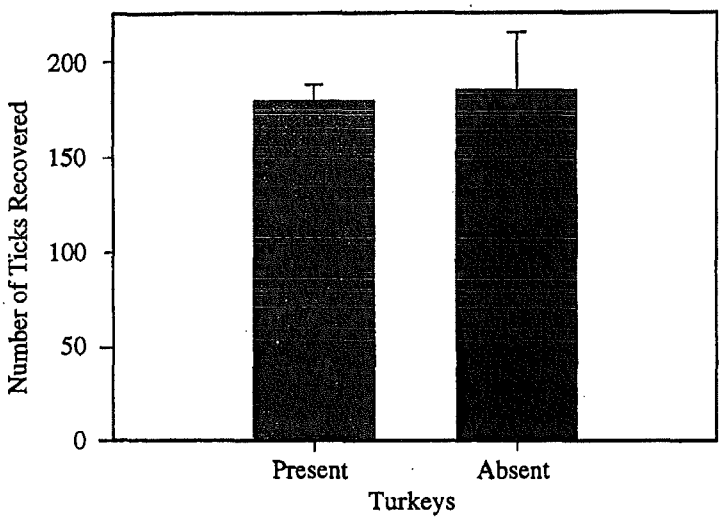

Figure 1. Number (+1 SE) of adult *Ixodes scapularis* ticks recovered using CO_2-baited traps and cloth drag-sampling inside 10m by 10m forest enclosures. Three replicates (experimental enclosures) had turkeys present for 16 hours over two days, and three (controls) had no turkeys.

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WILD TURKEY (*MELEAGRIS GALLOPAVO*) AS A HOST OF IXODID TICKS, LICE, AND LYME DISEASE SPIROCHETES (*BORRELIA BURGDORFERI* SENSU LATO) IN CALIFORNIA STATE PARKS

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ABSTRACT: Rio Grande wild turkeys (*Meleagris gallopavo intermedia*) were evaluated as potential hosts of ixodid ticks, lice, and Lyme disease spirochetes (*Borrelia burgdorferi* sensu lato [s.l.]) in three state parks in Sonoma County, California, USA, during 2003 and 2004. In total, 113 birds were collected, 50 (44.2%) of which were found to be infested by 361 ixodid ticks representing three species: the western black-legged tick (*Ixodes pacificus*, $n=248$), the rabbit tick (*Haemaphysalis leporispalustris*, $n=112$), and one American dog tick (*Dermacentor variabilis*). Year-round the prevalence of all ticks combined was unrelated to the age or sex of turkeys, and the prevalence of infestation by *I. pacificus* (35.4%) was significantly higher than it was for either *H. leporispalustris* (14.2%) or *D. variabilis* (0.9%). The proportion of the two prevalent tick species differed significantly by life stage with 86.3% of the *I. pacificus* and 82.1% of the *H. leporispalustris* enumerated being nymphs and larvae, respectively. Three species of lice were collected, including the chicken body louse *Menacanthus stramineus* (12.5% of total), *Chelopistes meleagridis* (37.5% of total), and *Oxylipeurus polytrapezius* (50% of total). The records for all three ticks are the first ever from wild turkeys, and those for the lice are the first from this host in the far-western United States. Wild turkeys potentially were exposed to the feeding activities of *I. pacificus* nymphs infected with *B. burgdorferi* s.l. as 15% of host-seeking nymphs ($n=200$) collected in woodlands used by turkeys as roosting or foraging areas were infected mainly with *B. burgdorferi* sensu stricto (s.s.). However, only one (1%) of 90 turkey blood specimens tested by PCR contained *B. burgdorferi* s.s., and four in vitro, complement-protein assays demonstrated that domestic turkey serum is moderately bacteriolytic for this spirochete. Taken together, these findings indicate that wild turkeys are important avian hosts of *I. pacificus* nymphs, but they appear to be inconsequential hosts of *B. burgdorferi* s.l.

Key words: *Borrelia burgdorferi*, complement, ixodid ticks, lice, wild turkey.

INTRODUCTION

Wild turkeys (*Meleagris gallopavo*) from Mexico apparently were first introduced into California in 1876 (Gardner et al., 2004), and more than 8,000 turkeys were released into the state during the 20th century (Charlton, 2000). Wild turkeys currently are established in an area comprising approximately 75,545 square kilometers or nearly 19% of California's landscape, and the statewide population recently was estimated to be 242,000 birds (Gardner et al., 2004). The wild turkey has become a highly valued game bird in mixed oak and pine woodlands throughout much of California, and in 2003 an all-time high of roughly 25,000 birds were harvested by about 37,000 hunters during the combined spring and fall seasons.

Despite their contemporary popularity as a game species, a review of the literature published since 1950 revealed that little has been reported about their associated microparasites (e.g., *Mycoplasma* spp., pox virus) and nothing about their macroparasites (e.g., ticks or lice), in the far-western United States (Jessup et al., 1983; Lutz and Crawford, 1987; Charlton, 2000). Most of what is known about the parasites of wild turkeys is based on research conducted in the eastern United States (Davidson and Wentworth, 1992). Furthermore, wild turkeys have not been examined heretofore as either hosts, or reservoir hosts, for the bacterial agent

of Lyme disease, *Borrelia burgdorferi* sensu stricto (s.s.), in North America. Host, as used herein with respect to *B. burgdorferi* s.s., merely denotes a vertebrate species that may become infected naturally with this bacterium. In contrast, a reservoir is a proven natural host of a vector tick, serves as a source of infection for uninfected ticks that feed on it, and amplifies the number of infected ticks in a given area (Kahl et al., 2002).

In 2003, a study was initiated to determine the status, food habits, and other biologic parameters of Rio Grande wild turkeys (*M. gallopavo intermedia*) in three Sonoma County state parks: Annadel State Park (ASP), Jack London State Historic Park (JLSP), and Sugarloaf Ridge State Park (SRSP). Wild turkeys first appeared in these parks around 1992 and became sufficiently abundant by 2002 to arouse concern that this nonnative bird was disrupting park ecosystems by negatively impacting native plants or animals (Barrett, unpubl. data). As one component of the study, we evaluated the capacity of turkeys to serve as a host of ticks, lice, and borreliae belonging to the *B. burgdorferi* sensu lato (s.l.) complex, particularly the human pathogen *B. burgdorferi* s.s.

Lyme disease is endemic in Sonoma County, and adults of the primary regional tick vector, the western black-legged tick (*Ixodes pacificus*), have been found infected naturally there (Burgdorfer et al., 1985). The reported incidence of Lyme disease in Sonoma County was within the range of 1.0 to 5.0 cases per 100,000 person-years between 1990 and 2000 (Fritz and Vugia, 2001). Our specific objectives were to determine the seasonal distribution and abundance of ixodid ticks infesting wild turkeys in these parks, especially ASP, over a 1-yr period; to ascertain what species of lice also parasitize turkeys; to determine if host-seeking *I. pacificus* nymphs inhabiting leaf litter/fir-needle areas at ASP are infected with *B. burgdorferi* s.l.; and to discover by laboratory bioassays if turkeys could serve as natural hosts of *B. burgdorferi* s.s.

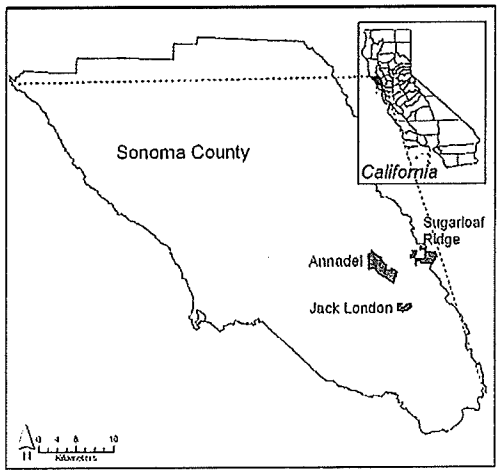

FIGURE 1. Map of Sonoma County, California, USA, showing locations of Annadel State Park, Jack London State Historic Park, and Sugarloaf Ridge State Park.

MATERIALS AND METHODS

Study areas

Turkeys were collected from ASP (n=97, 85.8% of total), SRSP (n=12, 10.6%), or JLSP (n=4, 3.5%) in east-central Sonoma County, California, USA (Fig. 1). Because the borders of all three parks are located within a radius of ~4.1 km, their populations of turkeys are treated here as a metapopulation. The principal study area, ASP (38°25′53″N, 122°36′49″W), is a 2,023-ha multipurpose, heavily used recreational area located on the eastern outskirts of the city of Santa Rosa (population, ~156,000). The topography is characterized by rolling hills with grassland, woodlands, meadows, intermittent streams, and a 10.5-ha lake. At least 14 vegetative types are present with Douglas fir (*Pseudotsuga menziesii*), California black oak (*Quercus kelloggii*), grassland, California bay (*Umbellularia californica*), coast live oak (*Quercus agrifolia*), and common manzanita (*Arctostaphylos manzanita*) comprising most of the ground cover (Barrett et al., 1988). The climate is Mediterranean with cool, moist winters and hot, dry summers. Rainfall occurs largely in winter and early spring, and averages about 762 mm per year.

To the east of ASP, SRSP (38°26′26″N, 122°29′43″W) encompasses 1,093 ha of oak

woodland, chaparral, meadows, and redwood (*Sequoia sempervirens*). To the southeast, JLSP (38°21′25″N, 122°32′31″W) consists of 324 ha of grassy meadows and mixed forests composed of Douglas fir, oaks, Pacific madrone (*Arbutus menziesii*), coast redwood, and manzanita and a 2-ha lake.

Turkey collections

Turkeys were collected monthly from 30 September 2003 to 9 September 2004 by shooting with a .22-caliber rifle in accordance with collecting permits issued by the California Department of Parks and Recreation, the California Department of Fish and Game, and in compliance with procedures approved by the Animal Care and Use Committee at the University of California, Berkeley. Permission was obtained to collect up to 12 turkeys per month.

Birds were processed in the field after a postmortem interval of approximately 0.25 hr to 3 hr. The age (juvenile or adult), gender, weight, and standard ornithologic measurements were recorded for each bird, and all birds were inspected cursorily for presence of ticks. Any ticks found were stored in 95% ethanol for later specific identification. Blood was withdrawn from the jugular vein, the heart, or an internal blood vessel with a 27 g 1/2 inch needle (Becton Dickinson, Franklin Lakes, New Jersey, USA) and injected into a 4- or 5-ml vacutainer tube containing EDTA (Becton Dickinson). Next, the head of each bird was cut off at the base of the neck and placed into a labeled plastic bag on wet ice. In the laboratory, the blood samples and heads were frozen until they could be tested by PCR (blood) or carefully inspected for ticks and lice (heads and necks).

After thawing, the turkey heads were examined for lice as well as ticks for ≥10 min with a dissecting microscope at a magnification of 13×. The plastic bags in which the heads were frozen also were inspected for presence of ticks or lice. The specific location of attached ticks on the head or neck was noted, and all ectoparasites found were preserved in 95% ethanol for subsequent taxonomic determination. Ticks were identified to species with a dissecting microscope at magnifications up to 90× using Furman and Loomis (1984) and an unpublished key to immature ixodid ticks (Kleinjan and Lane, unpubl. data), and voucher specimens were deposited in the collection of R.S.L. Lice were slide mounted and identified with a compound microscope at magnifications ranging from 40× to 400× using several taxonomic works (Clay, 1938; Price and Graham, 1997; Price et al., 2003), and by comparison with reference specimens in the collections of the Natural History Museum, London, and the Smithsonian Institution, Washington, D.C. Voucher specimens have been deposited in the Natural History Museum (London).

Collection of questing *Ixodes pacificus* nymphs

On 8 May 2004, host-seeking *I. pacificus* nymphs were collected from fir-needle/leaf-litter areas beneath two turkey-roosting sites and two foraging areas at ASP. Two of us used standardized flannel tick-drags, 1 m by 1.25 m, to sample each site for 1 hr apiece. Sampling at sites 1–4 was begun at 11:30 AM, 2:00 PM, 3:12 PM, and 4:51 PM, respectively. The predominant tree species at all sites were Douglas fir and California bay with lesser elements of coast live oak and madrone. Besides leaf or fir-needle litter, the ground at each site contained a variable amount of branches and tree limbs. All ticks found were preserved in 95% ethanol and identified as described above. Fifty nymphs obtained from each site were assayed for borrelial infection by PCR.

DNA extraction and PCR

Blood specimens from turkeys were stored in 4- or 5-ml EDTA tubes at −20 C, and ticks were stored in 95% ethanol, prior to DNA extraction. DNA was extracted from 10 µl of turkey blood and the entire bodies of ticks using the DNeasy Tissue Kit (QiaGen, Chatsworth, Massachusetts, USA) according to the manufacturer's instructions. Our total DNA extraction protocol requires 5–10 µl of bird blood to yield ~20 µg to 100 µg of DNA. DNA from blood samples and ticks was eluted in final volumes of 200 µl and 100 µl of AE buffer, respectively.

Presence of borreliae was determined by PCR using primer sets targeting the 5S–23S rRNA intergenic spacer region (Lane et al., 2004). PCR assays used 3 µl of each DNA extract as a template in a total reaction volume of 25 µl. All PCR mixtures contained 2.5 µl of 10× PCR buffer (Applied Biosystems, Foster City, California, USA), 2.5 µl of 8 mM dNTP, 1.5 µl of 25 mM $MgCl_2$, 1 µl of 10 µM primers, and 0.2 µl of 5 unit/µl *Taq* polymerase (Applied Biosystems). Cycling conditions involved an initial 4 min denaturation at 94 C followed by amplification cycles, each consisting of a 40-sec denaturation at 94 C, a 40-sec annealing at 52–58 C, and a 1-min extension at 72 C. These cycles were followed by a 10-min extension at 72 C. Positive

controls (CA4 strain) and negative controls (autoclaved distilled water) were included in each run.

Sequence alignment and phylogenetic analysis

Positive amplicons were characterized by sequence analysis of the 5S–23S rRNA intergenic spacer region. The amplicons were purified with the Qiaquick PCR Purification Kit (QiaGen, Valencia, California, USA). Each 10-µl cycle sequencing reaction contained 6.5 µl of PCR-grade water, 0.5 µl of Big Dye Terminator Ready Reaction Mix (Applied Biosystems), 0.5 µl of 3.2 µmol of the primer that was used to produce the PCR product, 1.5 µl of 5× Sequencing Dilution Buffer (Applied Biosystems), and 1 µl of purified PCR product. All cycle-sequencing products were purified with Sephadex Centri-Sep columns (Edge Biosystems, Gaithersburg, Maryland, USA) and run on an ABI 3100 (Applied Biosystems).

Complement sensitivity

To determine if turkeys could serve as reservoir hosts of Lyme disease spirochetes, the sensitivity of *B. burgdorferi* s.s. isolate CA4 to complement proteins present in domestic turkey serum was determined. To that end, four in vitro serum assays were performed in 96-well microtiter plates (Dynatech Laboratories & Co., Chantilly, Virginia, USA) as described previously (Kuo et al., 2000), that is, untreated (preimmune serum), heat treated (56 C for 30 min), EDTA treated (10 mM), and EGTA treated (10 mM) with $MgCl_2$ (4 mM). Each well contained a final volume of 100 µl, 50% of which was either treated or untreated serum and the remainder BSK-II culture medium containing viable spirochetes. The survivability of spirochetes was determined with a Petroff-Hausser counting chamber (Hausser Scientific Co., Horsham, Pennsylvania, USA) at 1 and 2 hr postinoculation by examining the viability of 100 individual spirochetes in each of 10-µl aliquots. Spirochetes were considered dead if they were nonmotile or lysed. Spirochetes were inoculated into BSK-II culture medium as a positive control, and into preimmune serum from a western fence lizard (*Sceloporus occidentalis*), which previously had been demonstrated to be highly bacteriolytic for *B. burgdorferi* s.s. (Lane and Quistad, 1998; Kuo et al., 2000).

Blood specimens were drawn from four Nicholas large white domestic turkeys at the Nicholas Turkey Breeding Farms in Sonoma, California, USA. All birds were males 17 wk of age. Although their feed had been medicated with an antiprotozoal drug (amprolium hydrochloride) during the first 6 wk to 8 wk of life, none of them had been treated with antibiotics or exposed to vector ticks (Dr. Yan Ghazikhanian, pers. commun.) The blood samples were transported to the Berkeley campus on wet ice, refrigerated at 4 C for several hours, centrifuged and then the sera were removed and stored at −80 C prior to testing.

Statistical analyses

All prevalence data were evaluated in either 2×2, or 2×4, chi-square contingency tables. A probability value of 5% was set for rejection of the null hypothesis.

RESULTS

Tick infestations

In total, 113 turkeys were collected including 69 males and 44 females; of these, 25 were juveniles and 88 adults. Significantly fewer females ($n=2$) than males ($n=21$) ($P=0.009$), and more adults ($n=22$) than juveniles ($n=1$) ($P=0.075$), were collected in fall. Most adults were males (61/88), whereas the majority of juveniles were females (17/25, $P=0.0007$).

Fifty (44.2%) turkeys were infested by 361 ixodid ticks representing three species; these included 248 western blacklegged ticks (*I. pacificus*), 112 rabbit ticks (*Haemaphysalis leporispalustris*), and one American dog tick (*Dermacentor variabilis*) (Table 1). Ignoring season, the prevalence of all ticks combined was unrelated to the age ($P=0.16$) or sex of turkeys ($P=0.86$). Most ticks (290/361, 80.3%) were found on the head or neck during the ≥10-min laboratory inspections; the remainder were collected during the cursory field inspections. Attached ticks ($n=101$, 28.0% of total) were distributed almost equally on the head (53) and neck (48) regions. Among those affixed to the head, 83% were found on the crown ($n=23$, 43.4%), around the eye ($n=11$, 20.8%), and on the auricular ($n=10$, 18.9%). Low percentages were removed from the dewlap (5.7%), snood (5.7%), around the mandibles (3.8%), or in the suborbital region (1.9%).

TABLE 1. Prevalence and abundance of ixodid ticks on 113 wild turkeys collected from September 2003 to September 2004, Sonoma County, California, USA.

Tick species by stage	No. ticks collected (no. birds infested)	Prevalence of infestation (%)	Mean per bird±SD	Mean intensity (range)
Ixodes pacificus				
Larva	33 (15)	13.3	0.29±1.12	2.2 (1–10)
Nymph	214 (38)	33.6	1.89±12.24	5.6 (1–130)
Adult	1 (1)	0.9	0.01±0.09	1.0
Total	248 (40)	35.4	2.19±12.45	6.2 (1–131)
Haemaphysalis leporispalustris				
Larva	92 (10)	8.8	0.81±5.50	9.2 (1–55)
Nymph	20 (8)	7.1	0.18±0.86	2.5 (1–7)
Total	112 (16)	14.2	0.99±5.61	7.0 (1–55)
Dermacentor variabilis				
Adult	1 (1)	0.9	0.01±0.09	1.0
Totals	361 (50)	44.2	3.19±14.13	7.2 (1–138)

The prevalence of infestation by *I. pacificus* (35.4%) was significantly higher than it was for *H. leporispalustris* (14.2%) ($P=0.0004$) or *D. variabilis* (0.9%) ($P\leq0.0001$). Seven (14.0%) of the infested birds were co-infested with *I. pacificus* and *H. leporispalustris*. The proportion of the two most prevalent tick species differed significantly by life stage ($P\leq0.0001$). Specifically, 86.3% of the *I. pacificus* were nymphs, whereas 82.1% of the *H. leporispalustris* were larvae (Table 1). Two turkeys contributed about one half of all the *I. pacificus* or *H. leporispalustris* obtained from all birds. A juvenile female collected at ASP on 19 May 2004 was parasitized by 131 *I. pacificus* (1 larva, 130 nymphs) and seven *H. leporispalustris* nymphs. This bird was the lightest (2,950 g) of nine juvenile females (mean±SD=3,722±446; range, 2,950–4,200 g) taken at ASP in spring 2004. An adult female collected at ASP on 17 August 2004 was parasitized by 55 *H. leporispalustris* larvae. The weight of this bird (3,750 g) was slightly higher than the average weight (mean±SD=3,514±273; range, 3,250–4,000 g) of seven adult females collected at ASP in summer 2004.

Larvae and nymphs of *I. pacificus* were present on turkeys in winter and spring but were most prevalent in spring (Fig. 2A). The nymphs also occurred on birds in summer, but neither life stage was found on birds in fall. One *I. pacificus* female was removed from a turkey in spring. Larvae of *H. leporispalustris* infested turkeys in summer and fall, especially the former, whereas nymphs were found on low percentages of birds taken in spring, summer, and fall (Fig. 2B). The prevalence of *I. pacificus* and *H. leporispalustris* larvae or nymphs on turkeys (Table 2) did not differ significantly by the age or sex of the bird (P values range from 0.69 to 0.90). A single *D. variabilis* male was collected from a turkey in fall.

Louse Infestations

Three species of lice (Insecta: Phthiraptera) were removed from the heads or necks of 20 (17.7%) of the turkeys (Table 3). Fourteen birds were infested by one species of louse, five birds by two species, and one bird by all three species. These included the cosmopolitan chicken body louse *Menacanthus stramineus*, which accounted for 12.5% of the 64 lice enumerated, the large turkey louse *Chelopistes meleagridis* (37.5% of total), and the slender turkey louse *Oxylipeurus polytrapezius* (50% of total). Forty-seven (73.4%) of the lice were collected in summer versus 4.7, 7.8, and 14.1% in fall,

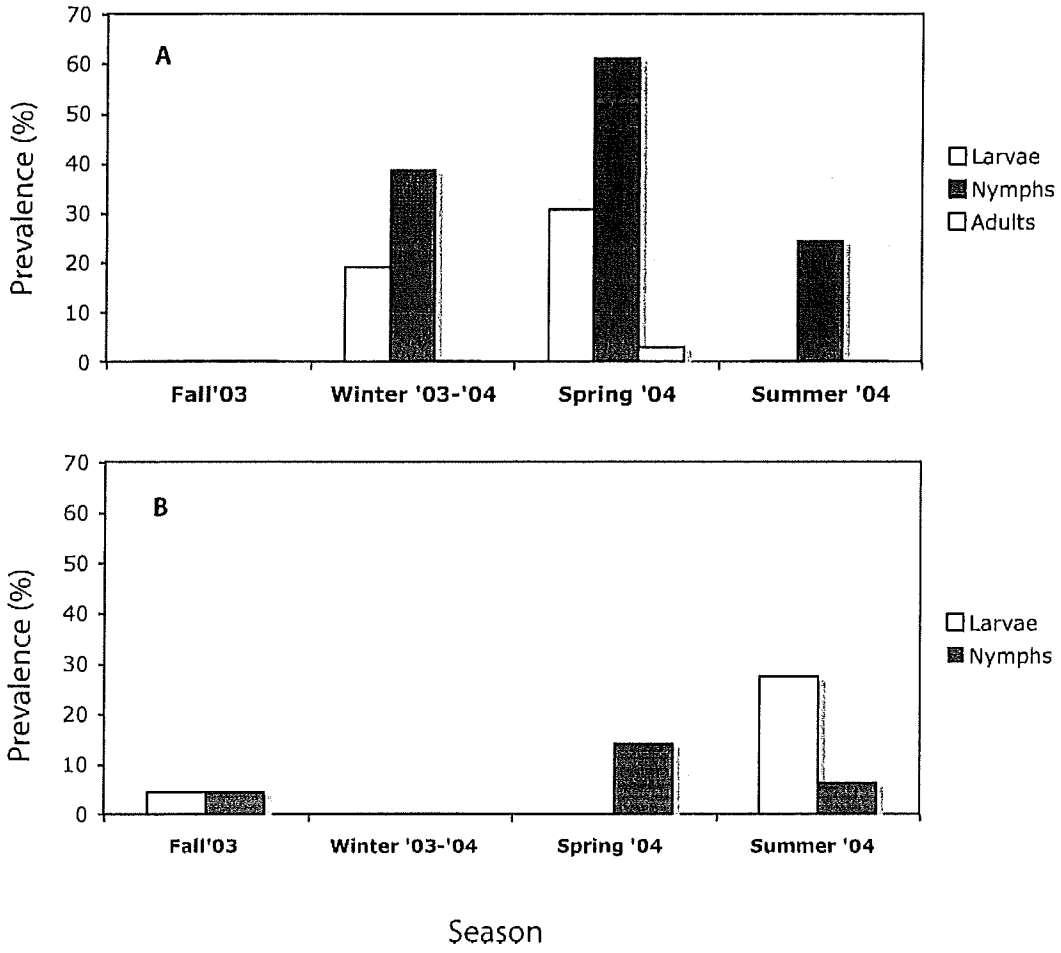

FIGURE 2. (A) Seasonal prevalence of *Ixodes pacificus* by life stage on wild turkeys ($n=113$), Sonoma County, California, USA, 2003–2004. (B) Seasonal prevalence of *Haemaphysalis leporispalustris* by life stage on wild turkeys ($n=113$), Sonoma County, California, USA, 2003–2004.

TABLE 2. Prevalence of ixodid ticks on 113 wild turkeys by age and sex of bird, Sonoma County, California, USA, 2003–2004.

	Comparison of infestation levels (%)			
Tick species by stage	Males ($n=69$)[a]	Females ($n=44$)[b]	Juveniles ($n=25$)	Adults ($n=88$)
Ixodes pacificus				
Larva	14.5	11.4	16.0	12.5
Nymph	31.9	36.4	28.0	35.2
Adult	1.4	0.0	4.0	0.0
Haemaphysalis leporispalustris				
Larva	8.7	9.1	4.0	10.2
Nymph	7.2	6.8	12.0	5.7

[a] 61 adults, 8 juveniles.

[b] 27 adults, 17 juveniles.

TABLE 3. Lice collected from 113 wild turkeys in Sonoma County, California, USA, 2003–2004.

Louse species (suborder)	Number collected				Prevalence (%)[a]
	Nymph	Male	Female	Total	
Menacanthus stramineus (Amblycera)	3	0	5	8	4.4
Chelopistes meleagridis (Ischnocera)	10	1	13	24	11.5
Oxylipeurus polytrapezius (Ischnocera)	25	0	7	32	8.0

[a] Since the entire body of each bird was examined cursorily in the field, these data should be viewed as reflecting the prevalence of lice on the head and neck regions only.

winter, and spring, respectively. Further, 14 of the louse-infested birds were parasitized by one ($n=11$ birds) or two ($n=3$ birds) species of ticks.

Prevalence of borrelial DNA in turkey blood

Blood was drawn successfully from 90 (79.6%) of the turkeys and tested by PCR. One specimen (1%) was positive for *B. burgdorferi* s.l., and sequencing analysis revealed that the genospecies was *B. burgdorferi* s.s. This bird, an adult male, was collected at ASP on 21 October 2003. It was parasitized by a *D. variabilis* male, which proved to be PCR negative for borrelial DNA.

Sensitivity of *B. burgdorferi* s.s. to turkey-serum complement

Over 50% of spirochetes inoculated into domestic turkey sera were alive after 1 hr of incubation at room temperature, as compared with zero of those injected into lizard serum and ~86% introduced into BSK-II culture medium (Table 4). Similar results were observed after 2 hr of incubation (data not shown). Heat treatment (56 C, 30 min) abolished the moderate bactericidal activity of turkey serum and the complete bactericidal activity of lizard serum (Table 4). Adding EDTA to sera from turkeys or the western fence lizard similarly reduced spirochetal mortality. The addition of EGTA plus $MgCl_2$ to turkey or lizard sera resulted in bactericidal activity like that observed for untreated sera.

Abundance of questing *I. pacificus* nymphs at ASP

Drag-sampling leaf litter/fir-needle areas in four turkey-roosting or foraging areas for 8 hr at ASP yielded 430 *I. pacificus* nymphs for a mean of 53.8 ticks/hr (SD=23.1, range=23–91/hr). Additionally, two larvae and four males of *I. pacificus*, one *Ixodes spinipalpis* nymph, nine *H. leporispalustris* nymphs, and 13 nymphs, three males and one female of *Dermacentor occidentalis* were collected.

Prevalence of *B. burgdorferi* s.l. in questing *I. pacificus* nymphs

Borrelia burgdorferi s.l. DNA was detected in 15.0% (range, 8–28% per site) of the 200 nymphs tested (Table 5). Twenty-eight of the 30 positive amplicons

TABLE 4. Complement sensitivity of *B. burgdorferi* s.s. (isolate CA4) after 1 hour of incubation in sera of domestic turkeys and the western fence lizard subjected to different treatments.

Source of serum (number specimens)	Survivability (%) ±SD (range) by serum treatment[a]			
	Untreated	Heat	EDTA	EGTA/$MgCl_2$
Domestic turkey (4)	55.5±16.9 (41–79)	82.0±11.7 (69–95)	84.3±10.7 (72–98)	63.3±20.5 (36–81)
Lizard (1)[b]	0	93	93	0

[a] Spirochetal survivability (%) among the BSK-II controls averaged 85.6±6.7 (range, 76–90) for the domestic-turkey serum runs, and it was 93% during the single lizard-serum run.

[b] Serum from the western fence lizard was assayed for comparative purposes because of its proven bacteriolytic activity.

TABLE 5. Prevalence of *Borrelia burgdorferi* s.l. infection in host-seeking *Ixodes pacificus* nymphs collected by dragging fir-needle/leaf-litter areas in dense woodlands, Annadel State Park, California, USA, 8 May 2004.

Site	Number ticks tested	Number ticks positive (%)	Genospecies[a]
1	50	14 (28)	14 Bb ss
2	50	7 (14)	5 Bb ss, 2 ud
3	50	4 (8)	4 Bb ss
4	50	5 (10)	4 Bb ss, 1 Bb sl
Totals	200	30 (15)	27 Bb ss, 1 Bb sl, 2 ud

[a] Bb ss = *Borrelia burgdorferi* s.s.; Bb sl = uncharacterized *B. burgdorferi* s.l.; ud = undetermined.

were sequenced and, of these, 27 were determined to be the human pathogen *B. burgdorferi* s.s. and one was identified as an unclassified *B. burgdorferi* s.l.

DISCUSSION

Turkeys as hosts of ectoparasites

The wild turkey is indigenous to the North American continent (Dickson, 1992). Following numerous translocations during the 20th century, this bird now is widespread throughout much of the continental United States (Stangel et al., 1992) including the three major geographic foci where humans contract Lyme disease, the Northeast, the Upper Midwest, and the Far West. Nonetheless, wild turkeys have not been evaluated heretofore as potential hosts of Lyme disease spirochetes, and there have been no previously published records of wild turkeys being naturally infested with either of the two primary *Ixodes* spp. tick vectors of *B. burgdorferi* s.s. in the United States, *I. pacificus* in the Far West and the black-legged tick *Ixodes scapularis* in the East. Here we report new records for three species of ixodid ticks parasitizing wild turkeys including *I. pacificus*, the detection of *B. burgdorferi* s.s. DNA in a low percentage of birds (1%, $n=90$), and the moderate sensitivity of *B. burgdorferi* s.s. to complement proteins present in sera from domestic turkeys. Moreover, three species of lice common on wild turkeys in the eastern United States are recorded for the first time from this host in California.

During preceding investigations of the role of birds in the ecology of *B. burgdorferi* s.l. in northern California, *I. pacificus* immatures (i.e., larvae, nymphs or both) were removed from three (13%) of 24 avian species in an oak-woodland (Manweiler et al., 1990), eight (24%) of 34 species in an oak/pine woodland (Wright et al., 2000), 13 (38%) of 34 species from either chaparral or woodland-grass habitats (Slowik and Lane, 2001), and 23 (51%) of 45 species in an isolated canyon containing mixed hardwoods (Wright et al., 2006). In two of those studies, when the avian sample size was ≥10 for birds infested by *I. pacificus*, the prevalence and the mean intensities (mean number of ticks per infested bird species) were relatively low and ranged from 7.1–10.0% and 1.0–3.0 ticks (Manweiler et al., 1990) and 4.2–30.8% and 1.0–2.0 ticks (Slowik and Lane, 2001), respectively. In another study, the prevalence (2.2–100%) and intensity data (1.0–7.8) were considerably higher (Wright et al., 2006). In the fourth study, these data were not provided, but the average number of ticks removed from infested birds representing five species ranged from 0.08 to 1.14 when the avian sample size exceeded 10 (Wright et al., 2000). The foregoing studies are not strictly comparable because sampling was not uniform with respect to the seasons when birds were sampled.

Among potential avian hosts in California, the prevalence (35.4%), and especially the mean intensity (6.2 ticks) of *I. pacificus* immatures on wild turkeys examined year-round during the present

study were moderately high. In spring alone, 66.7% of the turkeys collected were infested by *I. pacificus*, and the mean number of ticks per bird was 9.0 (data not shown). To determine the actual significance of any vertebrate species as a host of a particular tick, the area-wide abundance of the host must be determined relative to that of other potential hosts, as well as the tick burdens present on each host species. Our abundance data for *I. pacificus* larvae and nymphs must be considered underestimates because the entire body of each bird was examined superficially in the field, whereas only the head/neck regions were inspected thoroughly in the laboratory with the aid of a dissecting microscope and proper lighting conditions. In future studies involving wild turkeys, the entire body of each bird should be inspected exhaustively to obtain a more reliable estimate of tick burdens.

Overall, birds seem to contribute less to the maintenance of *I. pacificus* larvae or nymphs in oak/Pacific-madrone woodlands, and adjacent grasslands or chaparral than do lizards and western gray squirrels (*Sciurus griseus*) (Eisen et al., 2004). Infestation of lizards (western fence lizards; alligator lizards [*Elgaria* spp.]) and western gray squirrels by *I. pacificus* immatures (means of 9–35 larvae and 5–6 nymphs per animal) was several times higher than it was for dusky-footed wood rats (*Neotoma fuscipes*), deer mice (*Peromyscus* spp.), and birds (means of 0.9–3.5 larvae and 0–0.3 nymphs). In dense woodlands, lizards alone hosted 84% of *I. pacificus* larvae and 91% of nymphs removed from all animals (lizards, birds, rodents) collected simultaneously (Eisen et al., 2004).

Elsewhere in the continental United States, wild turkeys have been recorded as hosts of four ixodid (*Amblyomma americanum*, *Amblyomma cajennense*, *Haemaphysalis chordeilis*, *Rhipicephalus sanguineus*) and two argasid ticks (*Argas miniatus*, *Argas persicus*) (Cooley and Kohls, 1944; Bishopp and Trembley, 1945; Kellogg et al., 1969; Jacobson and Hurst, 1979; Davidson and Wentworth, 1992; Mock et al., 2001). Two of these tick species (*A. americanum*, *H. chordeilis*) reportedly cause losses among wild turkeys (Bishopp and Trembley, 1945). Losses or incapacity directly attributable to high tick burdens were not observed during the present study. The most heavily tick-infested turkey (138 ticks) was the lightest juvenile female collected in spring, and it weighed 21% less than the average bird in its age/sex cohort taken at that time of year. However, the weight of the only other abundantly parasitized bird (55 ticks) was close to the average for its cohort/sex.

Although the other primary vector of *B. burgdorferi* s.s. in the United States, *I. scapularis*, has never been reported from wild turkeys, an experimental study in which hundreds of *I. scapularis* immatures were placed directly on five captive wild birds demonstrated that no larvae and few nymphs actually engorged on turkeys (Ostfeld and Lewis, 1999). The authors concluded that wild turkeys are unlikely to serve as natural hosts of *I. scapularis* larvae or nymphs, which is consistent with the absence of published collection records indicative of such a tick/host association.

Lice typically are the most commonly reported ectoparasites of wild turkeys. Eight species of chewing lice have been recorded from wild turkeys in the United States (Davidson and Wentworth, 1992). The three species we found (*M. stramineus*, *C. meleagridis*, *O. polytrapezius*) were known previously to infest wild turkeys in seven to 10 states from other geographic regions (Davidson and Wentworth, 1992). Our data indicate that lice were most prevalent on birds in summer, but both the prevalence and abundance data should be regarded circumspectly, if not as gross underestimates. We did not attempt to collect lice from turkeys in the field, and our search was confined solely to the head and neck regions in the laboratory. Moreover, *M. stramineus* feeds

in part on feathers, *C. meleagridis* is a niche specialist restricted in distribution to feathers on the neck and breast of its host, and *O. polytrapezius* exploits turkey wing feathers (Johnson and Clayton, 2003)

Menacanthus stramineus parasitizes many species of domestic poultry worldwide, but the wild turkey generally is considered to be its native host because this louse has never been recorded from any other wild avian species (Price and Graham, 1997). It is the most prevalent and destructive species of louse infesting modern poultry in the United States (Axtell, 1999). *Menacanthus stramineus* also is considered to be a possible vector of various avian viral and bacterial disease agents (Derylo, 1970) because, unlike most chewing lice, its diet includes host blood as well as feathers, hair, and skin debris (Derylo and Gogacz, 1974).

Two species of *Chelopistes* occur in North America North of Mexico, and *C. meleagridis* is by far the most common (Price et al., 2003). This louse is a cosmopolitan parasite of domestic turkeys and is a common parasite of wild turkeys in the United States. It also has been recorded from the ocellated turkey (*Meleagris ocellata*) of southern Mexico and Central America (Clay, 1941). *Oxylipeurus polytrapezius* was the most prevalent louse among the three species collected. Although it is a common parasite of both domestic and wild turkeys, its life history and habits are poorly known. Its slender morphology enables it to exploit the wing feathers, where it can slot between barbules to escape the preening activities of its host (Johnson and Clayton, 2003).

Turkeys as hosts of *B. burgdorferi* s.s.

The fact that *B. burgdorferi* s.s. DNA was detected in blood from only 1% of wild turkeys collected year-round suggests that this bird is not an important host of this particular Lyme disease spirochete. The wild turkey is just the second avian species from the far western United States found to contain *B. burgdorferi* s.s. DNA in its blood. A specimen from a hermit thrush (*Catharus guttatus*) collected from a wooded canyon in the Sutter Buttes of northern California was PCR positive for this spirochete (Wright et al., 2006). The low prevalence of spirochetal infection detected in turkeys during the present study is noteworthy because most turkeys were collected at ASP where 15% of the *I. pacificus* nymphs assayed were infected with *B. burgdorferi* s.l. in spring, and 86% of all the *I. pacificus* removed from birds were nymphs. Thus, at least some of the turkeys had been, or were being, fed upon by spirochete-infected nymphs at the time of collection. We did not test the relatively few *I. pacificus* larvae (n=33) obtained from turkeys because no larval ticks were found attached to the one infected bird. Curiously, that bird was collected in fall when *I. pacificus* nymphs usually are inactive, and the only tick found on it, a *D. variabilis* male, was PCR negative for *B. burgdorferi* s.s.

The complement system plays an important role in defense against infection (Sim and Dodds, 1997). Among other functions, it promotes and regulates the lysis or phagocytosis of foreign cells including gram-negative bacteria (e.g., borreliae), and it interacts with the adaptive immune system. The level of complement activity in serum has been found to be an important intrinsic factor determining the reservoir competence of lizards, birds, and mammals for several genospecies of *B. burgdorferi* s.l. (Isogai et al., 1994; Kurtenbach et al., 1998; Kuo et al., 2000; Nelson et al., 2000). Our complement-protein assays demonstrated that untreated (preimmune) serum from domestic turkeys was moderately bacteriolytic for *B. burgdorferi* s.s. because 45% of spirochetes introduced into it were dead within 1 hr. In contrast, 100% of spirochetes injected into untreated lizard serum died within 1 hr, as expected (Lane and Quistad, 1998; Kuo et al., 2000). Taken together, the assays implicate components of the alternative com-

plement pathway as a significant source of much of the observed bacteriolytic activity: heat or EDTA treatment of domestic-turkey serum largely arrested bacteriolysis, whereas a lack of treatment or the addition of EGTA/$MgCl_2$ allowed turkey serum to retain its moderate borreliacidal effects.

In related studies, serum from northern bobwhite quail (*Colinus virginianus*) was nonlytic for the B-31 type strain of *B. burgdorferi* s.s. and only partially lytic for two strains of the related spirochete *Borrelia bissettii* (Ullmann et al., 2003). Like turkeys, serum from pheasant was moderately lytic for *B. burgdorferi* s.s., whereas it was either nonlytic or highly lytic for four other genospecies of *B. burgdorferi* s.l. (Kurtenbach et al., 1998). In vitro complement studies such as these, and reservoir-competence trials using xenodiagnostic larval ticks and wild-caught birds (e.g., Ginsberg et al., 2005), demonstrate that avian species differ characteristically in their capacity to host and disseminate various genospecies of *B. burgdorferi* s.l. group spirochetes.

We used sera from domestic turkeys rather than sera from wild turkeys in our complement assays because these birds represent a single species (*M. gallopavo*), and we did not have a source of pre-immune serum from captive wild birds that had been held in a tick-free environment. Nevertheless, the complement-test results, when considered alongside the low spirochetal infection prevalence detected in blood specimens of field-derived turkeys and the low infestation prevalence by *I. pacificus* larvae, suggest that the Rio Grande wild turkey is an inefficient host of *B. burgdorferi* s.s. in northern California woodlands. A competent reservoir of a tick-borne disease agent must not only be susceptible to the agent and capable of serving as a source of infection for uninfected ticks that feed on it, but it also must be fed upon by at least two life stages of a vector tick in order to amplify the infection in nature.

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ADDENDUM

While this paper was *in press*, we decided to test the *I. pacificus* larvae that had infested 15 of the wild turkeys (Table 1). All 33 larvae were PCR negative for Lyme disease-group spirochetes, which reconfirms our conclusion that the Rio grande wild turkey is an inefficient host of *B. burgdorferi* s.s.

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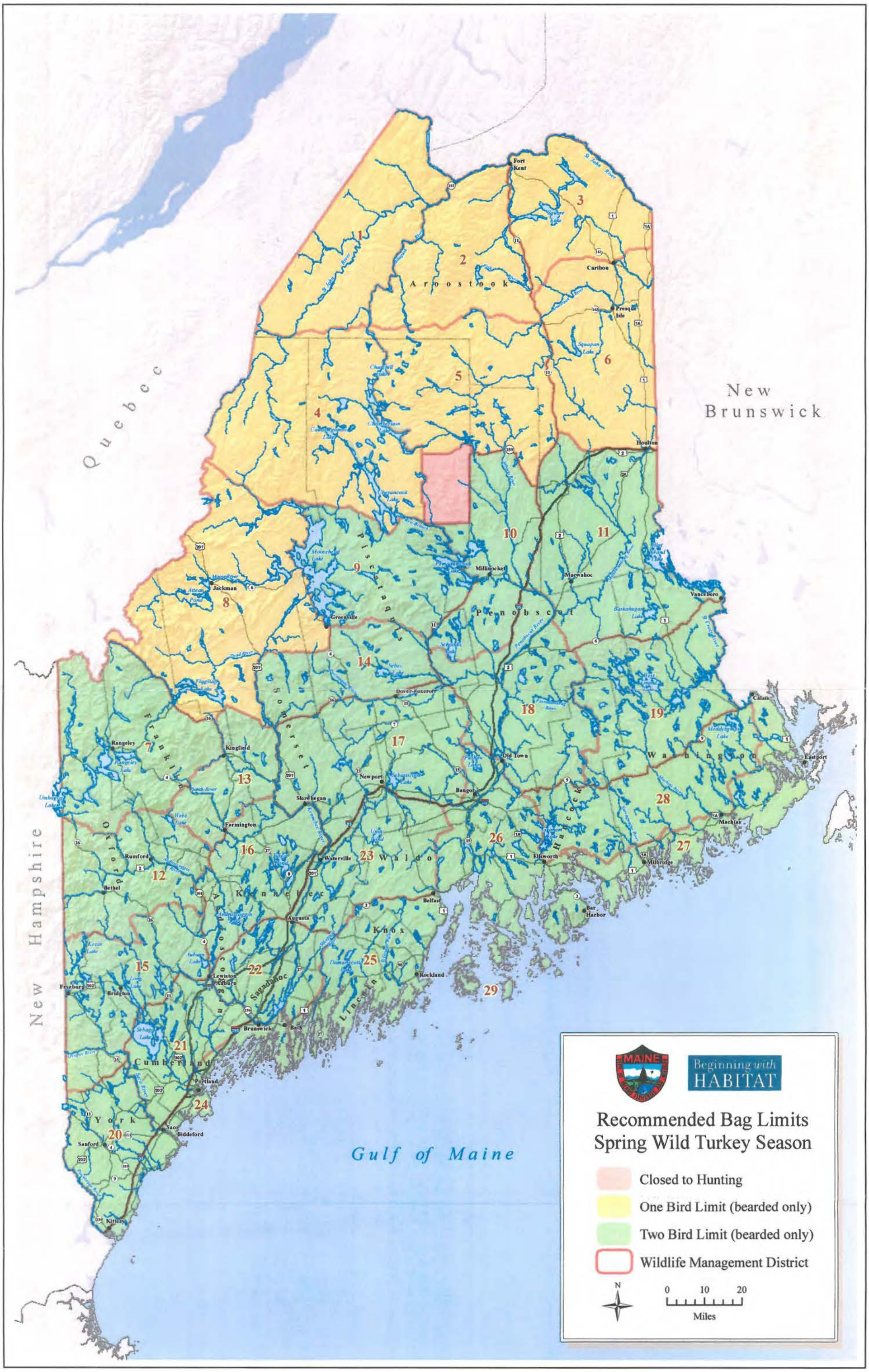
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Beginning with HABITAT
Recommended Bag Limits
Spring Wild Turkey Season
Closed to Hunting
One Bird Limit (bearded only)
Two Bird Limit (bearded only)
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Rockland
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Bridgton
Brunswick
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Portland
Saco
Biddeford
Sanford
Kittery
Quebec
New Hampshire
New Brunswick
Gulf of Maine

Beginning with HABITAT

Recommended Bag Limits
Fall Wild Turkey Season

- Closed Fall Season
- One Bird Limit (M or F)
- Two Bird Limit (M or F)
- Wildlife Management District

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Miles