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A Characterization of Poultry Flocks and Poultry Producers in Maine

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A CHARACTERIZATION OF POULTRY FLOCKS AND POULTRY PRODUCERS IN MAINE

by

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ABSTRACT

This study sought to characterize backyard poultry flocks and poultry producers' knowledge of poultry husbandry in Maine. A survey on poultry flock characterization, management, and health was sent to poultry producers living in Maine. Based on the survey, most backyard poultry flocks contained 7-20 birds. Chickens were the predominant poultry species in Maine. Flocks were used primarily for egg production and companionship. Management practices varied greatly among producers, indicating a need for more flock management education. Mites and coccidiosis were the most commonly reported causes of illness by producers, but several diseases affected poultry in Maine. Producers cited the internet as their main source of information but wanted more poultry publications and workshops. They expressed an interest in a wide range of poultry topics, mostly diseases.

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INTRODUCTION

Over the past few years, backyard poultry production increased in the United States (Elkhoraibi et al., 2014). A study conducted by the National Animal Health Monitoring System revealed 4% of households plan to own chickens within the next five years (Department of Agriculture, 2010). Most of these upcoming poultry producers cited food production and pets as the main reason for wanting to start their own flocks (Elkhoraibi et al., 2014, Garber et al., 2007, Karabozhilova et al., 2012, Smith et al., 2011).

Demographics

Studies conducted in Canada, Finland, and the United States yielded similar data on backyard flock characteristics. In Alberta, Canada, 25.6% of backyard poultry producers owned their flock for less than a year, and 73.1% of producers owned their flock for less than 5 years. Most producers owned layer hens (93.4%). The flock average was 136.4 birds, and the flock median was 34 birds. As for flock function, 39.9% of flocks were strictly layers. Composite flocks (flocks with multiple species) accounted for 58.1% of flocks. Popular poultry pairs were layers and ducks, layers and turkeys, and layers and broilers (Mainali, 2017).

In Finland, every flock included chickens, and 35% of flocks included one other species. The majority of flocks enumerated 11 to 50 birds (1-10 birds 20.2%, 11-20 birds 36.5%, 21- 50 birds 34.3%). Only 9% of flocks were larger than 50 birds. Most flocks were used for egg production (79.2%) and pets (71.9%). 30% of flocks were used for meat production (Pohjola et al., 2015).

In the United States, flock characterization research was conducted in Colorado and Maryland. In Colorado, backyard flocks consisted mainly of layer chickens (85.49%). Like Finland, most backyard flocks in Colorado included more than one species. 27.76% of flocks comprised two species of bird. 68.8% of flocks contained fewer than 50 birds. The predominant function of backyard poultry was food production, but different species were associated with different functions. Layers chickens were used for food production, but waterfowl were bred for sale (Smith et al., 2011).

On the opposite side of the country in Maryland, the median flock size was 38 birds. This value is close to Alberta's median flock size (34 birds). Every backyard flock contained chickens, with 51.2% of flocks containing only chickens. Chickens represented 86.5% of all backyard poultry in Maryland. The predominant function of the flocks was egg production (56.1%). Most producers (61%) owned backyard poultry for fewer than 5 years (Madsen et al., 2013).

Flock Health

Multiple studies have been conducted on backyard flock health in California. In 2007, the California Department of Food and Agriculture funded the Backyard Flock program, which offered free necropsy services to backyard poultry producers. The program lasted from 2007-2012. During this time, backyard poultry submissions to the California Animal Health and Food Safety laboratory (CAHFS) increased 383%. During this same period, the total number of poultry submissions decreased 43%, which made the increase in backyard poultry submissions even more significant. The necropsy data revealed that digestive (32.5%), hemolymphatic (16.9%), reproductive (14.1%), and respiratory (13.8%) diseases were the most common in backyard poultry. Marek's

Disease was the most commonly diagnosed disease, accounting for 13.8% of the cases (n=492). Only 1.9% of the diagnoses were classified as "unexplained". (Stinson et al., 2013).

A second study conducted by the CAHFS showed that infectious diseases accounted for 60.4% of diagnoses (n = 786) in backyard poultry between 2007 and 2011. Of these diagnoses, 50% were viral and 39% were bacterial. Marek's Disease and *Escherichia coli* were the most common viral and bacterial diagnoses, respectively. 13.2% of the diagnoses were "unknown" (Mete et al., 2013).

The Avian Health and Food Safety Laboratory (AHFSL) in Washington conducted a retrospective study using data from their own laboratory and well as CAHFS to investigate and etiologically categorize the most common diagnoses in backyard poultry. AHFSL also reported Marek's Disease and *Escherichia coli* as being the most common diseases in backyard poultry (17.7% and 17.4% respectively) (Crespo et al., 2015).

Researchers in the Greater London Urban Area evaluated the welfare of backyard flocks based on the 5 freedoms: freedom from hunger and thirst, freedom from discomfort, freedom from pain, injury, and disease, freedom to express normal behavior, and freedom from fear and distress. According to their welfare assessment, 6 flocks were "in need of improvement", 19 flocks had "acceptable welfare", and 5 flocks had "enhanced welfare" (Karabozhilova et al., 2012).

Producer Awareness

Swiss research focusing on Highly Pathogenic Avian Influenza (HPAI) assessed poultry producers' awareness of HPAI transmission, prevention, and clinical signs. Producers demonstrated a strong understanding of HPAI risk factors and transmission but lacked a strong understanding of clinical signs and prevention. However, when comparing the awareness scores of commercial and non-commercial producers, commercial producers who only raised chickens and received information from professional journals scored the highest (Saurina et al., 2010).

Chinese research focusing on HPAI yielded similar results; a poultry producer's awareness of biosecurity preventative knowledge positively associated with their biosecurity preventative behavior (i.e. they practiced what they preached) (Cui, 2016).

A United States flock survey revealed that 64% of poultry producers wanted to improve their detection and treatment of poultry health problems (Elkhoraibi et al., 2014). A different study conducted in Pakistan showed that poultry producers demonstrated successful identification of prevalent diseases but struggled to identify and control less common diseases (Amir et al., 2016).

Sources of Information

The majority of poultry producers indicated the internet was their primary source of information (Elkhoraibi et al., 2014, Mainali, 2017, Saurina et al., 2010). Less than 20% of producers sought information from a veterinarian (Elkhoraibi et al., 2014, Mainali, 2017). Producers cited reasons such as treatment cost and veterinarians' alleged inexperience with poultry for not contacting veterinarians (Mainali, 2017). When

searching the internet for information, producers said flock diseases, nutrition, and natural/organic remedies were the topics of greatest interest (Mainali, 2017).

Objectives

This study sought to evaluate poultry health and poultry producers' knowledge of poultry husbandry in Maine. Specifically, this study attempted to do four things: 1) describe poultry flocks (i.e. obtain data of flock size and species composition, management practices, and biosecurity practices); 2) estimate poultry disease prevalence; 3) evaluate poultry producers' understanding of the risks and responsibilities associated with poultry husbandry; and 4) devise and implement educational programs to increase poultry health awareness.

MATERIALS AND METHODS

Survey Creation

An online survey was designed to evaluate backyard flock demographics and management practices in Maine (Appendix F). The survey also investigated producer awareness of poultry diseases and management practices. The survey consisted of 22 questions, using a combination of multiple choice and open-answer responses. The survey was delivered using an online survey platform called Qualtrics.

Survey Approval

The survey was submitted to the University of Maine Institutional Review Board (IRB) for approval. The survey required modification after the first submission, but it received approval after the second submission (Appendix A).

Survey Distribution

The survey was posted as a link on the Maine Poultry Connection Facebook group page with 10,713 members (Appendix D). Permission to post the link was obtained from the group administrator prior to posting the link (Appendix C). The survey was also sent to 1,292 members of the UMaine Cooperative Extension (UMCE) poultry interest email list using Constant Contact (Appendix B), as well as reaching 886 UMCE Facebook followers. The survey was available online from March 25 to April 26, 2018. Participation in the survey was voluntary and anonymous.

Survey Analysis

The survey was analyzed using Qualtrics. The data collected from the survey was downloaded as an excel .csv file from Qualtrics onto the researcher's computer. The excel file was used for further analysis of the data.

RESULTS

Survey Response

290 surveys (260 fully completed, 30 partially completed) were received. Many questions allowed for the selection of multiple responses. Thus, the total number of responses occasionally exceeded the total number of respondents. The combination of incomplete surveys and multiple-response question formats required the frequencies of responses to be calculated on a per question basis.

Demographics

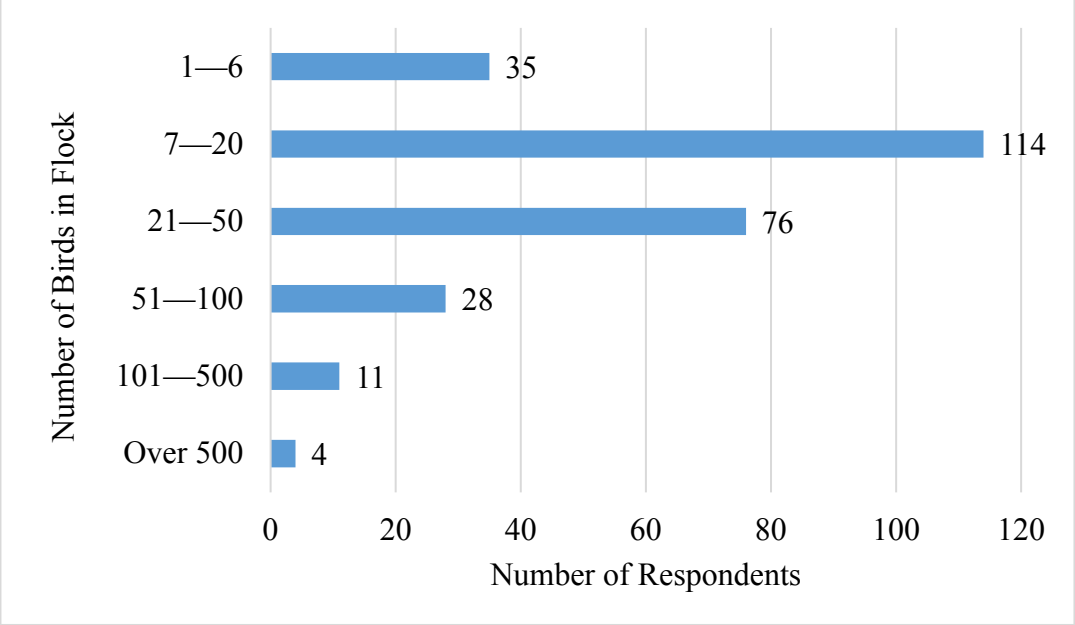

Figure 1. Flock Size

The majority of backyard poultry producers (84.0%) owned 50 or fewer birds (Fig. 1). The most common flock size (42.5% of flocks) was 7 to 20 birds. Based on Figure 1 and Table 2, four producers owned 49.3% of backyard poultry in Maine, whereas the largest producer demographic (7 to 20 birds, n=114) only owned 7.98% of poultry in Maine.

Table 1—Species Estimate

Chickens	Turkeys	Geese	Ducks	Guinea Fowl	Peafowl	Other
18,476	1,084	160	787	539	11	370

A total of 21,427 birds were recorded in the survey (Table 1). Chickens predominated the backyard flocks (86.2% of total poultry estimate). Chickens were not included in every flock, but they were present in 96.3% of flocks. Peafowl were the least common bird species (0.0513% of total poultry estimate).

Less than half (39.6%) of flocks included mixed species (Table 3). However, as flock sized increased, so did the number of mixed flocks. Only 10% of flocks with 1 to 6 birds contained more than one species, but 80% of flocks with over 100 birds contained multiple species. The most common assortments of species were chickens and ducks (27%) and chickens and turkeys (16%) (Table 4, see Appendix F). The greatest species variation occurred in the flocks composed of more than 100 birds (Table 3). Of the 106 mixed species flocks, 63 included 2 species, 26 included 3 species, 11 included 4 species, and 6 included 5 species (Table 4). The average flock composition was 68.9 chickens, 4.04 turkeys, 0.579 geese, 2.94 ducks, 2.01 guinea fowl, 0.0410 peafowl, and 1.38 other.

Table 2—Species by Flock Size

Flock Size (Birds)	Chickens	Turkeys	Geese	Ducks	Guinea Fowl	Peafowl	Other	Total
1 – 6	263	5	0	6	12	0	1	287
7 – 20	1,404	52	24	166	37	0	27	1,710
21 – 50	2,565	150	55	151	64	8	182	3,175
51 – 100	2,837	163	33	131	46	3	60	3,273
101 – 500	1,407	104	48	325	365	0	100	2,349
Over 500	10,000	610	0	8	15	0	0	10,633

Table 3— Number of Mixed Species Flocks

Flock Size (Birds)	Number of Mixed Flocks	Number of Total Flocks	% of Flocks Mixed
1—6	4	35	10
7—20	35	114	31
21—50	38	76	50
51—100	17	28	61
101—500	9	11	80
Over 500	3	4	80
Total	106	268	39.6

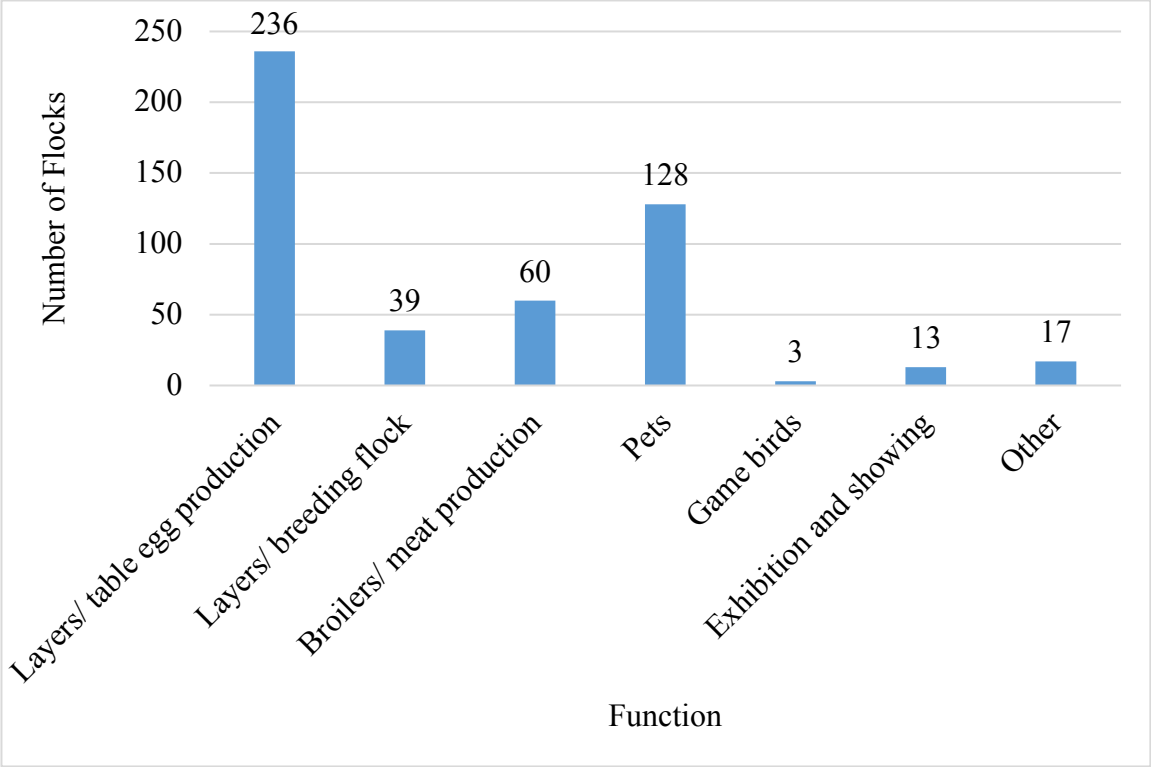

Figure 2. Flock Function

Layers and pets (88.1% and 47.8% respectively, n=268) were the most popular functions for flocks (Fig. 2). None of the flocks with 1 to 6 birds were used for breeding, game, or meat production. Flocks with 7 to 21 birds were used for breeding, game, and meat production, but they were predominantly used for egg production and pets. Flocks with 21 to 100 birds saw an increase in functioning for meat production, but they still mostly produced eggs. Flocks with over 500 birds were used solely for meat and egg production.

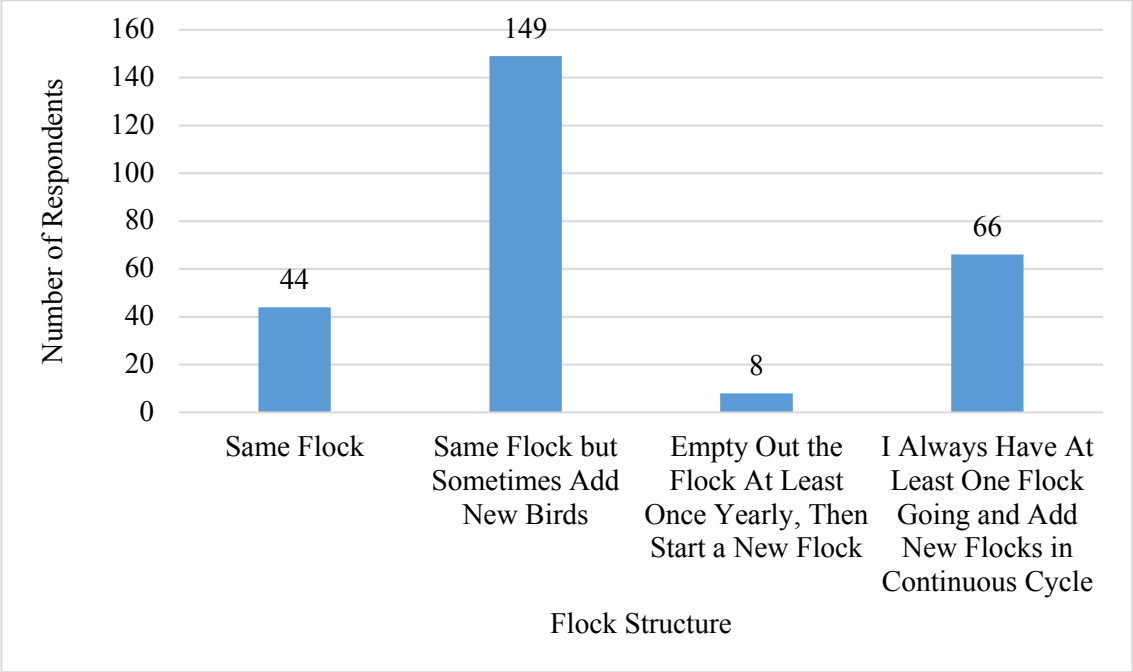

Figure 3. Flock Structure

More than half (55.8%) of poultry producers in Maine keep the same flock year round and occasionally add new birds to it (Fig. 3). Only 3.0% of producers cull their existing flock and start a new flock at least once a year. Of the 8 producers who empty out their flock, 2 owned flocks with over 1,000 birds and 2 owned flocks with more than 100 birds.

Table 5—Body Condition Score (BCS) Assessment

Method of Assessment	Number of Respondents	Number of Sick Birds	Number of Total Birds	% of Birds Sick
Weigh, Look at Birds	1	0	5,500	0
Weigh, Feel Birds	1	0	163	0
Look at Birds, Don't Assess BCS	3	2	45	4
Look at Birds	141	274	10,119	2.71
Feel Birds, Look at Birds	16	49	744	6.6
Feel Birds	29	112	1,804	6.21
Don't Assess BCS	74	78	3,014	2.6

Most poultry producers (60%, n=286) looked at their birds to assess body condition score (Table 5). 16% of producers felt their birds and 0.70% of producers weighed their birds to assess body condition score. 27% of poultry producers indicated they do not assess their birds' body condition score.

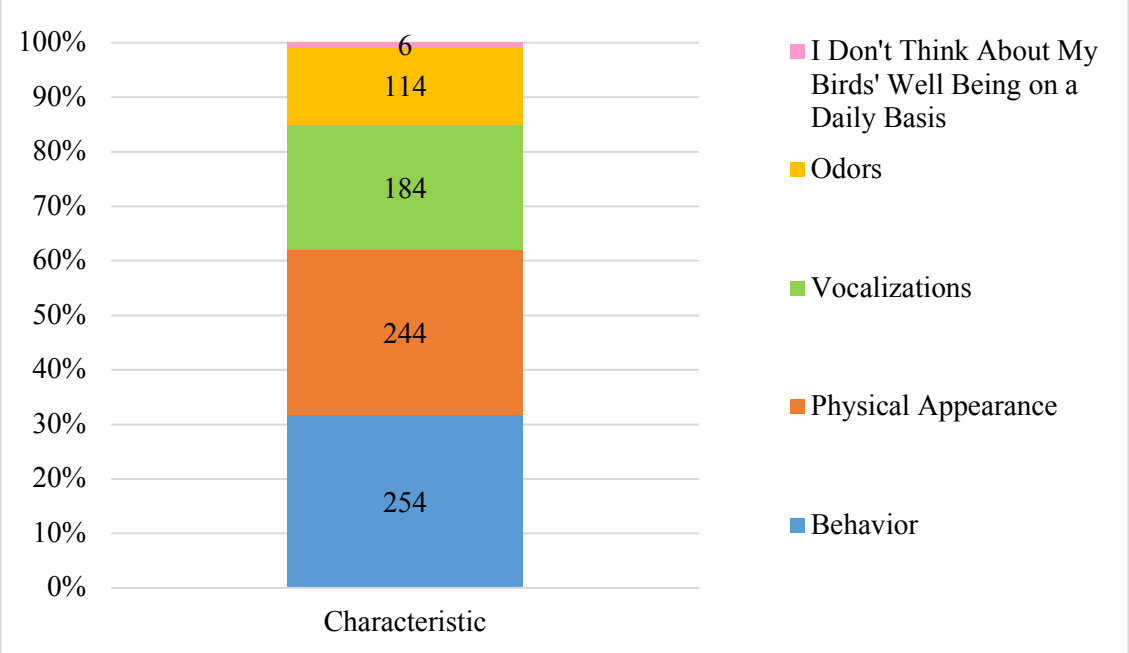

Figure 4. Characteristics Evaluated By Producers to Assess Poultry Health on a Daily Basis

Poultry producers evaluated a variety of characteristics to assess the health of their poultry on a daily basis (Fig. 4). They favored observing behavior (95%, n=266) and physical appearance (92%) over observing vocalizations (69%) and odors (43%). Only 2.3% of producers did not consider their poultry's health on a daily basis.

Poultry producers also considered a wide range of qualities when determining the housing for their poultry. The frequencies of the factors were distributed evenly (Table 6). Protection from the elements was the most chosen factor (16.1% of respondents), and litter quality and other were the least chosen factors (7.14% and 1.12% respectively).

Table 6—Factors Used In Determining Poultry Housing

Factor	% (n=1,512)
Space Availability	15.7
Climate	12.1
Predators	15.4
Pest and Parasites	8.53
Litter Quality	7.14
Protection from the Elements	16.1
Easy to Clean and Disinfect	11.3
Longevity of the Housing Structure	12.6
Other	1.12

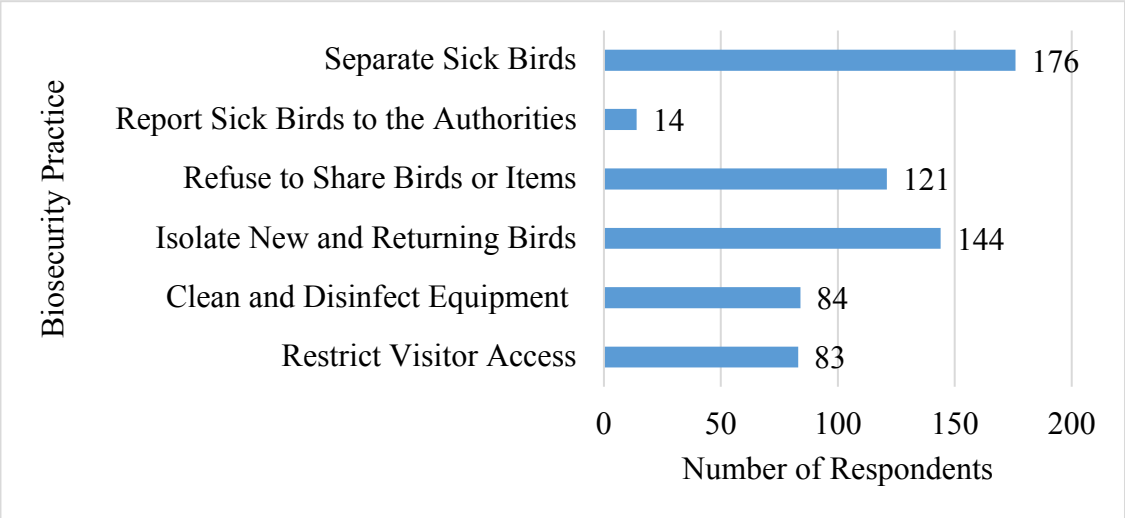

Figure 5. Frequency of Biosecurity Practices

Separating sick birds from healthy birds was the most practiced form of biosecurity, followed by isolating new and returning birds for at least 30 days (Fig. 5). The least practiced form of biosecurity was reporting sick birds to the authorities. Only 6.6% (n=213) of producers reported sick birds to veterinarians, specialists, or the USDA.

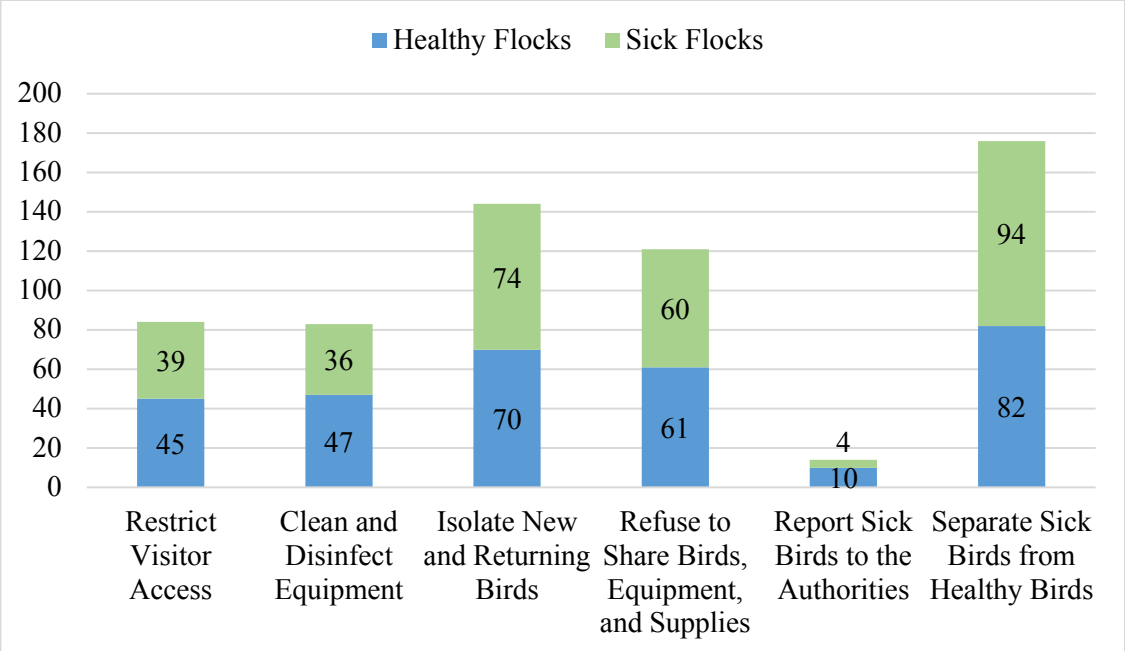

Figure 6. Number of Healthy Flocks versus Sick Flocks per Biosecurity Practice

Most poultry producers (24.4 %) practiced 3 methods of biosecurity (Table 7). The most popular combinations of biosecurity practices were: separate sick birds and healthy birds (n=28), isolate new birds and returning birds/ separate sick birds and healthy birds (n=25), restrict visitor access/ clean and disinfect equipment/ isolate new and returning birds/ refuse to share birds and items/ separate sick birds from healthy birds (n=22), and isolate new and returning flocks/refuse to share birds and items/ separate sick birds from healthy birds (n=20). Only 10 producers implemented all 6 biosecurity practices (Table 7). However, the producers who used all 6 practices had the lowest amount of sick birds in their flocks (0.9%) and the highest confidence (8.6/10).

There was a balanced number of healthy and unhealthy flocks per biosecurity practice (Fig. 6).

Table 7—Comparison of Biosecurity Practices, Poultry Illness, and Producer Confidence

Number of Biosecurity Practices	Number of Respondents	Average Sick Birds in Flock (%)	Average Confidence Rank (1—10)
1	43	4.08	5.8
2	50	4.89	6.0
3	52	2.53	6.5
4	36	3.39	6.2
5	22	2.2	5.9
6	10	0.9	8.6

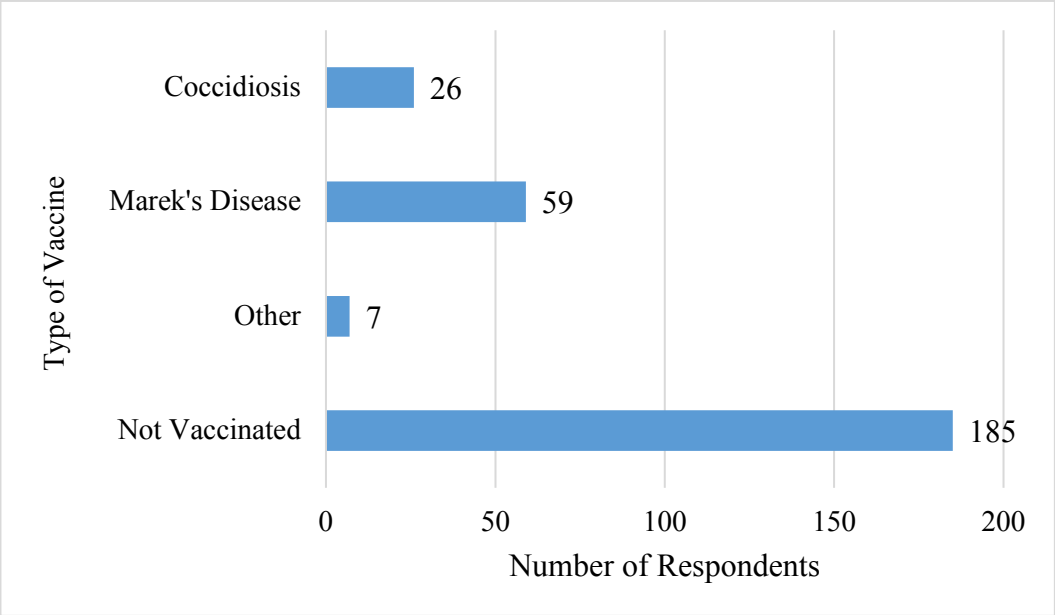

Figure 7. Vaccination Status of Poultry Flocks in Maine

50 of the producers who owned vaccinated birds purchased them already vaccinated from a hatchery. 1 producer vaccinated their flock themselves, and 1 producer explicitly stated they were anti-vaccines. 36% (n=28) of producers purchased poultry from hatcheries with 2 National Poultry Improvement Plan certifications (Table 8). 25% of producers purchased poultry from hatcheries with 1 certification, and another 25% of producers purchased poultry from hatcheries with 8 certifications. Avian Influenza and *Salmonella* Pullorum were the most common certifications.

Table 8—National Poultry Improvement Plan (NPIP) Certifications

Certification	Number of Respondents
Avian Influenza	22
Salmonella Pullorum (SP)	22
Salmonella enterica Enteridis (SE)	9
Mycoplasma gallisepticum (MG)	13
Mycoplasma synoviae (MS)	10
Mycoplasma meleagridis (MM)	7
U.S. Salmonella Monitored	12
U.S. Sanitation Monitored	11
Number of Certifications	
1	7
2	10
3	1
4	0
5	1
6	1
7	1
8	7

Flock Health

Table 9—Number of Sick Flocks and Birds in 2017

Flock Size (Birds)	Number of Sick Flocks	Number of Flocks	% of Flocks with Sick Birds	Number of Sick Birds	Number of Birds	% of Birds Sick in Flock
1—6	10	35	29	13	287	4.5
7—20	41	114	36	91	1,1710	5.3
21—50	46	76	61	139	3,175	4.4
51—100	16	28	57	98	3,273	3.0
101—500	5	11	45	76	2,349	3.2
Over 500	3	4	75	98	10,633	0.92

The percentage of flocks containing sick birds increased as the flock size increased (Table 7). However, the percentage of sick birds in a flock decreased as flock size increased.

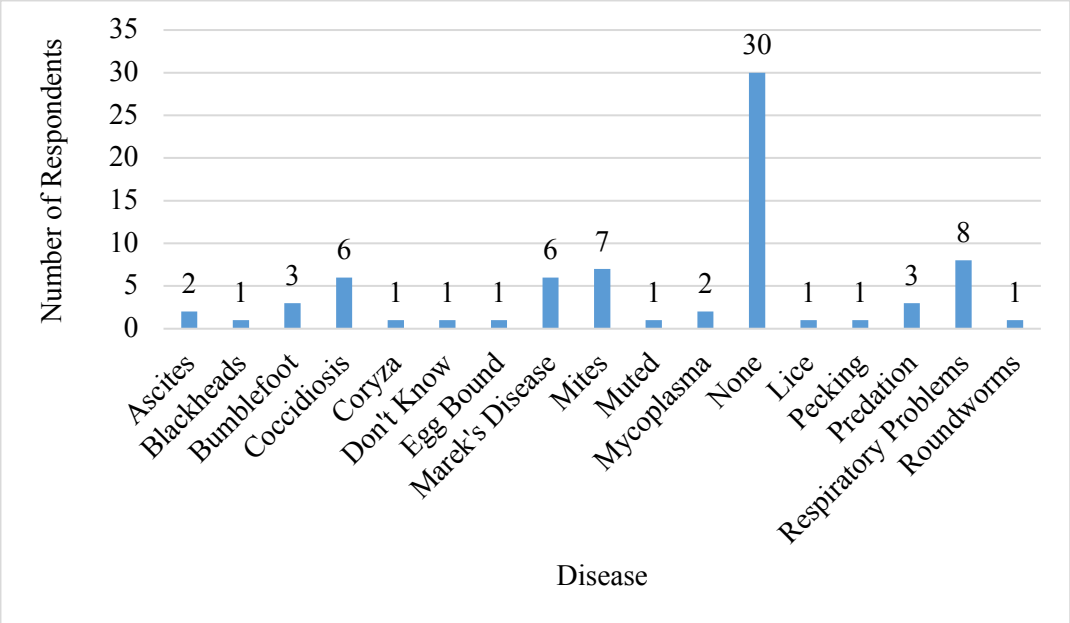

Figure 8. Diseases Encountered Frequently by Maine Producers

The majority of producers claimed to have no struggles with specific diseases in their flocks (Fig. 7). The diseases that were most frequently reported by producers as being an issue were respiratory problems, mites, Marek's Disease, and coccidiosis.

Most producers did not know what caused their poultry's illnesses (Table 9). As for the producers who could identify the cause of illness in their poultry, mites and cold weather were the most common causes.

Table 10—Suspected Causes of Illness in Poultry Flocks

Cause of Illness	Number of Respondents
Bacteria	
Ascites	1
Botulism	1
Bumblefoot	1
Coccidiosis	5
Coryza	1
Mycoplasma	1
Unknown Bacteria	4
Virus	
Chronic Cold	1
Marek's Disease	2
Parasites	
Gapeworm	1
Mites	13
Mites and Lice	5
Lice	3
Roundworms	1
Worms	2
Nutrition	
Hay	1
Genetics	1
Mineral Deficiency	2
Prolapse	1
Sour Crop	3
Unknown	2
Vitamin Deficiency	2
Environment	
Age	9
Ammonia	1
Cold Weather	10
Egg Binding	2
Genetics	2
Hit By Car	1
Internal Mass	2
Light Overexposure	1
Predator	4
Unknown	1
Unknown	
Injury	1
Respiratory Infection	5
Unknown	46
Vent Gleet	1

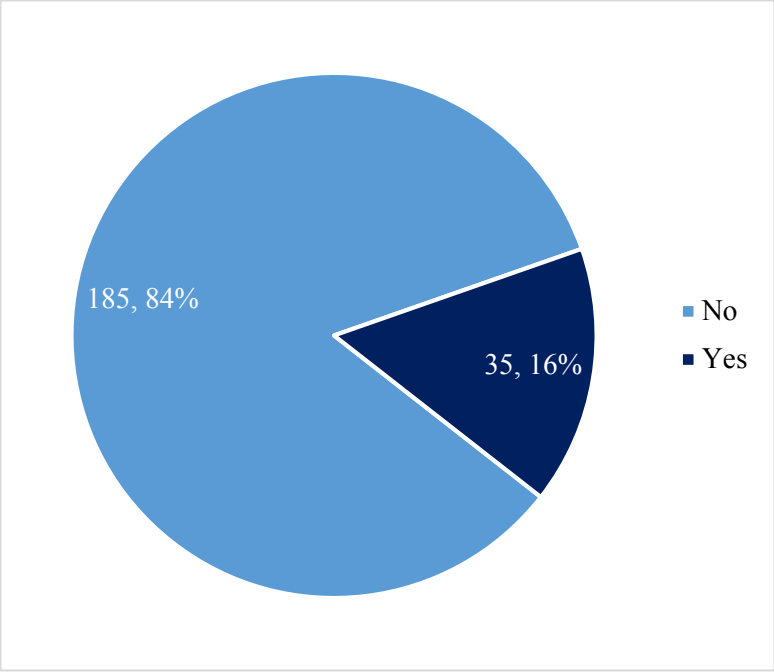

Figure 9. Producers Affected By Seasonal Illness

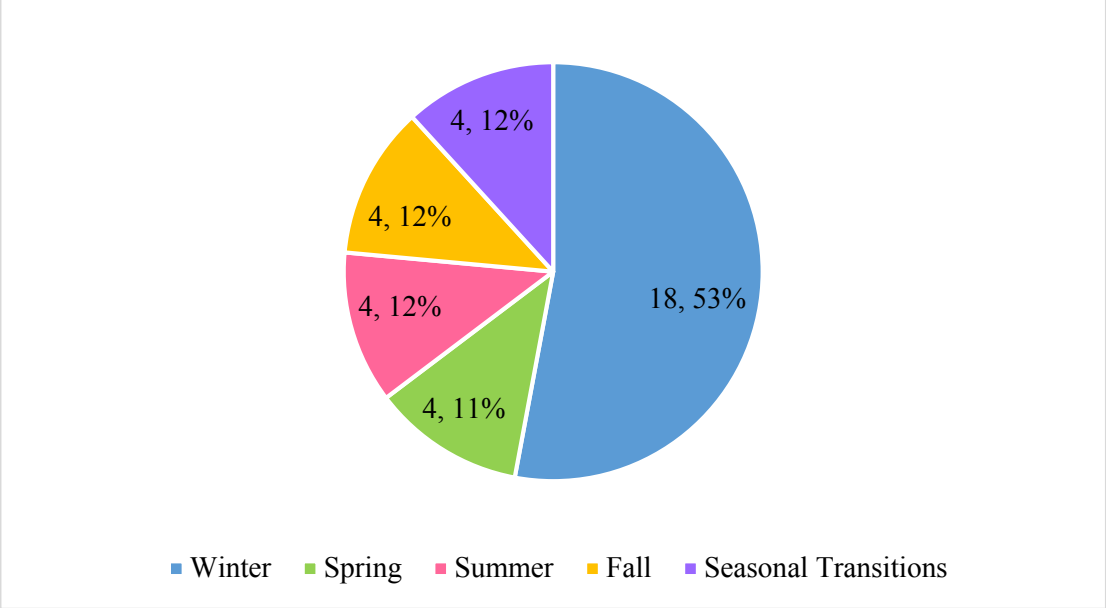

Figure 10. Frequency of Illness by Season

84% of producers' flocks were not seasonally susceptible to illness (Fig. 9). The 16% of producers whose flocks suffered from seasonal illnesses reported winter (53% of responses) as the worst season for illnesses (Fig. 10). 60% of producers indicated their birds became ill on an individual basis rather than in groups (2%) (Fig. 11). Of the 6

respondents whose birds became ill en masse, 2 of them owned flocks of 1 to 6 birds, and 4 of them owned flocks of 7 to 20 birds. 3 of the 152 flocks that became ill on an individual basis contained over 500 birds. 38% of producers reported not having ill birds at all.

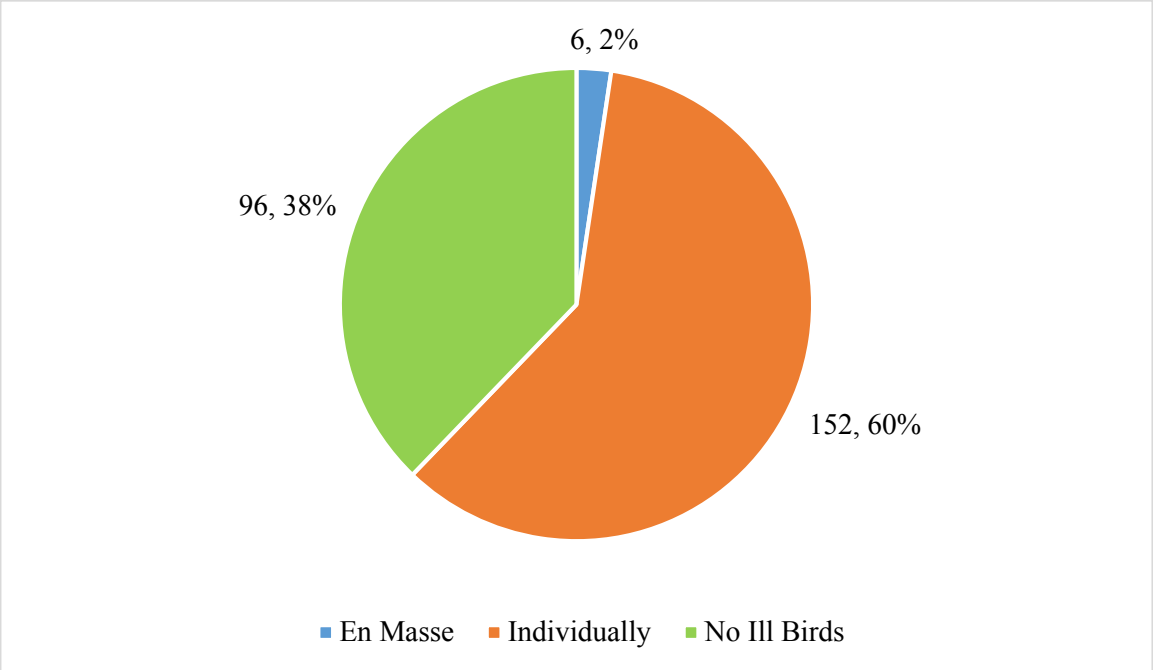

Figure 11. Poultry Flock Illness Trends

In regard to veterinary care, 84% of producers answered they would not seek veterinary treatment for their birds (Table 11). The top reason for declining veterinary care was treatment cost (40%). The flock health of producers who sought veterinary care was similar to the flock health of producers who avoided veterinary care (Fig. 12).

Table 11—Veterinary Treatment of Poultry Flocks in Maine

Characteristic	Number of Respondents	%
Would You Take Your Bird(s) to the Veterinarian?		
Yes	44	16
No	230	84
Reasons Why You Would Not Take Your Bird(s) to the Veterinarian		
Treatment Is Too Expensive	92	40
Veterinarians Near My Location Do Not Have Poultry Experience	82	36
I Would Never Take My Bird(s) to the Veterinarian	56	24

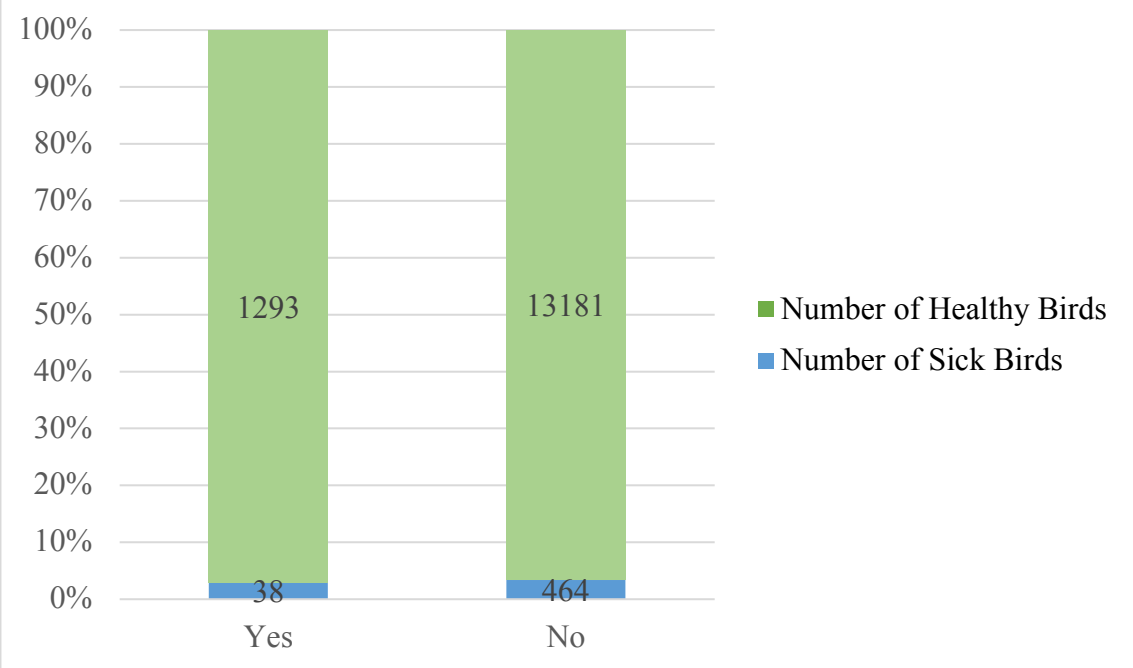

Figure 12. Flock Health of Producers Who Indicated They Would Seek Veterinary Treatment versus Flock Health of Producers Who Indicated They Would Not Seek Veterinary Treatment

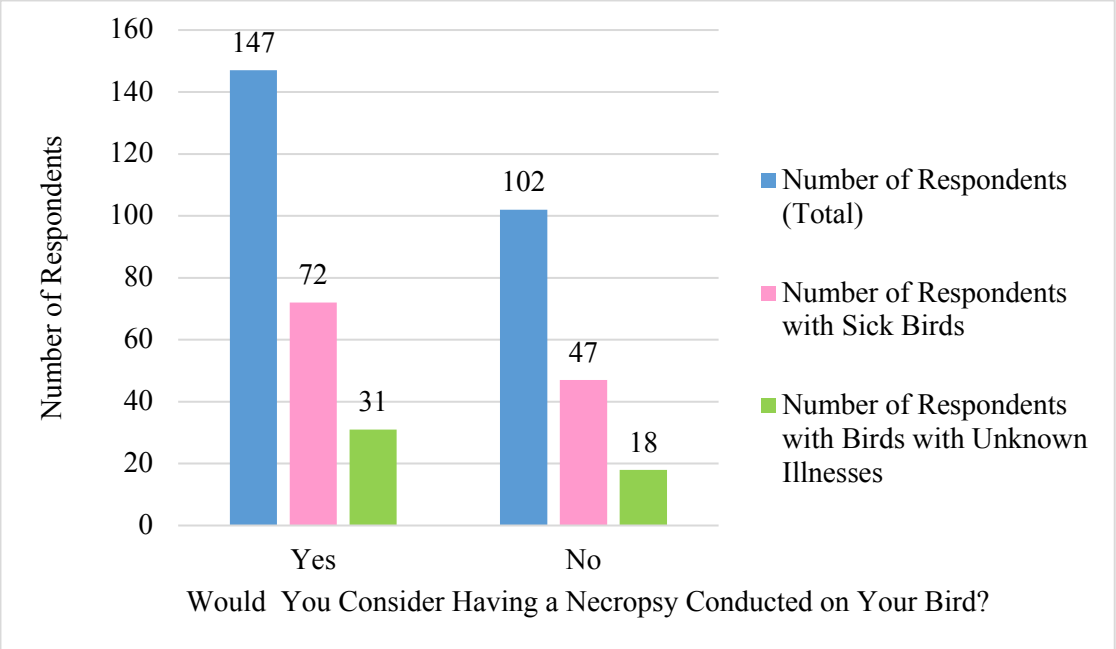

Figure 13. Respondents Who Would Consider Having a Necropsy Conducted on Their Bird

59% (n=249) of poultry producers would consider having a necropsy performed on their bird. Of those producers, 49% (n=147) owned flocks with sick birds. Of those producers with sick birds, 43% (n=72) did not know what caused their birds' illnesses. 41% of poultry producers did not consider necropsy services for their birds. Of those producers, 46% (n=102) owned flocks with sick birds. Of those producers with sick birds, 38% (n=47) did not know what caused their birds' illnesses.

Producer Awareness

Table 12—Average Producer Self-Ranked Confidence

Flock Size (Birds)	Confidence Rank (1—10)	Sick Birds in Flock (%)
1 – 6	5.7	4.5
7 – 20	6.44	5.3
21 – 50	6.5	4.4
51 – 100	7.5	3.0
101 – 500	7.5	3.2
Over 500	5.3	0.92

The average self-ranked confidence score was 6.51. With the exception of flocks with over 500 birds, the confidence ranking increased as flock size increased (Table 7). The percentage of sick birds in a flock was lower in larger flocks than smaller flocks.

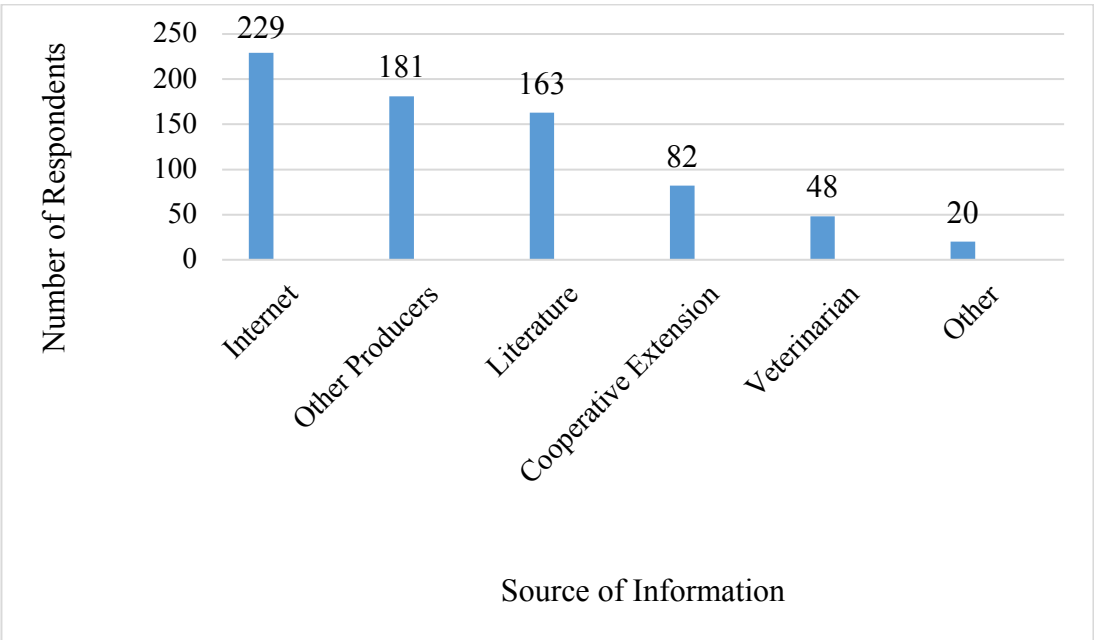

Figure 14. Sources of Information

The predominant source of information for poultry producers was the internet (91.2%, n=251) (Fig. 14). 19% of producers sought information from veterinarians. When asked what their preferred source of information would be, poultry producers responded that publications (28%) and workshops (19%) would be there preferred source (Fig. 15).

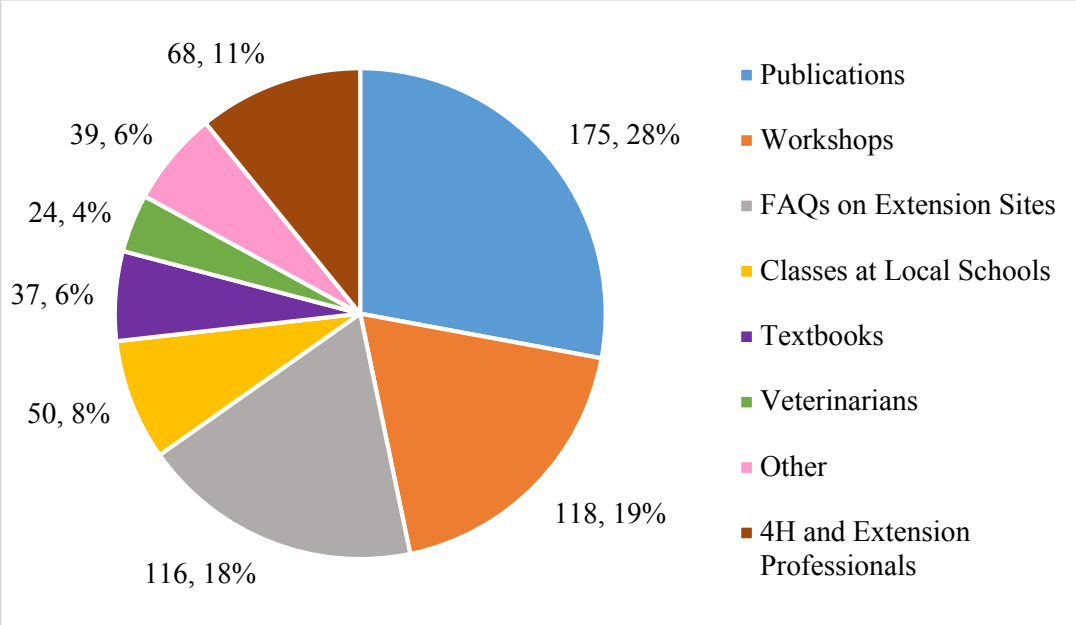

Figure 15. Preferred Source of Information

DISCUSSION

The study aimed to collect information on the demography and management of backyard poultry flocks in Maine. This study represented the first characterization of backyard poultry flocks in Maine. These findings were intended to provide an initial, not a definitive, understanding of backyard poultry flocks and their producers. The data was also meant to provide insight on poultry producers' understanding of poultry health and husbandry. For example, did producers research hatchery certifications (caveat emptor!) or blindly purchase chicks? Did they understand *why* they used select biosecurity practices or provided their birds certain housing? The ultimate goal of the research project was to motivate people to care about their birds.

Survey Responses

Surveys demand verity from the participants in order to yield results of any significance. Participants may report what they believe to be the desirable response instead of reporting the truth. They may also intentionally submit false information for the sake of skewing the data. Therefore, the data obtained in this study must not be considered absolute. The data should be considered a starting point for flock characterization. The format of the survey came with innate limitations as well. The online format was most readily accessible to participants with internet access and familiarity with technology. The survey also favored participants fluent in the English language

Demographics

Producers indicated a preference towards small flocks (fewer than 50 birds), with the most common flock size being 7 to 20 birds. Perhaps the smaller flocks are more manageable and economical for poultry producers. Chickens were the predominant species in Maine flocks. The popularity of chickens in Maine could be attributed to their functional versatility as well as their size. Chickens are small and can be used for egg production, meet production, companionship, and pest control.

The most common function of Maine flocks was egg production. The popularity of egg production was seconded by pets. Although it was beyond the scope of this study, it would be interesting to compare the health of poultry producers who own poultry as pets to poultry producers who own poultry for other reasons. Living in close proximity to animals poses health risks to humans, and pet poultry owners are at a heightened risk of contracting zoonotic diseases such as salmonella and E. coli. When it came to food production, Maine poultry producers favored egg production over meat production. Although the difference in popularity could be due to the differences in management practices, it could be indicative of a larger nutritional shift in humans. Overall, the small flock sizes coupled with the popularity of egg production and pets implies that Maine poultry producers are keeping flocks to sustain themselves.

Less than half of the flocks exhibited species diversity. The reasons for the dominance of homogenous flocks was unclear, but it is possible that heterogeneous flocks present management difficulties to producers. The different species would require different housing and nutrition requirements. Conversely, a mixed flock would allow producers to optimize the qualities of different species for different functions (e.g.

chickens for eggs and turkeys for meat), which may be why there were more mixed species in large, food production flocks than small, companionship flocks. Chickens and ducks were the most popular combination of species in mixed flocks. Both species are known for controlling pests, and since Maine is infested with ticks, they could be reducing the tick populations on producers' properties. Maine also has plenty of ponds, lakes, rivers, and streams, which are great for raising ducks.

Flock Management

55.8% of producers kept the same resident flock and sometimes added new birds to it, and 25% of producers added new flocks in a continuous cycle. The maintenance of resident flocks in conjunction with the addition of new birds and flocks means that both the number of flocks and the number of birds per flock are increasing in Maine. The Maine poultry population is on the rise. Only 8 (30%) producers culled and replaced their flock yearly. The lack of "all in all out" poultry systems in Maine was indicative of a poor understanding of biosecurity. However, 2 flocks with over 1,000 birds and 2 flocks with over 100 birds practiced the "all in all out" system, which suggests large, commercial flock producers have a better understanding of biosecurity than small flock producers.

There was a great deal of variation in biosecurity practices. Most producers used 3 biosecurity practices. The most common combination of practices was isolating new and returning birds from the flock and separating sick birds from the flock. Maine producers seemed to prefer quarantining their birds to other biosecurity practices. Only 6s.4% of producers reported sick birds to the authorities. This low percentage raises several concerns. Failure to report diseases hinders the detection and mapping of disease

breakouts. The disease could silently spread to dozens of other flocks before it is finally reported. Failure to report diseases also delays the outbreak response and recovery time and increases the recovery expenses. Producers may feel embarrassed or stigmatized for reporting diseases to the authorities. They might even distrust the government, but it is a necessary practice. The welfare of the animal trumps the emotions of the producers. Producers that reported their sick birds to the authorities had healthier flocks on average than producers who used other biosecurity methods (Fig 6.). In general, half of the total flocks per biosecurity practice were healthy, but 71% of the flocks owned by producers who reported illnesses to authorities were healthy. Ten producers implemented all 6 biosecurity practices. Those producers had the fewest incidences of illness in their flocks. They also ranked themselves as the most confident at recognizing signs of infectious disease. Implementation of more biosecurity practices is associated with healthies flocks and higher levels of producer confidence. Overall, most flocks implemented minimal biosecurity efforts. Strengthening biosecurity should be every flock's priority because it is a cost effective way to prevent diseases and improve poultry health. The wide variation of biosecurity practices exposed a need for better education on biosecurity.

Most producers (60%) looked at their birds to assess their body condition score. Evaluating the physical appearance of the bird is a subjective and inaccurate method of determining body condition score, for feathers can conceal an overconditioned or underconditioned bird. Therefore, a visual assessment should be performed in conjunction with other assessments. The least subjective method of determining body condition score is weighing the bird. Only 2 producers kept records of their birds' weights. Nevertheless, those producers did not have any illnesses in their flocks. One of

those producers owned a flock of 5,500 birds and did not have a single sick bird. Objective assessments of body condition score seem to be associated with lower incidences of illness. 27% of producers did not even evaluate the body condition score of their birds. These findings reveal a lack of education surrounding the importance of body condition scoring.

As for determining the health of their birds on a daily basis, producers used all of their senses, except taste, to judge health. Most producers monitored the behavior and physical appearance of their birds to judge their health and welfare, yet both of those characteristics rely on subjective visual assessments. 2.3% of producers did not consider the health of their birds on a daily basis, which means that most producers care about their birds. However, producers need a more objective method of assessing poultry health.

Producers considered a wide array of factors when choosing housing for their birds. The most common factor, though, was protection from the elements (16.1%). Maine experiences long, harsh winters with (below) freezing temperatures and above average snowfall, so protection from the elements is crucial to the vitality of poultry.

Flock Health

The number of sick flocks increased as flock size increased (Table 9). Conversely, the percentage of birds within a flock that were sick decreased ad flock size increased. It can be inferred from this data that producers of large flocks are better at treating sick birds and preventing disease transmission.

Mites and cold weather were blamed for causing the most diseases in flocks. Maine has unforgiving winters, which are hard on both humans and poultry. It can be

challenging to keep poultry warm and prevent water buckets from freezing. Although 16% of producers experienced seasonal illnesses in their flocks, 53% of those producers specified winter as the worst month for illness.

60% of birds became sick on an individual basis rather than in groups. It is worth noting that 3 of the 152 flocks in this category contained more than 500 birds. The individual cases of illness could be characteristic of Marek's Disease, which is prevalent in Maine. Otherwise, the individual cases could be representative of good biosecurity and treatment, especially since most producers reported separating sick birds as their primary method of biosecurity.

The majority of producers (84%) did not seek veterinary treatment for their birds. The most cited reason for declining treatment was cost. More producers might seek veterinary treatment if the cost was reduced. Producers who sought veterinary care experienced similar, albeit slightly lower, rates of illness in their flocks as producers who did not seek veterinary care (2.9% and 3.5% respectively).

More producers (59%) expressed interest in necropsy services than those who expressed disinterest. 49% of producers who were interested in necropsies owned sick birds, and 43% of those sick birds had unknown illnesses. Perhaps if Maine offered a limited-time, free necropsy service to backyard poultry producers like CAHFS, more producers would be willing to necropsy their birds.

Producer Awareness

The average producer's self-rated level of confidence was a 6.51. Confidence score increased as flock size increased. The exception to this trend was producers with over 500 birds. Those producers had a lower confidence score than producers from the

previous flock size. The drop in confidence could possibly be attributed to a stronger reliance of professional care or humbleness. Minus this exception, the number of sick birds per flock decreased as flock size and self-rated confidence increased.

Sources of Information

The majority of poultry producers indicated the internet was their main source of information. Access to accurate poultry information is crucial to the success of raising a flock. However, sifting through information on the internet requires great caution. False information on the internet could lead to wrongful treatments or dangerous practices. False information paired with an absence of veterinary care could jeopardize a flock's health. A lack of proper diagnostics may result in inappropriate treatments, leading to poor poultry health and subsequent welfare issues. Perhaps veterinarians could find a way to spread information to producers on public internet forums.

When asked for their preferred method of obtaining information, producers wanted publications and workshops. Therefore, publications and methods are the best vectors of information for Maine poultry producers. Interestingly, none of the producers wanted to get information from the internet. The apparent disinterest in the internet was most likely because the internet was not an option for the question, but the producers could have selected the "other" option instead.

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APPENDICES

APPLICATION COVER PAGE

- ***KEEP THIS PAGE AS ONE PAGE – DO NOT CHANGE MARGINS/FONTS!!!!!!!!!***
- ***PLEASE SUBMIT THIS PAGE AS WORD DOCUMENT***

APPLICATION FOR APPROVAL OF RESEARCH WITH HUMAN SUBJECTS
Protection of Human Subjects Review Board, 400 Corbett Hall

(Type inside gray areas)
PRINCIPAL INVESTIGATOR: Alice Gluchanicz **EMAIL:** alice.gluchanicz@maine.edu
CO-INVESTIGATOR: **EMAIL:**
CO-INVESTIGATOR: **EMAIL:**
FACULTY SPONSOR: Dr. Anne Lichtenwalner **EMAIL:** anne.lichtenwalner@maine.edu
(Required if PI is a student):
TITLE OF PROJECT: Assessing Poultry Disease Prevalence and Poultry Producer Awareness in the Northeast
START DATE: March 12, 2018 **PI DEPARTMENT:** SFA (NSFA)
FUNDING AGENCY (if any):

STATUS OF PI: FACULTY/STAFF/GRADUATE/UNDERGRADUATE U **(F,S,G,U)**

1. **If PI is a student, is this research to be performed:**

   ☒ for an honors thesis/senior thesis/capstone? ☐ for a master's thesis?
   ☐ for a doctoral dissertation? ☐ for a course project?
   ☐ other (specify)

2. **Does this application modify a previously approved project?** N **(Y/N). If yes, please give assigned number (if known) of previously approved project:**

3. **Is an expedited review requested?** Y **(Y/N).**

Submitting the application indicates the principal investigator's agreement to abide by the responsibilities outlined in Section I.E. of the Policies and Procedures for the Protection of Human Subjects.

Faculty Sponsors are responsible for oversight of research conducted by their students. The Faculty Sponsor ensures that he/she has read the application and that the conduct of such research will be in accordance with the University of Maine's Policies and Procedures for the Protection of Human Subjects of Research. REMINDER: if the principal investigator is an undergraduate student, the Faculty Sponsor MUST submit the application to the IRB.

Email this cover page and complete application to UMRIC@maine.edu

****

FOR IRB USE ONLY **Application # 2018-03-01** **Review (F/E): E**
ACTION TAKEN:

X **Judged Exempt; category 2** **Modifications required? Y** **Accepted (date) 3/6/2018**
☐ **Approved as submitted. Date of next review: by** **Degree of Risk:**
☐ **Approved pending modifications. Date of next review: by** **Degree of Risk:**
Modifications accepted (date):
☐ **Not approved (see attached statement)**
☐ **Judged not research with human subjects**

FINAL APPROVAL TO BEGIN **3/6/2018**
Date

01/2017

Appendix B: Constant Contact Recruitment Text

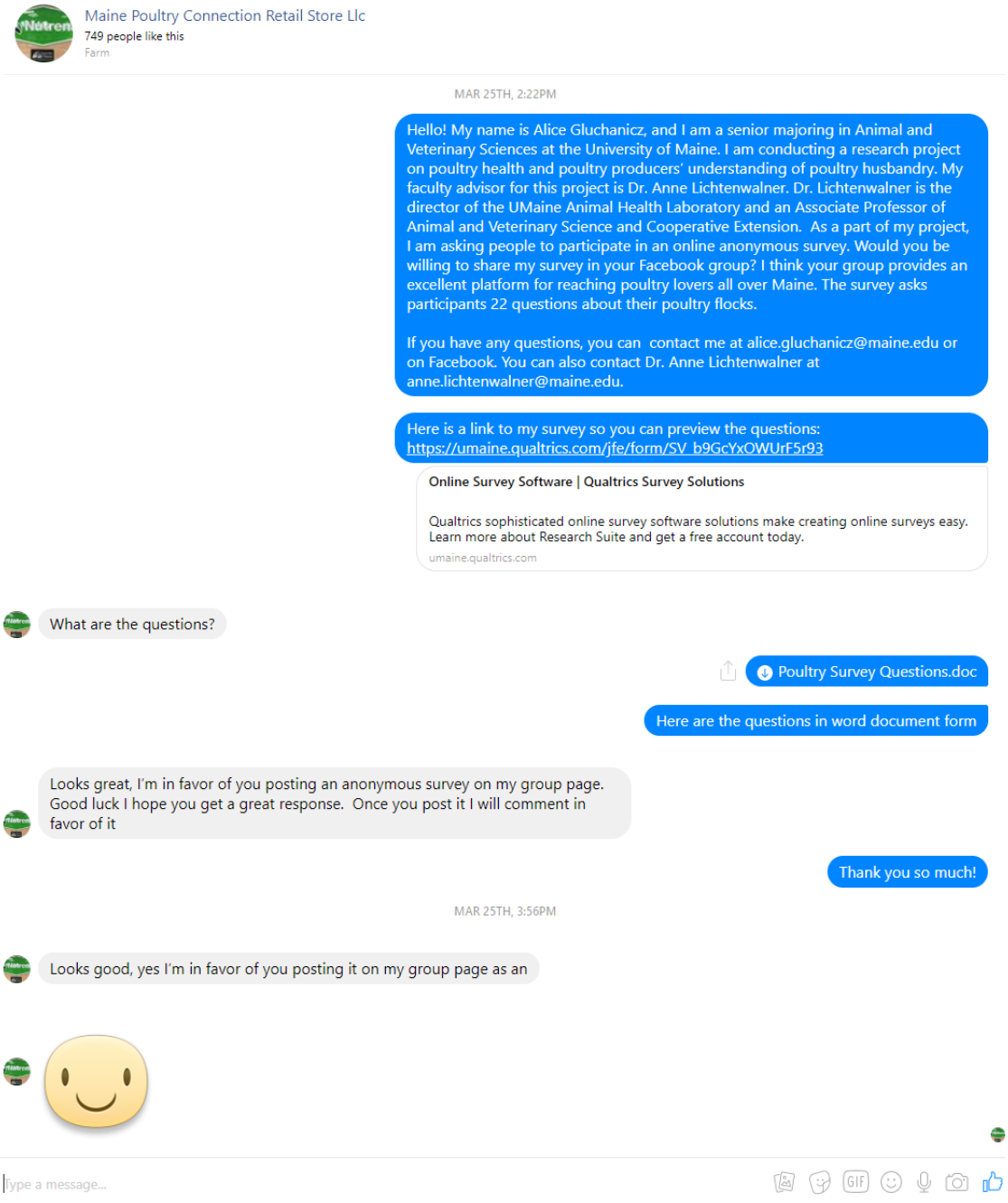
My name is Alice Gluchanicz, and I am a senior majoring in Animal and Veterinary Sciences at the University of Maine. I am conducting a research project on poultry health and poultry producers' understanding of poultry husbandry. My faculty advisor for this project is Dr. Anne Lichtenwalner. Dr. Lichtenwalner is the director of the UMaine Animal Health Laboratory and an Associate Professor of Animal and Veterinary Science and Cooperative Extension. As a part of my project, I am inviting you to participate in an online anonymous survey. You must be at least 18 years old to participate. The survey contains 22 questions about your poultry flock. If you have any questions, you can contact me on Facebook or email me at alice.gluchanicz@maine.edu. You can also email Dr. Anne Lichtenwalner at anne.lichtenwalner@maine.edu.
Below is a completely anonymous link to the survey:

Click her for Survey

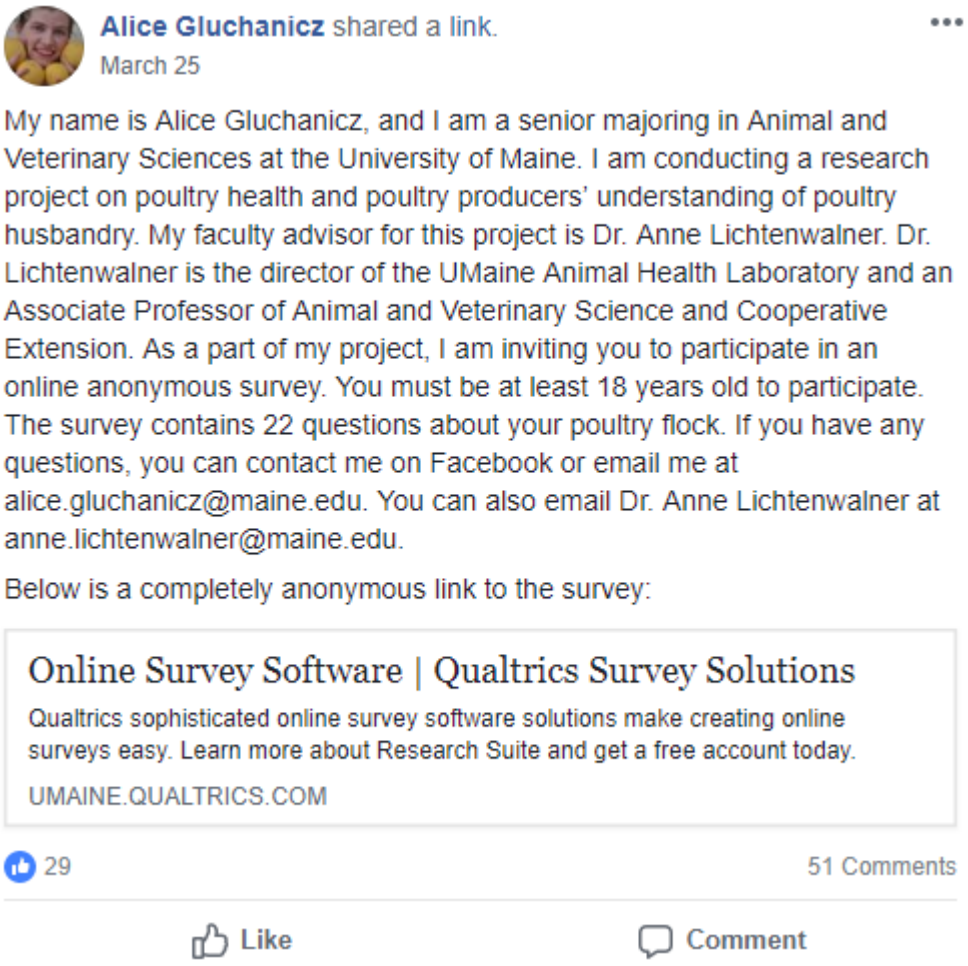
Thanks for helping us.

University of Maine Cooperative Extension
Hitchner Hall
Orono, ME 04469

Appendix C: Permission from Maine Poultry Connection



Appendix D: Maine Poultry Connection Recruitment Text



Appendix E: Informed Consent

Informed Consent

My name is Alice Gluchanicz, and I am a senior majoring in animal and veterinary sciences at the University of Maine. I am conducting a research project on poultry health and poultry producers' understanding of poultry husbandry. My faculty advisor for this project is Dr. Anne Lichtenwalner. Dr. Lichtenwalner is the director of the UMaine Animal Health Laboratory and an Associate Professor of Animal and Veterinary Science and Cooperative Extension. As a part of my project, I am inviting you to participate in an online anonymous survey. You must be at least 18 years old to participate.

What Will You Be Asked to Do?

If you choose to participate, you will be asked to answer 22 questions about your poultry flock. Completion of the survey may take approximately 20-30 minutes.

Risks

The risks of participating in this survey are your time and inconvenience. If a question makes you feel uncomfortable, you may skip it. You may also exit the survey at any time.

Benefits

The questions are designed to be educational tools for participants. They may teach participants something new about caring for poultry. The survey responses will help researchers obtain data on poultry flocks in the northeast and direct research to help address whatever problems poultry producers may be experiencing.

Confidentiality

The survey is completely anonymous. There will be no information linking you to the data. Only my faculty advisor and I will have access to the responses stored on password-protected computers. The data will be deleted at the end of April 2018.

Voluntary

Participation in this survey is completely voluntary. You may skip questions or exit the survey at any time. You are not obligated to complete the survey.

Contact Information

If you have any questions, contact Alice Gluchanicz at alice.gluchanicz@maine.edu or Dr. Anne Lichtenwalner at anne.lichtenwalner@maine.edu. If you have any questions about your rights as a research participant, please contact the Office of Research Compliance, University of Maine, 207/581-1498 or 207/581-2657 (or e-mail umric@maine.edu).

By completing this survey, you indicate that you understand the conditions and agree to participate.

Appendix F: Survey Questions

Q 1. Describe the size of your flock during 2017.

- 1-6
- 7-20
- 21-50
- 50-100
- 101-500
- Over 500 birds

Q 2. Please choose the best description of how you structure your flock(s).

- I always have the same flock on my farm (resident, long-lived birds)
- I have a resident flock but sometimes add new birds to it
- I empty out the flock at least once yearly (no birds left), then start a new flock
- I always have at least one flock going, and add new flocks in a continuous cycle

Q 3. Check all the species you had on your farm during 2017. Next to each species, please estimate how many birds of that species you owned.

- Chicken __
- Turkey __
- Goose __
- Duck __
- Guinea fowl __
- Peafowl __
- Other (name of species and number) __

Q 4. Which of the following best describes the purpose of your flock? Check all that apply.

- Layers/ table egg production
- Layers/ breeding flock for sales of chicks
- Broilers/ meat production
- Pets
- Game birds and exhibition
- Other

Q 5. How do you assess your birds' body condition score? Check all that apply.

- I weigh my birds and keep records for weekly comparisons
- I feel my birds' keels and use a scoring system for that type of bird
- I simply look at my birds to see if they look like they are the proper weight
- I don't assess my birds' body condition scores

Q 6. How do you decide on daily basis if your birds are healthy? Check all that apply.

- I observe my birds' behavior (eating/drinking/pecking activity)
- I observe the physical appearance of my birds
- I check for abnormal odors
- I listen to my birds
- I don't think about my birds' well-being on a daily basis

Q 7. Which of these factors did you consider in deciding how to house your birds? Check all that apply.

- Space availability (at least 2sq. ft. per bird)
- Climate
- Predators
- Avoiding pests and parasites
- Availability of good-quality litter
- Protection from the elements
- Easy to clean and disinfect
- Longevity of the structure
- Other _____

Q 8. Are your birds vaccinated for any of the following diseases?

- Marek's Disease
- Coccidiosis
- Other_____
- Don't know

If the answer is yes, please state which vaccinations your birds received, and when.5

Q 9. Do you know what NPIP stands for? Yes__ No__

Q 10. Were your birds purchased from a NPIP certified hatchery? Yes__ No __

If the answer is yes, please state the hatchery's certification(s). _____

Q 11. Have any of your birds been sick in the past year? Yes__ No__

If so, how many? __

Q 12. What do you think made your birds sick? Check all that apply.

- Bacteria (name _____)
- Parasite (name _____)
- Nutrition (what kind of nutritional problem_____)
- Environmental stressor (what kind? _____)
- Other _____

Q 13. Would you consider having a necropsy done on your next dead bird to find out why it died?

Yes __ No __

Q 14. Are there specific diseases you encounter with your birds? Yes __ No __

If the answer is yes, please name the disease(s). _____

Q15. When your birds fall ill, are they usually affected en masse or individually?

- En masse
- Individually

Q 16. Do you birds tend to become ill during a specific time of the year? Yes __ No __

If the answer is yes, please indicate the time of year. _____

Q 17. Do you seek veterinary care for your birds when they become ill?

- Yes
- No because the cost of veterinary treatment is too expensive
- No because there aren't any veterinarians with poultry experience near my location
- No I would never take a bird to a vet

Q 18. Do you practice any of the following biosecurity methods? Check all that apply.

- Restrict visitor access to birds and property
- Clean and disinfect equipment (e.g. vehicles, shoes, clothes, cages, etc) that has been in contact with birds
- Isolate new birds (and birds returning from exhibitions) for at least 30 days
- Refuse to share birds, equipment, or supplies with other poultry owners
- Report sick birds to local veterinarian, state veterinarian, agricultural extension specialist, or USDA
- Separate sick birds from healthy birds, and feed/clean/treat them last

Q 19. On a scale of 1 to 10, how confident are you in your ability to recognize the signs of infectious poultry diseases? _____

Q 20. What are your primary sources of information regarding poultry health? (check all that apply)

- Internet
- Other farmers (clubs, internet, friends)
- Literature (books, handouts, journal publications, etc.)
- Cooperative Extension
- Veterinarian
- Other

Q 21. What topic(s) would you like to know more about regarding poultry health?

_____

Q 22. What is your preferred way to learn more about those topics?

- Workshops in Maine
- Publications, such as poultry care newsletters
- FAQs on Extension sites
- Classes at local colleges or high schools
- Conversations with 4H and Extension professionals
- Working through my veterinarian's office
- Textbooks available through my library
- Other _____

Appendix G: Table 4—Composition of Mixed Species Flocks

Species Combination	Frequency	% of Mixed Flocks (n=106)
Chicken, Duck	29	27
Chicken, Duck, Goose	6	6
Chicken, Duck, Goose, Guinea Fowl	3	3
Chicken, Duck, Goose, Guinea Fowl, Turkey	5	5
Chicken, Duck, Goose, Peafowl	1	0.9
Chicken, Duck, Goose, Peafowl, Turkey	1	0.9
Chicken, Duck, Goose, Turkey	1	0.9
Chicken, Duck, Guinea Fowl	7	7
Chicken, Duck, Guinea Fowl, Other	1	0.9
Chicken, Duck, Guinea Fowl, Turkey	3	3
Chicken, Duck, Other	1	0.9
Chicken, Duck, Turkey	8	8
Chicken, Goose	2	2
Chicken, Goose, Guinea Fowl	1	0.9
Chicken, Goose, Guinea Fowl, Other	1	0.9
Chicken, Goose, Guinea Fowl, Turkey	1	0.9
Chicken, Goose, Turkey	1	0.9
Chicken, Guinea Fowl	7	7
Chicken, Guinea Fowl, Turkey	2	2
Chicken, Other	5	5
Chicken, Peafowl	1	0.9
Chicken, Turkey	17	16
Goose, Duck	1	0.9
Guinea Fowl, Turkey	1	0.9

AUTHOR'S BIOGRAPHY

Alice Gluchanicz was born in Boca Raton, Florida on May 4, 1995. She moved to Wayne, Pennsylvania in 2000 and lived there for 13 years. After nearly pursuing a fine art degree, she took a gap year after high school to contemplate her career aspirations. She moved to New Harbor, Maine after graduating Conestoga High School in 2013.

At the University of Maine, Alice majored in Animal and Veterinary Sciences with a Pre-Vet concentration. There she was able to indulge in all of her passions. She was a DJ at WMEB, a member of Ewe Maine Sheep Club, and a devoted Zumba student.

She has accepted an offer to study at the University of Glasgow School of Veterinary Medicine class of 2023. Alice wishes to specialize in small animal emergency and critical care. She has a particular fascination with dermatology, soft tissue surgery and wound reconstruction.