Improving Poultry Data for Modeling the Chesapeake Bay Watershed

Report of the
Poultry Litter Subcommittee
of the
Chesapeake Bay Program

Overview

- Background
- Process
- Results
- Conclusion
- Recommendations

PLS- Background

- Founded in 2011 by the Ag Workgroup to review modeling assumptions in Phase 5.3.2 Watershed Model (Bay Model) for nutrient generation by poultry and application of nutrient loading in the model
- Decision was in response to jurisdictions concerns that the poultry nutrient generation in the Bay Model did not accurately reflect litter amounts and nutrient generation by poultry across the Watershed.

PLS - Background

Examples: Maryland's broiler litter generation available for transport or field application

Bay Model 5.3.2 Assumptions	Annual Implementation Report (AIR) Summary Data
2.2 million tons wet litter generated/year	2012- 334,000 tons/year collected

PLS - Background

Examples: Maryland's broiler nutrient application

Bay Model 5.3.2 Assumptions	Proposed Bay Model 6.0
8.7 tons wet litter/ac (assumes all litter generated remains on MD's lower shore)	1.5 tons/ac
~48, 740,000 lbs N*	~22,252,000 lbs N
~12,974,000 lbs P	~7,439,000 lbs P

* Includes approximately 14% of available N pounds lost to volatization prior to land application

PLS – Background

Examples: Broilers Delaware -nutrient concentration

Bay Model 5.3.2 Assumptions	Laboratory Data
0.0498 lbs N/lb dry litter (all years)[1]	1995[2]- 0.043 lbs/lbs litter
	2013[2]- 0.043 lbs/lbs litter
0.0114 lbs P/ lb dry litter (all years)[1]	1995[2]-0.017 lbs/lbs litter
	2013[2]-0.014 lbs/lbs litter

1. 2003 ASABE based on 1990 caged studies
2. Based upon a 5.5lb bird

PLS - Background

Calculations of populations, poultry litter volume, and N & P generation in Bay Model 5.3.2 required three parameters:

- Nutrient concentrations (source 2003 ASABE)
- Litter generation (source 2003 ASABE)
- Population (source Census- Dec 31 bird inventory **x 365 days**)

PLS- Process

- Develop alternative methods to re-estimate populations for each type of poultry
- Develop updated poultry litter generation quantities for each poultry type, both modern and historic
- Collect data that reflects modern and historical N & P concentrations in poultry litter for each poultry type, within the watershed
- Collect annual data at the state scale to determine differences within the watershed for concentrations of manure, manure generation, and bird populations

PLS – Process

2013 Poultry Litter Subcommittee Broiler State Data Request

State	Delaware																
Agency	DDA																
Lab	DDA testing lab (2003-present); Agri-Analysis (1996-2002)																
Year (1985-Present)	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2012	2013
Manure Type																	
Dry																	
Wet	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Sample Type																	
In-House								x		x	x	x	x	x	x	x	x
Uncovered Stack								x	x	x	x	x	x	x	x	x	x
Covered Stack								x		x	x	x	x	x	x	x	x
Roofed Storage								x	x	x	x	x	x	x	x	x	x
Other (specify)	unknown	unknown	unknown	unknown	unknown	unknown	unk										
Bird Population (x10^6)																	
NASS Value	294.8	295.3	290.9	294.4	283.3	287.8	29[illegible]	292.4	284.6	256.0	271.8	294.8	298.6	291.9	300.5	212	
Bird Market Wt lbs																	
Value Range																	
Weighted Average	4.7	4.8	4.7	[illegible]	4.8	4.8	4.7	4.7	4.8	4.8	5.4	5.4	5.4	5.8		7.1	
Growout Periods days																	
Value Range																	
Weighted Average											56	56	56	56	56	56	56
Flocks per year #/yr																	
Value Range																	
Weighted Average											4.8	4.8	4.8	4.8	4.8	4.8	4.8
Manure Generation lbs/1000 birds																	
Value Range											.2-4.6	.2-4.6	.2-4.6	.2-4.6	.2-4.6	.2-4.6	.2-4.7
Weighted Average	2326	2368	2409	2451	2492	2534	2575	2617	2658	2700	2742	2783	2825	2866	2908	2991	3032

PLS- Results

Examples: Delaware's broiler population estimates

Year	Census Inventory	NASS Placements	NASS Production	NASS Slaughter
2012	43,206,514	215,987,000	212,000,000	309,147,000
2011	N/A	223,589,000	217,800,000	302,305,000
2010	N/A	243,035,000	235,000,000	304,471,000
2009	N/A	243,572,000	231,700,000	296,595,000
2008	N/A	245,505,000	242,900,000	304,657,000
2007	51,092,495	257,973,000	245,800,000	306,875,000

PLS- Results

Examples: State broiler manure generation

State/region	Manure generation (t/1000 birds)	Reference
Delaware	1.25	UD (Malone et al. 2000)
Delaware	1.5	DDA/UD (2012)
Maryland	1.0	UMD (Carr et al. 1990)
Virginia	1.1 – 1.4	VT (Collins 2009
Pennsylvania	1.5	PSU (Patterson et al. 1998)
Georgia	1.2	UGA (Vest et al. 1994)
Alabama	1.7 (0.6 lbs/lb meat produced)	(Mitchell and Donald 1995)
Mississippi	1.25	(Chamblee and Todd 2002)
Nationwide	1.25	(NRAES 1999)

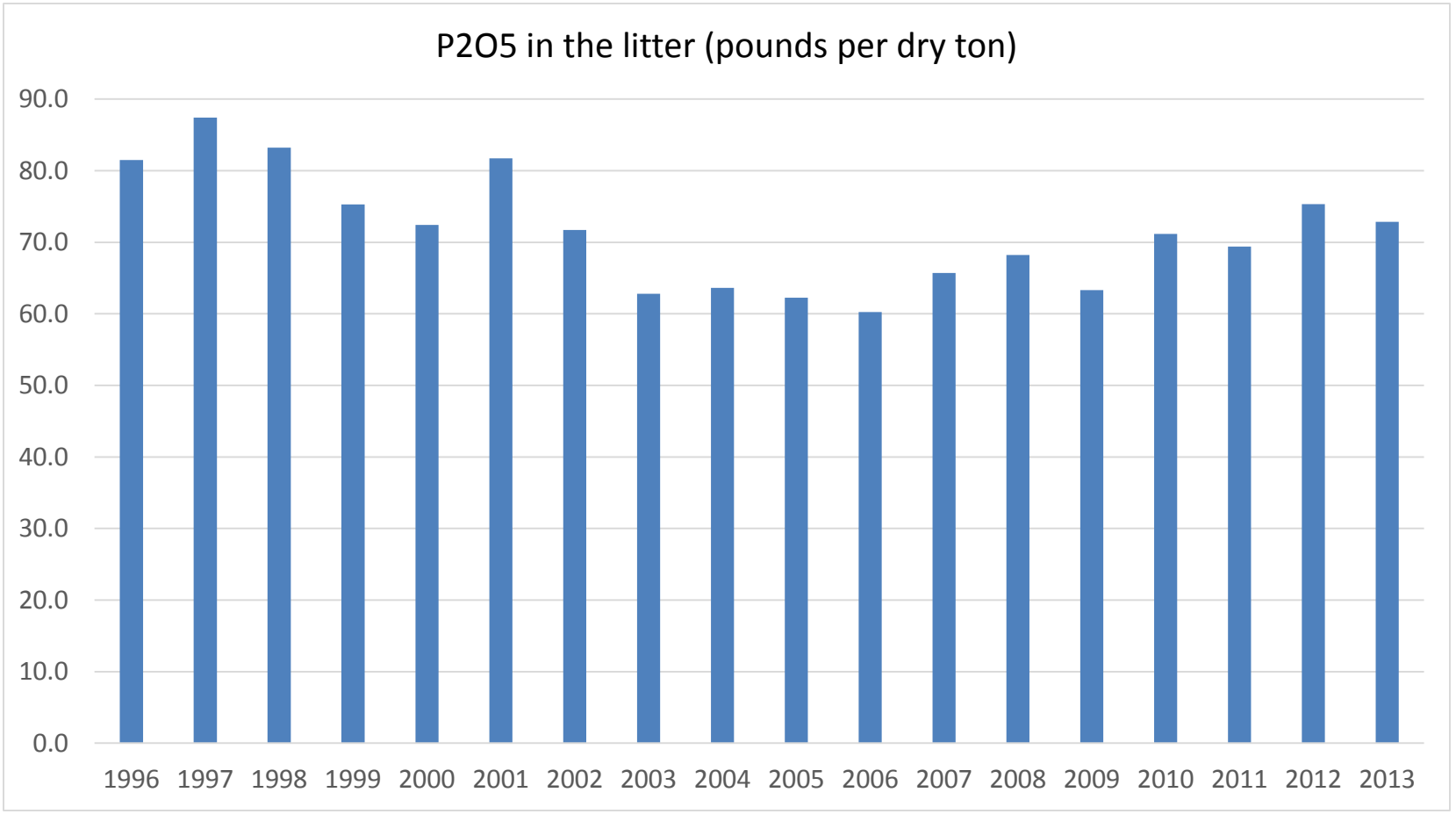
PLS- Results

Examples: Delaware broiler manure N & P concentrations

	2005	2006	2007	2008	2009	2010	2011	2012	2013
lbs TKN/ton dry litter	81.6	81.4	81.0	79.7	78.6	83.1	85.6	84.3	87.9
lbs P205/ton dry litter	62.3	60.2	65.7	68.2	63.3	71.2	69.4	75.3	72.9

PLS – Results

Examples: Changes in P205 concentrations in broiler samples, Delmarva Peninsula (1996-2013)



PLS – Results

Examples: Comparison Across the Watershed – Broilers (2006-2012)

Parameter	Units	Delmarva	Virginia	West Virginia
Total N (wet)	lbs/ton	57	71	61
Total P (wet)	lbs/ton	20	15	20
Manure generation (wet)	lbs/1000 birds	2,990	2,500	2,000
Moisture	%	30	27	33

Parameter	Units	Delmarva	Virginia	West Virginia
Total N (dry)	lbs/ton	81	97	91
Total P (dry)	lbs/ton	29	21	30
Manure generation (dry)	lbs/1000 birds	2,086	1,825	1,340

PLS – Results

Examples: Comparison Across the Watershed – Broilers (2006-2012)

Parameter	Units	Delmarva	Virginia	West Virginia
N generation	lbs/1000 birds	84.9	88.8	61.0
P generation	lbs/1000 birds	29.8	18.8	20.0

Poultry Production-Delaware

	Finished Bird Weight (lbs)	Growout (days)	Flocks per Year	% in Delaware
Broilers	5.7	49	5.5	40
Roasters	8	61	4.3	60
Delaware	7.08	56.2	4.8	100

Poultry Production-Maryland

	Finished Bird Weight (lbs)	Growout (days)	Flocks per Year	% in Maryland
Broilers	5.3	46	5.3	95

PLS- Results

- The PLS developed an alternative method to estimate poultry populations
- The PLS developed a method to allow states to annually update their litter generation and N&P concentrations
- However, these results cannot be utilized in the current Bay Model 5.3.2, rather are recommendations for the Bay Model Phase 6

PLS – Results

Examples: Comparison of Maryland's manure generation and concentration under current Bay Model method and two proposed methods for 2012

Parameter	Maryland (Bay Model 5.3.2)	Maryland (Bay Model 6.0)	Maryland (ASABE 2005)
Produced Birds		302,800,000	302,800,000
Inventoried Birds	64,192,424		
Days of Litter Production	365		
Lbs of Wet Litter/Bird/Day	0.186813		
Lbs of Wet Litter/Finished Bird*	NA	2.3916	11
Lbs of Dry Matter/Lb of Litter	0.26	0.7135	0.26
Lbs P/Lb of Dry Litter	0.0114	0.014397	0.0125
Lbs N/Lb of Dry Litter	0.0498	0.043065	0.0429
Total Lbs Wet Litter	4,377,072,446	724,176,480	3,330,800,000
Total Tons Wet Litter	2,188,536	362,088	1,665,400
Total Lbs Dry Litter	1,138,038,836	516,699,918	866,008,000
Total Tons Dry Litter	569,019.42	258,350	433,004
Total P Lbs	12,973,643	7,438,929	10,825,100
Total N Lbs**	48,739,927	22,251,682	37,151,743

* assumes a 5.3lb bird

** ~14% volatization factor is included

PLS- Conclusions

- The PLS focused on updating and quantifying values to develop creditable estimates for concentrations, manure generation and population for each poultry type at the state and regional scale.
- Data suggests a state/county difference in the concentration of manure, manure generation, and each poultry type population
- Where data gaps exist in these parameters in any state or poultry type data the PLS recommends default data be used

PLS- Conclusions

- Concentrations: Utilize annual average N & P concentrations for each state based on samples from certified state and private labs
- Manure generation: Utilize annual average litter mass data from each state and relate it to the size of the bird produced (days of litter produced)

PLS- Conclusions

- Population: utilize the USDA-NASS annual production numbers for broilers and turkeys. However, there is insufficient NASS data for layers, breeders and pullets

PLS- Recommendations

- The PLS will continue to pursue alternative methods to better quantify the data utilized in the Bay Model
- The PLS will continue to work with the poultry industry to quantify how the changes in feed formulas, genetics, phytase amendments, and litter management impact the litter volume and nutrient concentration

PLS- Recommendations

- Suggestions:
  - Need county scale bird populations including:
    - Layers, breeders, and pullets
    - Turkey hens and toms
  - Need average live bird weight at county scales
  - Need mass of litter or manure produced for all poultry types
  - Need concentration values of N & P for all poultry types