Chesapeake Bay & the case of the missing chickens

Oversight highlights growing worries about accuracy of Bay cleanup data

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Jul 13, 2022

Driving down Oxford Road north of Gettysburg, PA, Hillandale Farms is hard to overlook.

Two-story chicken houses, each longer than a football field, line the road. Inside, and at Hillandale's other nearby poultry houses, are more than 5 million chickens, each churning out one egg roughly every 26 hours.

Hillandale produces eggs for almost all markets: regular, organic or cage-free. It is the fourth largest egg-producing operation in the nation and the largest livestock operation in Pennsylvania.

But there is one place where Hillandale's chickens are absent: In data that the state-federal Chesapeake Bay Program uses to help estimate the amount of nutrients reaching the Bay.

Each year, Hillandale chickens produce about 5 million pounds of nitrogen — the most problematic form of nutrient pollution in the Chesapeake Bay — in their manure. That's roughly a pound per chicken and more than is discharged annually by the Blue Plains Regional Wastewater Authority, the world's largest sewage treatment plant, located outside Washington, DC.

"We've had all these birds here, and have for a number of years, and we didn't exist," said Ron Ballew, senior manager of the Hillandale operation, which voluntarily reported the data.

It's unclear, in the context of the entire Bay watershed, how significant the Hillandale oversight is — a computer model estimate suggested only a portion of its nitrogen enters the Bay.

But with the region far off pace to meet its 2025 cleanup goals, accounting for the Hillandale chickens would make that job even tougher.

That likely won't happen until at least next year. After months of discussions, Bay Program partners were unable to agree on how, or whether, the chickens should be counted.

And the problem may extend beyond Hillandale. While remarkable primarily because of its sheer size, Hillandale is probably not the only animal operation that is missed or improperly counted, some Bay Program staffers believe.

Yet the Hillandale oversight is a highly visible illustration of growing concerns among states regarding the accuracy of key data the Bay Program uses to assess progress as its 2025 pollution reduction deadline approaches. The issue has flared at various Bay Program meetings recently, often without resolution.

It's worrisome because getting people to embrace and fund nutrient reduction projects requires trust in Bay Program information — and in what it says about the status of the Bay cleanup.

"We are talking to our counties, our local stakeholders, the landowners, getting them to buy in to invest their own time, resources, labor and money," said Jill Whitcomb, director of the Pennsylvania Department of Environmental Protection's Chesapeake Bay Office.

"It's a challenge," she added. "We can't be convincing because we're not necessarily having a lot of confidence either."

Watershed of data needs

The nutrients nitrogen and phosphorus reach the Bay from a 64,000-square-mile watershed that drains parts of Delaware, Maryland, Pennsylvania, New York, Virginia and West Virginia, and all of the District of Columbia.

Determining the amount that enters the estuary — spurring algae blooms that cloud the water and cause oxygen-starved "dead zones" — is central to the work of the Bay Program, which includes all of the jurisdictions in the watershed, the U.S. Environmental Protection Agency and Chesapeake Bay Commission, which represents state legislatures.

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Those estimates are derived from complex computer models using massive amounts of information about wastewater discharges, applications of fertilizer and animal manure to crop fields, atmospheric deposition and other nutrient sources. It also uses information about state actions that reduce that pollution, such as the planting of cover crops and streamside buffers and upgrading wastewater plants.

The resulting estimates influence how hundreds of millions of dollars are spent to reach Bay cleanup goals.

Getting uniform, reliable data to feed into the model has long been a challenge. Decades ago, states reported having more acres of cropland under nutrient management plans than actually existed.

Over the years, the Bay Program has worked to standardize data and methodology across states. Still, there has been ongoing concern about the data used to determine the amount of nitrogen (roughly 650 million pounds annually) applied

to farms, lawns and other landscapes in a typical year, as animal manure, biosolids from wastewater treatment plants or purchased fertilizer.
Data on manure inputs come from several sources, including the U.S. Department of Agriculture's farm livestock population estimates. Fertilizer sales data is collected by the Association of American Plant Food Control Officials.
The processes for using that information in the Bay Program's computer models were signed off on years ago, though it was recognized that the data, collected for other purposes, weren't perfect.
"Everybody acknowledged that, 'Hey, there are issues here,'" said Norm Goulet, senior environmental planner with the Northern Virginia Regional Commission who chairs the Bay Program's Urban Stormwater Workgroup. "But we've got to use something. The question then becomes, OK, what is that something?"
But problems, like the missing Hillandale chickens, often emerge over time.
Fixing problems is complicated because of the Bay Program makeup. Its committees, workgroups, task forces and action teams include a range of state and federal representatives, as well as nonprofit organizations, local governments and other stakeholder groups.
Committee decisions require a consensus, not a majority. And when the missing Hillandale data was discovered, it was not incorporated because there was no consensus on how to do so. When problems were identified in urban fertilizer figures this spring, it could not be resolved. A two-year effort to improve the tracking of runoff control practices recently failed to reach an agreement on changes.
Often, nearly everyone agreed the data were problematic. They just couldn't agree on a fix. Without consensus, old data and procedures remain.
"I think that we've tried to use the best available data to track inputs to the model, and certainly there's good reason to take that approach," said Joe Wood, senior scientist with the Chesapeake Bay Foundation's Virginia office who participates on several Bay Program committees. "But that's led to some real challenges, too. 'Best available' is not always good enough."
Concerns about fertilizer data have been around for years, but they recently came to the fore when the latest figures — which were already 5 years old — showed a sharp uptick in use.
The impact was particularly significant for farms. Computer model estimates showed that the annual amount of nitrogen reaching the Bay from farms had been reduced by 5.7 million pounds since 2009.When new data, along with other smaller updates, were included into the modeling, that figure was reduced to about 400,000 pounds — nearly erasing, at least on paper, more than a decade of efforts.
In an unusual move, the Bay Program's Water Quality Goal Implementation Team — the committee most directly involved in nutrient reduction efforts — sent a letter to the broader partnership expressing "multiple concerns" with the fertilizer data. Those included the potential for double-counting nutrients, assumptions that fertilizer is applied the same year it is bought and other issues.
The fertilizer data, said Frank Schneider of the Pennsylvania Conservation Commission, is collected primarily for issues related to consumer protection and ensuring products are properly labeled. "Getting that information and then trying to put it into the water quality realm, it's like trying to put a square peg in a round hole."
Wood agreed that the data need to be carefully evaluated but said that should be a consistent process, not just when they produce results people don't like. "We can't have a system that when things look hard, all of the sudden we change our system," Wood said. "We need to have a process that is not influenced by the outcomes."

The missing chickens

One piece of information is still missing in the updated computer estimates: the Hillandale chickens.
To help deal with the waste from those chickens, the company has supported the development of a manure treatment facility, EnergyWorks, adjacent to its Adams County site. EnergyWorks can eliminate much of the ammonia emissions related to manure storage and field applications, while also reprocessing manure into fertilizers that are more easily transported out of pollution hotspots and can be applied to fields with a higher rate of precision.
But the facility requires multiple funding streams to be viable. For several years, it was partially supported by selling nutrient reduction credits to the Brunner Island Steam Electric Station on the Susquehanna River, but that ended in 2017. Without enough funding, it ceased operations.
While working to find a buyer for nutrient reduction credits, Pat Thompson, president of EnergyWorks, learned the Hillandale chickens weren't included in the Bay Program database. He was, in effect, trying to get credit for reducing pollution at a facility that, in the Bay Program system, did not exist.
At that point, Hillandale provided its production data to Pennsylvania officials, who urged the Bay Program to research the matter.
The Bay Program uses livestock population estimates from the U.S. Department of Agriculture. Its 2017 Census of Agriculture — the most recent available — estimated there were 210,832 egg-producing chickens, or "layers," in Adams

County, where Hillandale's main operation is located. But the company, in data reported to the Bay Program, said it had 4.7 million chickens — 22 times more.
In adjacent York County, the census reported 274,532 layers. But Hillandale's operation in that county reported 1.2 million — 4.5 times more.
At first, Bay Program staffers thought that was explained by the way the USDA reports data. When there are only a few facilities in a county for a particular type of livestock, the department does not list results for the county to protect confidentiality. Instead, those populations are typically reported at the state-scale.
"That has some constraints of what we're able to do or share with anyone," explained Travis Averill, chief of the livestock branch of the USDA National Agricultural Statistics Service, at a recent meeting. But "when we're collecting data it gives us a little help for producers, knowing that their information is protected."
When staff began crosschecking statewide figures with other sources, such as concentrated animal feeding operation permits, it appeared that Hillandale's chickens were not included anywhere.
"That's a really significant difference. It didn't show up in the statewide data, either, which is where normally it should," said Mark Dubin of the University of Maryland, who is the Bay Program's senior agricultural adviser. "For whatever reason, we don't know why, the numbers aren't there."
Dubin spent months meeting with Hillandale representatives, county conservation district staff and others to piece together the missing data from 1995 to 2021. While the Hillandale layers were not accounted for, other small layer operations in the two counties were included.
It's unclear what happened. Averill said the USDA had statistical procedures to account for the presence of unusually large facilities or those that do not respond to the department's surveys.
Ballew, of Hillandale, says the company regularly reports data to the USDA.

Widespread impact

When Bay Program modelers included the Hillandale chickens, they found that the amount of nitrogen reaching the Bay had been undercounted by more than 200,000 pounds a year.
And because those chickens produce more manure than is needed to fertilize crops in Adams or York counties, it is largely transported elsewhere for use. That triggers other adjustments in the model regarding field application rates for manure and chemical fertilizers. When it was all factored in, estimates showed higher nutrient loads not only from Pennsylvania, but also Maryland and Delaware.
The impact of the missing chickens would be enough to offset more than half of the nearly 400,000 pounds of nitrogen reduction achieved by the entire agricultural sector in the Bay watershed since 2009 — if they were included in the latest modeling.
But, officially, they're not. When the issue repeatedly came up in Bay Program committees last year, there was widespread agreement that the missing data were problematic, but members were unable to agree on a solution.
Most, including those representing Pennsylvania and the EPA, supported incorporating the data. But some worried about changing the procedures for gathering livestock information, especially if it involved industry sources.

Not an isolated incident?

Hillandale may not be the only missing facility in USDA data, Dubin said.
As a concentrated animal feeding operation, or CAFO, Hillandale is required to have a federal permit. But smaller operations wouldn't necessarily have such publicly available documentation. A county could have three or four operations of 50,000 chickens each, for instance, and they would not show up in USDA county figures — and they wouldn't be required to have a federal CAFO permit that could verify the data.
CAFO permits don't provide the full picture, either. They only capture a portion of the livestock population. In Lancaster County, PA, for example, those permits don't even cover half of its sizable dairy population.
Further, numbers in a CAFO permit may not accurately reflect the livestock population, Dubin noted. For instance, operators often overestimate the number to avoid being in violation of their permits. "You can easily introduce a degree of error by looking at just CAFO permits alone," Dubin said.
The Bay Program chose to use USDA data because it provided the most complete picture, with a consistent methodology, across the region. But no system captures the entire livestock population, Dubin said, and it's likely that animals are undercounted in some places and overcounted in others.
"The county that actually did the work doesn't necessarily get the credit for that work. It can go somewhere else." – Jill Whitcomb, PA Dept. of Environmental Protection Chesapeake Bay Office
In 2016, the Bay Program supported work by Virginia Tech and Penn State University to collect industry data on commercial hog production in Virginia and Pennsylvania. That study showed that USDA figures overcounted the animals by about 6%.

At around the same time, another Bay Program-supported study involving Virginia Tech and the U.S. Poultry & Egg Association found that USDA turkey estimates in Virginia and West Virginia were overestimated by about 27%.
Such errors have other impacts. In Pennsylvania, for instance, some activities, such as manure transport or the construction of manure storage facilities, may not get counted toward nutrient reduction efforts. That's because the figures for some locations indicate that too little manure is generated to justify the need for those practices.
"If the animals aren't 'there,' they're not producing manure," said Whitcomb, of the Pennsylvania Department of Environmental Protection. "And then we're not able to account for the storage of that manure."
Sometimes, the practices can be counted at a broader geographic scale, but then they get reported in the wrong county. That's problematic in Pennsylvania, where each county has its own cleanup goal. "The county that actually did the work doesn't necessarily get the credit for that work," Whitcomb said. "It can go somewhere else."

Getting better data

One way to obtain better livestock data might be to get it directly from major livestock industries, but that is often complicated by privacy issues.
Paul Bredwell, executive vice president of the U.S. Poultry & Egg Association and a member of the Bay Program's Agriculture Workgroup, has been working with the chicken broiler industry on a research project with the University of Maryland and Virginia Tech to determine if they can collect more accurate information.
Bredwell, who worked with Dubin on the Virginia turkey project, said if the effort produces information that the industry believes is more accurate, he believes they will work with the Bay Program on an ongoing basis — whether it shows a greater, or lesser, impact on nutrient pollution.
Bredwell supported the use of Hillandale data, even though it showed a greater impact than previously estimated. "That's a part of our footprint," he said. "So we want to be responsible for it."
Dubin said industry data need to be crosschecked against public information, such as CAFO records and nutrient management plans. Not all nutrient management plans are public, though. Where they aren't, Dubin said producers in earlier projects signed consent forms allowing researchers to verify data with their plans.
"That's important because then I can say I didn't just get information from a private entity or individual," Dubin said. "I received information that was collaborated by other sources."
"I think you could make a pretty good case that resources should be invested to improve data." –Joe Wood, Chesapeake Bay Foundation
If the latest project is successful, Dubin said, the biggest impediment to using the data could be the Bay Program. Updating and crosschecking information on an annual basis would require more investments — possibly several more staff positions as well as more support at the state level, he said.
Although results from the hog and turkey studies differed from USDA data, Bay Program participants opted not to use it in part because there was no way to continue collecting the data.
The question, Dubin said, is whether "the partnership wants to invest more resources into more fully developing these avenues. That is the question."
Wood, of the Bay Foundation, said he was open to using industry information as long as there are measures to ensure its quality. And, he said, other options should be explored.
"I think you could make a pretty good case that resources should be invested to improve data," Wood said. "A lot of the conversations instead are, 'Well, how should we use this data that we do have.' "
The Bay Program has invested significantly in some data upgrades, such as high-resolution images to track land use, but it has not made similar-size investments to improve its nutrient input data.
It's not just livestock numbers and fertilizer amounts that raise concerns. Basic information, such as nutrient concentrations in manure, are often drawn from decades-old studies, even though feeding practices, animal housing conditions and other factors that could influence those numbers have changed.
"We run into a lot of things like this," said Jeremy Daubert, an extension agent with Virginia Tech who chairs the Bay Program's agricultural workgroup. "We think something is happening, but we don't have any good research."
Wood said better information is also needed to verify nutrient control activities. It's a costly, time-consuming process, and many believe the current system results in undercounts.
Wood said improving such data may not mean spending more money but spending it better. Instead of sending individuals to verify pollution control practices, he said, aerial surveys might do the job.
The recent controversies have brought more attention to the data issue. In a memo to Bay Program participants, Adam Ortiz, director of the EPA's Mid-Atlantic Region, acknowledged the concerns and urged them to "look at data and methods that are replicable across the watershed and jurisdictions." That could mean directing "additional resources" to the agricultural workgroup, he added.

Dubin said such investments could reap rewards. “At the end of the day, regardless of what the impact is … if we can increase the confidence of the results, that’s where you get people to believe in the results and buy in and implement what you’re asking them to do.”

Cover photo: A view of the “Site 5” chicken houses at Hillendale Farms near