Pierre Mineau, PhD.
Pierre Mineau Consulting
Salt Spring Island, British Columbia
Canada

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New York Assembly Standing Committee on Environmental Conservation
LOB 623
Albany, NY 12248

**Written Testimony of Dr. Pierre Mineau Regarding Neonicotinoid Pesticides and Their Impacts on New York Water and Ecosystems**

Dear Chair Englebright and the Assembly Standing Committee on Environmental Conservation:

I write to offer the following testimony indicating the solid scientific support for the need to dramatically reduce neonicotinoid use in order to protect New York's pollinators and aquatic and terrestrial environment more generally.

**Personal Background**

I am a biologist, environmental scientist, and ecotoxicologist with over 40 years of experience with scientific issues surrounding pesticides and the environment. For a 16-year period, I was responsible for the regulatory evaluation of impacts of pesticides to wildlife and to the broader environment for the Canadian government at Canada's principal environmental agency, Environment Canada. Following a restructure of government function, I became a Senior Research Scientist in the Science and Technology Division of Environment Canada, continuing to work on the environmental risk assessment of pesticides. I retired from public service in 2012, but I continue to publish and write extensive reports in the area of pesticide risk assessment. I also consult and maintain my academic status as adjunct professor at Carleton University in Ottawa, Ontario.

In my career, I have collaborated and have consulted in the area of pesticide risk assessment with several international agencies as well as governmental and non-governmental organizations in Canada. This includes working with, and providing expert testimony on behalf of the U.S. Environmental Protection Agency (USEPA).

I have detailed knowledge of the neonicotinoid class of insecticides (neonics). I have completed comprehensive and novel assessments and reports on their risk to birds[i] and, more recently, bats[ii] and co-authored several recent published reviews in the scientific literature on both their terrestrial and aquatic ecotoxicology.[iii] I have provided legal expert opinion on the impact of neonicotinoid seed treatments on federally endangered species and authored a report of neonic use and resulting aquatic contamination of New York State surface and ground water.[iv] The short 'executive version' of that report is attached as an appendix to this testimony. Finally, I most recently completed a review of the impact of neonic use as seed treatments, using California as a test case.[v] This report involved a complete review of USEPA's pollinator assessment for neonicotinoid insecticides. I would urge the committee to look at the attached report and the others cited in this testimony for a more comprehensive discussion of the issues. All are available online at: https://www.researchgate.net/profile/Pierre_Mineau/publications.

**Neonic Use in New York**

Compiling use data for any pesticide requires several sources of information. In my report on neonic use and water contamination in New York State, I combined data from the New York State Department of Environmental Conservation (NYSDEC) as well as from the U.S. Geological Survey (USGS). The latter data are critical to understand agricultural uses but, as of 2015, no longer include seed treatments (these uses are not included in the NYSDEC data either). I therefore derived estimates of the agricultural and non-agricultural uses of neonics in 2014. Given the exponential increase in neonics over the last few decades, this is likely an underrepresentation of current uses.

| **Active ingredient** | **Best estimate (or range) of agricultural use (kg)** | **Best estimate of non-agricultural use (may include some application to agricultural land by commercial applicators for acetamiprid especially)** | **Best estimate of total neonic use in New York State 2014 (kg)** |
|---|---|---|---|
| Acetamiprid | 541 - 2,932 | 1,774 | 2,315 - 4,706 |
| Clothianidin | 17,491 | 2 | 17,493 |
| Dinotefuran | 0 - 40 | 0 | 0 - 40 |
| Imidacloprid | 11,709 - 11,995 | 22,652 | 34,361 - 34,647 |
| Thiacloprid[1] | 3,281 - 3,482 | 15 | 3,296 - 3,497 |
| Thiamethoxam | 5,764 - 7,828 | 828 | 6,592 - 8,656 |
| **Total Neonics** | **38,786 – 43,768** | **25,271** | **64,057 - 69,039** |

[1] The USEPA registration for thiacloprid was voluntarily cancelled in 2014.

In total, I estimated that over 64 metric tons of neonicotinoids were used in NY State or over 141,000 pounds in 2014. This is likely much higher now.

My analysis shows that clothianidin is the principal neonic used in New York agriculture despite the fact that NYSDEC effectively prohibited outdoor uses of clothianidin in 2007 by refusing to register the chemical out of concern over ground water contamination. This anomaly is due to the fact that clothianidin is extensively used as a coating or "treatment" on corn, soybean, and wheat seeds, which, due to a perceived legal loophole, NYSDEC does not regulate as "pesticides".

My analysis also shows that a large part of the total use is the non-agricultural use of imidacloprid, notably for ornamentals or turf uses as well as structural uses. As this does not account for domestic or veterinary uses of imidacloprid, it is also a clear underestimate.

**Neonic Detections in New York Water**

I analyzed water quality monitoring data available as of early February of 2019. The proportion of surface water samples analyzed from New York State that showed detections of imidacloprid varied between 15% and 50% of samples—without regard to minimum reporting levels. The proportion of positive samples (with imidacloprid detections) peaked at 50% in 2004.

With the exception of the 2008-2015 period of reduced sampling intensity, imidacloprid when detected was present at levels above the USEPA chronic aquatic benchmark level of harm to aquatic resources 90-100% of the time. A very high proportion of samples (up to 60% of samples in at least two years) had imidacloprid levels that were over 10 times the critical benchmark concentration. Sites with multiple detections of imidacloprid show that most 'grab samples' underestimate true water concentrations – a well-documented deficiency of water sampling programs. All of the above suggests that impacts to aquatic invertebrate fauna in New York State from imidacloprid alone have been substantial.

It is more difficult to comment on exceedances from the other neonics because they are not as well covered in water monitoring and because the USEPA has yet to derive a proper scientific benchmark. It is noteworthy that the imidacloprid chronic benchmark dropped 50-fold between the USEPA's 2007 and 2017 assessments. The clothianidin and thiamethoxam benchmarks have yet to be similarly revised. My opinion as well as that of other scientists is that the same benchmark level should be applied to the sum of all neonic insecticide residues combined for any given water sample. Also, we do know that both clothianidin and thiamethoxam are more prone to end up in surface and groundwater than imidacloprid as a result of their properties, namely higher persistence and water solubility.

**Expected Ecological Damage**

While more extensive and comprehensive testing (i.e., for all five neonic chemicals, not just imidacloprid; as well as more intensive sampling at more sites) is needed to understand the full impact of neonic water contamination in New York, the available data raise concerns that current neonic contamination is causing considerable ecological harm to aquatic resources.

As mentioned above, USEPA in its latest review has set a 0.01 µg/L "chronic benchmark" value for imidacloprid in water for harm to aquatic invertebrates[vi] consistent with that of European authorities.[vii] This benchmark value is the level of imidacloprid in water expected to be lethal to more sensitive species present in aquatic ecosystems. In the real world, it is likely that ecological damage occurs at concentrations even below this threshold, given that sub-lethal harms—such as feeding inhibition, reduced growth, mobility impairment, and delayed emergence—can also endanger affected species and modify entire aquatic communities on the longer term. For example, work in the Midwest has already shown a link between imidacloprid detection and decreased mayfly abundance in streams.[viii]

Only imidacloprid concentrations have been extensively measured so far; yet other neonics, like clothianidin and thiamethoxam, have a higher runoff potential and are more persistent. Because the toxicity of all neonics is at least additive (if not synergistic), it is very clear that ecological damage estimates based on imidacloprid alone fails to capture the full range of impacts to aquatic ecosystems. Further, as regular water monitoring generally fails to capture peak values, most sites with neonic detections will, at some point, likely receive a high 'slug' of one or several of these insecticides capable of decimating its aquatic invertebrate fauna. At this point, it is important to point out that, as indicated in my detailed New York analysis, there is strong evidence that, contrary to USEPA conclusions, marine environments are much more at risk than currently assumed.

Impacts on aquatic invertebrates—such as those the water data suggest are occurring in New York—ripple up the food chain, as these invertebrates represent an important food source for birds, mammals, fish, amphibians, and reptiles. Indeed, research from the Netherlands shows a convincing correlation between neonic use and declining insectivorous bird populations.[ix] Dividing their analysis into pre- and post-neonic exposure periods, they showed not only that neonic-monitored concentrations explained bird declines, but that these site-specific declines were not seen before the introduction of neonics, despite the use of other insecticides of high aquatic toxicity. A more recent study from Japan documented the collapse of a fishery as a result of neonics used as seed treatment on rice. This caused a massive decline in planktonic species which led to the fish collapse.[x]

On the whole, the apparent unanimous conclusion of independent researchers and the regulatory community is that the use of neonics entails an inevitable loss of invertebrate life in both terrestrial and aquatic systems.[xi] Even USEPA's initial 2008 review of the neonic thiamethoxam predicted "structural and functional changes of both the aquatic and terrestrial ecosystems" from its use.[xii]

In summary, the available data suggest that current neonic use in New York is almost certainly having a significant negative impact on the state's aquatic ecosystems.

**Agronomic and pollinator considerations as they relate to New York State.**

Much of the agricultural use of neonics in New York is in the form of seed treatments. Based on my analysis of New York State, corn and soy alone accounted for 73% of the State's total agricultural neonic use in 2014. A review of the existing agronomic literature shows that these applications are often unnecessary and not cost-effective; they represent an unnecessary cost to growers. The vast majority of available seeds for corn and other field crops are pre-treated and farmers are therefore using neonics whether or not the use is warranted. Several authors such as Douglas and Tooker[xiii] believe that there are many opportunities to dramatically reduce the use of neonics through a more judicious framework of integrated pest management.

This point has also been made in the recent assessment by scientists at Cornell University[xiv] that touches on pollinator protection. The Cornell scientists highlighted the fact that the data for New York State show no clear benefit (other than to the manufacturer) from the largest uses of neonicotinoid seed treatments. In that report, the authors use various bee toxicity benchmarks to assess which of the New

York agricultural uses present the most risk. Although the report is thorough and correctly identifies numerous risks to bees posed by the majority of neonic uses, the Cornell analysis most certainly underestimates the threat neonics poses to the State's pollinators; indeed the authors acknowledge this in their report.

The Cornell analysis, however, is a clear improvement on the regulatory (USEPA) pollinator assessment. The USEPA assessment is seriously flawed and clearly underestimates the risk to New York pollinators. This is because USEPA's benchmarks are deficient or in error in several key areas: (1) They underestimate risks to wild bee species and other pollinators by relying on honey bee colony survival as a proxy for overall pollinator health; (2) They ignore exposures of bees and other pollinators to neonic contaminated water – including, guttation fluid and puddles in or near fields. This is especially important when considering seed treatments because existing field estimates show that these routes of exposure can completely dwarf the routes that have been formally assessed; (3) They ignore risks from neonic uses on crops deemed unattractive to honey bees, despite evidence that neonic residues migrate into adjoining areas, including adjacent wildflowers that can exceed levels in the field proper; (4) They exclude available peer-reviewed literature from quantitative risk assessment in favor of industry studies; and (5) They ignore the growing amount of field data which now links the use of neonics to pollinator failure on a landscape scale. With respect to the evaluation of seed treatments specifically, the USEPA regulatory analysis: (1) underestimates nectar and pollen contamination levels by assuming that the majority of crop species will have residue values at the low end of the measured spectrum; and (2) ignores risks of dust from neonic treated seeds at planting, despite ample evidence that this route of exposure is still highly relevant despite some research improvements in trying to mitigate the issue.

Details behind these statements are in the report of seed treatments in California referenced in my introduction.

**Conclusion**

In summary, it is clear that New York State needs to seriously restrict the use of neonicotinoid insecticides in order to protect its pollinators, its aquatic ecosystems (both fresh and saltwater), and the wildlife resources that depend on those environments. Fortunately, it is possible to eliminate much of the environmental damage by a judicious restriction of products in cropping situations where the agronomic need for neonics is slight or absent (as pointed out by the Cornell analysis), and by putting in place better measures to protect surface and ground water resources. New York State also needs to come to grips with the fact that the bulk of current neonic use, that is as seed treatments, escapes its scrutiny.

Respectfully,

Pierre Mineau, Ph.D.

[i] Mineau, P. and C. Palmer. 2013. *The impact of the nation's most widely used insecticides on birds.* Unpublished report prepared for the American Bird Conservancy, March 2013. 96 pp. https://abcbirds.org/article/birds-bees-and-aquatic-life-threatened-by-gross-underestimate-of-toxicity-of-worlds-most-widely-used-pesticide-2/

[ii] Mineau, P. and C. Callaghan. 2018. *Neonicotinoid insecticides and bats: an assessment of the direct and indirect risks.* Unpublished report prepared for the Canadian Wildlife Federation. 87 pp. http://cwf-fcf.org/en/resources/research-papers/bats-neonics-report.html

[iii] Morrissey, C.A., P. Mineau, J.H. Devries, F. Sanchez-Bayo, M. Liess, M.C. Cavallaro, K. Liber. 2015. *Neonicotinoid contamination of global surface waters and associated risk to aquatic invertebrates: A review.* Environment International 74: 291–303. DOI: 10.1016/j.envint.2014.10.024; Simon-Delso, N., et al. 2014. *Systemic insecticides (neonicotinoids and fipronil): trends, uses, mode of action and metabolites.* Environmental Science and Pollution Research. DOI: 10.1007/s11356-014-3470-y.; van der Sluijs, J.P., et al. 2014. *Conclusions of the Worldwide Integrated Assessment on the risks of neonicotinoids and fipronil to biodiversity and ecosystem functioning.* Environmental Science and Pollution Research. DOI 10.1007/s11356-014-3229-5.; Gibbons, D., C. Morrissey and P. Mineau. 2014. *A review of the direct and indirect effects of neonicotinoids and fipronil on vertebrate wildlife.* Worldwide Integrated Assessment of the impact of Systemic Pesticides on Biodiversity and Ecosystems. Environmental Science and Pollution Research. DOI 10.1007/s11356-014-3180-5.

[iv] *Mineau, P. 2019. An assessment of neonicotinoid insecticides with emphasis on New York. Use, contamination, impacts on aquatic systems and agronomic aspects. Report prepared for the Natural Resources Defense Council, 64 pp.* https://www.nrdc.org/sites/default/files/assessment-neonicotinoid-insecticides-emphasis-new-york.pdf. A summary version of this report has also been prepared: *Mineau, P. 2019. Impacts of Neonics in New York Water. Their Use and Threats to the State's Aquatic Ecosystems. Unpublished report prepared for the Natural Resources Defense Council, 18 pp.*

[v] Mineau, P. 2020. Neonicotinoids in California. Their Use and Threats to the State's Aquatic Ecosystems and Pollinators, with a Focus on Neonic-Treated Seed. Technical Report prepared for the Natural Resource Defense Council (NRDC), 55pp. https://www.nrdc.org/sites/default/files/neonicotinoids-california-20200922.pdf.

[vi] USEPA 2017a. Preliminary Aquatic Risk Assessment to Support the Registration Review of Imidacloprid. 22 December 2016. 218 pp.

[vii] European Food Safety Authority 2014. Conclusion on the peer review of the pesticide risk assessment for aquatic organisms for the active substance imidacloprid. EFSA Journal 2014;12(10):3835. 49 pp.; Rijksinstituut voor Volksgezondheid en Milieu, 2014. Water Quality Standards for imidacloprid: Proposal for an Update According to the Water Framework Directive. In: Smit, C.E. (Ed.), RIVM [National Institute for Public Health and the Environment], Bilthoven, Netherlands.

[viii] Nowell, L.H., Patrick, P.W., Schmidt, T.S., Norman, J.E., Nakagaki, N., Shoda, M.E., Mahler, B.J., Van Metre, P.C., Stone, W.W., Sandstrom, M.W., Hladik, M.L. 2017. Complex Mixtures of Dissolved Pesticides Show Potential Aquatic Toxicity in a Synoptic Study of Midwestern U.S. Streams. Science of The Total Environment 613–614, 1 February 2018, 1469-1488. https://www.sciencedirect.com/science/article/abs/pii/S0048969717315735.

[ix] Hallmann, C.A., Foppen, R.P.B., van Turnhout, C.A.M., De Kroon, H., and Jongejans, E. 2014. Declines in Insectivorous Birds Are Associated with High Neonicotinoid Concentrations. Doi:10.1038/nature13531. https://www.nature.com/articles/nature13531

[x] Yamamuro, M., Komuro, T., Kamiya, H., Kato, T., Hasegawa, H., Kameda, Y., 2019. Neonicotinoids disrupt aquatic food webs and decrease fishery yields. Science 366, 620–623. https://doi.org/10.1126/science.aax3442

[xi] See endnote iii above.

[xii] USEPA 2008b. Ecological Risk Assessment for the Section 3 New Use Registration of Thiamethoxam on Citrus Fruits and Tree Nuts.

[xiii] Douglas, M.R., Tooker, J.F., 2015. Large-scale deployment of seed treatments has driven rapid increase in use of neonicotinoid insecticides and preemptive pest management in U.S. field crops. Environmental Science & Technology 150402080236006. https://doi.org/10.1021/es506141g.

[xiv] Grout, T.A., Koenig, P.A., Kapuvari, J.K., McArt, S.H., 2020. Neonicotinoid Insecticides in New York State: economic benefits and risk to pollinators. Unpublished report, Cornell University 432pp. https://pollinator.cals.cornell.edu/sites/pollinator.cals.cornell.edu/files/shared/documents/0727%20Accessible%20Neonicotinoid%20Assessment%20compressed.pdf.

## Appendix

See attached file for the executive report. A more detailed version with a more in-depth analysis of use in New York State as well as the changing USEPA benchmarks is also available at the following:
https://www.nrdc.org/sites/default/files/assessment-neonicotinoid-insecticides-emphasis-new-york.pdf

# Impacts of Neonics in New York Water

Their Use and Threats to the State's Aquatic Ecosystems

Pierre Mineau; *Pierre Mineau Consulting*