

Impact of Neonicotinoid Pesticides on Chesapeake Bay Watershed Aquatic Life

Neonicotinoids (neonics) are among the most widely used pesticides in the world. One particular neonic insecticide, imidacloprid, is the largest-selling and is one of the top 10 pesticides of over 360 pesticides used in Maryland, according to a 2011 survey by the Maryland Department of Agriculture.¹

A peer-reviewed scientific review of the over 200 available scientific studies on the toxicity of neonics to freshwater invertebrate species found a preponderance of evidence that many important stream species are at risk of death or harm at concentrations of neonics that are reported in their aquatic habitats.²

- ✓ **Neonics threaten our blue crabs** and other aquatic invertebrates such as freshwater snails and water fleas. A recent laboratory study has shown that imidacloprid is acutely toxic to larval crabs at low concentrations and at even lower levels can inhibit crabs surviving from larval to crab stages.³ This increased death of blue crabs is a huge concern for the Bay region, because the study also concluded that frequently molting juveniles crabs may be particularly vulnerable to these pesticides in estuaries.⁴ Our blue crabs support commercial and recreational fisheries and are an integral part of the Chesapeake Bay ecosystem.



- ✓ The impact of neonics on often-overlooked crustaceans such as copepods and sand shrimp also is a concern. These small crustaceans constitute the foundation of the fish food web, serving as the main forage for menhaden and larval fish of many species. If neonics have detrimental effects on this resource, it could have ripple effects up the food chain to fish such as white perch and spot.

- ✓ Another study on declines in macro-invertebrates such as slugs, snails, mayflies and crustaceans concluded that based on data from large-scale field monitoring over multiple years, serious concern is justified regarding the far-reaching consequences of the abundant use of a neonic pesticides for aquatic ecosystems.⁵



¹ http://www.mda.maryland.gov/documents/MD_Pesticide_Stats_2011.pdf

² Morrissey, C.A., Mineau, P. *et al.* (2015). *Environment International*, 74, 291-303.

³ Osterberg, J.S., Darnell, K.M., Blickley, T.M., Romano, J.A. and Rittschof, D. (2012). *Journal of Experimental Marine Biology and Ecology*, 424-425, 5-14.

⁴ St-Hilaire, A., Courtenay, S.C., Dupont, F. and Boghen, A.D. (2002) *Northeastern Naturalist* 9: 303-316

⁵ Van Dijk, T.C., Van Staalduinen, M.A and Van der Sluijs, J.P. (2013). *PLoS ONE* 8(5): e62374.

Neonics are neurotoxins designed to be highly toxic to a broad range of insects that may damage crops, but these pesticides are also active against unintended beneficial insects, such as bees and other pollinators. A large percentage of the pesticide enters the soil, where it can persist – with half-lives of a week to over a year⁶ – especially after repeated applications. Neonics are also moderately water-soluble and are prone to run-off, leaching into waterways and groundwater. They have been detected in groundwater, storm-water ponds, tidal creeks and streams. In a 2015 nationwide study the US Geological Survey reported the widespread occurrence of neonicotinoids, especially Imidacloprid, in streams, including sites in Maryland. In this study neonicotinoids were often detected at levels toxic to some aquatic species.^{7 8}



Major knowledge gaps remain on the fate of neonics in the environment and their toxicity to non-target organisms. However, in the data that do exist it is clear that current use of neonicotinoids is likely to impact a broad range of aquatic and non-aquatic life, including pollinators and soil and aquatic invertebrates; hence neonics threaten key ecosystems and our food supply.

Even more troubling are studies demonstrating important sublethal effects, such as reduced feeding, movement and reproduction at much lower concentrations.⁹ Neonics like Imidacloprid are neurotoxic substances acting specifically on the insect nervous system. They have the potential to indirectly cause die-offs and population-level consequences in aquatic invertebrate populations at low, sublethal concentrations by impairing movements and feeding.

More generally, **over 1100 scientific studies indicate that neonicotinoid pesticides play a significant role** in the ongoing global bee die-off that is threatening our food supply.¹⁰ While disease, mono-cropping, habitat loss and climate change are significant factors in pollinator decline, neonics adversely impact pollinators both directly and via sublethal impacts – including impacting memory, ability to forage and weakening immune systems to diseases such as the varroa mite.¹¹ Bee-colony die-offs in Maryland have been as high as 615 – the fifth-highest rate in the USA – during the winter of 2014-15.¹²

Scientific evidence has mounted so quickly that in 2015 the US EPA effectively declared a moratorium on approving new uses of neonics, while awaiting new research. EPA's decision did, however, leave 100 existing uses of neonics in place. It also is important to note that the European Union has banned the neonic pesticides considered most harmful to pollinators.

Chemical names for neonic pesticides include: Acetamiprid, Clothianidin, Dinotefuran, Imidacloprid, Nitenpyram, Thiamethoxam, Thiocloprid.

For more information go to: www.smartonpesticides.org Questions: email info@mdpestnet.org

⁶ Goulson, D. (2013). *Journal of Applied Ecology*, 50, 977-987.

⁷ Hladik and Kolpin. 2015. *Environmental Chemistry*. <http://dx.doi.org/10.1071/EN15061>

⁸ <http://www.usgs.gov/newsroom/article.asp?ID=3941#.VOJpGXbTjc9>

⁹ Goulson, D. (2013). *Journal of Applied Ecology*, 50, 977-987.

¹⁰ Worldwide Integrated Assessment, The Task Force on Systemic Pesticides, 2015. http://www.tfsp.info/assets/WIA_2015.pdf

¹¹ Neonicotinoid Residues in Wildflowers, a Potential Route of Chronic Exposure for Bees, Cristina Botias, et.al; *Environ Sci. Technol.*, Oct. 10, 2015

¹² Colony Loss 2014-2015, Bee Informed Partnership. 05.13.2015 <https://beeinformed.org/2015/05/colony-loss-2014-2015-preliminary-resul>