Testimony of Carys L. Mitchelmore, Ph.D.

Before the Senate Education, Health and Environmental Affairs Committee

Re: SB 163: Pollinator Protection Act

February 17, 2015

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Madam chair and members of the committee:

I would like to take this opportunity to thank you for considering my testimony today in support of Senate Bill 163. I am Dr. Carys Mitchelmore a faculty member (Associate Professor) at the University of Maryland Center for Environmental Science (UMCES), Chesapeake Biological Laboratory where I study the fate and effects of pollutants on aquatic organisms. Today I am representing my personal views as a researcher in the field of environmental health and as a local citizen of the Chesapeake Bay watershed.

Neonicotinoids (or neonics) are some of the most commonly and widely used pesticides in the world. In fact one particular neonic insecticide, imidacloprid, is the largest-selling and is one of the top ten pesticides of over 360 pesticides used in Maryland according to MDA's 2011 survey.[1]

Neonics are neurotoxins with a high toxicity and effectiveness to a broad range of target insect pests, particularly arthropods. There are various modes of application for these pesticides and they act systemically travelling through plant tissues and protecting all parts of the crop. Therefore, being systemic they can also be found in the nectar and pollen of treated crops. Neonics are also widely applied as seed dressings, however, studies have shown that only a small amount of the active ingredient is absorbed by the crop and during sowing aerial dusts can result in exposure to non-target animal and plant species.[2] Furthermore a large percentage of the active ingredient enters the soil where they have been shown to persist (with half-lives of a week to over a year[2]) and although data is sparse they can potentially accumulate in soils 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 levels up to 9 ppb (μg/l).[2,3]

Reported levels in soils, waterways, field margin plants and floral resources can overlap substantially with concentrations that are sufficient to control pests in crops and commonly exceed the LC50 (the concentration which kills 50% of individuals) for non-target beneficial organisms.[2] For example in a recent 2012 Californian study imidacloprid was detected in 89% of environmental water samples, 19% of which exceeded the US EPA guideline concentration of 1.05 ppb (μg/l).[4] More recently a USGS study found neonics widespread in mid-western streams, often at levels toxic to some aquatic species.[5] Although, it should also be noted that many water-monitoring efforts do not screen for neonic metabolites despite these being potentially as toxic as the parent compound.

One of the biggest problems is that major knowledge gaps remain regarding the fate of neonics in the environment and their toxicity to non-target organisms. Obviously a key question is whether typical environmental exposure concentrations (via one or multiple routes) will lead to significant individual or population level effects. However, in the data that does exist, it is clear that the current use of neonicotinoids are likely to be impacting a broad range of non-target taxa, including pollinators and soil and aquatic invertebrates and hence threatens a range of ecosystem services.

Toxicity studies show a high variability in toxicity between different species, many of which are at environmentally relevant levels. Aquatic insects, especially mayflies, are particularly susceptible to neonic toxicity with 24-96 hr LC50s in the low ppb concentrations.[2] Similarly, some aquatic crustaceans can also show LC50's in the low ppb concentrations.[2] Furthermore many studies using non-traditional aquatic species have shown common aquatic organisms to be more sensitive than traditional laboratory test species.

However, more troubling are the studies demonstrating important sublethal effects, such as reduced feeding, movement and reproduction at much lower concentrations[2]. Neonics like Imidacloprid are neurotoxic substances acting specifically on the insect nervous system. Therefore, they have the potential to indirectly cause lethality and population level consequences in aquatic invertebrate populations at low, sublethal concentrations by impairing movements and thus feeding.[6] For example a recent 2014 study have demonstrated that Imidacloprid decreased feeding 50% in *G. pulex* at environmentally relevant concentrations (i.e. 5 ppb). This altered food uptake by detritivorous macroinvertebrates could disrupt ecosystem services of leaf litter breakdown[7].

Many other sublethal impacts are often overlooked in traditional toxicity studies and therefore their toxicity may be underestimated in real-world field situations. Furthermore, many studies have shown co-stressors that are often overlooked in traditional laboratory studies to be important, such as, the amount of food availability[8].

The results of a recent 2013 field-based aquatic microcosm study that investigated the effects of repeated pulses of the neonic imidacloprid are troubling. The results of this study show that repeated short-term low concentrations of imidacloprid even at optimal conditions for photodegradation at low concentration levels may affect aquatic ecosystems, particularly *Ephemeroptera* and chironomid species.[9] Furthermore in another 2013 study that focused on the neonic thiadroprid, the populations of an aquatic invertebrate exposed over several generations to repeated pulses at low concentrations continuously declined and did not recover in the presence of a competing species.[10] Neonics like thiacloprid enter agricultural surface waters, where they may affect predator prey-interactions, which are of central importance for ecosystems as well as for the functions these systems provide (such as leaf litter breakdown).[11]

Neonics threaten our blue crabs and aquatic invertebrates such as freshwater snails and water fleas, which are vulnerable to low exposures, acutely or via a variety of sublethal mechanisms. A recent laboratory study has shown that imidacloprid is acutely toxic to megalopae at low ppb concentrations (25hr LC50 of 10 ppb) and more importantly at even lower concentrations sublethal impacts such as fewer crabs surviving metamorphosis were apparent in megalopae and juvenile blue crabs.[11] This increased death of blue crabs is of concern for this region as this study concluded that the sensitivity of molting blue crabs to these pesticides makes frequently molting juveniles particularly vulnerable to these pesticides in estuaries.[12] There is nothing more "Chesapeake Bay" than the blue crab. Our blue crabs support commercial and recreational fisheries and are an integral part of the Chesapeake Bay ecosystem.

Another study regarding declines in macro–invertebrates (including slugs, snails, mayflies and crustaceans) concluded that based on their data from large-scale field monitoring during multiple years, serious concern is justified regarding the far-reaching consequences of the abundant use of a neonic pesticides for aquatic ecosystems.[13]

While more basic research regarding the toxicity of these pesticides to aquatic organisms is clearly needed, especially directed towards sublethal effects, a first step would be to know where neonics are being used in the state and in what quantities in order to further understand their fate and potential impacts (if any) to our resident species. It is imperative that we need to protect our blue crabs, our macro-invertebrates and our waterways. SB 163 is an important step in providing information that may ultimately potentially reduce neonic runoff. As a citizen of the Chesapeake Bay I urge a favorable report for SB 163.

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