Madam chair and members of the committee:

I would like to take this opportunity to thank you for considering this testimony today in support of House Bill 605. I am representing myself and Dr. Carys Mitchelmore. Dr. Mitchelmore is an Associate Professor at the University of Maryland Center for Environmental Science (UMCES), Chesapeake Biological Laboratory, and I am an Assistant Professor at the Institute of Marine and Environmental Technology. Our respective fields of study include the fate and effects of pollutants on aquatic organisms and the health of crabs and oysters in the Chesapeake Bay. Today we are representing our personal views as researchers in the field of environmental health and as local citizens of the Chesapeake Bay watershed.

Neonicotinoids (or neonics) are some of the most 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 designed to be highly toxic to a broad range of insects. The intended targets are pest insects that may damage crops, but the pesticides are also active against unintended beneficial insects, such as pollinators. 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 crops2. Neonics are widely applied as seed dressings, however, only a small amount of the active ingredient is absorbed by the crop and dust created during sowing can result in exposure to non-target animal and plant species.3 Furthermore a large percentage of the pesticide enters the soil where it can persist (with half-lives of a week to over a year3) 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).3,4

Neonic levels reported in soils, waterways, field margin plants and pollinator resources can be as high or higher than 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.³ For example in a recent 2012 California 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.⁶

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. This highlights that the problem 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 is likely to impact 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. Aquatic insects, especially mayflies, are particularly susceptible to neonic toxicity with 24-96 hour lethality (LC50) in the low ppb concentrations.³ Similarly, some aquatic crustaceans can also show sensitivity to these same low concentrations.³ 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.³ 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.⁷ 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.⁸

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.⁹

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 study showed 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.¹⁰ Furthermore in another 2013 study that focused on the neonic thiacloprid, 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.¹¹ 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).¹²
Neonics threaten our blue crabs and other 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 larval crabs (megalopae) at low ppb concentrations (25 hr LC50 of 10 ppb). More importantly, even lower concentrations had sublethal impacts such as fewer crabs surviving the developmental metamorphosis from larval to crab stages. This increased death of blue crabs is of concern for our region and the study concluded that frequently molting juveniles crabs may be particularly vulnerable to these pesticides in estuaries. 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. Still not known, but of concern to us, is the effect of neonics on the often overlooked crustaceans such as copepods and sand shrimp. 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 aquatic resource, it could have ripple effects up the food chain to fish such as white perch and spot.

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 neonic pesticides for aquatic ecosystems.

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 protect our blue crabs, our macro-invertebrates and our waterways. HB 605 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 HB 605.

References:
6 http://www.usgs.gov/newsroom/article.asp?ID=3941#.VOjphGxBoTjc9