IMPACT OF WATER CHEMISTRY ON INVERTEBRATE COMMUNITIES IN AGRICULTURAL WETLANDS AND THE EFFECT ON DUCK BROOD USE IN THE ANNAPOLIS VALLEY, NOVA SCOTIA

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Over 90 percent of the wetlands in the Annapolis Valley have been lost to development. In order to mitigate these losses Ducks Unlimited (DU) has constructed wetlands in the Annapolis Valley. In addition, most farms have both wetlands and ponds that are used for irrigation but which can still serve as an important habitat for a variety of species. In 2008, the Nova Scotia Eastern Habitat Joint Venture (NS-EHJV) developed a plan to assess wetland habitat quality for duck broods of various species. To evaluate the assumptions of the NS-EHJV for increasing duck production in the agricultural landscape, surveys of duck broods, invertebrates and water chemistry were carried out in the Annapolis Valley in 2012

The objectives of this study were to assess the relationships of type of wetland (DU or farm ponds/wetlands) on water chemistry variables, chlorophyll *a* concentrations and relate this to invertebrate communities, and duck brood presence.

Water chemistry in DU and farm ponds/wetlands over the summer was variable but did not negatively affect duck use, nor invertebrate abundance or diversity.

Wetlands with both high conductance values and total phosphorus concentrations are linked to anthropogenic input. Conductance appeared variable between DU and farm ponds/wetlands. Specific conductivity did not increase over time. A correlation of specific conductivity and invertebrate biomass implied a potential weak positive association.

pH can affect invertebrate communities, and can subsequently alter habitat quality and food resources for waterfowl. Variability in pH was evident between both wetland type and visit. At visit two, pH was significantly different between DU and farm ponds/wetlands, with farm

ponds/wetlands having a lower pH. pH also decreased significantly in both DU and farm ponds/wetlands over the summer.

Phosphate, a component of total phosphorus that is biologically available to macrophytes and algae, was found to have a weak negative relationship to invertebrate diversity. This indicates that with increasing phosphate addition, nutrient conditions in the wetlands are altered so that habitat suitability is favouring the dominance of one species. This relationship could be a facet of increased macrophyte and algae production with increased phosphate availability, affecting biotic environmental factors such as reduced nocturnal oxygen availability; stratified light may lead to reduced species diversity.

Chlorophyll *a* was not significantly correlated to any water chemistry variables, excluding total phosphorus, or to any invertebrate measures. Though chlorophyll *a* can be an assessment of phytoplankton/algal biomass, it appears that macrophyte communities may have a more ecologically significant role in these agricultural wetlands. Higher chlorophyll *a* concentrations are expected in wetlands lacking substantial macrophyte communities.

Invertebrate biomass was not significantly different between type of wetland nor was it different over time. Invertebrate biomass was correlated to increasing total phosphorus, and possibly correlated to specific conductivity. Increasing nutrients can alter invertebrate community structure, favouring dominance of one species, which may cause an increase in the abundance of a specific species that could increase total biomass, but not affect taxonomic richness.

Taxonomic richness of invertebrates differed between DU and farm ponds/wetlands, with farm ponds/wetlands having consistently higher taxonomic richness. Though total phosphorus had no significant correlation to taxonomic richness, nutrient loading can negatively affect aquatic invertebrate taxonomic richness.

Interestingly, though taxonomic richness may not directly affect duck brood-rearing preference, ducklings of age class Ia were observed in greater abundances in ponds with higher Diversity Indices. This relationship could indicate a potential preference for brood-rearing in wetlands with a well-developed invertebrate community structure, with evenness among invertebrate species.

It has been found that abundance of aquatic invertebrates is the best predictor of insectivorous waterfowl. Though physical characteristics such as size and vegetation cover play a role in duckling survival, without adequate food resources, other environmental variables are negligible. Mallards and other ducks species rely solely on invertebrates for the first two weeks of life, then rely progressively more on vegetation. In more productive habitats, with an abundance of invertebrates, brood densities are generally higher and duckling survival is enhanced.

The general conclusion is that wetlands in the Annapolis Valley are eutrophic, but not detrimentally so for invertebrates and therefore not for successful duck-brood rearing. There is variation in duck brood use of wetlands, which must be a function of other variables, most likely adjacent land use. This is currently being investigated.