Surveillance for various pathogens and lead in American Black Ducks (Anas rubripes) from the northeastern and mid-Atlantic United States

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American Black Ducks

- Once the most common duck species in the eastern US and Canada
  - Population peaked in the 1950’s reached a low in the 1980’s
- Decline attributed to
  - Loss of habitat
  - Hybridization with Mallards (Anas platyrhynchos)
  - Hunting pressure (Compensatory vs. Additive mortality)
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General Health of ABDU

- Very little work on pathogens in ABDU
  - 6 avian influenza virus studies
  - No studies on exposure
  - No haemosporidian studies since 1980’s
  - Little information of avian paramyxoviruses, *Pasteurella multocida*, and duck viral enteritis

- One study on lead exposure since 1991 lead shot ban
Major Pathogens of Waterfowl

- *Pasteurella multocida*
  - Several strains
  - Highly contagious
  - High mortality

- Duck Viral Enteritis
  - Duck enteritis virus
  - ABDU one of most affected species
  - Started in NE US
  - 1973 – Largest outbreak in waterfowl

Photograph (Copyright - Milton Friend)
During the 1973 outbreak of duck plague at Lake Andes National Wildlife Refuge in South Dakota, more than 40,000 mallards died.
Major Pathogens of Waterfowl

- Avian Influenza viruses and Avian Paramyxoviruses
  - Not known to have population effects
  - May have impact on individual birds
  - Both important to poultry industry
    - H5, H7, and Newcastle Disease Virus

- Avian haemosporidians parasites
  - Mortality in goslings
  - Breeding selection in passerine birds
  - New techniques (Molecular)
Objectives and Hypothesis

• Objective
Determine what pathogens are circulating and determine blood lead levels in ABDU from the eastern US

• Hypotheses
• We do not expect to detect either Pasteurella multocida or DEV
• We expect to detect both AIVs and APMVs
• We expect to detect high levels of avian haemosporidian parasites
• We expect to detect low exposure to toxic levels of lead
Methods

- Sampled 119 ducks from wintering locations in CT, ME, MD, OH, and VA and 87 ducks from breeding areas in ME.
- Collected blood and paired cloacal/oropharyngeal swabs.
- Blood samples were sent to Michigan State University for blood lead testing.
## Methods

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<td>Blood and Oropharyngeal/cloacal swabs</td>
<td>PCR (KMT1)</td>
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Results

- We did not detect either *Pasteurella multocida* or DEV in any of the collected samples

- We isolated AIVs from 6/206 (3%) ducks
  - No H5

- 85/204 (42%) had antibodies to AIVs

- We isolated APMV-1 in 6/206 (3%) and APMV-4 in 1/206 (0.5%)
  - All APMV-1 were consistent with low pathogenic viruses
  - All APMVs were isolated from ME
Results: Haemosporidian Parasites

• *Haemoproteus* spp. and/or *Plasmodium* spp. were detected in 151/206 (73%)
  - Birds sampled in ME during the fall had significantly higher infection rates than those sampled in winter ($\chi^2 = 23.4$, $p<0.005$)

• *Leucocytozoon* spp. were detected in 108/206 (52%) and there was no difference in prevalence between seasons ($\chi^2 = 0.7$, $p=0.4$)

• We detected DNA from both in 87/206 (42%)
A total of 23/206 (11%) ducks had lead blood levels >200 ppb
- 15 from MD
- 2 ducks 10x toxic amount
- 5 from ME
- 2 from CT
- 1 from VA

Lead exposure did not increase risk of infection with haemosporidians
- *Haemoproteus/Plasmodium* (χ²=0.4, p>0.5)
- *Leucocytozoon* (χ²= 0.41, p>0.5)
- Dual infection (χ²= 0.41, p>0.7)
• The high number ($n=23$) of ducks with lead blood levels $\geq 200$ ppb was surprising
  • Only other study had $<7\%$ (Samuel et al., 2002)
  • 15 ducks were from 1 location in MD
  • Common source?

• Historically, lead accounted for $\sim3\%$ yearly mortality in waterfowl species
  • Chronic exposure can lead to weight loss and neurologic affects
  • Could increase non-hunting mortality
    • Predation
    • One pellet can cause mortality
• Detecting >50% of ducks infected with avian haemosporidian parasites was expected
  • Traditional blood smear analysis detected >70% in some populations
  • Probably low on dual infection due to PCR assay

• Increase detection of *Haemoproteus* spp. and/or *Plasmodium* spp. in the fall probably related to increase in vectors

• Population effects of haemosporidians poorly studied in waterfowl
  • *Leucocytozoon simondi* is known to cause mortality in Canada goose goslings
  • Reported mortality in ducks
Discussion

• Our low prevalence of AIV shedding (3%), was surprising
  • 87 samples were collected in August when viral shedding peaks
  • 42% had antibodies
  • Maybe related to species composition and density

• Avian influenza viruses are not known to have adverse affects on waterfowl
  • No detection of H5 viruses important to poultry

• Detection of APMVs was similar to previous studies of waterfowl
  • All NDV isolates lentogenic
Overall, lead was the only known significant health threat found
• May play a role in population decline even after ban

Further work needs to be done on other pathogens
• AIVs have been shown to adversely affect Bewick’s Swans in Europe
• Cause hatch-year mallards to spend more time in stop-over areas
• Haemosporidian parasites cause mortality in Canada goose goslings
Future Work

- Comparison of morphology and molecular data for haemosporidians
- Subtypes for AIVs
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Questions