Case Report: Great Blue Heron (*Ardea herodias*) Morbidity and Mortality Investigation in Maryland’s Chesapeake Bay

Cindy P. Driscoll D.V.M., Maryland Department of Natural Resources Fish and Wildlife Health Program, Oxford, Maryland
Peter C. McGowan, U.S. Fish and Wildlife Service, Chesapeake Bay Field Office, Annapolis, Maryland
Erica A. Miller D.V.M., Tri-State Bird Rescue and Research Inc., Newark, Delaware
Wayne W. Carmichael Ph.D., Department of Biological Sciences, Wright State University, Dayton, Ohio

1. Open a blank Powerpoint presentation; and click on “insert”, then on “Text Box”. Type in the title and authors and move the text box to the top and center.

2. Next click on “insert” then on “Picture” and insert your logo or the logos of any of the other authors

3. Drag the logos to wherever you want them (usually up near the title or author names and affiliations.)
ABSTRACT
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On October 18, 2001 a GBH was euthanized and sent to the National Wildlife Health Center, Madison, WI, for a post-mortem examination. Remaining birds were necropsied at the MD DNR Cooperative Oxford Laboratory or at TSBRR. Consistent necropsy findings included emaciation, decreased muscle mass, pale muscle color, fat atrophy, gastro-intestinal parasitism, and excessive deposits of waxy yellow fat in the abdomen, subcutis, and throughout the body cavity (Figures 3 and 4). A gross necropsy diagnosis of steatitis was determined to be the consistent finding in all carcasses. Selected tissues were sent to the Armed Forces Institute of Pathology for histopathological confirmation of steatitis (Figure 5).

Steatitis is defined as an inflammation of adipose tissue . In mammals, it is associated with a deficiency of Vitamin E and or Selenium. Vitamin E and selenium have antioxidant properties and are essential to cell membrane integrity. Interaction between Vitamin E / Selenium and dietary unsaturated lipids likely play a role in the pathogenesis of steatitis though the exact mechanism is unknown. In birds, this condition is suspected to be caused by a diet high in rancid or oily fish containing polyunsaturated fats . Steatitis has been reported in several other bird species (black crowned night heron Nycticorax nycticorax, osprey Pandion haliaetus, double crested cormorant Phalacrocorys auritus). Concurrent with gross necropsy findings, was the finding of unusually large counts of the cyanobacterium (blue-green algae) Microcystis plus some other cyanobacteria and algae. Microcystis is known to produce the potent cyclic peptide toxins called Microcystins. These potential toxin producers were found in water samples collected from the three die-off locales (Figure 2). Microcystins are hepatotoxins produced by at least two Microcystis sp. and several other genera of cyanobacteria. These potent toxins are known to be toxic to fish, mammals (including humans), and birds through skin contact, ingestion, and possibly inhalation . Microcystis are part of a group of microorganisms that are responsible for harmful algal blooms (HABs; Figure 6) that include: red tides, paralytic and neurotoxic shellfish poisoning, Pfiesteria, etc.

While analysis of all bird tissues was the goal, due to monetary constraints, only the tissues from those birds dying in the GBH event were tested for microcystin. Liver samples from six of the eight GBH in custody were sent to Wright State University for cyanobacterial toxin identification using immunoassay (ELISA), plus liquid chromatography/mass spectrophotometry (LC/MS). Results of the ELISA and LC/MS toxin analyses detected microcystin in 5 of the 6 samples. Toxic levels of microcystin known to cause acute lethal toxicosis were found in 4 of the 6 tissue samples (Table 1). The significance of these findings is currently under investigation.

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4. Click on “insert text box” and insert your write/up (“paper”). We recommend inserting each paragraph in a separate text box so that the paragraphs can be arranged around photos and tables at a later time.

NOTE: this poster is a little too wordy and has more references and acknowledgments than are usually needed.
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5. Add any tables that summarize your findings
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Case summaries (5 GBHs presented to TSBRR)

<table>
<thead>
<tr>
<th>ID</th>
<th>SEX</th>
<th>Location</th>
<th>Wgt</th>
<th>BCI</th>
<th>Metals</th>
<th>Microcystin</th>
<th>Treatment on entry</th>
<th>On-going care</th>
<th>Time in care</th>
<th>Date of Euthanasia</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHAHE16</td>
<td></td>
<td>M Stevensville</td>
<td>2610</td>
<td>N/A</td>
<td>3</td>
<td>N/A</td>
<td>N/A</td>
<td>Dexamethasone 3mg/kg (1/3)</td>
<td></td>
<td>3 days--died</td>
</tr>
<tr>
<td>WHAHE25</td>
<td></td>
<td>N/A</td>
<td>N/A</td>
<td>1.65</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
<td>Ivermectin 0.2mg/kg SQ once (1/3)</td>
<td></td>
<td>7 days--euthanized (agonal)</td>
</tr>
<tr>
<td>WHAHE24</td>
<td></td>
<td></td>
<td></td>
<td>1.63</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
<td>Metronidazole 50mg/kg PO BID (3/3)</td>
<td></td>
<td>euthanized on arrival (agonal)</td>
</tr>
<tr>
<td>WHAHE23</td>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
<td>Vit E 2000U PO BID (2/3)</td>
<td></td>
<td>Selenious 20mg PO SID (1/3)</td>
</tr>
<tr>
<td>WHAHE22</td>
<td></td>
<td></td>
<td></td>
<td>0.24</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
<td>Gavage feed prn (3-5% of body weight, up to 3x/day) if not self-feeding on fish (3/3)</td>
<td></td>
<td>5 days--euthanized (morbund)</td>
</tr>
<tr>
<td>WHAHE21</td>
<td></td>
<td></td>
<td></td>
<td>0.95</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
<td></td>
<td>WHEAHE21 5 days--euthanized (morbund)</td>
<td></td>
</tr>
<tr>
<td>WHAHE20</td>
<td></td>
<td></td>
<td></td>
<td>1.63</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
<td></td>
<td>WHEAHE20 euthanized on arrival (agonal)</td>
<td></td>
</tr>
<tr>
<td>WHAHE19</td>
<td></td>
<td>N/A</td>
<td>N/A</td>
<td>0.95</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
<td></td>
<td>WHEAHE19 7 days--euthanized (agonal)</td>
<td></td>
</tr>
<tr>
<td>WHAHE18</td>
<td></td>
<td></td>
<td></td>
<td>1.25</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
<td></td>
<td>WHEAHE18 euthanized on arrival (agonal)</td>
<td></td>
</tr>
</tbody>
</table>

**Presentation**
- Not standing (5/5)
- Firm, “ropy” abdomen (5/5)
- Open wound on back (1/5)
- Yellow-brown diarrhea (5/5)
- Agonal respiration (1/5)
- Covered in mud (1/5)

**Treatment on entry**
- Oxytetracycline 0.2mg/kg SQ once (1/3)
- Metronidazole 50mg/kg PO BID (3/3)
- Vit E 2000U PO BID (2/3)
- Selenious 20mg PO SID (1/3)
- Gavage feed (1-3% of body weight, up to 3x/day) if not self-feeding on fish (3/3)

**Time in care** (avg. = 3 days; range = 0-7 days)

**A.** GBH = Great Blue Heron
**B.** BCI = Body Condition Index, scale of 1-5 (1 = emaciated, 3 = normal, 5 = fat)

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Table 1. Blood/tissue chemistry and Body Condition Index (BCI) for 6 great blue herons collected from the Chesapeake Bay during the Fall 2001.

<table>
<thead>
<tr>
<th>ID</th>
<th>SEX</th>
<th>Location</th>
<th>Wgt (g)</th>
<th>Metals</th>
<th>HCT/BC</th>
<th>BCI</th>
<th>Steatitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHAHE16</td>
<td></td>
<td>Poplar Is.</td>
<td>1270</td>
<td>23</td>
<td>3.0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>WHAHE20</td>
<td></td>
<td>M</td>
<td>5 days</td>
<td>4.0</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>WHAHE22</td>
<td></td>
<td>M</td>
<td>5 days</td>
<td>4.0</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>WHAHE24</td>
<td></td>
<td>M</td>
<td>5 days</td>
<td>4.0</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>WHAHE25</td>
<td></td>
<td>M</td>
<td>5 days</td>
<td>4.0</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>WHAHE27</td>
<td></td>
<td>M</td>
<td>5 days</td>
<td>4.0</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Table 2. Case summaries (5 GBHs presented to TSBRR)**

<table>
<thead>
<tr>
<th>Presentation</th>
<th>Treatment on entry</th>
<th>Time in care</th>
<th><strong>Case summaries (5 GBHs presented to TSBRR)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>+Not standing (5/5)</td>
<td>+Dexamethasone 3mg/kg (1/3)</td>
<td>3 days</td>
<td>Head and neck paralysis (1/5)</td>
</tr>
<tr>
<td><strong>Yellow-brown diarrhea (5/5)</strong></td>
<td><strong>Hetastarch PO (2/3)</strong></td>
<td>3 days</td>
<td>Limb weakness (1/5)</td>
</tr>
<tr>
<td><strong>Agoral respiration (5/5)</strong></td>
<td><strong>2.5% Dextrose in Lactated Ringer’s Solution, 35-40cc IV (3/3)</strong></td>
<td>3 days</td>
<td>Diarrhea (1/5)</td>
</tr>
</tbody>
</table>

**Figure 3.** Great blue heron (Ardea herodias)

**Figure 2.** Location of avian morbidity events, harmful algal blooms, and sites where debilitated great blue herons were collected in the Chesapeake Bay during the Fall 2001.

7. Rearrange the text and photos and tables so that the information flows well and looks good
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<table>
<thead>
<tr>
<th>ID</th>
<th>Sex</th>
<th>Location</th>
<th>Age</th>
<th>BCI</th>
<th>BC</th>
<th>BB</th>
<th>TST</th>
<th>WHAHE27</th>
<th>WHAHE28</th>
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**VIT = Vitamin (mg/kg body weight)**
**BC = Body condition index; scale of 1-5 (1 = emaciated, 3 = normal, 5 = fat)**
**TC = Trace elements expressed in µg/g**
**BCI = Body condition index, scale of 1-5 (1 = emaciated, 3 = normal, 5 = fat)**

**Organochlorine =GC/MS/GC screens that detect insecticides (organophosphates, carbamates and organochlorines), polychlorinated biphenyls, dieldrin, and endrin.**

**Organochlorine = GC/MS/GC screens that detect organochlorine pesticides (organochlorines, carbamates and organochlorines), polychlorinated biphenyls, dieldrin, and endrin.**

**Table 2. Case summaries (5 GBHs presented to TSBBR)**

**Presentation**
- Not standing (5/5)
- Firm, “ropy” abdomen (5/5)
- Open wound on back (5/5)
- Yellow-brown diarrhea (5/5)
- Agonal respiration (5/5)
- Covered in mud (5/5)

**Treatment on entry**
- N-A
- Dexamethasone 3mg/kg (3/3)
- Metrizamide 6mg/kg (PO BID 3/3)
- Vit E 500UI PO BID (2/3)
- Selenium 20mg/kg PO SID (3/3)
- Garlic feed (0.5% of body weight, up to 3x/day) if not self-feeding on fish (3/3)

**Time in care (avg. = 3 days; range = 0-7 days)**

WAHE20 5 days—euthanized (moribund)  WAHE22 euthanized on arrival (agonal)
WAHE23 3 days—died
WAHE24 7 days—euthanized (agonal)
WAHE25 euthanized on arrival (agonal)

**References**

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