Waterbird Mortality Surveys on the Upper Mississippi River
National Wildlife and Fish Refuge

Monitoring the Impact of Trematodiasis

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Waterbird die-offs

- First occurrence in 2002 in Pool 7
- Most subsequent mortality events in Pools 7 & 8
Ingestion of infective parasite by new bird hosts continues the life cycle.

Metacercariae develop into adult trematodes (flukes) within the host and produce eggs.

Eggs are shed via bird’s feces and embryonate and produce a free-swimming miracidium which is ingested by the first intermediate host.

Further development of the parasite occurs in first intermediate host.

Cercariae become encysted as metacercariae on or in second intermediate host.

Second intermediate host

Bird ingests infectious metacercariae while feeding.

First intermediate host

Free-swimming cercariae leave first host.

from Cole and Friend 1999
Dead birds collected and submitted to USGS National Wildlife Health Center

- 2002–2013
- 429 individual birds
- 22 species
  - 16 Anatidae
  - 2 Rallidae
  - 2 Laridae
  - 1 Phalacrocoracidae
## Collected and Tested Positive

<table>
<thead>
<tr>
<th>Date of first collection</th>
<th>Species</th>
<th>Pool</th>
</tr>
</thead>
<tbody>
<tr>
<td>fall, 2002</td>
<td>American coot</td>
<td>7</td>
</tr>
<tr>
<td>fall, 2002</td>
<td>lesser scaup</td>
<td>7</td>
</tr>
<tr>
<td>fall, 2003</td>
<td>mallard</td>
<td>7</td>
</tr>
<tr>
<td>fall, 2003</td>
<td>ruddy duck</td>
<td>7</td>
</tr>
<tr>
<td>spring, 2004</td>
<td>ring-necked duck</td>
<td>7</td>
</tr>
<tr>
<td>fall, 2004</td>
<td>American black duck</td>
<td>7</td>
</tr>
<tr>
<td>spring, 2005</td>
<td>bufflehead</td>
<td>7</td>
</tr>
<tr>
<td>fall, 2005</td>
<td>blue-winged teal</td>
<td>7</td>
</tr>
<tr>
<td>fall, 2005</td>
<td>canvasback</td>
<td>7</td>
</tr>
<tr>
<td>fall, 2005</td>
<td>northern pintail</td>
<td>8</td>
</tr>
<tr>
<td>fall, 2005</td>
<td>redhead</td>
<td>9</td>
</tr>
<tr>
<td>fall, 2006</td>
<td>northern shoveler</td>
<td>7</td>
</tr>
<tr>
<td>fall, 2012</td>
<td>sora</td>
<td>8</td>
</tr>
</tbody>
</table>
Collected and Tested Negative

- Double-crested cormorant
- Lesser snow goose
- American wigeon
- Wood duck
- Common goldeneye
- Herring gull
- Ring-billed gull
Surveys

- Approximately weekly
- Spring (March–May)
  - 4–7 surveys/season
- Fall (August–December)
  - 8–14 surveys/season
Survey Segments

- Pool 7 - surveys by boat
  - Arrowhead Island
  - Broken Gun Island
  - A, B, and C Islands

- Pool 8 - surveys by truck
  - Lock & Dam 8

- All dead (but “fresh”) birds observed along survey segments
Spring Proportions
2004–2013

LESC
AMCO
7 others
Fall Proportions
2004–2013

- LESC
- AMCO
- 12 others
Index of mortality

- Pool 7 – surveyed by boat
  - Arrowhead Island = 1.0 km
  - Broken Gun Island = 1.0 km
  - Islands A, B, C = 3.9 km

- Pool 8 – surveyed by vehicle
  - Lock & Dam 8 = 5.3 km

- Individuals per km of survey route
Spring Mortality Index

![Graph showing the Spring Mortality Index with data points for LESC and AMCO from 2004 to 2013. The graph indicates a fluctuation in the number of individuals per km, with LESC generally showing a lower number compared to AMCO, except for a notable increase in 2011.]
Fall Mortality Index

- LESC
- AMCO

[Graph showing annual mortality index from 2004 to 2013 with data points for LESC and AMCO, indicating trends and values for each year, including a note for no data in 2013.]
Fall Mortality Index

AMCO mortality index (individuals per km)

LESC mortality index (individuals per km)
Are mortality dynamics related to waterbird abundance?
Index of fall abundance

- Aerial surveys
- Only conducted in the fall
- Conducted approximately weekly
- Fixed routes with known length

- Calculation of Waterbird Use Days (WUD)
- Season-long measure of abundance

- WUD per km of survey route
Are mortality dynamics related to ice cover?

A big shout-out to Charlotte Roy, MN DNR, for this idea.
Index of ice cover

- USACE records available on the internet
- Lock and Dam 8
- First barge of season: proxy for spring ice-out
- Last barge of season: proxy for fall ice-up
- Calendar dates converted to Julian date
Discussion

• Scaup mortality events tend to be worse in the spring

• Coot mortality events tend to be worse in the fall

• No apparent relationship between waterbird mortality and waterbird abundance, but...

• No apparent relationship between waterbird mortality and a proxy for ice cover, but...
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