Instream Bacteria Concentrations

AND THE

Influence of Bird Colonies at Bridges

David Pendergrass
Birds poop.

Bird poop can be a major contributor to high instream *E. coli* concentrations.

Instream *E. coli* samples are often collected near bridges.

Some birds, such as cliff swallows, roost at bridges in large numbers.

Landowners in some bacteria TMDL watersheds pin blame on bird colonies at water sampling sites.
Do birds roosting at bridge crossings significantly increase instream bacteria concentrations in the vicinity of bridges?

$H_0 = \text{No significant increase in E. coli concentrations between upstream and downstream samples}$
Study Design
Study Design

1 x 1 Meter Frames

Assess Defecation Densities

Assess Instream Bacteria Concentrations

Bacteria Sampling Locations

Upstream

Bridge

Downstream

Stream
Study Design

2 Treatment Bridges (16404 & 21186...swallows)

1 Spatial Control (20018...no swallows)

1 Temporal Control (16404... prior to swallow arrival)
Study Design

(5 Up + 5 Bridge + 5 Down) * 3 Events = 45 Samples
45 Samples * 8 Visits = 360 Samples
360 Samples * 2 Treatment Bridges = 720 Samples
720 Treatment Samples + 315 Control Samples = 1,035
Natural History of Cliff Swallows
Cliff Swallow
(Petrochelidon pyrrhonota)

In Texas: Arrive early March, depart mid-June

Data: www.ebird.org
Cliff Swallow
(Petrochelidon pyrrhonota)

The Three Phases of Nesting

- Feeding/Nest Building
- Incubation
- Nestling (Early)
- Nestling (Late)

Fecal Deposition Frequency
Sortie Duration
Sortie Frequency
Results
Densely Populated Treatment Bridge

E. coli (CFU/100 ml)

Station 16404

Geomean Criterion: 126

Date

Apr 19  Apr 30  May 22  May 23  Apr 08  Apr 23  May 06  May 30

**Results**

**E. coli**

**Moderately Populated Treatment Bridge**

![Graph showing E. coli concentrations over time at Station 21186. Geomean Criterion: 126. Values of 860 and 1000 at Bridge not shown.**
Instream E. coli

Results

Control Bridges

E. coli (CFU/100 ml)

Geomean Criterion: 126

Bridge values for Survey 3 not shown. Multiple high outliers likely caused by fish foraging in sediment.

Spatial Control - Station 20018

Temporal Control - Station 16404

Date

Upstream  Bridge  Downstream  Geomeans
Discussion
Do birds roosting at bridge crossings significantly increase instream bacteria concentrations in the vicinity of bridges?

Yes...

Sometimes...

It Depends...
Discussing...

Sometimes...

It Depends...

Yes...

Differences were always significant between upstream and downstream samples...

At the densely birded bridge...

When swallows were present...
Meanwhile at the moderately birded bridge...

Differences were less pronounced...

Differences were significant only during peak bird activity...

<table>
<thead>
<tr>
<th>Date</th>
<th>Upstream</th>
<th>Bridge</th>
<th>Downstream</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apr 26</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>May 01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>May 24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>May 29</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apr 09</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apr 22</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>May 07</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>May 31</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Values of 860 and 1000 at Bridge not shown.
Furthermore, at the control bridges...

No differences at nestless SPATIAL control bridge...

Significant differences at TEMPORAL control likely due to small perennial house sparrow colonies...

<table>
<thead>
<tr>
<th>Date</th>
<th>Upstream</th>
<th>Bridge</th>
<th>Downstream</th>
<th>Geomeans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apr 27</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>May 03</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>May 30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jun 25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jan 24</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feb 06</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feb 27</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Geomean Criterion:** 126

*Bridge values for Survey 3 not shown. Multiple high outliers likely caused by fish foraging in sediment.*
And the natural history...

*E. Coli* concentrations generally increased with bird activity at the nests.
More birds = more instream *E. coli*
Assess presence of birds (and bats?).

Sample at a BPJ distance from the upstream bridge face.

Be mindful of migratory patterns (avoid nesting periods?).

Landowners in TMDL watersheds can—but probably shouldn’t—pin high *E. coli* concentrations on migratory swallow colonies.
ACKNOWLEDGEMENTS

Funding: Texas State Soil and Water Conservation Board

Nabin Basnet, Christie Goffinet, Georgiana Hudson, Joseph Jackson, Ujwal Pandey, Matt Brown, and Stephanie Painter

Jesus Christ
QUESTIONS
Poop Frames

Appendix

16404 Median Counts

Downstream  Upstream

21186 Median Counts

Downstream  Upstream

Fecal Count vs. Distance From Bridge Face (m)
**Nest Counts**

- **Estimated Active Nests**
  - Total Active Nests
  - Nests Over Water

- **Control Sample**
  - Date
  - Estimated Active Nests:
    - 2012: 16404
    - 2013: 21186

- **Date**:
  - 19 Apr
  - 30 Apr
  - 29 May
  - 23 Jan
  - 08 Apr
  - 23 Apr
  - 08 May
  - 31 May

- **Graph**
  - X-axis: Date
  - Y-axis: Estimated Active Nests
  - Legend:
    - Red: Total Active Nests
    - Blue: Nests Over Water

- **Images**
  - Nest in a structure
  - Nest in a tree