



Raptor Resource Project Lesson Plans

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Lesson Plan: Blackfly Infestation

Grade/Level	Middle School, High School, College
Time Allotment	A minimum of 2 class periods
Content Area(s)	Life Science, Entomology, Animal Behavior, Climate Change

Objectives

To observe the effect of blackfly infestation on the Decorah and GSB nests and consider why this might become a more frequent problem.

Curricular Connections

- LS2 Ecosystem: Interactions, Energy and Dynamics
- ESS 3 Earth and Human Activity
- Science and Engineering Practice: Analyzing and interpreting data

Instructional Materials

Charts/information at the end of this chart | Also included with the download package Materials for a visual summary

Resources

- Blackflies at Raptor Resource Project nests
<https://www.raptorresource.org/2019/06/24/blackflies/>
- Eaglet DN9 responding to blackflies
<https://youtu.be/-F4fnXrOJ5Y>
- Basic blackfly biology and lifecycle
<https://soarraptors.org/2019/06/black-flies-once-again-torment/>

Background Knowledge

Students should read *Basic blackfly biology and lifecycle* to learn more about blackflies

Opener

The teacher projects the first part of the blog from RRP to show pictures of the flies. Then students continue with the info and lesson below. Link: <https://bit.ly/2SBiecv>

Procedure/Method/Activity

Students should study and discuss the data. Printable material and charts can be found at the end of this lesson plan or online at <https://bit.ly/2SBiecv>.

- **Production chart:** What did you learn from this data? In what years were there fewer fledges?
- **Water flow and blackflies:** What does this data tell us?
- **Are high water years becoming more frequent:** What did you learn from this data?

After studying and discussing the 3 charts, what trends do you see? (Students work in teams of 2 or 3 to discuss the data.) Summarize how the data demonstrates the relationship between survival to fledge, water flow, and frequency of high-water years in a visual way. Explain your thinking.

Assessment

Many people in NE Iowa complained about how bad the blackflies, aka gnats were in 2019. It was really a problem for people working in gardens, watching a ball game, etc.

- What are 5 important facts you now know that you would share with these people?
- Besides people, what other organisms are “bothered” by a blackfly infestation?
- How are they affected?
- Why are these infestations occurring more often?
- What is a possible link to climate change? Please cite data from the falcon nest box in answering this question.

Extension

People often want to “do something about the blackflies”. Read *The ins and outs of controlling blackflies at our sites* at the end of this lesson plan. Do you think people should interfere to lessen the effect of black flies on wild birds? What is causing the problem? Can it be eliminated? Could we end up inadvertently causing another disaster like DDT?

Chart 1: Peregrine Falcons at Great Spirit Bluff, 2005 – 2019

The chart below shows Peregrine Falcon production at Great Spirit Bluff between 2005 and 2019. Until 2012, production is listed in the following order: eggs laid, eggs hatched, falcons banded. After 2012, production is listed as eggs laid, eggs hatched, falcons fledged.

2012 was the first year we could watch Great Spirit Bluff online. Blackfly years – i.e., years where blackflies caused early fledging – are highlighted in green.

To watch and learn more about the Great Spirit Bluff falcons and their home, go to <https://www.raptorresource.org/birdcams/gsb-falcons/>

Year	Male	Female	Production
2005	Unknown	Katrinka	4 4 4
2006	Unknown	Katrinka	4 3 3
2007	Unknown	Unknown	4 3 3
2008	Unknown	Unknown	1 falcon banded
2009	Unknown	Unknown	4 4 4
2010	Unknown	Unknown	4 4 4
2011	Travis	Michelle	4 4 4
2012	Travis	Michelle	4 3 2
2013	Travis	Michelle	4 4 2
2014	Travis	Michelle	5 1 1
2015	Travis	Michelle	4 4 4
2016	Newman	Michelle	4 4 4
2017	Newman	Michelle	4 4 2
2018	Newman	Michelle	4 2 2
2019	Newman	Michelle	4 2 1

Chart 2: Water flow and black flies

The chart below shows water flow during May and June in La Crosse, WI between 2005 and 2019, sorted by the sum of the least to the greatest flow in May and June. Bad blackfly years are marked in green. Data collected by the USGS National Water Information System: <https://nwis.waterdata.usgs.gov/nwis>.

The data show that we've seen more blackfly-induced fledges since we put the nest box online. Is this because we've been able to see them, or is something else going on?

To take a closer look at the Mississippi River near La Crosse, go to <https://www.raptorresource.org/birdcams/flyway-cam/>

Year	May	Jun	Sum Total	Production
2005	288.5	242.3	530.8	4
2007	323.8	315.6	639.4	3
2010	364.4	431.4	795.8	4
2012	500.2	346.4	846.6	2
2006	468.1	400.1	868.2	3
2016	396.1	515.5	911.6	4
2015	419	505.4	924.4	4
2009	454.4	470.3	924.7	4
2011	543.8	490.7	1034.5	4
2017	586.4	524.3	1110.7	2
2014	538	584.3	1122.3	1
2018	742.2	490.8	1233	2
2008	444.4	800.1	1244.5	1
2013	620.4	679.5	1299.9	3
2019	716	632	1348	2

Chart 3: Are high water years becoming more frequent?

We know that blackfly years are driven by high water levels. But are high water years becoming more frequent? The chart below shows the five-year average flow in May and June between 2005 and 2019, sorted by year. Bad blackfly years are marked in green.

To take a deeper dive into waterflow, visit the USGS National Water System Information website: <https://maps.waterdata.usgs.gov/mapper/index.html>

Year	May	Jun	Sum Total	Five-Year Average
2005	288.5	242.3	530.8	
2006	468.1	400.1	868.2	
2007	323.8	315.6	639.4	
2008	444.4	800.1	1244.5	
2009	454.4	470.3	924.7	841.52
2010	364.4	431.4	795.8	
2011	543.8	490.7	1034.5	
2012	500.2	346.4	846.6	
2013	620.4	679.5	1299.9	
2014	538	584.3	1122.3	1019.82
2015	419	505.4	924.4	
2016	396.1	515.5	911.6	
2017	586.4	524.3	1110.7	
2018	742.2	490.8	1233	
2019	716	632	1348	1105.54

The ins and outs of controlling blackflies at our sites

To control blackflies, we need to know what kind of blackflies we're dealing with. Some flies are generalists, while others are specialists. Some species have one generation per year, while others have several. We contacted blackfly expert Dr. Peter Adler and will send him any flies we collect from Peregrine falcons. We've also asked regional rehabbers to send him any black flies that come in on their birds and will probably set up dry ice traps near our nests next spring.

Controlling black flies after hatch

Control strategies can be generally grouped into two categories – controlling black flies after hatch and preventing hatch altogether. To control flies after hatch, RRP Director John Howe installed a fan at Great Spirit Bluff and Neil Rettig installed a fan in the Wisconsin kestrel nest. Veterinarian Dr. Laura Johnson also applied Endure, a permethrin-based repellent, on the outside of the kestrel nestbox (although not the kestrels themselves). The combination of a high-powered fan with an insect repellent did a very good job at keeping blackflies out of the kestrel nestbox. Endure can last up to two weeks and is applied locally, making it a very good candidate for use at our nest boxes.

The two Decorah eagle nests are a little tougher to deal with. We can't access them without shooting a line, which puts the eagles at risk. Most products we apply during cam work in September will be gone by next May (this includes vanilla and cedar oils, which we tried unsuccessfully at Great Spirit Bluff in 2017). Insecticidal paints last longer, but they aren't proven to work against blackflies and can't be allowed to enter or run off into storm drains, drainage ditches, gutters or surface waters. They are extremely toxic to fish and invertebrates, which makes us hesitant to use them. We haven't given up on a post-hatch control strategy, but the difficulty of reaching the nests without hurting the eaglets makes it a lot harder.

Preventing blackfly hatch

How about preventing blackfly hatch? BTI, or *Bacillus thuringiensis israelensis*, produces toxins that are effective in killing various species of mosquitoes, fungus gnats, and blackflies. It is believed not to have an effect on non-target organisms, although questions remain about the consequences of wiping out a large number of invertebrates in any given natural system.

BTI is widely used in urban blackfly control, but has it been used to control ornithophilic blackflies in rural settings? It has! Researchers used BTI to control the blackfly population at the Necedah National Wildlife Refuge between 2010 and 2012 as part of a wider study investigating reproductive failure in reintroduced whooping cranes. They found that treating flowing water with BTI helped suppress blackfly hatch, although it isn't as simple as dumping BTI into every trickle, stream, and river. Researchers have to identify blackfly species and sources to control them effectively and BTI gets washed away if water is flowing high and fast.

We're currently talking with professor Peter Adler, a blackfly specialist, and others who participated in the Wisconsin study to determine whether BTI could be used safely and effectively near our nests. If we decide to go the BTI route, we'll be talking with landowners, the Iowa DNR, the City of Decorah, and raptor and black fly researchers. Any projects would need to be properly permitted and formally documented to determine their success. As an

environmental organization, we need to look for solutions that balance the health of the birds we watch with the health of the environment that surrounds and nourishes them.

In short: this problem doesn't appear to be going away and may become more common in the future as the effects of global climate change deepen. We're working on a solution that is safe for our birds, minimizes environmental impact, and can be documented and shared with others who are facing the same problem.

We've had a lot of followers suggest cedar oil, vanilla, and other homeopathic remedies. We've tried vanilla and cedar oils at GSB, but they volatilize or wash away too quickly to provide control throughout the season. This isn't a bad thing – DDT still remains a problem in some places 47 years after it was banned in the United States in part because it doesn't break down – but it means they aren't a good option for black fly control at our Bald Eagle nests.

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