

# The Lois Webster Fund-2013 Final Report

**Name of project:** Identification of diet of Black Swift (*Cypseloides niger*) in Colorado

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## Introduction

The goal of this project is to describe the type, numbers, and sizes of prey items taken by Black Swifts in Colorado. Black Swifts feed exclusively on aerial insects, often referred to as aerial plankton, whose lives are intimately tied to the terrestrial habitat. Changes in habitat or global climate change threaten this connection between insects and the Black Swifts' ability to forage optimally. Without knowledge of the swifts' diet, it is difficult to assess or model potential habitat threats.

The Black Swift has been identified as a species of conservation concern in every western state and province in which it nests. The western US Forest Service regions have designated it as a "sensitive species". The National Audubon Society, American Bird Conservancy, and the Partners in Flight North American Land Bird Conservation Plan all list it as a Watch List Species. These designations emphasize the need to understand basic food, foraging, and habitat requirements of this species and the need to address potential habitat threats.

There is very little information regarding the diet of the Black Swift. The literature describes a few instances where the diet was identified, but sample numbers were small, specimens were collected over short periods of time and only at specific locations; the studies do not adequately describe the diet of Black Swift on its North American breeding grounds.

We have been collecting and archiving insect boluses from Black Swifts in Colorado since 2006 as an ancillary part of our annual banding efforts. Black Swifts forage long distances from their breeding colonies and return to their nests carrying large masses of food items in their esophagus, from which they provision nestlings at intervals throughout the night. The food items are compacted into several tight masses of insects bound with thick saliva and referred to as boluses. The boluses of food items collected over a seven year period are the basis of our study.

## Methods

We collected and archived boluses from Black Swifts during the month of August from the years 2006 through 2012. Specimens were collected at three locations in Colorado: Fulton Resurgence Cave in Garfield County, Zapata Falls in Alamosa County, and Box Canyon Falls in Ouray County.

A single swift may have several boluses compacted into its esophagus and any expelled boluses were placed into labeled vials with alcohol. During banding sessions we measured and recorded the gape of a

sampling of Black Swifts. The gape was measured with calipers from hinge to hinge on the inside of the open swift mouth.

Identification of the insects was completed by Dr. Boris Kondratieff, Professor, Department of Bioagricultural Sciences and Pest Management, Colorado State University and Director, C. P. Gillette Museum of Arthropod Diversity. Insects were keyed to species when possible, measured in millimeters, quantified, and notes on habitat associations for the insects were included.

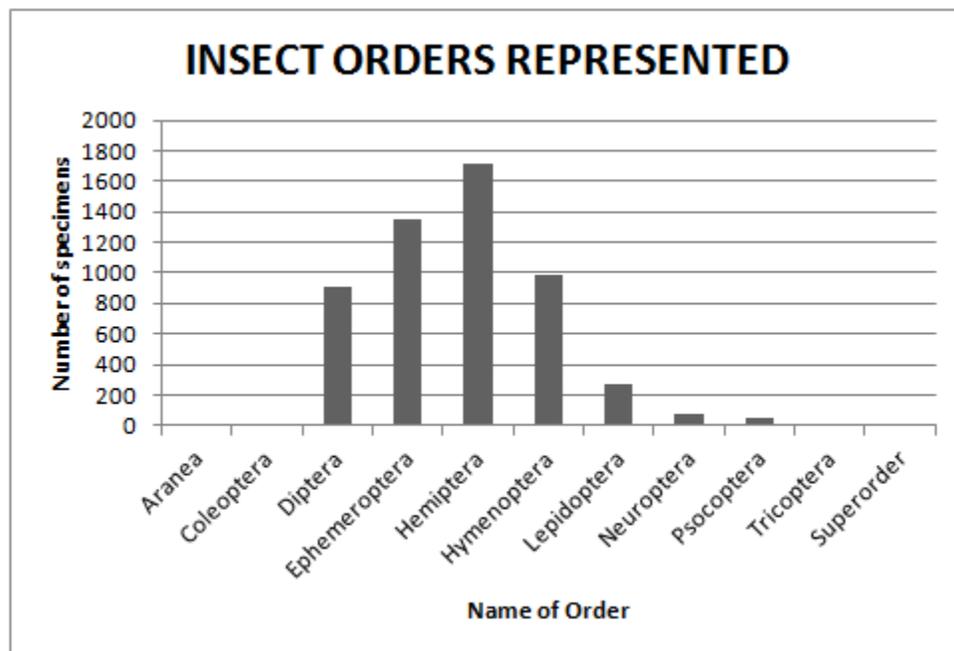
Available habitat maps will be used to characterize the habitats available for Black Swift foraging within a 50 mile radius of each of the collection sites.

## Results

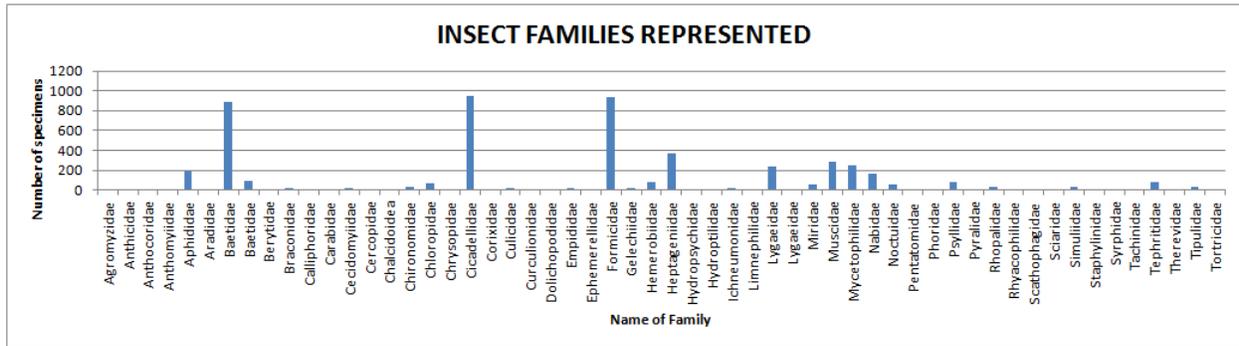
The identification of the insect specimens was completed by Dr. Kondratieff on June 13, 2013. These results represent the largest collection of diet specimens identified from Black Swifts with a sample size of 5,434 insects (Fig 1), representing 11 orders (Fig 2) and at least 56 families (Fig 3).

Location	Total numbers of insects
Fulton Resurgence Cave	4,099
Zapata Falls	1,158
Box Canyon Falls	177
<b>TOTALS</b>	<b>5,434</b>

**Figure 1.** Specimens from three Colorado Black Swift colonies were identified resulting in a robust dataset.



**Figure 2.** Quantified insect Orders represented in a seven year sampling of Black Swift diet during August 2006-2012.

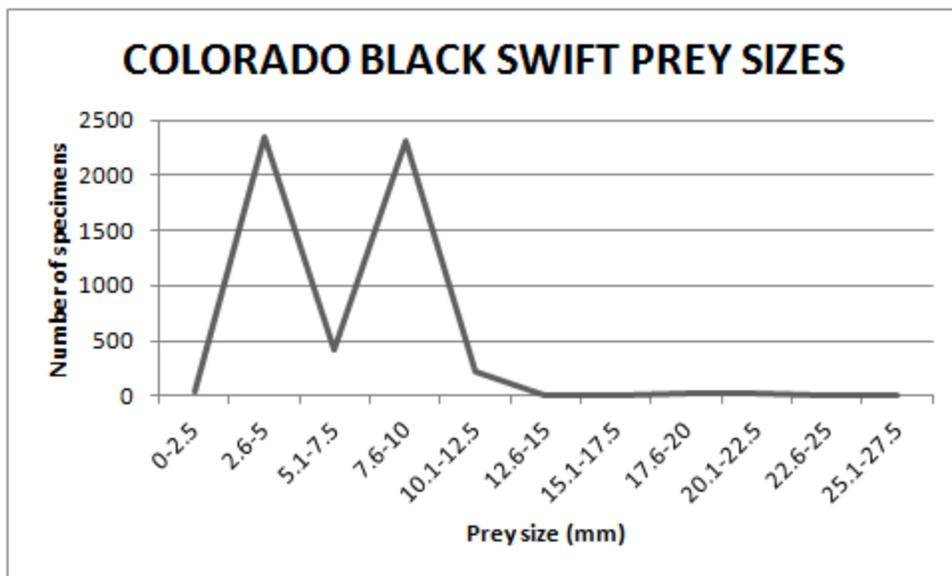


**Figure 3.** Quantified insect families represented in a seven year sampling of Black Swift diet during August 2006-2012.

The four most represented insect orders include Hemiptera, Ephemeroptera, Hymenoptera, and Diptera. Hemiptera, called true bugs, are represented by insects such as leafhoppers, aphids and plantlice; most are associated with plants and feed on plant juices. Ephemeroptera represent winged adult forms of insects originating from aquatic habitats. Hymenoptera is the largest insect order and includes bees, wasps and ants. Diptera include all the flies.

The three most consumed aerial insect families included leafhoppers and jassids of the Cicadellidae Family (Hemiptera Order), winged ants of the Formicidae Family (Diptera Order) and mayflies of the Baetidae Family (Ephemeroptera Order).

Of the 5,434 insects collected, the average prey size measured 6.2mm, the median prey size measured 5.5mm; sizes ranged between 1.5mm and 27.5mm (Fig 4).



**Figure 4.** Sizes of aerial plankton consumed by Black Swifts during a seven year sampling of Black Swift diet during August 2006-2012.

We measured the inside mouth gape of Black Swifts (n=7) and found the average gape was 15.9mm for males (range 15.1-17.2mm, n=3) and 14.2mm for females (range 13.5-14.8mm, n=4). Gape size correlates well with prey sizes.

## **Discussion**

This study has resulted in an extremely accurate and robust dataset of Black Swift diet items. Our sampling is limited to August but represents the most critical feeding period in the breeding season. It is also limited to sampling areas within Colorado and does not represent the entire breeding range of this subspecies of Black Swift. This study suggests that Black Swifts specialize in aerial plankton and several different orders and families are important to their diet. Swifts are opportunistic in choosing those insect species that are available during foraging forays.

## **Future Analysis**

During the upcoming winter season we will prepare a manuscript to be submitted to an appropriate peer-reviewed ornithological journal for publication. This will include further analysis of the data collected, analysis of the habitat within a 50 mile radius of each of the three Colorado sampling sites, detailed comparison of our findings with other studies, detailed discussion of Black Swift foraging strategies, and discussion of the connectedness of Black Swift diet to habitat and climate change. We will also give presentations on the findings to interested parties or other contributors.

**Other partners on the project:** An additional \$1,500 was received from the Colorado Field Ornithologists for this project. Dr. Kondratieff, Professor, Department of Bioagricultural Sciences and Pest Management, Colorado State University and Director, C. P. Gillette Museum of Arthropod Diversity has identified the specimens (the specimens were donated to the C.P. Gillette Museum of Arthropod Diversity in Ft. Collins, Colorado). The specimens were collected by employees of the US Forest Service, White River National Forest, Rifle Ranger District, Rocky Mountain Bird Observatory staff, and volunteer citizen scientists.

We wish to thank the Lois Webster Fund for support of our project and research of Black Swifts. All funds received from LWF went directly to the C.P. Gillette Museum of Arthropod Diversity in Ft. Collins, Colorado for their expertise and future manuscript reviews, and for the identification, quantification, measuring and supplemental information for the 5,434 insect diet items upon which this study was based.

Project Manager: **Kim M. Potter**

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