The annual recurrence of the animals on campus and their position as higher are insectivorous so often prey on flying insects that swarm near their nesting sites. The purpose of this research is to determine how human activities impact the local environment and the species that live within it. The species of interest is the Cliff Swallow (Petrochelidon pyrrhonota) which nests and breeds on the Moreno Valley College campus each spring. Nesting site information for the years 2014 and 2015 have been recorded, and a map was created using ArcGIS Online software. The map was analyzed within the context of monthly precipitation and temperature. In addition, feathers, nesting materials, and fecal samples have been collected for analysis of the concentration of nitrates, nitrates, and heavy metals. Water and mud (for nest building) samples from sources near the nesting location have also been collected. The study aims to analyze the biomagnification of toxins throughout the trophic levels of the local ecosystem. The chemical data in conjunction with the population data accumulated over a long period of time will allow to assess the influence of human-caused environmental changes on wildlife.

Much of Southern California's landscape has been modified for agriculture, industry, and suburban living space. For many years, Cliff Swallows (Petrochelidon pyrrhonota) have used the Moreno Valley College campus as a nesting and breeding site. They have migrated from South America and gather in large numbers each spring to build their gourd-shaped nests from mud in which they lay eggs and brood their offspring. They are insectivorous so often prey on flying insects that swarm near their nesting sites. The annual recurrence of the animals on campus and their position as higher consumers in the local ecosystem makes the swallows a convenient candidate and ideal for a study of biomagnification.

Abstract

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Introduction

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Materials and Methods

To study cliff swallows, we utilized ESRI’s ArcGIS online software to record and organize nesting locations. ESRI is a company that develops geographic information systems software.

Nesting data was then compared to local monthly climate data obtained through NOAA’s National Climatic Data Center online datasets for the years 2013, 2014, and 2015. Time-lapse cameras mounted near nesting locations were placed to make automatic observations of the nest-building process in order to obtain general information about the swallows’ behaviors. Samples of water from nearby sources, feathers, mud from abandoned nests, and droppings have been collected for analysis of their chemical contents to determine the presence and concentration of heavy metals, nitrates, and nitrates.

Results

The map produced allows us to keep track of population size throughout the season. Mapping the nest locations also illustrates the nesting preferences of the birds. The highest density is on south-facing windows of buildings. Exposure to sunlight may be a factor for determining the ideal placement of a nest. The sun arcs across the southern sky from east to west, so south-facing nests will be exposed to sunlight at dawn and will be shaded during midday. The map produced allows us to keep track of population size throughout the season. Mapping the nest locations also illustrates the nesting preferences of the birds. The highest density is on south-facing windows of buildings. Exposure to sunlight may be a factor for determining the ideal placement of a nest. The sun arcs across the southern sky from east to west, so south-facing nests will be exposed to sunlight at dawn and will be shaded during midday.

Figure 1 & 2: Left: a typical nest and its resident; Right: cliff swallows work in pairs to lay the foundation for a nest on the south side of MVC’s science building in March 2015.

Results Continued

Data in fig. 5 shows a correlation between the arrival date of the swallows and rising temperature. In the year 2013, the observed arrival date was 3-12. In the years 2014 and 2015, arrival was about one month earlier on 2-19 and 2-17, respectively. For each of these three years, the arrival of the swallows coincides with an increase in mean monthly temperature to about 17°C and a mean monthly maximum near 25°C. Their departure in 2014 is also one month earlier than 2013.

Comparing the months 3-2014 and 3-2015 in fig. 6 shows a correlation between nest-building and rainfall. It appears that rainfall occurring during the nest building months contributes to a higher completion rate of nests in those months. This concurs with the observation that nests are constructed from wet soil. The swallows will travel only up to 1 mile to collect mud so the amount of local precipitation may affect their success each breeding season.

Discussion

There has been a significant decrease in the overall population size of Cliff Swallows on the Moreno Valley campus between 2014 and 2015. While there seems to be a correlation between precipitation and the success of nest construction, more data is required to make a definitive statement. Other factors that could affect the population should be explored, such as the effect of deterrents utilized by the school and alternative nesting sites off campus that may provide better access to resources. Additionally, the samples of mud, water, feathers, insects, etc., that have been collected will be analyzed to provide information about the accumulation of toxins from soil and water and any effect it may have on the ecosystem.

The study is ongoing and intended to involve long-term observations. Continued study of these animals and their habits will provide more insight into how environmental factors such as climate and toxicity affect Moreno Valley’s cliff swallow population.

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References


Figures 3 & 4: The 3-2014 (top) and 4-2014 (bottom) population is shown here. Nest initiation is shown in yellow. Completed nests are indicated by green points. Black indicates a damaged or destroyed nest. ArcGIS's software allowed monitoring the Cliff Swallow population throughout the breeding season.