Saguaro Features & Characteristics Favored by Purple Martins

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Introduction:

Along with my work with the native subspecies, Desert Purple Martins, I researched their preferences for desirable features and characteristics within saguaro cavities. My prediction anticipates a significant tendency for nest cavities situated in vertical regions of the saguaro body. In the initial citation, a University of Arizona master's student conducted early studies on saguaro cavities, monitoring temperature, humidity, and light intensity throughout the day, month, and year. He observed activity and usage patterns among different species, revealing variations in cavity characteristics and their susceptibility to environmental factors. The second citation explores research on the Purple Martin species, which includes the Desert Purple Martin subspecies. The study reveals that environmental factors, such as temperature fluctuations throughout the day, influence the parenting behavior of Purple Martins. Nests with specific characteristics can result in less time and effort manning the nest. The third citation has broadened research of Purple Martin populations across the US including a couple of key points of Desert Purple Martins. The article emphasizes the role of male Purple Martins in defending cavities to attract mates, indicating intentional selection of cavities with specific characteristics for optimal nesting conditions. This research has further pushed the potential results and speculation in intentional survival-driven decision-making skills of Desert Purple Martins to analyze saguaros for key traits and features.

Methods:

My research question for Desert Puple Martins' preferences for the angularity of the saguaro represents a subset of the broader tasks covered during my internship with Tucson Audubon. With the help of my manager/mentor Jennie Macfarland, who leads this project, this project afforded me access to a range of tools and resources enabling diverse methods and strategies to address my research question. A significant aspect of this research involved active field participation, where I conducted surveys and exploratory research for nests among many volunteers, the public, and a big part Jennie Macfarland. This included visiting marked nests and pursuing potential leads for previously unidentified ones. Following the collection and upload of current-year data to iNaturalist and eBird, I examined the map of surveys conducted across Tucson, Arizona. My analysis focused on evaluating survey quality for further data collection and analysis. Subsequently, I selected a subset of surveys to populate a datasheet tailored to target and analyze patterns in features and characteristics of saguaro cavities of confirmed nest sites. This data sheet was constructed on a Google Sheets platform using visible

pictures. Importantly, utilized this data to create visually informative graphs, enhancing the clarity of the findings.

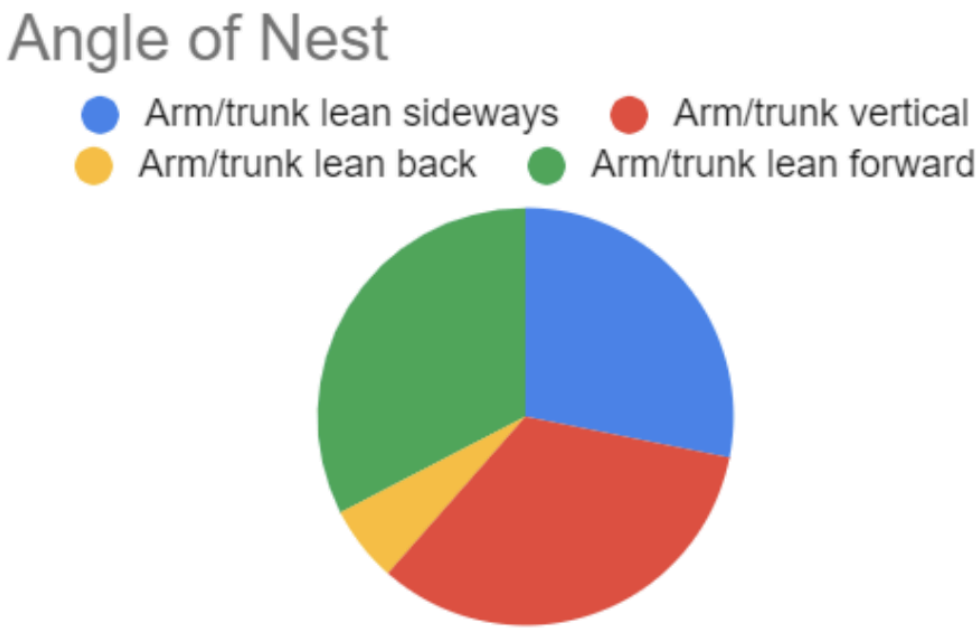
Results:

Upon investigating the data, illustrated in Figure 1, and comparing it in a pie chart (Figure 2), potential preferences for Desert Purple Martins come into view. Initially, my prediction proposed a higher inclination of Purple Martins making nests in cavities towards saguaros with cavities positioned on a vertical part of the plant, free of significant learnings in any particular direction. Notably, I observed a general indifference toward the saguaro's angle, except for one direction. Each angle displayed an average occurrence rate of around 30%, as depicted in Figure 2. However, a cavity hole leaning backward exhibited a markedly lower average occurrence rate of 5.9%. This observation leads me to theorize that the lower rate may be attributed to the enhanced exposure and vulnerability of cavities in this position to environmental factors, consequently diminishing the protective and stable attributes of the nesting environment.

Figure 1:

Angle of nest							
Arm/trunk lean sideways	Arm/trunk vertical	Arm/trunk lean sideways	Arm/trunk lean back	Arm/trunk lean sideways	Arm/trunk lean sideways	Arm/trunk lean forward	Arm/trunk lean sideways
Arm/trunk lean forward	Arm/trunk vertical	Arm/trunk lean forward	Arm/trunk vertical	Arm/trunk lean sideways	Arm/trunk lean sideways	Arm/trunk vertical	Arm/trunk vertical
Arm/trunk vertical	Arm/trunk lean sideways	Arm/trunk lean sideways	Arm/trunk vertical	Arm/trunk lean forward	Arm/trunk lean sideways	Arm/trunk lean sideways	Arm/trunk lean forward
Arm/trunk lean forward	Arm/trunk vertical	Arm/trunk lean forward	Arm/trunk vertical	Arm/trunk vertical	Arm/trunk lean forward	Arm/trunk vertical	Arm/trunk vertical
Arm/trunk lean sideways	Arm/trunk lean sideways	Arm/trunk lean forward	Arm/trunk lean forward	Arm/trunk lean sideways	Arm/trunk lean forward	Arm/trunk lean forward	Arm/trunk lean forward
Arm/trunk lean sideways	Arm/trunk lean forward	Arm/trunk lean sideways	Arm/trunk lean forward	Arm/trunk lean sideways	Arm/trunk lean forward	Arm/trunk vertical	Arm/trunk lean forward
Arm/trunk vertical	Arm/trunk lean sideways	Arm/trunk vertical	Arm/trunk lean back	Arm/trunk lean forward	Arm/trunk vertical	Arm/trunk lean forward	Arm/trunk vertical
Arm/trunk lean back	Arm/trunk lean forward	Arm/trunk lean forward	Arm/trunk lean forward	Arm/trunk vertical	Arm/trunk lean sideways	Arm/trunk vertical	Arm/trunk lean back
Arm/trunk lean sideways	Arm/trunk lean forward	Arm/trunk lean back	Arm/trunk lean sideways	Arm/trunk lean forward	Arm/trunk lean sideways	Arm/trunk lean forward	Arm/trunk lean sideways
Arm/trunk vertical	Arm/trunk vertical	Arm/trunk lean sideways	Arm/trunk vertical	Arm/trunk lean sideways	Arm/trunk vertical	Arm/trunk vertical	Arm/trunk lean forward
Arm/trunk vertical	Arm/trunk lean forward	Arm/trunk vertical	Arm/trunk vertical	Arm/trunk vertical	Arm/trunk lean sideways	Arm/trunk lean sideways	Arm/trunk lean sideways
Arm/trunk vertical	Arm/trunk lean forward	Arm/trunk vertical	Arm/trunk vertical	Arm/trunk lean forward	Arm/trunk vertical	Arm/trunk lean forward	Arm/trunk vertical
Arm/trunk lean sideways	Arm/trunk lean sideways	Arm/trunk vertical	Arm/trunk lean back	Arm/trunk lean sideways	Arm/trunk lean forward	Arm/trunk vertical	Arm/trunk lean forward
Arm/trunk lean forward	Arm/trunk lean forward	Arm/trunk lean sideways	Arm/trunk lean forward	Arm/trunk lean back	Arm/trunk lean sideways	Arm/trunk lean sideways	Arm/trunk vertical
Arm/trunk vertical	Arm/trunk lean back	Arm/trunk lean forward	Arm/trunk lean sideways	Arm/trunk lean forward	Arm/trunk vertical	Arm/trunk lean forward	Arm/trunk vertical
Arm/trunk lean forward	Arm/trunk lean forward	Arm/trunk lean forward	Arm/trunk vertical	Arm/trunk lean forward	Arm/trunk lean forward	Arm/trunk vertical	Arm/trunk vertical
Arm/trunk vertical	Arm/trunk lean forward	Arm/trunk vertical	Arm/trunk vertical	Arm/trunk lean sideways	Arm/trunk lean sideways	Arm/trunk lean sideways	

Figure 2:



- Arm/Trunk Leans Sideways:
  - 38 Surveys
  - 28.1%
- Arm/Trunk Leans Vertical:
  - 45 Surveys
  - 33.3%
- Arm/Trunk Leans Forward:
  - 44 surveys
  - 32.6%
- Arm/Trunk Leand Back:
  - 8 Surveys
  - 5.9%

Discussion:

Alongside analyzing the data, I found no support for my initial prediction but uncovered insights into alternative angle preferences. The data shows a pronounced relationship for an alternate version to cavities leaning backward, marking them as least desirable for nesting. This observation aligns with the discussions in citations (1) and (2), underlining the sensitivity of saguaro cavities to environmental factors. At the conclusion, several potentially significant confounding factors have surfaced. Foremost among them is the cavity's orientation, a factor explored in citations (1) and (2). The direction a cavity faces, whether north, south, east, or west, influences the sunlight and intensity, thereby impacting temperature stability within the incubative nest. Additionally, the number of occupied nest cavities per saguaro, as mentioned in

the citation (3), introduces a social dynamic among Desert Purple Martins that may lead them to accept less suitable nest cavities for the sake of communal living, ultimately contributing to higher survival rates for their young. I also overlooked the influence of environmental surroundings, as Purple Martins prioritize habitats over the "perfect" nest cavity. Lastly, a critical confounding factor is the notably small sample size, making it challenging to distinguish between random occurrences and significant patterns. In conclusion, this research fails to uphold my prediction of Purple Martins favoring vertically angled saguaro cavities. A more promising question for exploration may lie in investigating the influence of nest orientation, which appears to yield more accurate and insightful results.

1. Soule, O. H. (1964). The saguaro tree-hole microenvironment in southern Arizona; II, Summer. https://repository.arizona.edu/bitstream/handle/10150/551730/AZU_TD_BOX245_E9791_1964_193.pdf?sequence=1&isAllowed=y

2. Williams, H. M., & DeLeon, R. L. (2020). Deep learning analysis of nest camera video recordings reveals temperature-sensitive incubation behavior in the purple martin (Progne subis). Behavioral Ecology and Sociobiology, 74, 1-12. https://link.springer.com/article/10.1007/s00265-019-2789-2

3. Allen, R. W., & Nice, M. M. (1952). A study of the breeding biology of the Purple Martin (Progne subis). American Midland Naturalist, 606-665. https://www.jstor.org/stable/2422034?casa_token=qeCX2KYZ0KcAAAAA%3AREKgQYKPZb1zYkQaT4J9Th4QHokqWWU_H5u3NwgbkqYTE_bDy2H4tFuvUXLd2ri1P__bONF57iqG1PanPBhaTz-wOWtXKxTheJv6JPkOPWuODzOqzw&seq=54