



CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

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Project Title Observing Mutualism of Vermivora cyanoptera and Psaltriparus minimus	
<p style="text-align: center;">Abstract</p> <p>Objectives Mutualism is defined as a relationship between two species where each individual fitness benefits from the interaction of the other and can occur both directly and indirectly in any ecosystem. The project's main objective is to determine and identify the suspected mutualistic interaction of the Vermivora cyanoptera (blue-winged warbler) and the Psaltriparus minimus (bushtit), two birds that are commonly seen flocking together.</p> <p>Methods Two pairs of cameras with microphones were installed at a local marsh preserve and wetland for 95 days, one adjacent to a seasonal path and the other at a sump. V. cyanoptera and P. minimus are sighted on the marsh preserve (impacted group) while the wetland primarily inhabits P. cyanoptera (control group). Data were collected on the movement of V. cyanoptera following the chirp of another V. cyanoptera or that of P. minimus, and a T-test for two sample means was conducted to determine the significance of the results.</p> <p>Results The two species were observed to have a mutualistic interaction that increases the fitness of both birds ($p=6.32 \times 10^{-50}$ for sumps & $p=2.02 \times 10^{-57}$ for seasonal paths). P. minimus served as a sentinel bird to alert V. cyanoptera of potential predators, and V. cyanoptera tended the nests of P. minimus in return. Additionally, human disturbance correlated with increased V. cyanoptera activity and P. minimus sentinel calls.</p> <p>Conclusions The new knowledge on the P. minimus sentinel call and V. cyanoptera survival behavior allows for accurate population counts and targeted conservation practices.</p>	
Summary Statement Through video captures and statistical analysis, I found a strong correlation of bushtits acting as a sentinel species for the blue-winged warbler.	
Help Received I designed, prepared, and conducted the field research myself. I received permission to gather data from Melissa Loebel at Madrona Marsh, and my Science Research teacher helped edit my research paper.	