Pacific Islands Climate Change Cooperative

PACIFIC ISLANDS CLIMATE CHANGE COOPERATIVE

A rapid field test for tolerance to avian malaria in Hawaiian honeycreepers: a new tool for restoring native Hawaiian forest birds?

Researchers with the US Geological Survey in Hawai‘i, sponsored by the Pacific Islands Climate Change Cooperative, have determined that high levels of natural antibodies could be used as a potential marker of resistance to avian malaria in the ‘Amakihi, a native species of honeycreeper. This field marker is present even in birds who have not been infected.

Avian malaria is a disease introduced into Hawai‘i in the early 1800s, and its rapid spread has contributed to the extinction of at least 10 native bird species. Native bird populations at cooler, higher elevations have been protected from exposure to malaria because the mosquitos that spread the disease cannot survive there. However, avian malaria is likely to spread into Hawai‘i’s highest elevation forests as a result of increasing mountaintop temperatures caused by global warming. For this reason, the best hope for remaining species of native birds may be the development of disease tolerance or resistance, known as “immunogenetic” resistance.

Hope for the evolution of disease tolerance

The recent finding that some low-elevation populations of Hawai‘i ‘Amakihi are recovering and expanding in spite of high rates of malaria transmission makes it possible that at least some native forest birds have indeed evolved some tolerance to avian malaria. However, reliable genetic markers for identifying disease-tolerant individuals are currently not available.

Researchers evaluated three techniques for their ability to rapidly measure a bird’s natural immunity with the hope that such tests may predict survival from avian malaria. One of the tests yielded results: data showed that compared to non-infected high-elevation birds, low-elevation ‘Amakihi at risk for contracting malaria had significantly higher levels of natural antibodies.

Additional work is needed to determine whether the high levels of natural antibodies correlate with the ability to recover from avian malaria in ‘Amakihi and other native honeycreepers. The field blood test used is rapid, works regardless of whether the birds are infected with malaria or not, is relatively inexpensive, and works for a wide range of species. This makes it an attractive management tool for distinguishing malaria-tolerant and susceptible individuals.

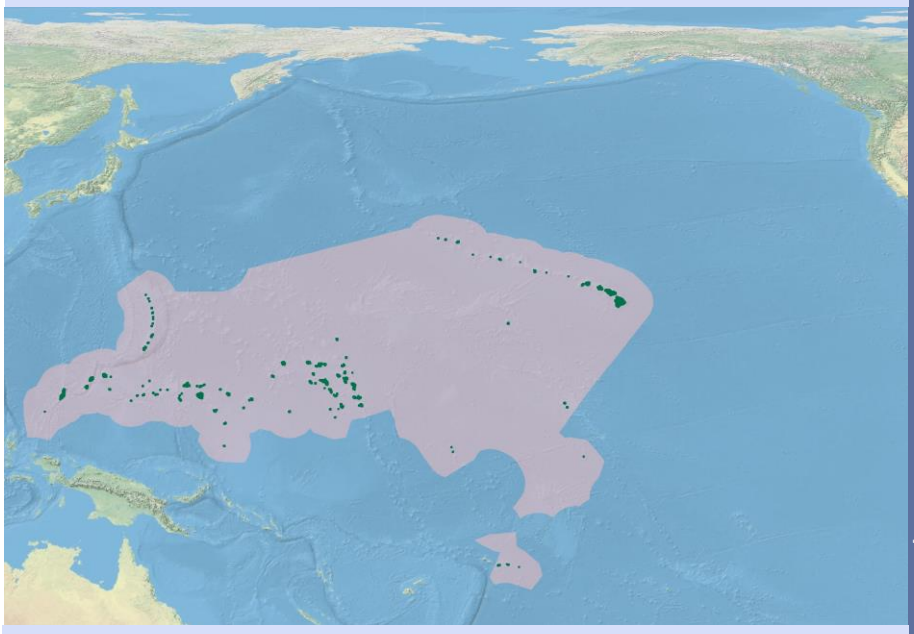
Applications of an avian malaria test for resistance

There is increasing evidence that disease transmission is already starting in high-elevation habitats and having an impact on susceptible native forest birds. If found to be a marker for malaria resistance, the natural antibody test could be applied in a variety of ways to achieve conservation objectives:

- map geographic populations of native forest birds that are tolerant to avian malaria and target them for intensive management;
- identify individual birds with resistance for translocation to sites where disease transmission is high;
- identify offspring from captive breeding programs appropriate for release in areas with disease transmission;
- identify populations that may not have the genetic variability sufficient to adapt to increased disease transmission at higher elevations.

For more details about this project, visit the PICCC projects page: piccc.net/our-projects.

The map below depicts the PICCC geography, which includes Hawai‘i, American Sāmoa, Guam, the Northern Mariana Islands, the Marshall Islands, the Federated States of Micronesia, Palau and 4 Marine National Monuments.



Banner photo of taro by Starr Environmental; ‘Amakihi by Byron Chin on Flickr; threatened honeycreeper by Eike Wulfmeyer on Wikimedia

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Project Partners

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The Pacific Islands Climate Change Cooperative (PICCC) was established in 2009 to assist those who manage native species, island ecosystems, and key cultural resources in adapting their management to climate change for the continuing benefit of the people of the Pacific Islands. The PICCC provides a range of services and tools to help managers in Hawai‘i, the Mariana Islands, American Sāmoa, and other Pacific Island groups make informed decisions for conservation of natural and cultural resources including climate models at the scale of islands and archipelagos, ecological response models, and implementation and monitoring strategies for island species, resources, and communities. Our goal is to help managers reach explicit biological and cultural conservation objectives in the face of climate change and ongoing threats such as fire, land conversion, and invasive species.

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