Parasites as Indicators of Coastal Wetland Health

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Background

"How healthy is that salt marsh?" Sea Grant biologists are examining certain kinds of parasites infecting marsh snails to answer this question. They have shown that the collection of parasites inside snails reflects the diversity of animal life at the marsh and hence can be used as an index of wetland health. Put simply: the more parasites in snails, the healthier the marsh.

This conclusion is based on what is known about the life cycles of the parasites they are studying. These trematodes, also known as flukes, must sequentially infect certain hosts, beginning with snails. Then, depending on the species, they go on to infect "intermediate" hosts such as crabs or fish. Usually, however, the life cycle begins in snails and ends in birds.

If any requisite host is absent, the fluke will die off and thus will be absent in snails. Conversely, if a fluke is present in snails, it means that the parasite's requisite hosts must also be living at the marsh. This is the key idea behind the scientists' plan to use snail parasites as a way to monitor wetland biodiversity.

"The horn snail is a mobile data recorder," says U.S. Geological Survey biologist Kevin Lafferty. "It is a hub for more than 20 trematode species." If any one requisite intermediate host is missing, the parasite cannot reproduce and hence will be underrepresented in the resident snail population. Examining a snail population's parasitic load is thus a clever way of summarizing the predator-prey relationships that must be occurring at a marsh.

Project

With Sea Grant support, UC Santa Barbara biology professor Armand Kuris and Lafferty are surveying horn snails and their parasites at more than 30 marshes between Marin and San Diego counties, including Drake's Estero, Coyote Hills Slough, Morro Bay, Los Angeles River, Huntington Beach, Agua Hedionda and the Tijuana Estuary.

The data will provide a baseline parasite count at these marshes. This, in turn, will allow scientists to monitor the before-and-after effects of various restoration projects on biodiversity and/or to evaluate further degradation of these habitats from exotic species invasions, pollution and other human-related activities.

The feasibility of the snail-as-data-logger idea was established at a case-study site at the Carpinteria salt marsh in Santa Barbara. There, the biologists showed the trematode community did indeed become measurably more vibrant after restoration due to an increase in the number of birds foraging on infected fish and benthic invertebrates.

To further validate the method, UCSB graduate student Ryan Hechinger conducted four month-long bird surveys at the study site, using video cameras to capture images of as many birds as possible. The results proved encouraging as the video-based estimates of the bird community were in close agreement with those from the snail-trematode analysis. "The more birds there were at a site, the more parasites," Hechinger said. "The more kinds of birds, the more kinds of trematodes, just as we predicted."

Hechinger hopes to produce a manual for resource managers that will explain how to collect snails, identify the trematodes inside them, and then translate this information into information on resident populations of birds, fishes and benthic invertebrates.

"We think counting trematodes is an effective tool for assessing the biodiversity of salt marshes in California," Lafferty said. "We are interested in developing similar techniques for other ecosystems, such as coral reefs and kelp forests." (*continued*)

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Application

Traditional survey techniques used to count the birds, animals and fishes in a habitat are time consuming and expensive. Collecting a single, slow-moving, abundant animal such as the common horn snail would be an inexpensive way to complement traditional survey data.

The absence of a certain kind of fluke could be used to direct further restoration efforts, such as digging marsh channels or planting key native vegetation.

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