DELTA SCIENCE FELLOW 2016

Delta Stewardship Council
Delta Science Program

Sea Grant California

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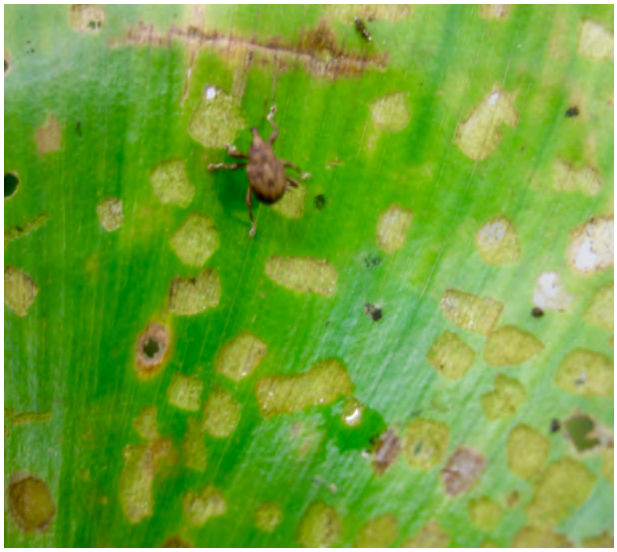
WHY THIS RESEARCH MATTERS

The invasive species water hyacinth, *Eichhornia crassipes*, grows abundantly in the Delta and causes serious ecological and economic harm. To date, application of herbicides and mechanical removal/ shredding have been costly and implementation has been difficult due to concerns of native endangered species. Although the classical biological control agents, the weevils *Neochetina bruchi* and *N. eichhorniae*, result in damage to water hyacinth, current control outcomes in the Delta have not reached the desirable levels observed in other regions where classical biological control has been implemented.

Mechanisms for the effective biological control of the invasive water hyacinth, Eichhornia crassipes, *in the Sacramento-San Joaquin River Delta, California*



LEFT: This close-up of a water hyacinth leaf shows damage inflicted by weevils, who feed on the invasive plant. *Julie Hopper*
BELOW: The weevil species *Neochetina bruchi* and *Neochitna eichhorniae* have proven less effective as biological control agents for water hyacinth in California than they did in other states.

PROJECT

This study investigated the effects of variation in seasonal temperature, pathogens, and genetic diversity on Delta populations of *N. bruchi* and *N. eichhorniae* at 16 sites in the Sacramento-San Joaquin River Delta and associated tributaries.

RESULTS

The two-year field survey found considerable spatial and temporal variation in densities of the biological control agents, the weevils: *Neochetina bruchi* and *N. eichhorniae*, with *N. bruchi* dominating in distribution and abundance. Weevil populations of *N. bruchi* were the highest in the summer and fall seasons. The study showed that pathogens do not appear to limit the efficacy of the biological control agents. Instead, the results indicated that reduced genetic diversity and cold adaptation may explain why the weevils, particularly *N. eichhorniae*, are less effective as biological control agents in California than in Florida and Texas. Laboratory tests demonstrated that low temperatures simulating the winter period in the Delta limited the development, survival rates, and reproduction of both weevil species. Genetic analyses additionally demonstrated a reduced genetic diversity in *N. eichhorniae*, but not in *N. bruchi*, compared to the native range of the species in South America.

MANAGEMENT APPLICATIONS

Temperature studies conducted by the USDA demonstrated a cool temperature-adapted biotype of *N. eichhorniae* from Australia, which may enhance the biological control of water hyacinth in the Delta. Genetic analyses conducted through this fellowship demonstrated that this biotype has a reduced genetic diversity compared to the biotype from Uruguay, in the native range. However, as the Australian biotype performed better under cold conditions, the data are currently being compiled for federal approval to import and release the cool-adapted Australian biotype of *N. eichhorniae* into the Delta. As the current biotype of *N. eichhorniae* is limited in distribution and abundance in the Delta, adding a cool-temperature adapted biotype is thought to have additive beneficial effects with that of *N. bruchi* and improve the biological control of water hyacinth in the Delta.

Postdoctoral researcher Julie Hopper floats by invasive water hyacinth in the Sacramento-San Joaquin River Delta.

PUBLICATIONS

Hopper JV, Pratt PD, McCue KF, Pitcairn M J, Moran PJ, and Madsen JD. 2017. Spatial and temporal variation of biological control agents associated with *Eichhornia crassipes* in the Sacramento-San Joaquin River Delta. *Biological Control.* 111, 13-22.

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