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Genetic Detection of Predation on Larval Delta Smelt in the North Delta

Abstract: In the Sacramento-San Joaquin Delta (Delta), delta smelt (*Hypomesus transpacificus*) have experienced recent dramatic population declines and are a species of conservation concern. In contrast, the invasive Mississippi silverside (*Menidia audens*) is increasing in abundance in the Delta and is thought to significantly impact delta smelt populations through intraguild predation, the preying on early life-stages of a competitor while also competing directly with adults. The IEP Pelagic Organism Decline (POD) conceptual model identified predation as a major stressor on delta smelt, and the Bay Delta Conservation Plan (BDCCP) identified invasive predator control as a conservation measure to protect native fishes. However, little is known about the prevalence of invasive species predation on larval delta smelt or the environmental conditions associated with that predation. During the spring of 2011, we sampled silversides and other putative predators of larval delta smelt using a combination of spring Kodiak trawls, electro-fishing, and beach seines in Suisun marsh and the north Delta. Predator stomachs were removed and analyzed using species specific Taqman probes to identify delta smelt DNA. A total of 558 silversides, 73 striped bass (*Saxatilis morone*), 44 Sacramento pikeminnow (*Ptychocheilus grandis*), and 30 largemouth bass (*Micropterus salmoides*) of sufficient size to prey on larval fish were collected and analyzed. Of these, 69 silversides (12.4%), 1 striped bass (1.4%), 2 pikeminnow (4.6%), and 2 largemouth bass (6.7%) tested positive for delta smelt DNA in their digestive tracts. Analyses indicated that the occurrence of predation by silversides is widespread in the study area, though modeling results indicated that for some areas, certain environmental variables are predictive of the presence of silversides testing positive for delta smelt DNA. The use of genetic techniques to detect predation on early life-stage delta smelt was both highly efficient and highly sensitive, and future studies building on this method are planned.

Statement of Relevance: Understanding predation patterns on the early life-stages of delta smelt will significantly benefit the planning and implementation of conservation and restoration efforts in the Delta by informing actions that can minimize the spatial, environmental, and habitat conditions that correlate with increased incidence of predation by invasive fish species.