DELTA SCIENCE FELLOW 2016

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WHY THIS RESEARCH MATTERS

Tidal marshes are productive nearshore ecosystems that provide food and refuge to juvenile fish, which is one reason that there is strong interest in restoring marsh ecosystems in the San Francisco Estuary. However, very little is known about what factors make a marsh a good fish nursery, in part because wetlands in the estuary have been widely developed and fragmented. Data from a long-term ecological monitoring program, the UC Davis Suisun Marsh Fish Study, demonstrate that nursery function is driven by habitat connectivity and complexity in this integrated habitat mosaic of marshes, ponds and uplands.

Ecological functions of tidal marsh for estuarine and migratory fishes in Suisun Marsh

LEFT: Long-term ecological monitoring in the Rush Ranch reserve, an important refuge for native fishes. *Amber Manfree*. BELOW: Colombano identified key areas that have consistently yielded high abundances of juvenile fishes like the tule perch. *Denise Colombano*

PROJECT

This project explored the ecological functions of tidal marsh in the San Francisco Estuary as a nursery habitat for juvenile fishes. The study aimed to identify landscape characteristics in the Suisun Marsh, a large brackish wetland system, that supported high densities of estuarine and migratory juvenile fishes by providing food and refuge. During her fellowship research, Colombano used long-term otter trawl data to identify nursery hotspots, and then conducted spatial analyses using geographic information systems and remote sensing to identify shared physical characteristics among nursery habitats. She modeled relationships between fish density and habitat parameters such as marsh to open water ratio, or water quality factors such as salinity. Finally, she synthesized these findings into a conceptual model describing the role of habitat connectivity and complexity in supporting nursery function.

RESULTS

This research identified nursery hotspots in Suisun Marsh for multiple species including Sacramento splittail, striped bass, tule perch, and starry flounder. The project established some of the key characteristics that create favorable rearing conditions which could help fish survive from their juvenile stage into adulthood. The nursery habitats supporting splittail, striped bass, and tule perch were typically high elevation dead-end channels with long

RESULTS (continued)

water residence time, hydrologic connectivity to marsh plains, managed ponds, and upland transition zones; starry flounder, on the other hand, were associated with larger channels closer to bays. Temperature and salinity were key factors for all species, the study showed.

The study results also support the idea that nursery function is an emergent property of marsh ecosystems, resulting from a complex suite of factors including the existence of a mosaic of varied habitat types and migratory corridors.

MANAGEMENT APPLICATIONS

In a highly modified landscape such as the San Francisco Estuary, it can be hard to predict what restoration approaches will work best to achieve specific goals such as increasing fish populations. By identifying the factors that make good nursery habitat, and increasing the understanding of how connectivity and complexity contribute to nursery function, this research provides restoration managers with practical information to enhance beneficial ecological processes and diversify restoration project designs.

Protection of juvenile fish nurseries is an important management tool in estuaries, yet there is no clear consensus on what makes 'good' fish habitat. To address this gap, Colombano identified regional fish nurseries that housed species like the starry flounder. *Amber Manfree*