

Roles and Impacts of Non-native Species in a Dynamic Delta

Delta Independent Science Board

Prospectus

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The purpose of this review is to assess the state, quality, and potential usefulness of scientific information that helps agencies understand and manage the consequences of species shifts into and out of Delta lands and waters. The focus is on non-native species (plants and animals). Appearances of non-native species have long been a major concern at national, state, and regional levels. Prevention and management of non-native species was one of the five core strategies identified under the “ecosystems” chapter in the Delta Plan. Species move about and their distributions change. These changes are driven by intrinsic life history characteristics of the species, and both environmental factors and anthropogenic influences. The ways in which species assemble and interact across the landscape, along and across waterways, and among land, freshwater, and the sea vary over time and in response to seasons, migrating species, climate change, and human interactions. Human actions can break up and transform landscapes and waterways, provide artificial vectors for new species introductions, and directly alter species diversity and composition. For example, climate change and sea level rise are now affecting the spatial distribution, assemblage, and very survival of some species.

Non-native species, once established, can change habitat structure and ecosystem processes such as food webs. How Delta planners and managers prepare, respond, or adapt to non-native species in a continually changing Delta is critical to furthering the goal of protecting, restoring, and enhancing the Delta ecosystem.

In this broad context, the Delta Independent Science Board (Delta ISB), as part of its statutory role to review Delta science that supports adaptive management, is reviewing the available science and the use of that science to protect, restore and enhance the Delta ecosystem in the context of an ever-changing complex of species and expectations of new non-native species arriving. Our review will focus on non-natives (often referred to as invasive species if deemed harmful), their effects on Delta ecosystems, and how to control or adapt to them.

The Review

More specifically, the review will consider:

1. Species turnover: What factors determine which/when/how species shift locations? Can the appearance of new non-native species be anticipated? What counteractive/adaptive measures are available? Can science inform the development of ways to prioritize non-natives for management attention based on their projected impacts? What approaches to control or manage non-native species are effective or feasible? At what point does the management of non-natives and natives converge?

2. Impacts to ecosystems: New non-native species can permanently change the composition of plant and animal communities, create new or novel assemblages, impact ecosystem structures and functions, and even benefit certain stakeholders (e.g., striped bass for sport fishers). Is the science adequate to predict interspecific interactions within trophic levels as well as among trophic levels; i.e., impacts on Delta food webs?
3. Effects on ecological restoration: Restoration of Delta habitats and ecosystems is and will be a major component of Delta management. Can restoration projects be designed to encourage desired species and/or discourage unwanted species? How are new non-native species likely to affect the progress and outcomes of restoration projects?
4. Stressor interactions: How will climate change and fundamental ecosystem stressors, such as habitat alterations and resource use, change our ability to restore and sustain ecosystems relative to the interactions of native and non-native species?
5. Ecosystem response: Is there a scientific framework available to begin to assess the relative impact of, or ecosystem vulnerability to, a potential new non-native?
6. Assisted migration: Is the science of assisted migration and immigration in response to climate change and other factors relevant to Delta species management and ecological restoration?

In summary, the review will focus on what current science can tell us about the causes and consequences of changes in species composition in Delta ecosystems, of which the interaction of native and established non-native species are a part. It will aim to establish the scientific foundation for assessing which species are likely to colonize; which are likely to have beneficial, neutral, or negative impacts; and how ecological restoration actions can influence or be influenced by species shifts. Our review will aim to identify the issues raised by changes in the flux of species and to identify the gaps in knowledge that impede effective management—both the known unknowns and the unknown unknowns. It will also include steps being taken by agencies in the Delta to prepare for these various scenarios.

The Review Process

As in previous Delta ISB reviews, we will emphasize what has been and is being done in the Delta, bolstered by information from similar systems elsewhere. We will draw on several sources of information:

- Relevant literature
- A targeted survey of Delta managers, scientists, and policy makers at multiple levels to determine what they see as information gaps or issues related to invasive, non-native, or colonist species in the Delta.
- In-person interviews with individuals and groups conducting scientific research on non-native species in the Delta and elsewhere.

- Two or more workshops/panels will be held to explore the broad conceptual and scientific issues concerning non-native species and their ecological impacts. Of interest is the ability of science to help Delta managers decide when a new non-native colonization is no longer reversible and when it is likely to catalyze further 'invasions.' In addition, these workshops/panels will focus on specific issues in the Delta and will delve into the adequacy of the science behind the management of new non-native species in the context of greatly-altered or novel ecosystems and ecological restoration in the Delta, noting that we have an existing review of adaptive management (Delta ISB 2016; Wiens et al. 2017) to build on. Initial workshops will be scheduled in December 2018 and March 2019.

This review will produce a report highlighting scientific approaches for ecosystem protection, restoration, and enhancement in the face of current and new non-native species and the consequences of species shifts into and out of Delta lands and waters.

Contact

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References

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