

# SEAWEB OCEAN UPDATE

May 1998

## **Non-native species invading San Francisco Bay at increasing rate**

Biological invasions in which species are introduced by humans into environments in which they do not naturally occur, causing disruption to local ecosystems are increasingly recognized as, in the words of two researchers, "a major global environmental and economic problem." A new study of San Francisco Bay by those same two researchers has revealed a large number of exotic species that dominate many habitats in terms of number of species, number of individuals and biomass, and a high and accelerating rate of invasion. The factors suggest, say the researchers, that the San Francisco Bay and Delta "may be the most invaded estuary and possibly the most invaded aquatic ecosystem in the world."

The researchers identified a total of 234 exotic species established in the ecosystem, including plants, protists, invertebrates, and vertebrates. "Exotic" was defined as a species that was not present in the North Pacific bioregion before the entry of Europeans in the 16<sup>th</sup> century, or present in distant parts of that region and later introduced to the Bay/Delta ecosystem by human-mediated mechanisms. Under this scenario, at least 125 additional species were categorized as cryptogenic that is, neither clearly native nor exotic.

Exotic species dominate many of the ecosystems biotic communities, including organisms living within or on the bottom sediments, brackish water zooplankton, and freshwater fish. In these communities, exotic organisms "typically account for 40 to 100% of the common species, up to 97% of the total number of

organisms, and up to 99% of the biomass."

According to the study, about half of all invasions in the estuary region occurred after 1960. The rate of invasions has, say the researchers, increased from an average of one new species established every 55 weeks from 1851 to 1960, to an average of one new species every 14 weeks from 1961 to 1995.

Conclude the papers authors: "Our study shows the San Francisco Bay and Delta to be extensively invaded, seemingly far more so than other large aquatic ecosystems. Given the potential impact of such invasions on both native biological diversity and human economic activities, it is a matter of some urgency to learn why."

**Source:** A.N. Cohen and J.T. Carlton. 1998. Accelerating invasion rate in a highly invaded estuary. *Science* 279: 555-57

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