

Memorandum

Date : May 12, 1994

To : Steve Yaeger
Bay-Delta Oversight Council

Randall L. Brown *RB*
Environmental Services Office

From : Department of Water Resources

Subject: Perspective on Introduced Species

As requested in your letter of April 14, 1994, the following is my perspective on introduced species and how they may be impacting the Sacramento-San Joaquin estuary.

Introduced species dominate many components of the Bay/Delta ecosystem.

Numerous investigators have shown that the benthic community in the more saline portions of the estuary is dominated by organisms accidentally introduced before the turn of the century; that most of the fish now present in the northern reach of the estuary, and especially the Delta, have been introduced either purposefully or accidentally; and that zooplankton biomass in the upper estuary contains a high proportion of non-native species.

Once established in the estuary control of introduced species is practically impossible.

There are few management measures which can be used to successfully control introduced animal and plant species. Also in many instances, introduced fish species (such as striped bass) have become such basic components of the ecosystem that there is little support for their control.

Introductions will continue

Although it is unlikely that many purposeful introductions of new species to the estuary will be made, accidental introductions will continue. There are species already present, such as the european green Shorecrab, which are still expanding their presence in the estuary and may become important components of the biota. Additional introductions will come via the discharge of ballast water. In spite of extensive treatment efforts white bass are still in the watershed (Pine Flat Reservoir) and could reach the estuary. Northern pike, successfully eradicated from Frenchman Reservoir

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in the Feather River drainage, may still be in the streams between Frenchman and Oroville reservoirs and could reach the Delta. Recently a dead zebra mussel was collected at the Arizona border from the bottom of a towed boat about to enter California. Unfortunately it is probably more a question of when the mussel will become established in California, not if.

Although the effect are often difficult to quantify, introduced species have impacted native fish and wildlife populations in the estuary.

A few of the more certain impacts of introduced species are:

- Eastern red fox and feral cats are causing extensive damage to native avian fauna in many wetland areas around the estuary.
- The Atlantic cordgrass will continue to invade exposed mudflats around the bay. The change may benefit a few species and harm a variety of species that formerly colonized or used the mudflats.
- The asian clam, Potamocorbula amurensis, appears to be lowering phytoplankton and zooplankton standing crops in the Suisun Bay reach of the estuary. A major concern is that organic matter produced in the water column is literally being siphoned off into the benthos and becoming unavailable to fish that forage in the open water. This new benthic sink is particularly troublesome in our estuary because zooplankton levels in this important mixing area were already low in comparison with other systems, such as the Chesapeake, even before the clam became dominant in the late 1980s. The clam's persistence after high 1994 outflows indicates that it may be a permanent feature of the benthos.
- An indirect effect of the asian clam is due to its ability to concentrate selenium discharged by refineries near Carquinez Strait. Bottom feeding fish such as white and green sturgeon in turn concentrate the selenium in their gonads which may impair reproductive success. Until the asian clam appeared there was not such an abundant and stable food supply available for benthic feeding fish in the northern reach.

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- Overall diversity of the fish fauna in the northern reach and the Delta has been increased due to introduced fish. Catfish, striped bass, the sunfishes (crappies, bluegill, green sunfish, and blackbass), carp, goldfish, inland silversides, chameleon and yellow gobies, etc. now dominate fish catches in this area. Perhaps because of its inability to compete with such aggressive invaders as striped bass, the two native fish, the Sacramento perch and the thicktail chub are no longer found in the estuary; in fact, the chub is extinct.

One of the most important unresolved issues related to introduced species, especially fish, is their impacts on native (or non-native species of economic or other importance) species through competition for the same, often scarce, food resources. For example, controlled studies have demonstrated that juvenile inland silversides feed on the same zooplankton as delta smelt and striped bass. (Studies have also shown that adult inland silversides consume striped bass larvae.) Although it has not been demonstrated that competition for food adversely impacts any life stage of any species in the wild, food habits and food availability data indicate there is cause for concern. Along a similar vein many introduced fish prey on other fish, such as inland silversides eating larval delta smelt.

The bottom line

- There are lots of introduced species and there will be more.
- Introduced species and other factors result in a constantly changing estuary.
- The scientific community does not have a good understanding of the interactions between newly introduced species and those already present, let alone those interactions that occurred over the past 150 years or so.
- Without a stable system it is almost impossible to define management actions that will result in specific changes in populations of target species. With this in mind, it doesn't make a lot of sense to establish population levels as management objectives.

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- Uncertainty about the effectiveness of such management actions as increased outflows or reduced pumping does not mean that these actions should not be taken. It does mean, however, that deliberations regarding these actions should recognize that they may not achieve their intended objectives because background conditions are not static. In other words, we really can't go back.
- Because it is essentially impossible to control species in the estuary once they are introduced, federal and State agencies must do all in their power to limit future introductions. Along these lines, white bass should be eradicated from Pine Flat Reservoir, discharge of freshwater ballast into the Bay/Delta should be eliminated and the California Department of Fish and Game Commission should continue to closely examine introductions proposed for scientific and commercial purposes. Animals and plants that have a potential for reaching the estuary and causing problems should be prohibited.

Please contact me at 322-7165, if you have any questions regarding this material.

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