Pest Risk Assessment for Asian Brackish Water Clams in Oregon

IDENTITY

Name: *Corbula amurensis* (formerly *Potamocorbula amurenis)*
Taxonomic Position: phylum Molluska; class Bivalvia; order Myodia; family Cobiculidae
Common Names: Amur River clam, Asian clam (not to be confused with *Corbicula fluminea* also known as the Asian clam), overbite clam, brackish-water Corbula

RISK RATING SUMMARY

Relative Risk Rating: HIGH
Numerical Score: 6 (on a 1-9 scale)
Uncertainty: HIGH*

The high level of uncertainty attributed to this risk assessment is due to several factors. The format the risk assessment follows was originally developed for forest pest species and, as such, fails to taken into consideration characteristics of invasive species that may be unique to aquatic organisms, especially marine ones. Secondly, while *Corbula amurensis* is considered a species of considerable concern, it is only present in one location outside of its native range. There may be a unique confluence of events needed for a successful establishment of this species. Some suggestions indicate that a scouring event of the extensive mudflats in the north portion of San Francisco Bay opened up opportunity for colonization (Cohen 2005) while others suggest that large brackish water dominated estuaries (NEMESIS) may be a key requirement for establishment. This would seem to indicate that, perhaps, there are environmental factors necessary for successful inoculation/establishment that have not taken into consideration by this risk assessment.

RECOMMENDATION

Corbula amurensis has been listed by the Invasive Species Specialist Group of the World Conservation Union (IUCN) as one of the '100 Worst Invasive Species' in the world. Ballast water, with its ability to inoculate a water body with numerous larvae at a time represents the pathway of primary concern for introduction, followed by hull fouling. Coastal and trans-oceanic ballast water exchange requirements should prevent the inoculation of Coos Bay and other Oregon estuaries with ballast water containing larvae from host regions however; the State of Oregon is not able to fully verify exchange compliance at this time.

RISK RATING DETAILS

Establishment Potential is HIGH

Justification: Native to Asia, *Corbula amurenis* has become well-established in San

"highly tolerant" species as it can survive both high and low salinity waters (1 – 33 ppm in San Francisco Bay) as well as in near-tropical to colder temperate waters (0 – 28 C in its native range) (Cohen 2005). While it prefers mixed mud/sand benthic habitats it can occur across a wide variety of bottom types and even into the intertidal zone (ISSG 2005) and has been found in hull-fouling assemblages (I. Davidson pers. com). High reproductive success even in fluctuating salinities (corresponding to upstream flood and drought conditions) has also been seen in this species opening up a wide variety of potentially suitable habitat in Oregon's estuaries.

Spread Potential is HIGH

Justification: *Corbula amurensis* is believed to have been introduced into San Francisco Bay via ballast water. *C. amurensis* has a planktonic larval life-stage that can stay in the water column (and weather a variety of salinities although larval development seems to be cued to temperature changes) for 17-19 days (ISSG 2004, Cohen 2005). Spawning occurs primarily in spring and fall although one population in the South San Francisco Bay spawns year round (Cohen 2005). Females can produce from 45,000 to 220,000 eggs per spawning event and clams reach maturity within a few months. Ballast water, with its ability to inoculate a water body with numerous larvae at a time represents the pathway of primary concern for introduction, followed by occurrences of extreme hull fouling.

The nearest source population of *Corbula amurenis* is San Francisco Bay, California. The other source populations of *C. amurensis* are its native range along the North Pacific coasts of Russia, Korea, China and Japan.

Environmental Impact Potential is MODERATE to HIGH

Justification: First discovered in 1986, it took only two years for *C. amurensis* to become a dominant benthic species in San Francisco Bay. Typical densities in the northern portion of the bay have been recorded at 2,000 clams per square meter (Werner and Hollibaugh 1993) and up to 43,000 per cubic meter (Cohen 2005). As a filter feeder, high densities of these brackish clams have the potential to become a major biological disturbance, massively altering food availability and thus causing considerable ecological consequences. By consuming a large amount of plankton, especially in areas where it represents over 95% of the benthic biomass, the clam dominates community dynamics including food webs assemblages and habitat availability. The establishment of this dominant filter feeder in the Bay is considered to be responsible for the overall decline of soft-bodied mudflat species as well as negatively impacting the recruitment of juvenile fishes dependant on zooplankton.

The efficiency of *C amurensis* at bioaccumulating toxins such as selenium can also be a concern for its predators such as diving ducks and sturgeon that shift to feeding heavily on the clam as it becomes the dominant mudflat species (Cohen 2005).

Economic Impact Potential is LOW to HIGH

Justification: The introduction of P. amurensis to the San Francisco Bay in California is thought to be responsible for the collapse of some recreational and commercial fisheries that existed within the Bay. Impacts to fishes, especially threatened or endangered species whose juveniles rear in estuarine waters before moving out into the ocean are unknown. The limited invasion history of this clam suggests a huge amount of uncertainty in this category.

Human Health Impact Potential is LOW to NONE

Justification: Complications from the long-tem ingestion of bioaccumulated toxins (including heavy metals) is possible if these are being harvested and eaten as a food item.

References:

Cohen, Andrew N. 2005 Guide to the Exotic Species of San Francisco Bay. San Francisco Estuary Institute, Oakland, CA, www.exoticsguide.org

ISSG 2005 Global Invasive Species Database: Potamocorbula amurensis. Invasive Species Specialist Group of the World Conservation Union http://www.issg.org/database/species/ecology.asp?si=136&fr=1&sts=sss&lang=EN

Werner, I. and J.T. Hollibaugh. 1993. Potamocorbula amurensis: comparison of clearance rates and asimilation efficiences for phytoplankton and bacterioplankton. Limnology and Oceanography 38(5): 949-964.

FORMAT

This pest risk assessment (PRA) is based on the format used by the Exotic Forest Pest Information System for North America. For a description of the evaluation process used, see Step 3 – Pest Risk Assessment under Guidelines at:
<http://spfnic.fs.fed.us/exfor/download.cfm>

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