

ASIAN OYSTERS: INTERACTIONS WITH NATIVE OYSTERS

The proposed introduction of the Asian “Suminoe” oyster, *Crassostrea ariakensis**, raises many questions about how this species might interact with the native Eastern oyster (*C. virginica*). Despite considerable declines in population, the Eastern oyster persists in many areas and numerous recovery efforts are underway; thus, the extent to which Asian oysters would compete with native oysters is of particular interest. Other factors, such as predation if one species is favored over the other, may influence the result of competitive interactions between the two species. Field and laboratory studies are providing valuable insight on these potential interactions (Figure 1), although the long-term outcome remains uncertain.

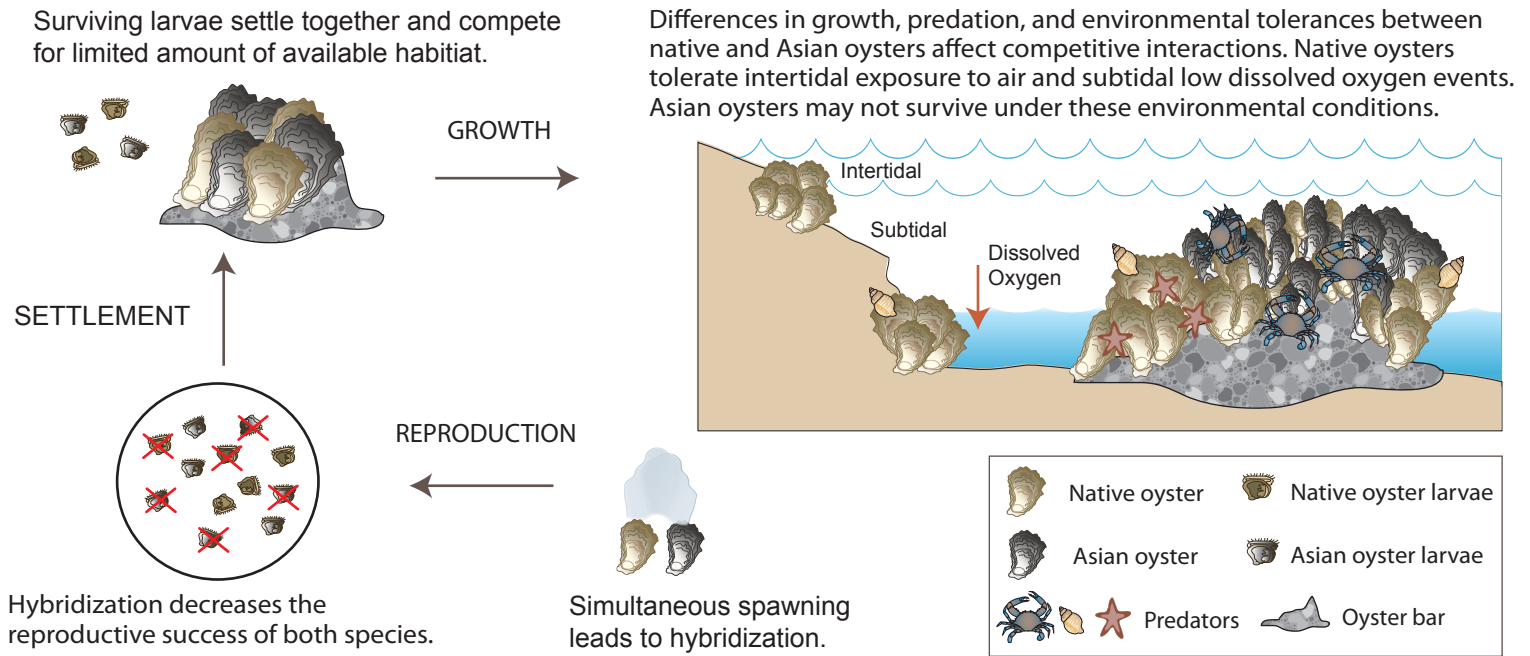


Figure 1. Several potential mechanisms for direct and indirect interactions between native and Asian oysters.

SETTLEMENT – COMPETITION FOR LIMITED HABITAT

Chemical cues from adult *Crassostrea* oysters increase settlement of both native and Asian oyster larvae. Aggregations of native or Asian oysters will provide concentrated sources of these cues and attract settling larvae of both species.

Larvae of both species prefer to settle on sediment-free surfaces, and favor natural substrates such as shell or granite over fiberglass, PVC, or steel; however, the Asian oyster has a slightly greater tendency to settle on these artificial surfaces (Figure 2).

Similarities in larval settlement cues and substrate preferences suggest that Asian and native oysters would settle together, resulting in competition for limited habitat and the potential for a variety of interactions between the two species.

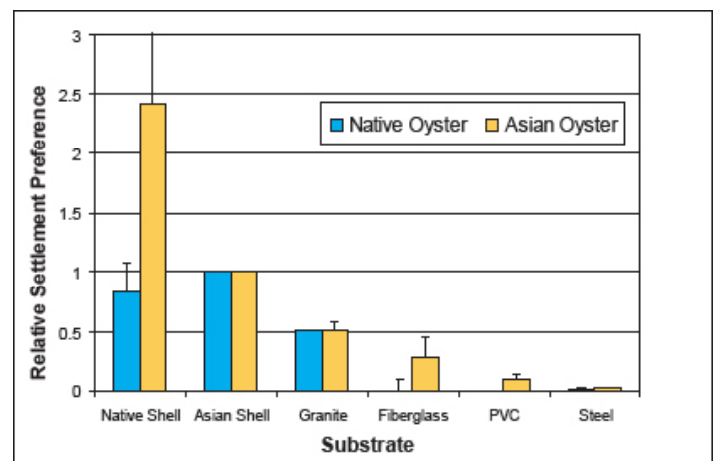


Figure 2. Mean relative settlement preference of native oysters and Asian oysters (Oregon strain) on various natural and artificial substrates. Data: Tamburri et al., in press.

* referred to as the Asian oyster throughout this newsletter

DIRECT CONTACT – SLOWER GROWTH IN BOTH SPECIES

Soon after larvae have settled, competition for space intensifies as oysters grow. Early post-settlement crowding slows the growth of young oysters, and both species grow even slower in mixed versus single-species assemblages.

In single species assemblages, native oysters grow vertically when they encounter another oyster, whereas Asian oysters tend to grow horizontally away from other oysters. In mixed assemblages, both species respond with increased vertical growth; however, the Asian oyster's response is much less pronounced.

This information indicates that co-occurrence of the two species may increase the impact of crowding on both species. Greater propensity for vertical growth suggests native oyster are better adapted to space-limited conditions.



Peter Kingsley-Smith

Differences in growth form in response to direct competition for space: (a) Native oysters, (b) Asian oysters, (c) Native and Asian oysters in a mixed assemblage. Both species exhibit a broad range of growth forms; (a) and (b) are extreme cases chosen to highlight differences typically

observed in laboratory studies.

HYBRIDIZATION – REDUCED REPRODUCTIVE SUCCESS

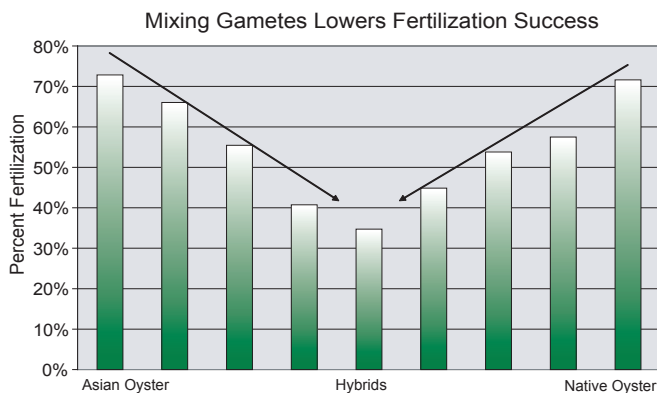


Figure 3. Fertilization rates for the native oyster alone, the Asian oyster alone, and combined. Data: Bushek et al. (in press).

Crossing native and Asian oysters produces hybrid larvae that die after several days. This creates a "gamete sink" – the loss of gametes that could otherwise produce viable offspring. Reproductive interference occurs when gametes of the two species are mixed, reducing the percentage of eggs that become fertilized. This may represent a significant threat to the reproductive success of both native and Asian oysters if the two species co-occur and spawn simultaneously. The two species have overlapping reproductive seasons and similar salinity and temperature triggers for spawning, suggesting the potential for synchronous spawning. Fertilization rates for both species decline by as much as 50% as conspecific gametes are replaced by gametes from the other species (Figure 3).

LONG-TERM OUTCOME OF COMPETITION – UNCERTAIN

The long-term outcome of competitive interactions will also depend on differences in growth rates, mortality due to predation or disease*, and environmental tolerances of the two species. In general, Asian oysters grow faster than native oysters and this difference is most pronounced at higher salinities. Asian oysters also continue to grow during the winter when native oyster growth has ceased. Faster growth rates and a near year-round growing season may give Asian oysters a long-term advantage over the native oyster in terms of biomass accumulation.

Greater susceptibility to predation may negate some of the Asian oyster's growth advantage in parts of the Bay, depending upon the suite of predators present and their preference for one oyster species over the other. For example, flatworm predation, a major problem for newly set oysters, is similar for both species. However, five common Chesapeake Bay crabs prey significantly more on Asian oysters than native oysters, which have stronger shells. In contrast, oyster drills (whelks) and a seastar – all of which

are associated with higher salinity environments – prefer native oysters.

While the Eastern oyster uses intertidal areas as a refuge from predators, the Asian oyster is less tolerant of exposure to the air and may not be able to utilize intertidal habitats. The native oyster is also more tolerant of low dissolved oxygen (DO) and may have an advantage in subtidal areas subject to periodic low DO, a common problem in many parts of the Bay. These differences in environmental tolerance suggest the possibility of habitat partitioning, which might allow regional co-existence of both species in the long term.

The possibility also exists that Asian oysters might eventually increase the amount of habitat for native oysters. Native oyster larvae have been observed to set on Asian oyster shell in both field and laboratory studies. If Asian oysters establish populations in areas with conditions suited to their tolerances, they could provide valuable habitat for native oysters and other species. The ultimate outcome of all these interactions remains uncertain.

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Printed on post-consumer recycled paper Printed: October 2007



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