



NOAA FISHERIES SERVICE



Holes found upon inspection often indicate the presence of snails, oyster drills or other exotic predators within source waters. The hole displayed above was made by a moon snail. Although larger, these holes are identical in shape to those made by oyster drills (Photo credit: Dailykos.com).

Decontamination of Shells used for Habitat Restoration

Background

Shells (oyster, clam, whelk, and others) have been placed in coastal waters for use in oyster culture as well as to restore habitat for native oysters and other organisms. However, the shells needed to rebuild reefs are generally limited in areas where restoration is most needed. For example, competition for shells motivated a Florida law that maintains the state owns half of all shells processed commercially,

When shells are imported from other locations, there is a potential for introducing invasive organisms. A variety of organisms attach to oyster shells or live in tubes attached to them, including algae, protozoans, sponges, hydroids, anemones, and others. Material from oyster shells may also carry disease-causing microorganisms such as *Perkinsus marinus* (Dermo disease) and *Haplosporidium nelsoni* (MSX disease).

Research and bio-sanitary protocols are warranted to prevent the spread of invasive species and diseases through the relocation of bivalve shells. Several states have recognized the risk that is present by the movement of shells and have instituted requirements or recommendations for shells transplanted into state waters; however no specific scientific studies have been conducted to determine if the requirements are effective:

- **Washington Department of Fish and Game** requires shells to be kept in a pile at least 200 feet from any body of water for at least 90 days before the shells can be moved from one site to another. Further, shells transported from areas infested with the Japanese oyster drill (*Ocenebrellus inornatus*) must be inspected before they can be planted in an uninfested area.
- **The State of Oregon** requires a permit for the placement of shell in state waters; however, there are currently no requirements for decontamination of the shells.
- **California Department of Fish and Game** recommends that oyster shells be kept out of the water for a period of six months before being placed into state waters.
- **South Carolina Department of Natural Resources** also recommends a drying period of six months before shells are planted.
- **Maryland Department of Natural Resources** recommends that shell harvested outside of Maryland should be dried for a period of one year before transplanted into state waters.



Inspection and Decontamination of Shells

To prevent the unintentional introduction of invasive organisms or disease, it is important to know the original source of any shell being used. Most shells used for restoration are imported. Even those from recycling programs may include shells from both imported and locally-grown oysters. If the origin of the shells is unknown, it is best to assume they were transported from infested waters. Shells do not need to be moved far to serve as vector for invasive species as biological diversity varies significantly along coastlines.

Inspection of shells or restriction of transfer of shells from infested sites may prevent the introduction of targeted diseases or organisms; however, these measures are likely to be ineffective for the range of other invasive species that may be transported by the shell. Therefore decontamination treatments are recommended in place of, or in addition to, inspection:



The pathogen *Perkinsus marinus* causes Dermo disease, resulting in tissue degradation and massive mortality in oyster populations. The American oyster (*Crassostrea virginica*) on right shows typical signs of infection; the specimen on left is healthy (Photo Credit: E Burreson; Australian Government, Department of Agriculture, Fisheries, and Forestry).

- Baking shucked shells in a propane oven prior to transplant may be effective but costly in terms of fuel, labor, and equipment. Currently, no studies have investigated the temperature or duration necessary to thoroughly decontaminate shells.
- The most common method of treatment is to dry the shells in piles on land, away from the reach of the tides. Many organisms are capable of surviving long period out of the water, especially in cool, humid conditions. A drying period of at least **six months for shucked and unshucked shells** is recommended to reduce the risk of invasive species or disease being introduced along with transplanted shells.
- For high risk areas or those with cool, wet periods a drying time of one year may be desired, as this duration would include a winter period that may reduce the viability of any organisms or disease associated with the shell.
- Following the drying period, all shells should be thoroughly washed prior to transplant.

Use of Live Shellfish for Habitat Restoration

Oyster reef restoration often involves the placement of adult and larval oysters raised in hatcheries. All living shellfish moved or seeded for restoration should be:

- Native, to reduce introduction of non-native genes.
- Moved within the same body of water, when possible.
- When movement of live shellfish across waterbodies is a necessity, all organisms should be subject to rigorous, independent testing for disease, oyster drills, and other invasive species.



Suggested Resources:

Brumbaugh, R.D., M.W. Beck, L. D. Coen, L.Craig and P. Hicks. 2006. [A Practitioners' Guide to the Design and Monitoring of Shellfish Restoration Projects: An Ecosystem Services Approach](#). The Nature Conservancy, Arlington, VA.

Bushek, D., D. Richardson, M. Y. Bobo & L. D. Coen. 2004. [Quarantine of Oyster Shell Cultch Reduces the Abundance of *Perkinsus marinus*](#). Journal of Shellfish Research 23: 369–373.

Cohen AN., Zabin CJ. 2009. [Oyster Shells as Vectors for Exotic Organisms](#). Journal of Shellfish Research 28: 163–167.

Ruesink JL., Lenihan HS., Trimble AC., Heiman KW., Micheli F., Byers JE., Kay MC. 2005. Introduction of non-native oysters: Ecosystem effects and restoration implications. Annual Review of Ecology Evolution and Systematics 36: 643 – 689.