Hard Clams Guild

Northern Quahog *Mercenaria mercenaria*
Southern Quahog *M. campechiensis*

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DESCRIPTION

Taxonomy and Basic Description

Members of the genus *Mercenaria* are bivalve mollusks in the Veneridae family. Common names for *Mercenaria mercenaria* (Linnaeus 1758) include the hard clam, quahog, quahaug, northern quahog, littleneck clam, and cherrystone clam, although the latter two are actually referring to commercial size classes. The sister species, *M. campechiensis*, is commonly known as the southern quahog.

The hard clam has two thick, equal-sized valves that are elliptical in shape and marked with conspicuous concentric rings (Eversole 1987). The valves are joined dorsally by a dark brown external ligament just below the anteriorly-inclined umbo. Opposite the hinge is a distinct heart-shaped lunule. The external shell is generally tan-colored or off-white and may have reddish markings (*notata* form). The internal shell is white or pale yellow with a dark purple margin. The prominent adductor muscle scar may also be purple.

The body of the hard clam is surrounded by a mantle that secretes the shell. The clam filters through a pair of siphons fused at the bases. The incurrent siphon has sensory tentacles that are involved in food selection. The siphons are generally creamy white, but the margins may be colored in a range of yellows, browns, purples, or reds. The clam has a large hatchet-shaped foot that is used for digging.

Clams may live for up to 46 years (Peterson 1986) and reach a size of 150 mm (5 in.) although the mean size is usually 60 to 70 mm (2 to 3 in.) (Stanley and Dewitt 1983).

Status

Hard clams are not state or federally listed; however, clams and other filter feeders are very ecologically important in marine ecosystems. Filter feeders affect nutrient cycling in estuarine habitats and improve water quality by removing suspended particles along with phytoplankton (Officer et al. 1982; Dame 1996; Dame et al. 2001; Newell 2004). A large adult clam filters an average of 7 to 8 L (2 gal.) per hour. Clams also readily ingest bacteria, viruses, and other waterborne pathogens that can cause human health problems. Although clam stocks appear to be stable based on high densities observed in some locations, they are a high priority for conservation in marine ecosystems.

Hard clams are harvested both recreationally and commercially and are the most valuable commercially harvested clam species in the United States (Pritchard 2004). In South Carolina, the hard clam fishery was at one time valued at $3 million but has decreased in recent years, both in volume and in value. This reflects depressed market values of hard clams rather than any resource problem. More than half of the hard clam landings are from mariculture operations. Approximately 40 hard clam mariculture permits are active in South Carolina. The Southern Regional Aquaculture Center has two fact sheets on hard clam biology and aquaculture (Hadley and Whetstone 2007; Whetstone, Sturmer and Oestenberger 2005).

POPULATION SIZE AND DISTRIBUTION

Mercenaria mercenaria is found from the Gulf of St. Lawrence to the Atlantic coast of Florida. This species has been introduced to other areas of the United States, notably Humboldt Bay, California (Murphy 1985), Washington State, and Puerto Rico. It has also been introduced into Great Britain and Southern Brittany, where it is now well established, as well as the Mediterranean (France, Italy, Sicily, the Adriatic Sea) and China. A sister species, *M. campechiensis* (Gmelin 1791), is distributed primarily along the Atlantic Coast from North Carolina to Florida and in the Gulf of Mexico (Dillon and Manzi 1989b). A subspecies, *M. mercenaria texana* (Dillon and Manzi 1989a) is found primarily along the Gulf coasts of Texas and Louisiana. *M. mercenaria* and *M. campechiensis* readily hybridize where their ranges overlap. Both *M. campechiensis* and hybrids have been reported in South Carolina (Dillon 1992; Dillon and Manzi 1992), but only as a small percentage of the population. Kraeuter and Castagna (2001) provide a recent review of the biology of the hard clam.

Hard clams are contagiously distributed (randomly clumped) in South Carolina estuarine waters at relatively low densities of 6 to 24 per m^2 (Dame 1979; Rhodes et al. 1977; Anderson *et al*. 1978). A statewide survey in the 1970s (Anderson et al. 1978) estimated that 10% of estuarine waters in South Carolina contained clams, predominantly at low densities (< 4 per m^2). Most of the clams in this survey (68%) were in substrates composed of sand and shell; the fewest specimens were found in mud and sand mixtures. Small clams may be found in saltmarshes where the rhizomes provide protection from predators. Larger clams are often found in association with oyster reefs, burrowed under and adjacent to oyster clusters (Anderson et al. 1978). Larval clams (70 to 350 microns in length) are planktonic; they drift with the currents and may be distributed considerable distances from where they were spawned (Wood and Hargis 1971).

HABITATS AND NATURAL COMMUNITY REQUIREMENTS

Hard clams occupy intertidal as well as subtidal habitats and burrow into the substrate to depths up to 20 cm (8 in.), but more commonly to a depth of 1 to 2 cm (0.4 to 0.8 in.) (Roberts et al. 1989; Eversole 1987). Hard clams are found in a variety of substrates including sand, mud, shell, and mixtures of these; however, studies have demonstrated a preference for coarser substrates that may relate to associated water currents (Stanley and Dewitt 1983). They are often most abundant where there is an overlying layer of shell or course sand (Anderson et al. 1978) which provides predator protection. Although clams are infaunal, they can 'migrate' horizontally, as well as vertically (Toll et al. 2003). Adult clams have been shown to repopulate a harvested area in a relatively short period of time (Toll et al. 2003).

The hard clam is a moderately euryhaline osmoconformer. Although it has been found in salinities ranging from 4 to greater than 35 parts per thousand (ppt) (Eversole 1987), growth is optimal at salinities between 24 and 28 ppt. Hard clams can tolerate long periods of reduced salinity by closing their valves (Eversole 1987) and are tolerant of low dissolved oxygen, surviving up to 3 weeks at 1 mg/L (Stanley and Dewitt 1983). Hard clams, especially larval and juvenile stages, are sensitive to pH outside the range of 7.0 to 8.75 (Calabrese and Davis 1966).

Growth and reproduction in hard clams is largely controlled by temperature. Hard clams usually reach sexual maturity at a size of about 35 mm (1.4 in.) shell length. In South Carolina, hard clams usually spawn intermittently from May through October when water temperatures reach or exceed 24 °C (75 °F). The planktonic larval stage may last as long as 2 weeks during which time the larvae may be distributed widely by currents and winds. At the end of this stage, the clam metamorphoses to the adult form and rapidly burrows into the substrate (MacKenzie et al. 2002).

CHALLENGES

High turbidity—which can result from runoff, dredging, and boating activities, as well as natural causes, such as storm-induced flooding and winds—can negatively impact hard clams (reviewed in Ward et al. 1994; Coen 1995; Ward and Shumway 2004). As with other filter-feeding bivalves, high turbidity may interfere with feeding by potentially clogging the gills or even limiting the time that hard clams attempt to feed (Stanley and Dewitt 1983).

Hard clams, like other filter feeders, can be adversely affected by blooms of certain types of phytoplankton (microalgae) (Gainey and Shumway 1988; Shumway and Cucci 1987; Shumway 1990; Bricelj and MacQuarrie, 2007). Most phytoplankton blooms result from a combination of physical, chemical, and biological mechanisms and interactions that are only partially understood. Some phytoplankton species produce toxins and, in a bloom situation, can adversely affect other organisms. Even when such blooms do not harm the filter-feeding organisms, the toxins can accumulate in the filter-feeders and reach levels that can endanger consumers, including humans. Harmful algal blooms have increased in frequency and become more widely distributed in the last few decades; this suggests that human activities may be affecting bloom occurrence or distribution (Hallegraeff 1993; WHOI 2004). A specific concern associated with hard clams occurs when healthy bivalves from 'open' approved areas that have experienced harmful algal blooms are transferred to other bays or creeks that have not experienced such blooms. Such transfer is of interest because many of the phytoplankton species that cause harmful algal blooms can survive digestion (Burkholder and Shumway, 2011).

Mariculture-related importations of clams or other bivalves could inadvertently introduce new predators or diseases into South Carolina waters. The SCDNR has documented 27 other species, including oyster drills and a number of crab species—at least one of which is not indigenous to

South Carolina—in hard clams transferred from Florida as part of a mariculture operation. Mariculture operations could also potentially modify local population genetic structure (Metzner-Roop 1994; Arnold et al. 2003). Recent research has suggested that hard clam populations may differ in susceptibility to certain diseases (Ford et al. 2002; Ragone-Calvo and Burreson 2002; Camara et al. 2004; Ragone-Calvo et al. 2003). Hard clams imported for mariculture in South Carolina could be of strains that are more susceptible to certain diseases. Interbreeding with local populations could then result in an increased susceptibility of native stocks to disease.

Relatively few diseases have been reported in *M. mercenaria*. The most notable is the parasite QPX, (Quahog Pathogen Unknown), which was originally observed in the 1960s in New Brunswick, Canada, where it caused observable mortalities. Epizootics have since been observed in hard clam aquaculture plantings in parts of Atlantic Canada, Massachusetts, New Jersey, and Virginia (Smolowitz et al. 1998; Whyte et al. 1994; Ragone-Calvo et al. 1998; Ford 2001) and in wild populations near Raritan Bay (Bobo et al. 2004; Lyons et al. 2007). Lyons et al. 2007 reviewed the epizootiology of QPX, which has not been reported south of Virginia. The parasite is more prevalent in intermediate size clams (25-55 mm or 0.98 -2.2 in.) and in cultured populations. Research has found that southern (South Carolina and Florida) hard clam populations are more susceptible to QPX mortality than northern populations (Ford et al. 2002; Ragone-Calvo and Burreson 2002; Calvo et al. 2007). QPX has not been reported in South Carolina, either in wild or aquacultured populations (Bobo et al. 2004). Importations for mariculture from areas of QPX infestation could spread this disease into local waters where it could be a threat to wild populations as well as cultured clams.

CONSERVATION ACCOMPLISHMENTS

The South Carolina Department of Health and Environmental Control (DHEC) restricts harvest of shellfish, including clams, in approximately 30% of estuarine waters in South Carolina for human health reasons. There have been no outbreaks of human disease related to hard clam consumption in South Carolina.

The South Carolina Department of Natural Resources (SCDNR) regulates importations of hard clams and other bivalves for placement in South Carolina waters, primarily for mariculture. Importation from areas of known diseases, such as QPX, is restricted. Disease testing is required prior to importation, with zero tolerance for the presence of any known diseases. Shipments are also inspected by DNR staff for the presence of predators, non-native species, and other undesirable associated organisms.

The SCDNR regulates and monitors the commercial clam fishery, including annual compilation of fishery statistics. The SCDNR also assesses State Shellfish Grounds on an annual basis to evaluate clam and oyster population status and determine which State Grounds may need to be temporarily closed to allow populations to recover.

The South Carolina Algal Ecology Laboratory (SCAEL) has many initiatives underway to investigate harmful algal blooms (HABs) in the State, including their interactions with filter-feeders such as hard clams.

CONSERVATION RECOMMENDATIONS

- Regularly update importation policies of cultured clams to reflect changes in threats to native clams.
- Continue to regulate and monitor mariculture activities given that these practices have the greatest potential for introducing diseases or non-indigenous predators and for affecting the native population genetic structure.
- Monitor for signs of the QPX disease in wild and cultured clam populations.
- Continue to monitor population status through surveys and analysis of fishery trends.
- The South Carolina Algal Ecology Laboratory (SCAEL) should continue to investigate the causes of harmful algal blooms and possible effects on hard clams and other mollusks.
- Work with appropriate agencies to improve and implement Best Management Practices (BMP) in order to protect water quality and prevent turbidity caused by urban and agricultural runoff.

MEASURES OF SUCCESS

Determining that populations of hard clams are stable through annual fishery statistics and population monitoring within South Carolina would result in a measure of success. Another way to measure success is the absence of disease in native clam populations. Furthermore, the absence of human health problems associated with the consumption of hard clams would indicate successful conservation actions for this species.

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