Species Status Assessment

Class: Bivalvia
Family: Veneridae
Scientific Name: *Mercenaria mercenaria*
Common Name: Hard clam

Species synopsis:

Hard clams, commonly known as little necks, cherrystones, or northern quahogs (depending on their size), are found along the entire eastern coast of the U.S and into the Gulf of Mexico. They have been introduced for aquaculture purposes to the western U.S. coast, Asia, the Caribbean, and Europe (Eversole 1987). Hard clams are a popular food item and are often harvested both recreationally and commercially for that purpose. They are filter-feeding, benthic organisms and prefer a sandy-muddy substrate in which they can burrow (Eversole 1987). They are long-lived, typically living from 12 to 20 years, with some individuals being aged at 40 years (NOAA 2013). Historically, New York supported a productive and profitable hard clam fishery (NYSDEC 2005). Since the 1980s hard clams have been witnessing declines in abundance, with the cause of the decline directly linked to overfishing in the 1970s and 1980s (Bricelj 2009). Harvest pressure has been greatly reduced since its peak in 1976 but populations have yet to recover and several factors appear to be impeding this recovery (Bricelj 2009). These include: harmful algal blooms (i.e. brown tide), habitat loss, and inadequate densities, distributions, and viability of spawning adults (Bricelj 2009, LoBue and Starke 2013). Additionally, this species has been negatively impacted by the parasitic infection specific to hard clams, Quahog Parasite Unknown (QPX) (Sunila n.d., NYSG 2003).

I. Status

a. Current and Legal Protected Status

i. **Federal** ____Not listed____ **Candidate?** _No_____

ii. **New York** ____Not Listed_____

b. Natural Heritage Program Rank

i. **Global** ____G5_____

ii. **New York** ____NR_____ **Tracked by NYNHP?** ___No___

Other Rank:

Status Discussion:
Recreational and commercial harvesting of hard clams in New York still occurs even though abundance in New York is still low or in decline (see figs. 2 & 3, CTS 2011). Hard clams have not received any state or federal protection status. Additionally, they have received a secure global rank (G5) and are not ranked by New York's Natural Heritage Program.

II. Abundance and Distribution Trends

a. North America

i. **Abundance**

____ declining ____increasing _____stable __X__unknown

ii. **Distribution:**

____ declining ____increasing _____stable __X__unknown

Time frame considered: _____

b. Regional

i. Abundance

__X__ declining _____increasing _____stable _____unknown

ii. Distribution:

__X__ declining _____increasing _____stable _____unknown

Regional Unit Considered:____ Mid-Atlantic_____
Time Frame Considered: _____mid 1900s-present___ _____

c. Adjacent States and Provinces

CONNECTICUT Not Present _____ No data ___X____

i. Abundance

_____ declining _____ increasing _____ stable _____unknown

ii. Distribution:

_____ declining _____ increasing _____ stable _____unknown

Time frame considered: _____
Listing Status: _____Not Listed_____ SGCN? _____

MASSACHUSETTS Not Present _____ No data ___X____

i. Abundance

_____ declining _____ increasing _____ stable _____unknown

ii. Distribution:

_____ declining _____ increasing _____ stable _____unknown

Time frame considered: _____
Listing Status: _____Not Listed_____ SGCN? _____

*Abundance of hard clams in Massachusetts is not well-documented but the Monterey Bay Aquarium recommends hard clams from Massachusetts as a "Best Choice"(Wyer 2012). Based on this analysis it would seem that hard clam populations are stable.

NEW JERSEY **Not Present _____** **No data _____**

i. **Abundance**

__X__ declining ____ increasing ____ stable ____unknown

ii. **Distribution:**

__X__ declining ____ increasing ____ stable ____unknown

Time frame considered: _____1960-present_____
Listing Status: _____Not Listed_____ SGCN? _____

(Bricelj et al. 2012)

ONTARIO **Not Present __X____** **No data _____**

i. **Abundance**

____ declining ____increasing _____stable ____unknown

ii. **Distribution:**

____ declining ____increasing _____stable ____unknown

Time frame considered: _____
Listing Status: _____

PENNSYLVANIA **Not Present __X____** **No data _____**

i. **Abundance**

____ declining ____increasing ____stable ____unknown

ii. **Distribution:**

____ declining ____increasing ____stable ____unknown

Time frame considered: _____
Listing Status: _____ SGCN? _____

QUEBEC **Not Present _____** **No data __X____**

i. **Abundance**

____ declining ____increasing _____stable ____unknown

ii. **Distribution:**

____ declining ____increasing _____stable ____unknown

Time frame considered: _____
Listing Status: _____Not Listed_____

VERMONT **Not Present __X____** **No data _____**

i. **Abundance**

____ declining ____increasing ____stable ____unknown

ii. **Distribution:**

____ declining ____increasing ____stable ____unknown

Time frame considered: _____
Listing Status: _____ SGCN? _____

*The coastwide abundance and distribution trends may be similar to New York, although there is a lack of available information pertaining to these states making it difficult to assess trends with great certainty (J. O'Dwyer, pers. comm.).

d. NEW YORK **No data _____**

i. **Abundance**

__X__ declining ____ increasing ____ stable _____ unknown

ii. **Distribution:**

__X__ declining ____ increasing ____ stable _____ unknown

Time frame considered: _____1980s to present_____

Monitoring in New York.

There are currently no monitoring activities or regular surveys specific to the hard clam that are run by the NYSDEC. The NYSDEC does collect harvest data from shellfish shippers as well as production reports from aquaculturists who grow hard clams and other shellfish. Although not a function of resource management but rather for public safety reasons, the NYSDEC also conducts water quality and biotoxin monitoring to regulate shellfish harvest areas (J. O'Dwyer, pers. comm.). The townships of Islip and Brookhaven, as well as The Nature Conservancy, all conduct abundance surveys in Great South Bay. Islip and Brookhaven begin their surveys in 1977 and 1987, respectively (Islip and Brookhaven n.d.). The Nature Conservancy's monitoring efforts for their restoration project include: "post stocking survival assessments, condition and spawning monitoring, and a large-scale survey of wild clams in the central bay using methods that allow for comparisons with surveys conducted on adjacent town property" (LoBue and Starke 2013).

Trends Discussion:

Historically, New York State had some of the most productive hard clam populations in the country and Great South Bay (GSB) contributed to a large percentage of New York's landings (CTS 2011, NYSDEC 2005). By the 1960s, after multiple years of good sets, clams had become vastly abundant in GSB. This increase in abundance of hard clams in GSB is possibly attributed to an increase in salinity originating from various inlets as well as a decrease in their natural predators, crabs, by use of DDT (CTS 2011). This increase in clam abundance brought forth a surge of new baymen who wanted to capitalize on the hard clam fishery (CTS 2011). In the mid 1960s, 400,000 bushels of hard clams were harvested from GSB, followed by a peak in 1976 of 700,000 bushels (statewide harvest was 750,000 that year) (CTS 2011, NYSDEC 2005). By 1980 hard clam harvest from GSB was already declining with 340,000 bushels harvested that year (CTS 2011). The decline in abundance of hard clams in GSB has been directly attributed to overfishing during the 1970s and 1980s (Bricelj 2009). This decline in harvest parallels the decline in abundance shown in Islip's and Brookhaven's surveys (see figs. 2 & 3, Bricelj 2009). The statewide harvest of hard clams in 2012 was 129,905 bushels, with only 3,368 bushels coming from GSB. The largest number harvested, 56,929 bushels, came from Oyster Bay and Cold Spring Harbor (harvest area NS2) (NYSDEC 2012).

Despite reduction in fishing pressure after the 1980s, hard clam populations have still been unable to rebound in GSB. Several factors are thought to be affecting their recovery including: brown tide, reduced reproductive success, and predation (Bricelj 2009). One model predicted that with the elimination of all fishing pressure on hard clams, it would still take a decade or more for hard clam densities to be restored to historic levels (Bricelj 2009). The Nature Conservancy has purchased 13,423 acres in GSB that had been previously owned by the now defunct Bluepoints Company, one of the largest hard clam dredging operations on Long Island. This area consists of a 21 square mile, no harvest area with 100 spawner sanctuaries stocked within (LoBue and Starke 2013). The first

four years of this project saw a significant increase in hard clam abundance in GSB, highlighting the efficacy of spawner sanctuaries (LoBue and Starke 2013). However, the strong year class seen in 2007 was unable to survive and thrive after several years of reoccurring HABs (LoBue and Starke 2013). The Nature Conservancy believes that several consecutive years without a HAB will be necessary for stocks to survive and become self-sustaining (LoBue and Starke 2013). The recent breach in Fire Island, caused by Hurricane Sandy in October 2012, could potentially help hard clam populations and the general health of Great South Bay by allowing for a greater exchange of water between the ocean and bay. This in turn will hopefully reduce the number of HABs and improve the conditions in the GSB enough to encourage seagrass growth and survival (LoBue and Starke 2013).

Other areas in New York have witnessed declines in abundance from historic levels, as well, with many of these populations considered stable but low in abundance or still in decline (NYSDEC 2005). Harvest shifted to other areas after the decline in abundance in GSB. Most recently the majority of harvest takes place from the Peconics and North shore bays, including Oyster Bay. Surveys are not conducted in these areas thus no abundance data is available (J. O'Dwyer, pers. comm.).

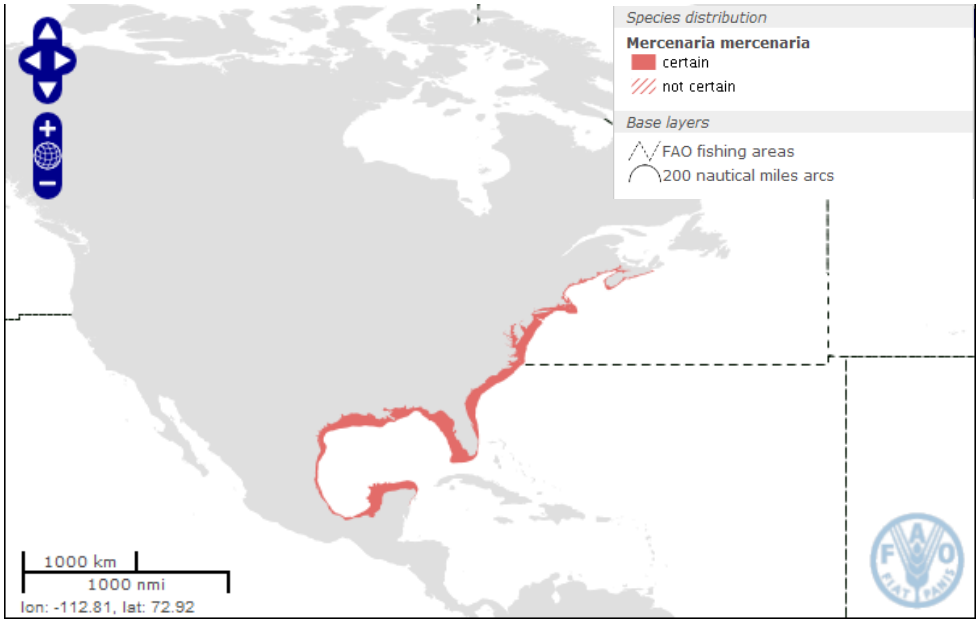

Figure 1. North American distribution of the hard clam, *Mercenaria mercenaria* (FAO 2013).

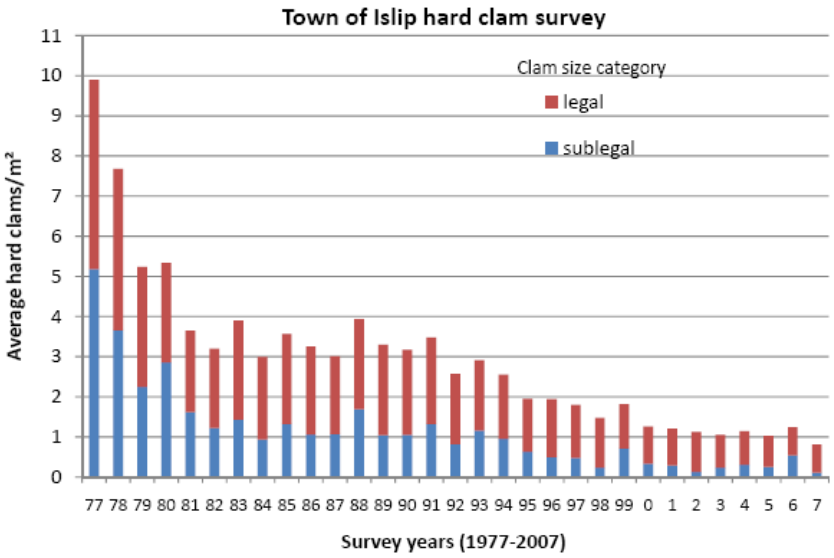

Figure 2. The average number of hard clams per m² (legal and sublegal sized clams) in Great South Bay in the Town of Islip (Islip and Brookhaven n.d.)

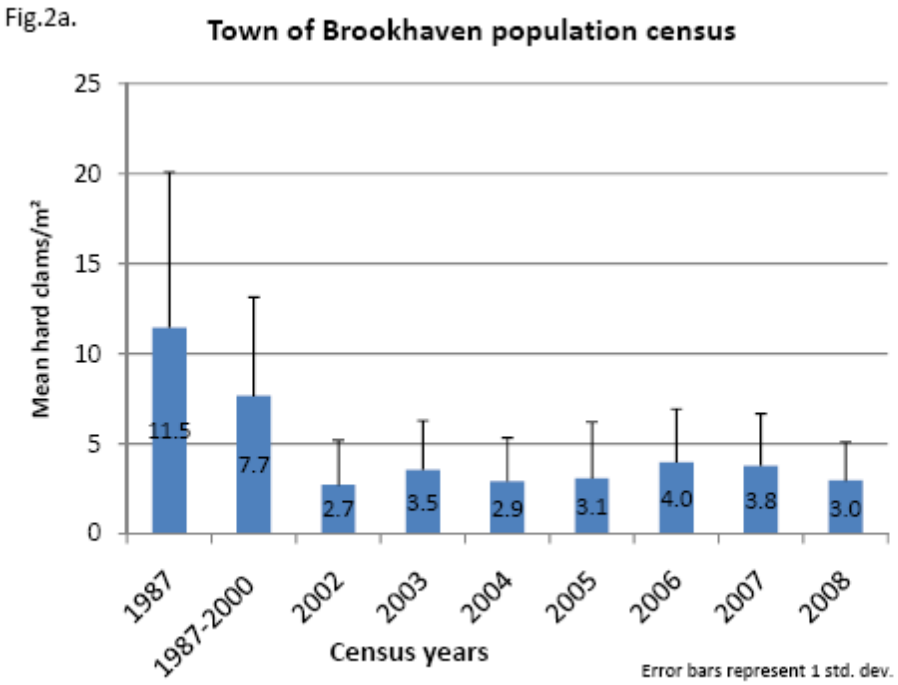

Figure 3. The mean number of hard clams per m² in Great South Bay in the Town of Brookhaven (Islip and Brookhaven n.d.).

III. New York Rarity, if known:

Historic	# of Animals	# of Locations	% of State
prior to 1970	_____	_____	_____
prior to 1980	_____	_____	_____
prior to 1990	_____	_____	_____

Details of historic occurrence:

Hard clams historically have been found in most bays in New York ranging from Raritan Bay in Staten Island to Napeague Bay in Montauk, as well as in the Long Island Sound (J. O'Dwyer, pers. comm.).

Current	# of Animals	# of Locations	% of State
	_____	_____	_____

Details of current occurrence:

Hard clams most likely still occur in all bays around Long Island. Harvest in 2012 came from many South Shore bays including but not limited to: Oyster Bay, Great South Bay, Patchogue Bay, Bellport Bay, Narrow Bay, Moriches Bay, Moneybogue Bay, Quantuck Bay, Quogue Canal, and Shinnecock Bay. They also were harvested from the Peconics, Gardiners Bay, Flanders Bay, Napeague Bay, the Long Island Sound, Huntington and Northport Bay, Oyster Bay, Cold Spring Harbor, Hempstead Harbor and other North shore areas (NYSDEC 2012). Raritan Bay has high densities of clams but due to water quality this area is closed to harvest (J. O'Dwyer, pers. comm.).

New York's Contribution to Species North American Range:

% of NA Range in New York	Classification of New York Range
____ 100 (endemic)	**____ Core**
____ 76-99	**__X__ Peripheral**
____ 51-75	**____ Disjunct**
____ 26-50	**Distance to core population:**
__X__ 1-25	**_____**

IV. Primary Habitat or Community Type:

1. Estuarine, Brackish Intertidal, Aquatic Bed/Benthic Geomorphology, Shellfish Bed

2. Estuarine, Brackish Shallow Subtidal, Aquatic Bed/Benthic Geomorphology, Shellfish Bed

Habitat or Community Type Trend in New York:

__X__ Declining ____Stable ____ Increasing ____Unknown

Time frame of decline/increase: ____1980s to present_____

Habitat Specialist? _____ Yes __X___ No

Indicator Species? __X__ Yes _____ No

Habitat Discussion:

Hard clams naturally occur along the eastern coast of North America from the Gulf of Saint Lawrence, Canada to the northern part of the Gulf of Mexico (Kraeuter 2004). They can burrow up to 15 centimeters below the substrate surface and occur in a variety of substrates including sand flats and eelgrass beds. A bottom that is a mix of sand and mud with shells or other debris present is the preferential habitat (Kraeuter 2004, NOAA 2013). Hard clams can be found in a range of salinities (12 to 30 ppt) but are generally more abundant in salinities that are greater than 15 ppt (Kraeuter 2004). They are found in the intertidal zone out to depths of 15 meters (Eversole 1987). Hard clams have been introduced for aquaculture purposes to the western U.S. coast, the Caribbean, Europe, and parts of Asia (Kraeuter 2004, NOAA 2013).

V. New York Species Demographics and Life History

__X__ Breeder in New York

__X__ Summer Resident

__X__ Winter Resident

_____ Anadromous

_____ Non-breeder in New York

_____ Summer Resident

_____ Winter Resident

_____ Catadromous

_____ Migratory only

_____Unknown

Species Demographics and Life History Discussion:

Hard clams are slow-growing and on average live from 12 to 20 years but can live up to 40 years (NOAA 2013). They reach reproductive maturity at around one year but evidence suggests that sexual maturity is more closely linked to size rather than age (NOAA 2013; Eversole 1987). Hard clams begin life as hermaphrodites, having both male and females reproductive organs. However, during this preadult/juvenile sexual phase the clam primarily functions as a male. After the juvenile phase the clam then differentiates into either a male or a female and remains as such throughout its adult life (Eversole 1987). Mature females produce from one to five million eggs during a single spawning event, with several spawning events occurring throughout the year (NOAA 2013). Water temperature and geographic latitude appear to be the primary factors that determine spawning period although other stimuli, such as food availability, may also initiate spawning events (Eversole 1987).

Fertilized eggs develop rapidly and after just ten hours from the time of fertilization the embryos hatch from the gelatinous eggs. The planktonic larvae then undergo several unshelled stages followed by several shelled stages (Eversole 1987). After the clams are about six to 20 days old, they begin to metamorphose into their adult benthic form (Kraeuter 2004). They attach to the sediment by means of a byssal thread and develop a calcified shell within another few days (Kraeuter 2004). Growth rates of clams can vary and appear to depend on a mixture of environmental, genetic, and

physiological factors (Eversole 1987). Below 5°C, hard clams are considered "dormant" and optimal growth occurs in waters ranging from 18 to 25°C (Kraeuter 2004).

Small hard clams are vulnerable to predation by crabs and gastropods (Mackenzie 1977). Predation from these organisms decreases as the clams become larger and their shells harder (Mackenzie 1977). Lobsters and larger snails, along with some fish and birds prey on adult hard clams (Kraeuter 2004).

VI. Threats:

Brown tide, caused by the alga, *Aureococcus anophagefferens* has been shown to affect the mortality and growth rates of hard clams in Long Island waters. During a brown tide bloom, juvenile clams experienced increased cumulative mortality and exhibited no measurable growth. However, the clams that survived the brown tide event showed rapid growth up to four weeks after the bloom, demonstrating that clams can potentially recover from these events (Greenfield and Lonsdale 2002). In addition to affecting juvenile clams, brown tides have also been shown to impact the condition and spawning of adults as well as the survival and growth of larvae (LoBue and Starke 2013). Increased incidences of harmful algal blooms (HAB), including brown tide can decrease the abundance of eelgrass, *Zostera marina* due to decreased light availability (Dennison et al. 1989). Peterson *et al.* (1984) showed that in eelgrass beds the average size of zero, one, and two year-class hard clams, along with the density of clams, was significantly higher when compared to sand flats. A possible explanation for this occurrence is that decreased water velocity occurs along the bottom of eelgrass beds trapping particulates which *M. mercenaria* can then feed upon. This increased concentration of nutrients in the water and sediment around eelgrass beds was further demonstrated through they study of sediment core samples (Peterson et al. 1984). The conservation of eelgrass habitats in New York waters is an important factor when considering the growth and survival of hard clams.

Quahog Parasite Unknown (QPX), a protozoan parasite specific to hard clams, is one threat currently facing hard clam populations along the eastern coast of the U.S (Sunila n.d). This parasite causes an intense inflammatory response in the clams' tissues and can eventually cause mortality if the parasite proliferates (Sunila n.d.). In 2002, a large die-off of hard clams due to QPX occurred in the Raritan Bay. At the time the Raritan Shellfish Transplant Program (which transplanted clams from the Raritan Bay to the eastern end of Long Island) was immediately stopped in order to protect the eastern clam populations (Sunila n.d., Branca and Zawacki n.d.). QPX is believed to be an opportunistic parasite, taking advantage of clams that may be experiencing physiological stress caused by environmental factors, and is ubiquitous in areas of high salinity; however, cause of QPX and its life history strategies are currently debated amongst researchers (NYSG 2003, Sunila n.d.). Further research is needed in order to better protect hard clam populations from this disease. Additionally, the combined effect of HAB's and QPX on hard clams should be further studied (Hegaret et al. 2010).

Ocean acidification as a consequence of increasing concentrations of carbon dioxide (CO_2) is a problem for organisms that synthesize calcium carbonate exoskeletons and shells, including the hard clam (Barrett et al. 2011). When studied under the concentrations of CO_2 that are projected to

occur in the future, *M. mercenaria* experienced delayed metamorphosis and decreased larval survivorship and size (Talmage and Gobler 2009). It is hypothesized that those bivalves which are able to survive and adapt will have decreased shell strength, potentially making them more vulnerable to predation and disease and ultimately making it difficult to rebuild wild stocks in the Long Island Sound (Barrett et al. 2011).

Are there regulatory mechanisms that protect the species or its habitat in New York?

_____ No ____ Unknown

__X__ Yes

New York currently has in place several regulations regarding the recreational and commercial harvesting of hard clams. Hard clams may be taken all year long but only from areas which have been designated as certified for shellfish harvest. Recreational marine shellfish harvest requires no permit. The recreational limit is 100 clams per day, however, no more than one bushel per day (combined volume) of oysters, clams, and mussels is allowed. Size restrictions allow for the taking of hard clams that have a one inch thickness or greater across the hinge. There is no commercial limit per day and any number is allowed to be taken. Rakes and tongs are permitted gear but must meet size specifications. Harvesting by mechanical means is prohibited. Local towns may require additional permits or licenses, and may also have size, gear, daily limit, and seasonal restrictions as well (NYSDEC 2013).

Describe knowledge of management/conservation actions that are needed for recovery/conservation, or to eliminate, minimize, or compensate for the identified threats:

Several actions must be taken if there are to be healthy, self-sustaining stocks of hard clams in New York. The establishment of spawner sanctuaries and no harvest areas can increase the chances of successful fertilization. Transplanting of adults to key areas can help also increase chances of fertilization, while planting of seed will help build future year classes. Overall, ensuring the survival of these transplants, hatchery seed, and wild seed is necessary if restoration efforts are to be successful. As populations recover, protection from overharvest is key in order to maintain an adequately abundant and densely distributed adult spawning stock--one of the requirements for successful recruitment (LoBue and Starke 2013). However, simply reducing harvest pressure has not resulted in any significant rebound in abundance and it has been found that the individual spawning adults must also be in good condition (LoBue and Starke 2013). Conditioning appears to be related to the availability of high quality food. Less than average condition and spawning of hard clams occurs when small microplankton (i.e. brown tide) has been present during critical times (LoBue and Starke 2013). Mitigating the effects of nutrient loading into Great South Bay and other bodies of water in New York, will help stop HABs, reestablish optimal phytoplankton assemblages (clam's food), and help with the recovery and survival of eelgrass habitats. Additionally, QPX research must continue in order to better understand its life history, distribution trends, and its ultimate effects on hard clams.

VII. References

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Date last revised: June 17, 2013