2013

European Green Crab (Fact Sheet)

Casco Bay Estuary Partnership

Casco Bay Estuary Partnership Factsheet:

European Green Crab

A Threat to Casco Bay's Fisheries

The European green crab, *Carcinus maenas*, an invasives species, has been present in Casco Bay for over 100 years (League-Pike and Shulman 2009). However, green crab populations have recently grown dramatically along Maine's coast, resulting in serious impacts to marine ecosystems and coastal fisheries. Green crabs are voracious predators and consume a variety of marine species, including soft-shell clams, eels, scallops and blue mussels, posing a significant threat to these commercial fisheries. Officials estimate that green crabs are the most significant threat in decades to Maine's $15.6 million soft-shell clam industry. Even Maine's lobster fishery may be affected. Young lobsters have been found in the stomachs of green crabs and studies have shown that green crabs can outcompete lobsters for food (Williams *et al.* 2009).

Damage to Eelgrass Beds and Tidal Marshes

Eelgrass beds are critical habitat for many commercially valued species, providing nesting, refugia, mating and feeding areas. Other important functions of eelgrass beds include nutrient absorption and water quality preservation (USGS 2013), and the economic value of eelgrass beds has been estimated elsewhere at $7,690/acre/year (Davis *et al.* 2002). Evidence is growing that green crabs are responsible for a more than 50% decline in Casco Bay's eelgrass beds in the last few years. Green crabs snip eelgrass off at the base in an effort to more easily access their prey (Klassen and Locke 2007). Eelgrass blades with characteristic green crab damage have been widely observed washing up on shores around the bay. Studies completed in 2013 found that eelgrass survival was higher in the absence of green crabs.

Salt marshes, which naturally evolve over time to accommodate rising seas, alterations to hydrology, and other factors, may also be impacted by green crabs. Green crabs have been observed using cavities in the banks of some salt marsh creek channels. Questions remain about the degree to which green crabs are using existing cavities, as opposed to burrowing new ones, but utilization of these spaces is likely to undermine salt marsh vegetation, accelerate creek channel erosion, and reduce salt marsh area as salt marsh creek channels expand.

A Threat to Water Quality?

By impacting shellfish, eelgrass, and salt marsh, green crabs could pose a threat to Casco Bay's water quality. Eelgrass beds absorb wave energy and reduce re-suspension of sediments on windy days. Soft-shell clams, mussels and other bivalves filter the water, trapping pollutants. Where eelgrass is gone, and shellfish populations have been reduced, and salt marshes are eroding, water clarity is likely to decline. Informal observations from around the Bay suggest that may already be happening.

FACTSHEET

The work of the Casco Bay Estuary Partnership is guided by the *Casco Bay Plan*, which identifies five priorities for watershed protection:

1. *Minimize pollution loading from stormwater and combined sewer overflows*
2. *Open and protect shellfish beds and swimming beaches*
3. *Protect and restore habitat*
4. *Reduce toxic pollution*
5. *Promote responsible stewardship*

(Photo: Oregon DFW—http://www.dfw.state.or. Us/mrp/shellfish/crab/crab_identification_specifics.asp)

Eelgrass coverage has declined in Maquoit Bay between 2001-2013, possibly due to impacts from green crabs. (Photo: Hillary Neckles, USGS Patuxent Wildlife Research Center)

History and Temperature Effects

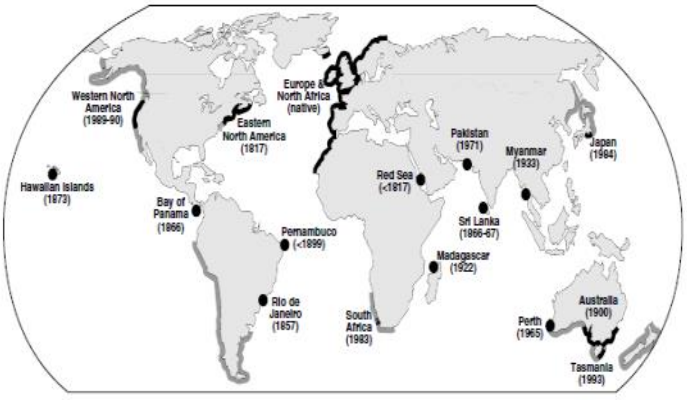
The European green crab is on the IUCN's list of the world's 100 most invasive species (Lowe *et al.* 2000). They have been present on the east coast of the United States since the mid-1800s and first arrived in Casco Bay around 1900 (League-Pike and Shulman 2009). The population of green crabs along Maine's coast spiked in the early 1950's during a period of warmer-than-average winters. When more typical cold winters returned in the 1960's, the population of green crabs decreased once again (Klassen and Locke 2007). Historically, scientists believed that cold water temperatures limit green crab populations due to increased mortality and reduced reproduction (Welch 1968). Warmer winters could be part of the reason for the recent explosion in green crabs.

A female green crab with a clutch of eggs. (Photo: www.alaskafisheries.noaa.gov)

Setting a green crab trap in Canada. (Photo: Dr. John Tremblay, Canada Department of Fisheries and Oceans: http://www.dfo-mpo.gc.ca/science/publications/article/2007/13-07-2007-eng.htm)

Biology

Green crabs grow to be approximately 4 inches in diameter and can be distinguished from other crabs by the presence of two sets of five spikes on the front of the carapace. Despite their name, coloration can be a mottled mix of green, red and brown. They commonly live in the intertidal zone, but have been observed in deeper waters as well (Klassen and Locke 2007). Green crabs can survive in low oxygen environments and are tolerant of salinities ranging from 4 - 52‰. They can spawn up to 185,000 eggs at a time and, larvae can travel long distances in the water column. A single female can produce one or two clutches of eggs each year. Along the mid-coast of Maine, females typically release their eggs in May or June but this can also occur earlier or later (League-Pike and Shulman 2009). Green crabs are omnivores, eating both plants and animals. Their prey include bivalve shellfish, juvenile lobsters, other green crabs, periwinkles and juvenile winter flounder, as well as other small fish (Taylor 2005). Their few natural predators include large fin fish, birds, and larger crustaceans like lobsters and other crabs.



Black bands represent the occupied range of European green crabs. Gray bands represent the potential range. Black circles represent the one-time collections of green crabs in regions without established populations. (Carlton and Cohen, 2003 accessed at bioinvasions.org/wp-content/uploads/2003-Green-Crab-Dispersal.pdf on April 23, 2014)

Genetics

Two different genetic strains of green crabs have been observed in Casco Bay. One variety has been in the region for over a century, and was transported to mid-Atlantic ports via shipping from southern Europe as early as the middle of the 1800's. A new genetic variety, moving south and west from the Canadian Maritimes, was introduced to Canadian ports from Iceland or Scandinavia in the 1980's (Roman 2006). The northern variety is thought to be both more cold tolerant and more aggressive than the southern strain. Recent increases in green crab numbers in Casco Bay may reflect the presence of the northern variety. Genetic studies are underway now to determine the presence and distribution.

Green Crab Management

Clammers were the first to raise the alarm about increased green crabs populations, and public concern surged in 2013 and early 2014. Numerous efforts are now underway to study the impact of green crabs on marine ecosystems, and look for ways to reduce their impact on commercial fisheries.

Green crabs have been trapped in large numbers. (Photo: Chebeague Island School)

Green crabs vary in color and male and females have different shaped triangles on their abdomen. (Photo: Chebeague Island School)

Studies in Maquoit Bay have explored whether fencing can exclude green crabs from eelgrass transplant plots. (Photo: Hilary Neckles, USGS Patuxent Wildlife Research Center)

Green Crab Management (continued)

Identifying the scope of the Problem: The Maine Department of Marine Resources led a one-day statewide green crab trapping survey in August 2013. Twenty-eight towns participated. Methods varied from place to place, making quantitative comparisons difficult, but large green crab populations were documented statewide. Catches were high (hundreds of crabs per trap) in several Casco Bay towns (Webber, 2013).

Scientific Research: Scientists are studying green crabs up and down the coast. Studies include investigation of the effects of green crab predation on juvenile clams, investigation of green crab effects on eelgrass, and efforts to understand green crab population size and structure.

Protecting Shellfish Resources: The Town of Freeport funded work in 2012 and 2013 to test approaches to reducing green crab damage to soft-shell clam populations. The Town, with participation of clammers, conducted studies to exclude crabs from tidal flats using fencing, or reduce populations by trapping. Intensive management efforts appear to have a beneficial effect. Additional studies are planned for 2014 in several Casco Bay towns (Beal, 2014).

Reducing Green Crab Populations: Canadian management strategies have shown that green crab populations can be reduced (at least locally) by intensive trapping efforts. Where populations are reduced, partial recovery of eelgrass and shellfish can occur. Green crabs are so abundant that reducing populations by trapping produces huge harvests of crabs, which for now, have little economic value (McCarthy, 2013).

Developing a Market: Efforts are underway to develop markets for the green crabs. The University of Maine at Orono is looking into whether value-added products such as food additive paste, lobster bait, aquaculture feed and compost can be developed (University of Maine at Orono, 2014). Soft shell green crabs are a delicacy in Spain and Portugal (where they are native) so there is potential to create a fishery in North America as well.

Next Steps:

The increased population of invasive European green crabs in Casco Bay, and the full extent of green crab impacts to the Bay's ecosystem, is not well understood and cannot be ignored. Research on green crab abundance, genotype, behavior and ecosystem impacts, as well as water quality impacts, are needed. The potential market for a green crab fishery presents an opportunity to incentivize trapping. Regional approaches to manage green crabs are likely necessary to have a meaningful impact on the overall population. A collaborative approach to research and management is already underway, and vital to countering the impacts of the aggressive invasive species.

B. Green Crab Control and Eradication Strategies

CBEP established the following goal and objectives to protect habitats in Casco Bay and can be applied.

Goal: Habitat Conservation

Objectives:

1. No net loss of aquatic and island habitats
2. Habitats in Casco Bay should be of quality that does not have an adverse effect on the structure and function of the biological community

End Notes:

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Protecting & restoring the ecological integrity of the Casco Bay watershed

Casco Bay Estuary PARTNERSHIP

The Casco Bay Estuary Partnership works to preserve the ecological integrity of Casco Bay and to ensure compatible human uses of the Bay's resources, through public stewardship and effective management.

Casco Bay Estuary Partnership · Muskie School of Public Service · University of Southern Maine
PO Box 9300 · Portland, ME 04104-9300 · 207.780.4820 (phone) · 207.228.8460 (fax) · www.cascobayestuary.org