Green Crabs

Frenchman Bay Partners

The European green crab (*Carnicus maneas*) is an invasive species that has been present on the eastern seaboard since the 1800s. The initial population arrived from southern Europe, likely in ballast water from ships, and is now found up and down the coasts of North America. A second invasion in Atlantic Canada in the 1980s introduced a population from Scandinavia. The genetic make up of the second wave of green crabs (northern haplotype) differs slightly from the first wave (southern haplotype), and is anecdotally reported to be more voracious and cold tolerant.

Green crabs flourish on a variety of substrates, from soft mud to the rocky intertidal. They reproduce well in a wide range of temperatures and salinities; because of this, rising water temperatures in the Gulf of Maine are a concern. Green crab populations increased dramatically in recent years, and this population explosion has been linked to a series of habitat disruptions along the Maine coast. The crabs feed on shellfish such as blue mussels and soft-shell clams, threatening commercially important organisms, and disturb habitats like eelgrass beds, jeopardizing ecosystems.

Several Partners conducted studies and experiments in an effort to better understand why the green crab population was increasing, what this increase meant for commercially important species, how it could impact habitats, and what could be done to control or eradicate the species.

Green crabs in Frenchman Bay

The southern haplotype of green crab has been present in the Gulf of Maine for 100 years. In 2013, the northern haplotype of green crab was documented in upper Frenchman Bay. That same year, eelgrass in the upper bay completely disappeared. In addition to eelgrass loss, shellfish harvesters and lobstermen were turning up record numbers of green crabs. The Frenchman Bay Partners were concerned about the effects the abundance of green crabs were having in Frenchman Bay and took action.

Factsheet

The Frenchman Bay Partners identify four conservation priorities:

1) Eelgrass
2) Benthic Habitats
3) Mudflats
4) Diadromous Fish

The **green crab** affects conservation targets 1-3 in a major way.

Population genetics of the green crab

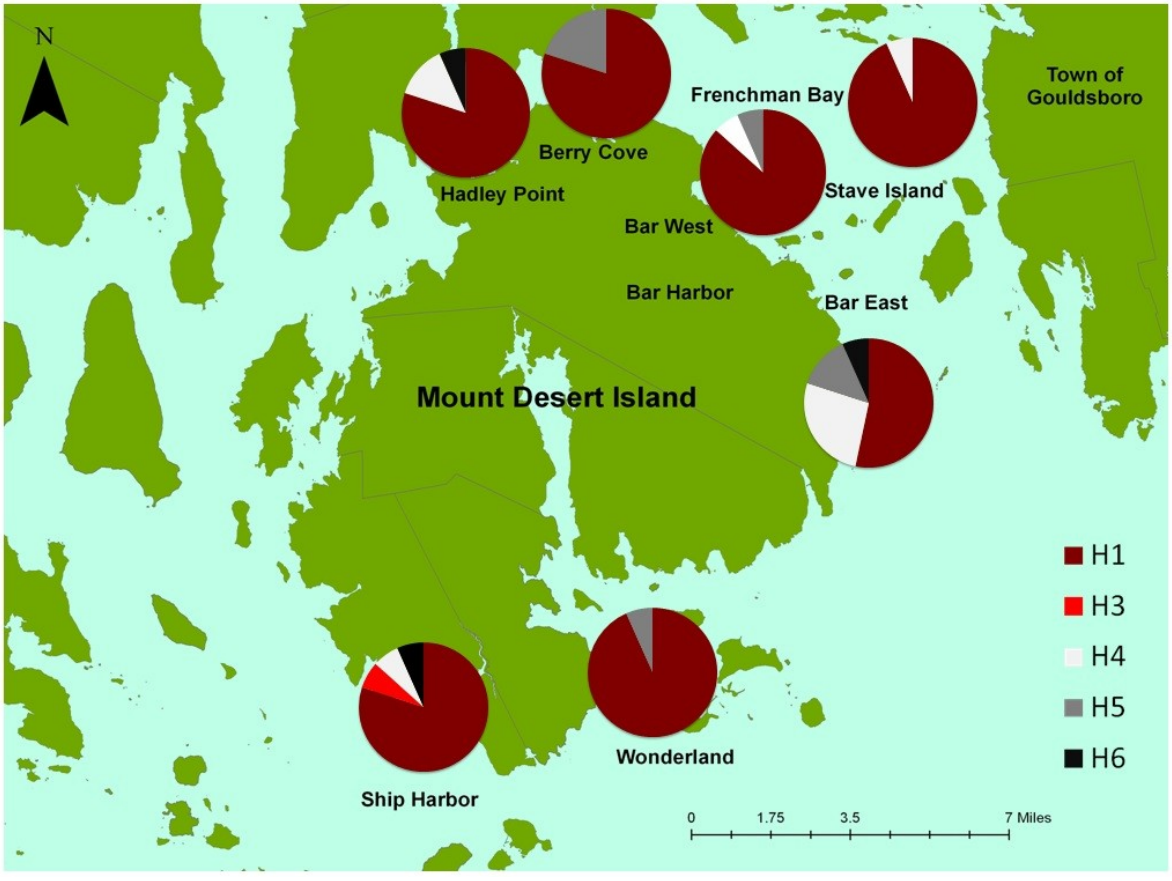
A study undertaken during summer 2014 aimed to ascertain whether the northern haplotypes had spread to areas around Mount Desert Island, and to determine whether the genetic composition of green crab populations varies with differing eelgrass biomass. The different haplotypes can be tracked by following mutations in the cytochrome oxidase 1 gene (CO1). These mutations do not affect the fitness of the animal.

Although green crabs have not been sighted eating eelgrass, they do have disruptive foraging behavior, which can damage eelgrass beds. Studies conducted in the Netherlands, Nova Scotia, and Maine linked eelgrass loss to the presence of green crabs, so interns at the Community Environmental Health Laboratory at MDI Biological Laboratory set up an experiment to determine whether the same was true in Frenchman Bay.

Eelgrass patches from six sites around Mount Desert Island (MDI) were mapped using GPS. Eelgrass abundance and plant density were determined by throwing quadrats. Crab abundance was determined by trapping crabs at seven sites around MDI over a four day period. At each of the seven sites, fifteen adult crabs were collected, their DNA extracted and the CO1 gene was amplified and sequenced.

The map below shows the distribution of crabs at each site by haplotype. Haplotypes 4, 5, and 6 are of the northern variety. Haploytypes 1 and 3 are of the southern variety. The study concluded a few things:

- Eelgrass abundance and density are significantly different among sites around MDI.
- Haplotypes derived from southern populations are predominant at all sites.
- Northern haplotypes are present at all sites around MDI.
- No significant relationship exists between the genetic make-up of crab populations and eelgrass abundance or biomass at locations around MDI.

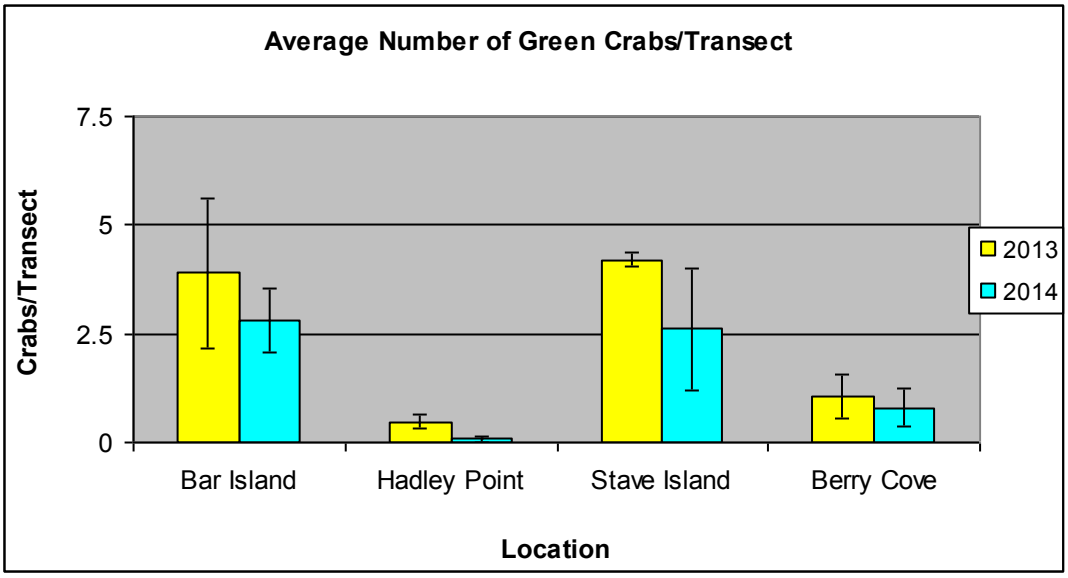


Intertidal Green crab census

In spring 2013 and 2014, young volunteers with the Community Environmental Health Laboratory collected green crab census data along transects in the intertidal zone at four different sites in Frenchman Bay. This involved throwing quadrats along a transect and digging in the sediment for crabs. There was a significant difference among sites in both years. There was a statistical difference in the average number of crabs per transect in 2013 and 2014 for Hadley Point, but not at other sites.

Young Environmental Leaders gathering data

Crab transects

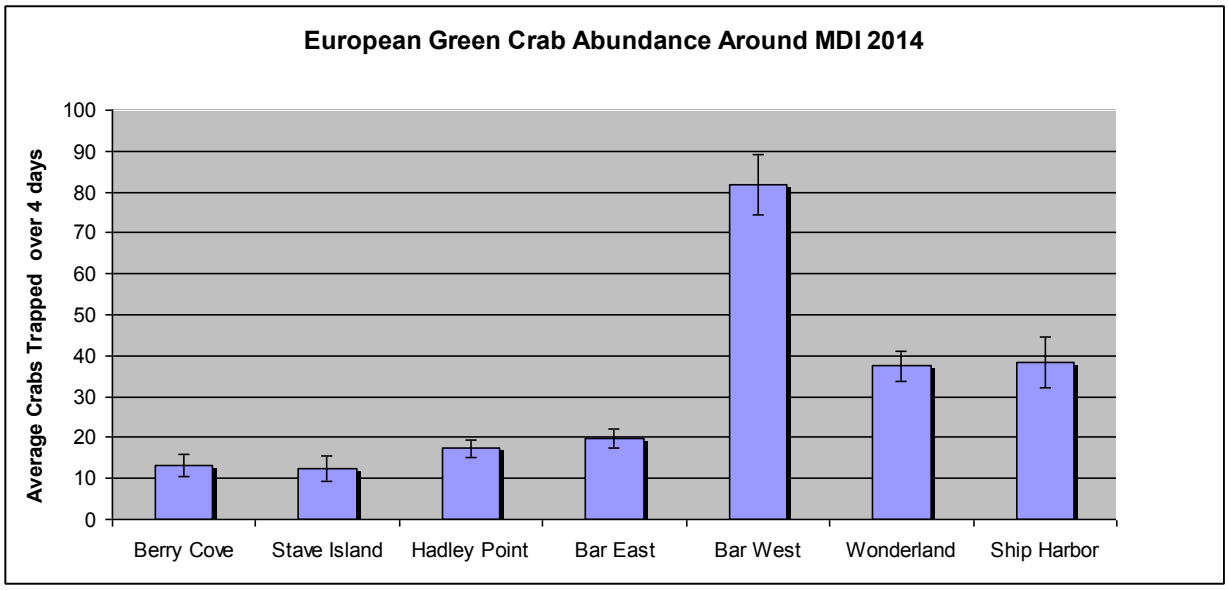


Mudflats

The Frenchman Bay Regional Shellfish Committee, in conjunction with the Frenchman Bay Partners, received a $6,000 grant in 2014 from the Maine Community Foundation (MCF) for a green crab control project as a follow up to the 610 Project grant from MCF (see the Mudflats Technical Report for more information about the 610 Project). The group purchased 30 green crab traps from Brazier Traps and Brooks Trap Mill, and set the traps throughout Frenchman Bay. They collected data about green crab populations and how the traps worked. Some site-specific data are presented on page 4.

In addition, the funds went to prepare the Shellfish Committee for participating in market-based solutions to the green crab problem. Market-based solutions may include participating in Asian live-markets, supplying processing facilities, and providing suppliers with chitin from the shell.

Chris Petersen (left) and Jim Norris (right) check out some trapped green crabs.



Next Steps

- Continue monitoring green crab populations in Frenchman Bay.
- Conduct studies looking at crab abundance as it relates to eelgrass abundance and water temperature.
- Install a GoPro camera underwater to observe crab behavior in eelgrass beds.

Emptying green crab traps.

Measuring a female green crab.

Partners

Collaboration is critical to any Frenchman Bay Partner undertaking. Key partners on green crab projects include: College of the Atlantic, the Frenchman Bay Regional Shellfish Committee, Maine Coast Heritage Trust, MDI Biological Laboratory.

For more information

For more information about our partners, projects, and events, visit our website at www.frenchmanbaypartners.org or call FBP President Jane Disney at 207.288.3605 x 429.

Frenchman Bay Partners

The Frenchman Bay Partners strives to ensure that the Frenchman Bay area is ecologically, economically and socially healthy and resilient in the face of future challenges.