frenchman bay partners

Green Crabs 2016

The Frenchman Bay Partners are guided by a conservation plan, the Frenchman Bay Action Plan, which identifies four conservation priorities: Eelgrass, Benthic Habitats, Mudflats, and Diadromous Fish.

What About Green Crabs?

The European green crab (*Carcinus 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 ship ballast water, and is now found up and down both North American coasts. A second invasion in Atlantic Canada in the 1980s introduced a population from Scandinavia. The genetic makeup of the second wave of green crabs (northern haplotype) differs slightly from the first wave (southern haplotype).

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. 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.

Green Crabs in Frenchman Bay

The southern haplotype of the green crab has been present in the Gulf of Maine for over 100 years. In 2013, the northern haplotype, which is reportedly more voracious, was documented in upper Frenchman Bay. That same year, eelgrass in the upper bay disappeared completely. In addition, shellfish harvesters and lobstermen were turning up record numbers of green crabs.

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.

Population Genetics of the Green Crab

A study in summer 2014 aimed to determine whether the northern haploytypes had spread to areas around Mt. Desert Island (MDI), 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 the MDI Biological Laboratory set up an experiment to determine whether the same was true in Frenchman Bay.

Eelgrass patches from six sites around 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, 15 adult crabs were collected, their DNA extracted, and the CO1 gene was amplified and sequenced.

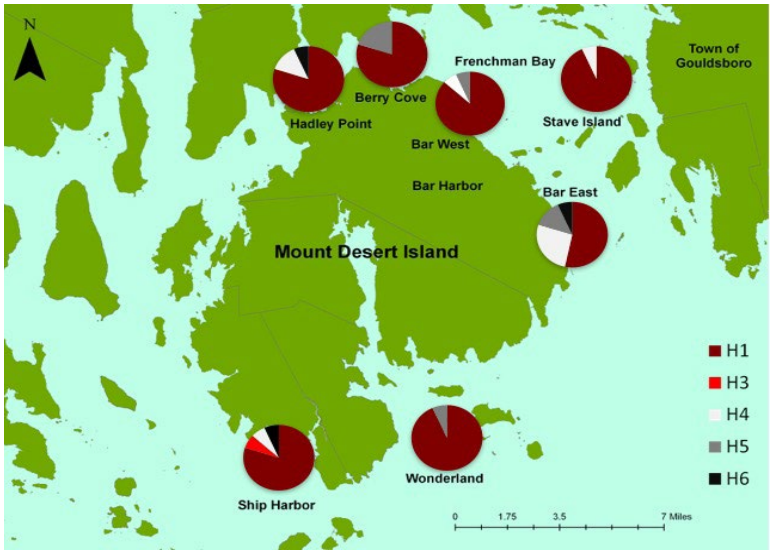

Figure 1. This map of Mt. Desert Island shows the distribution of crabs at each site by haplotype. Haplotypes 4, 5, and 6 are the northern variety. Haplotypes 1 and 3 are the southern variety.

The study concluded the following:

- Eelgrass abundance and density are significantly different among sites around MDI.
- Haplotypes derived from southern populations are predominant at all sites.
- Northern halptypes 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

Over the past four years, young volunteers with the Community Environmental Health Lab 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.

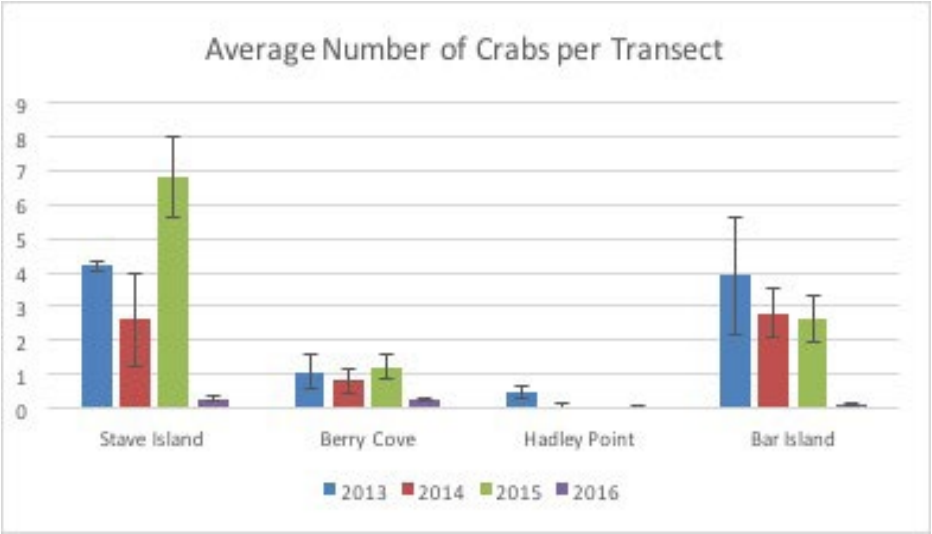

Figure 2. Average number of crabs/transect from 2013-2016 by site. Overall, the number of green crabs found along transects is not significantly different between years (ANOVA, $p = 0.28$).

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 in Figure 3.

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

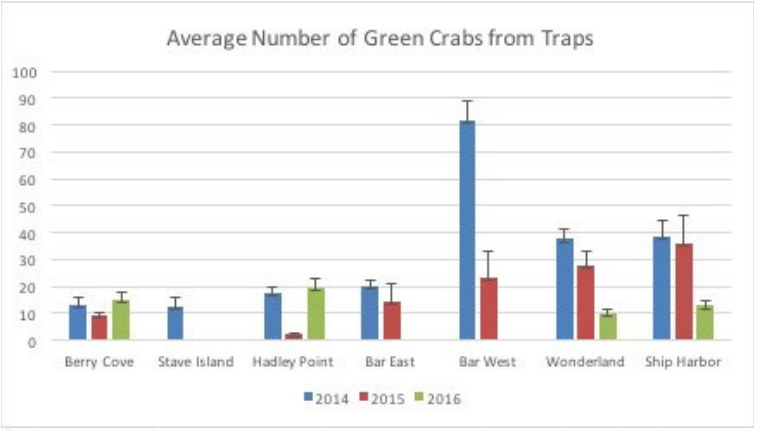

Figure 3. Five-day green crab abundance study. Green crab traps were not deployed at Stave Island, Bar East, and Bar West in 2016. Berry Cove and Hadley Point are eelgrass restoration areas; eelgrass loss in these areas has been extensive in past years. Wonderland and Ship Harbor have extensive eelgrass beds and have not experienced eelgrass loss comparative to Hadley point and Berry Cove. There was no significant difference in green crab averages between sites in 2016 (one-way ANOVA, $p = 0.16$)

Next Steps

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

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, and the MDI Biological Laboratory.

www.frenchmanbaypartners.org • PO Box 35 • Salisbury Cove, ME 04672
207-288-9880 x 125 • jdisney@mdibl.org