



Invasive Species Persist in a Warming Casco Bay

Tunicates Are Especially Abundant and May Displace Other Species

Wells NERR

WHY IT MATTERS

Invasive species are animals, algae, and other organisms that are not native to a region but arrive there through human activity and become self-sustaining. They may harm ecosystem processes, the economy, and public health.

The highly invasive European green crab, *Carcinus maenas*, was first observed in Casco Bay in 1905. It has become the dominant species of shore crab along the Maine coast, preying on soft-shell clams, uprooting eelgrass, and causing erosion in tidal marshes.

But other invasives are less noticeable. For example, small colonial tunicates and bryozoans grow abundantly as part of the “fouling communities” of organisms found on hard surfaces such as rocks, pilings, docks, and floats. While native species remain, many of the most abundant, colorful, and visible species are non-native arrivals. Some invasives grow on blades of eelgrass and kelp, impairing their growth.



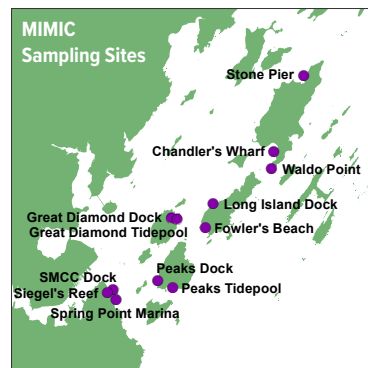
The European rock shrimp, *Palaemon elegans*, is an infrequently observed but distinctive member of fouling communities in Casco Bay. Note blue color on appendages. (Photo: Wells NERR)

Invasive species are often indicators of changing marine ecosystems. While many of the most harmful ones are native to Europe or Asia, other species turning up in our waters are from closer to home and are properly termed “range-shifters”. For example, mid-Atlantic species such as the fiddler crab are expanding their ranges and may displace native species.

STATUS & TRENDS

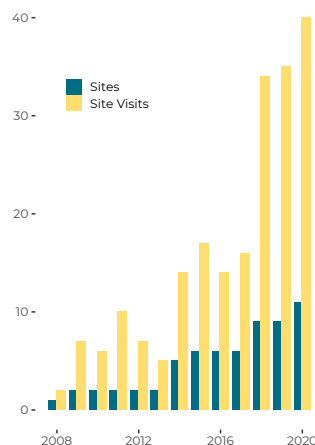
The Marine Invader Monitoring and Information Collaborative (MIMIC) in Casco Bay is a partnership between CBEP and the Wells National Estuarine Research Reserve (Wells NERR). Wells NERR trains community scientists to identify 23 species of invasives, including tunicates, bryozoans, algae, and crustaceans.

Community scientists visit floating docks at piers or marinas, and tidepools each month between May and October and document presence (and approximate abundance) of these species. The program began with two sites in Casco Bay in 2008 and has expanded to include twelve mainland and island locations (see map). Sampling on the islands began in 2014, when four volunteers sampled just two sites. In 2020, twenty-one volunteers sampled nine sites on four islands.



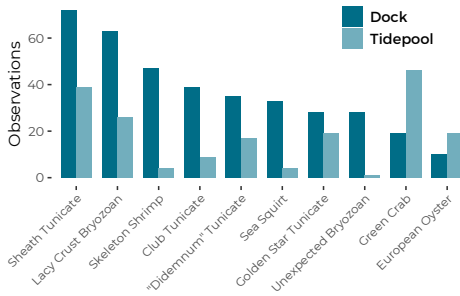
Among the most abundant non-native species are colonial or solitary tunicates (pictured at top of page), which are found more frequently on docks than in tidepools. Two species—*Didemnum vexillum* (present in Maine since approximately 1978) and *Diplosoma listerianum* (a recent arrival)—can grow over many other species and may become dominant at some sites.

Increase in Monitoring
2008 to 2020



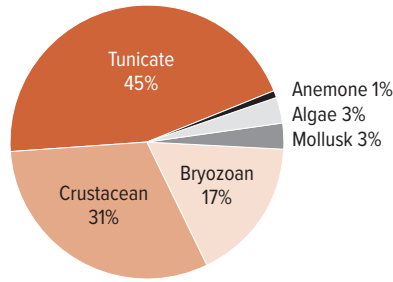
Monitoring sites and site visits
have risen steadily since 2008.

Number of Observations by Major Taxon



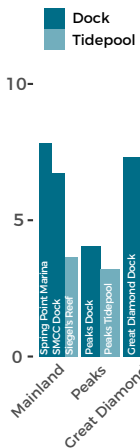
Green crabs were found mostly in tidepools, where they are the most frequently observed non-native species. Docks and piers were dominated by tunicates and bryozoans. Data based on observations from 2016 to 2020 at all Casco Bay sites.

Percentage of Observations by Major Taxon

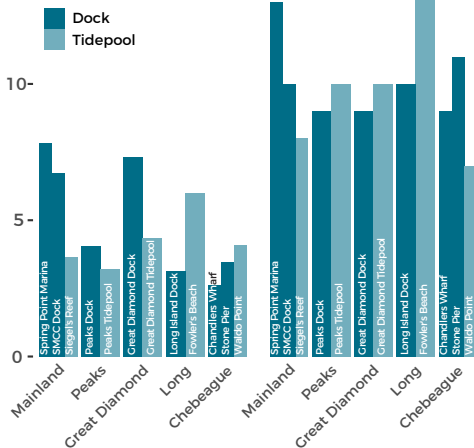


Of the 23 invasive species targeted by the MIMIC program, tunicates, which here includes six different species, are the most frequently observed invasives. This graph is based on 1,500 observations from 2016 to 2020.

Average Invasives per Site Visit

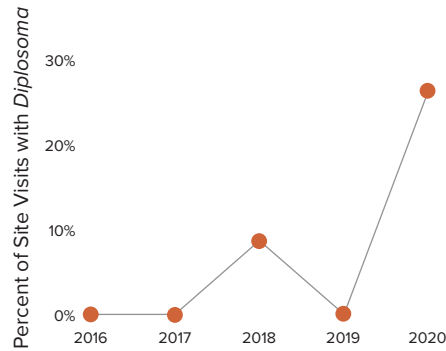


Total Invasives Observed at Sites



Almost every site visit identified at least one invasive species. From 2016 through 2020, typically two to eight invasive species were observed on each site visit. Between seven and fourteen different invasive species were observed at each location.

Colonial Tunicate Now Firmly Established



Although rarely seen in the past, *Diplosoma listerianum*, a colonial tunicate, increased dramatically in 2020. Before 2016, *Diplosoma* had only been observed once, in 2014. It was observed three times in 2018 and then eleven times in 2020. Observed in rocky intertidal communities since 2010 (MA CZM 2013), it now appears to be firmly established in the fouling community in our region.

SUCCESSSES & CHALLENGES

- ▶ The MIMIC program provides an “early detection system” for marine invaders in Casco Bay. MIMIC provides a network of organizations and trained volunteers to track marine invaders on the mainland and now on the islands. The data collected by MIMIC are shared with state agencies and others to provide insights into what species are present and alerts for new arrivals.
- ▶ Controlling or managing invasive species in the marine environment is difficult because of their diversity and complex life histories. Because few strategies exist for restricting the spread of invasive species once they become established, education to prevent new arrivals is paramount.
- ▶ Continued monitoring and collaborative efforts with local coastal stakeholders continue to be our best approach to understanding and mitigating the effects of these invaders. There are actions taking place to mitigate impacts from, and finding uses for, some of these species. For example, the Wells NERR and others are working with local fishermen in southern Maine to improve the market for green crabs.

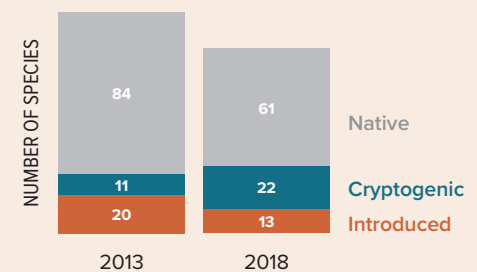
RAPID ASSESSMENT SURVEY (RAS)

The Gulf of Maine Rapid Assessment Survey (RAS) is a regional survey of invasive species conducted every three to five years and led by the Massachusetts Office of Coastal Zone Management and MIT Sea Grant College Program. Since 2000, scientists have sampled dozens of sites from Maine to New York in July or August. Taxonomic experts identify native and non-native macroalgae and invertebrates on floating docks and related structures, such as pilings, ropes, and boat fenders.

From Massachusetts to Maine, the teams found that the percentage of invasive species has remained relatively stable, with less than a quarter of all species observed in both 2013 and 2018 known to be invasive.

Several species, however, have expanded their range. For example, the colonial tunicate *Didemnum vexillum* and the bryozoan *Tricellaria inopinata* were observed more frequently in Maine, and the ranges for the algae *Colpomenia peregrina* (moving southward) and *Grateloupia turuturu* (moving northward) expanded. *Dasysiphonia japonica*, a red alga, was observed for the first time in 2018 at both sites surveyed in Casco Bay—Port Harbor Marine (Portland) and Brewer South Freeport Marine (South Freeport)—continuing its northward expansion. At Casco Bay sites, the total number of species declined from 2013 to 2018, and more cryptogenic species were observed.

Species at Two RAS Sites in Casco Bay



Less than one quarter of species observed during recent Rapid Assessment Surveys in Casco Bay are known to be introduced. Cryptogenic species are ones whose origins are unknown and may have been introduced (Kennedy et al. 2020).