You're Gonna Get Wet
Intertidal Monitoring on Appledore Island

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Introduction

For over three decades, students have been monitoring rocky intertidal transects on Appledore Island, Isles of Shoals, in the Gulf of Maine. Since 2011, research focus has been directed towards five vertical transects on the sheltered and exposed sides of the island. The goal of the internship is to continue collecting data for this long-term study to detect inter-annual variation in species cover and long-term trends due to climate change.

Changes in temperature, sea level, and storm intensity affect the sensitive intertidal organisms. Information about changes in seaweed and invertebrate abundance and shifts in species distribution contribute to our understanding of biotic responses to the environment.

Vertebrata lanosa

Fig. 1A (left)

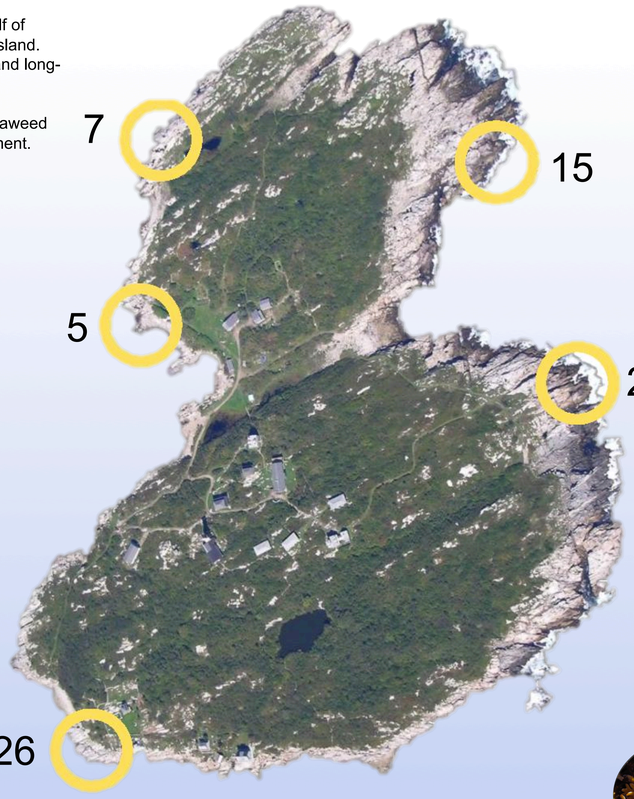
At Transect 26, a sheltered habitat, there is an inverse relationship between cover of *Vertebrata* and *Elachista,* both epiphytes on *Ascophyllum*. They may be competing for space.

Fig. 1B (right)

At Transect 15, an exposed habitat, there is no obvious relationship between cover of *Vertebrata* and *Elachista.*

Exposure to wave action influences the interactions among these species.

Elachista fucicola

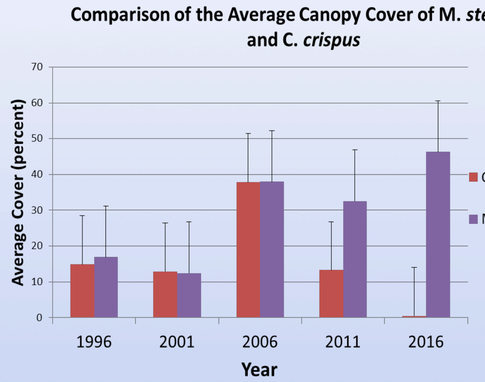


Methods

Transect Survey
We collected data from five vertical transects marked by pins set into the bedrock at 4.1m above mean low low water (MLLW). We quantified organisms with three replicate quadrats at 0.3m increments. We estimated percent cover, number, size (for select invertebrates and seaweeds), and frequency of common intertidal species.

Modified National Parks Service Survey
Each year, photographs are taken of five permanent 70x50cm photoplots in three biotic zones (*Ascophyllum*, *Fucus*, and *Chondrus/Mastocarpus*) at Transects 26 and 15, and five photoplots in the *Semibalanus* zone at Transect 15. Percent cover was determined using a point-intercept method (100 points) for each photograph.

At Transect 15, five permanent 20x20cm squares were photographed and then scraped clean every year to quantify barnacle recruitment. In each image, live barnacles were counted in four randomly selected 5x5cm quadrats.



Mastocarpus stellatus

Fig. 2 (left)

Comparison of the average canopy of *Chondrus crispus* and *Mastocarpus stellatus*, foundation species in their zone, at Transect 26. Error bars represent standard deviation. In the past twenty years, cover of *C. crispus* and *M. stellatus* were similar until 2006, when *C. crispus* cover declined markedly, possibly due to harsh winters, as in 2013-14. *Chondrus crispus* is damaged during periods of three or more hours of exposure to -5°C, while *M. stellatus* is much less affected by temperature extremes*. Changing weather patterns will alter species composition in the intertidal.

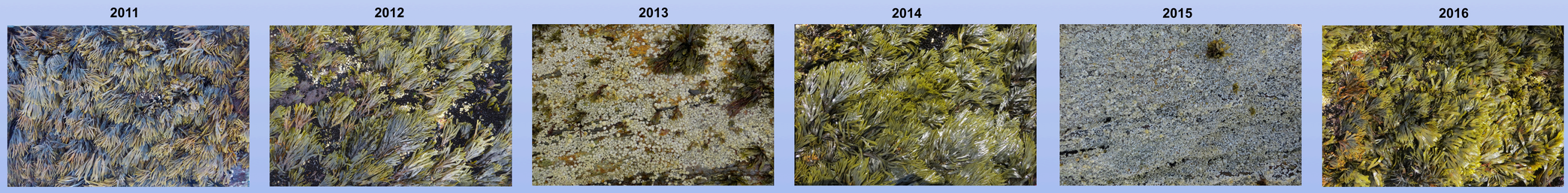
Chondrus crispus

*Dudgeon, S. R., I. R. Davison, and R. L. Vadas. 1990. Freezing tolerance in the Intertidal red algae *Chondrus crispus* and *Mastocarpus stellatus*: Relative importance of acclimation and adaptation. *Mar. Biol. Marine Biology* 106: 427-36.

Fig. 3

Photos were taken in permanent plots 1.1m above MLLW at Transect 15 annually.. Here we show photos of one plot over 6 years. They demonstrate the dramatic interannual variation in recruitment of *Fucus distichus, Semibalanus balanoides* and *Mytilus edulis*. When *S. balanoides* recruitment was low, *F. distichus* and *M. edulis* recruitments were high, and vice versa.

Fucus Zone



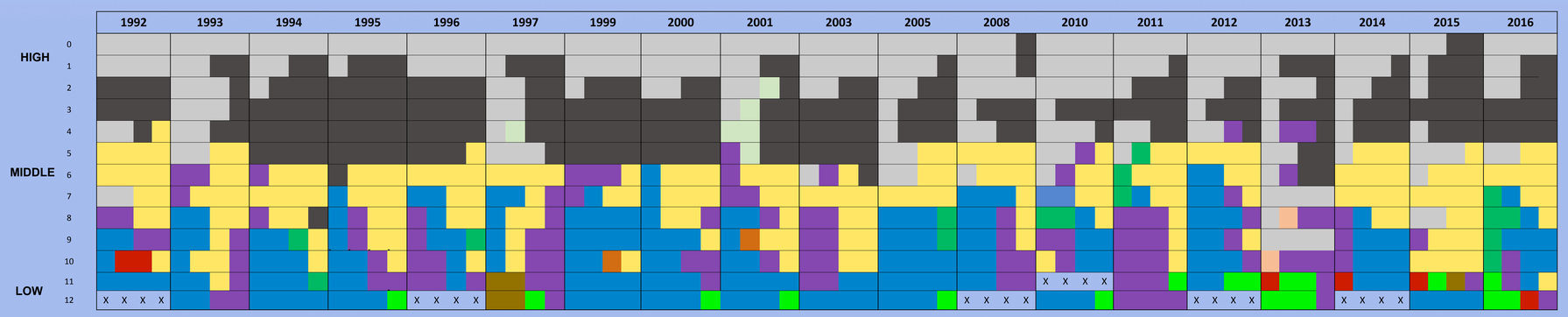


Fig. 4 (left)

Zonation mosaic showing the vertical distribution of common species at Transect 15 from 1990-2016. Species occupying at least 25% of the cover at each level are represented by colored boxes. Generally, barnacles dominate the upper levels while mussels dominate the lower levels. However, dominance of barnacle and mussel abundance varies across years, with clear episodic mussel recruitment (blue).

In 2016, barnacles cover diminished while mussels increased in cover and moved higher.

Acknowledgements
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