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Vignette 14: Eelgrass Wasting Disease

Olivia Graham

Morgan Eisenlord

Drew Harvell
Cornell University

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14 | EELGRASS WASTING DISEASE

Olivia Graham, Morgan Eisenlord, and Dr. Drew Harvell, Department of Ecology and Evolutionary Biology, Cornell University

Rising seawater temperatures can increase the risk of disease outbreaks in many taxa (Burge et al. 2014; Maynard et al. 2016; Burge & Hershberger 2020). In addition, heat waves, which occur when seawater temperature exceeds a threshold, are increasing in severity, duration, and intensity (Hobday et al. 2016; Oliver et al. 2018) and have been associated with numerous ecological changes in our waters. For example, documented impacts from the longest heat wave described to date, which occurred in the Northeast Pacific Ocean from 2014 to 2016, include mass mortality events of planktivorous seabirds, widespread harmful algal blooms, ecosystem regime shifts from bull kelp forests to sea urchin barrens, massive shifts in plankton productivity and composition, and an outbreak of seastar wasting disease in numerous species including the sunflower star (*Pycnopodia helianthoides*), a pivotal predator (Cavole et al. 2016; Gentemann et al. 2017; Harvell et al. 2019; Rogers-Bennett & Catton 2019).

Pathogens are potentially the ultimate keystone species in that their small biomass can have massive impacts that ripple through ecosystems. However, the triggers to epidemics are likely multivariate and complex, involving a combination of host stress, environmental conditions, and changes in biological communities. Progress in understanding the conditions that lead to epidemics has been hindered by a lack of integration among these various components that determine susceptibility and resilience to pathogens. Disease outbreaks can be particularly damaging when they affect ecosystem engineers, such as corals and seagrasses (Burge et al. 2014; Harvell & Lamb 2020). Outbreaks of wasting disease in seagrasses are one of a myriad of stressors associated with declining temperate and tropical seagrass meadows around the globe (Short et al. 1988; Waycott et al. 2009; Sullivan et al. 2013; Martin et al. 2016; Sullivan et al. 2018). The largest outbreak of wasting disease occurred in the 1930s along the European and American coastlines of the Atlantic Ocean (Renn 1936; Godet et al. 2008). During this outbreak, eelgrass meadows suffered up to 90% mortality. Impacts of the outbreak include altered sediment distribution and disrupted coastal food chains, fisheries, and migratory waterfowl (Short et al. 1988). These examples demonstrate the cascading ecological impacts of infectious diseases in foundation species (Hughes et al. 2008; Waycott et al. 2009; Plummer et al. 2013).

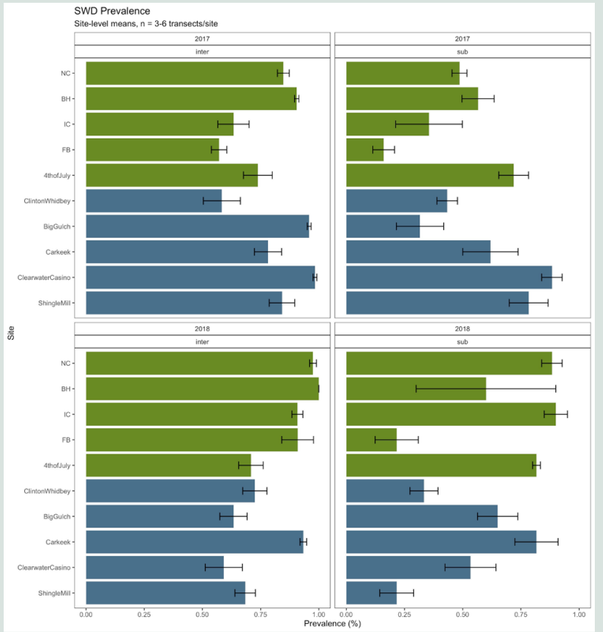
In recent years, eelgrass in critical estuaries on both the United States Atlantic and Pacific coasts has declined. Eelgrass meadows are affected globally by a wasting disease caused by the protozoan *Labyrinthula zosterae*. There are other disease agents under investigation that can also damage eelgrass, but wasting disease caused by *L. zosterae* is currently the most damaging in our waters.

Levels of eelgrass wasting disease are high in the San Juan Islands (Groner et al. 2016) and Puget Sound. Intertidal and subtidal seagrass wasting disease prevalence and severity were extremely high at field sites in the San Juan Islands (North Cove, Beach Haven, Indian Cove, False Bay, and 4th of July) and Puget Sound (Clinton-Whidbey, Big Gulch, Carkeek, Clearwater Casino, and Shingle Mill) in 2017 and 2018 (and ongoing). Prevalence exceeded 50% at all intertidal sites in both years and was higher in most intertidal than subtidal sites. Severity of infections were higher in intertidal than subtidal sites in the San Juan Islands and more variable in Puget Sound.

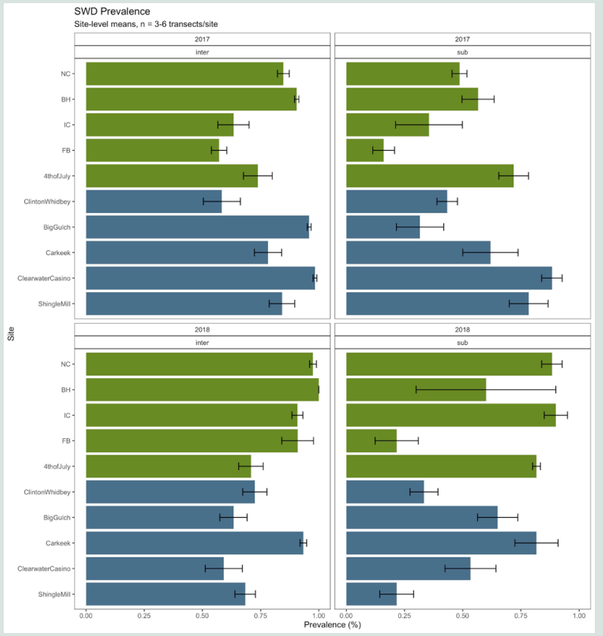
Our time-series studies from 2012 to 2017 (and ongoing) show sharply increasing levels of disease correlated with warming winter and spring temperatures (Groner et al. under review).

These increasing levels of disease are a threat to sustainability of eelgrass meadows, our most valuable marine habitat, vital for fish development and filtration services and blue carbon mitigation.

Shallow intertidal eelgrass with bubble snail eggs at False Bay, San Juan Island, WA. Photo credit: Sarah Petrini.



Prevalence (proportion of diseased blades, n = 40/transect, 3 transects per site) of disease in intertidal and subtidal eelgrass meadows in the San Juan Islands and Puget Sound.



Severity (percent of a blade damaged by lesions) of disease in the San Juan Islands and Puget Sound eelgrass meadows.