Reef

The north-facing shoreline of the Baliles Center for Environmental Education[[1]](#footnote-12104)—a six hundred plus acre research and education facility partially delimited by two tributaries of the Potomac River portion of the Chesapeake Bay estuary—has been restored to a “living shoreline”. This shoreline consists of a rock breakwater that encloses a swath of vegetated intertidal sediments between the subtidal portion of the creek and the embankment that demarcates the land. Living shorelines are engineered systems that prevent bank erosion while providing a simulacrum of a littoral ecosystem that can support marine life (in contrast to the “dead” shorelines created by alternative erosion prevention methods, such as sea walls). And the living shoreline of the Baliles Center does seem replete with life; the intertidal is a tangle of vegetation dotted with marsh periwinklesnails (*Littoraria irrorata*) and terrestrial insects, its mud is pockmarked with the burrows of polychaete worms and other invertebrates, isopods, known as sea roaches (*Ligia oceanica*) scuttle across the biofilm-slick rocks of the breakwater. But, despite its seeming vitality, the Baliles Center’s living shoreline is a depauperate and uncanny system, a lusus naturae.

Prior to their near elimination from the Chesapeake Bay during the twentieth century, the creeks flanking the Baliles Center would have contained huge populations of eastern oysters (*Crassostrea virginica*) assembled into multigenerational reefs of geologic scale. These reefs, having grown generation on generation over centuries would have spanned the subtidal and intertidal portions of the creek literally building the ecosystem to which they belonged. Yet today, there are no oysters in the living shoreline, nor are there any oysters in the surrounding creeks. However much “living” these systems are, what was once an ecological system built of the bodies of oysters is now something else. This is because by the turn of the twenty-first century, the oyster population of the Chesapeake Bay had been reduced to within one percent of its pre-colonial abundance due mainly to overfishing, although disease and poor water quality helped to further diminish the weakened populations[[2]](#footnote-10129). Efforts to restore the Bay’s oyster populations are ongoing and we are involved in plans to restore oyster reefs to the creeks of the Baliles Center; intercepting shore-bound waves with “oyster rock”[[3]](#footnote-27144) rather than piles of geologically incongruous rocks.

Restoring the oysters requires overcoming myriad challenges. There are the logistics of costs and permissions, the biological barriers inherent to a chronically and deeply impaired system[[4]](#footnote-9688), and finally, and perhaps most significantly, imagining what is being restored. Carse in his reflection on restoration and mitigation efforts in the Savanna River observes that restoration, “is by definition concerned with relationships between the present and the past”, and that by asking the question of “when should a landscape or ecosystem be restored to... the past is brought into the present”. However tempting the wish to simply turn back the clock of impairment may be, Carse’s emphasis on restored to *when* highlights the temporality of restoration but allows the temporal to subsume the ontological and risks defining the *what* of the system to simply a defined point in time. Furthermore, since we cannot return to the past[[5]](#footnote-13762), any understanding that we have of the *what* of a given *when* is an act of imagination (however well informed it may be). Thus, the real question of restoration is not to *when* would we like to return, since this is on one hand ultimately unknowable, and on the other hand, ultimately useless without an understanding of what makes a reef distinct from, and more desirable than, the ecological system that exists in the current state (e.g., the living shoreline). In other words, we must ask: what makes an oyster reef beyond simply an abundance of oysters[[6]](#footnote-26407).

The OED defines a “reef” as[[7]](#footnote-19957) “a ridge or bank of rock, sand, shingle, etc., lying just above or just below the surface of the sea or another body of water, usually in such a way as to pose a hazard to shipping. In later use frequently [specifically] a ridge of this kind formed of coral”. This definition imagines a reef from the perspective of a human observer as an underwater thing that is in the way, but fails to imagine the “life-ways”[[8]](#footnote-31446) of the organisms inhabiting the reef and the “emergent effects of [their] encounters”[[9]](#footnote-23921).

Oysters can be understood ecologically as a foundation species, which is “a species (or group of functionally similar taxa) that dominates an assemblage numerically and in overall size, determines the diversity of associated taxa through non-trophic interactions, and modulates fluxes of nutrients and energy at multiple control points in the ecosystem it defines”[[10]](#footnote-26381). Imagined in this way, the oyster reef is a set of relationships, an ecology in the literal sense[[11]](#footnote-308), where the structure and function of the system is the created by, and an emergent property of, the “life ways” of the organisms. What distinguishes this from the ecology of the living shoreline, where species interact in non-additive ways to be sure, is that the interactions of the oyster reef are the product of a shared evolutionary history. In this imaginative framework, Carse’s question of *when* to restore a system to fails to capture the integrated, temporal, spatial, and relational structure of the reef. The reef is not simply defined by interactions between organisms[[12]](#footnote-22722) but by the shared co-creation of the ecology of the reef over evolutionary time[[13]](#footnote-20024). In this imagining, the significance of the temporal is recovered as the continual act of co-creation by evolutionarily entangled organisms and the reef is recognized, not simply as the presence of individual interacting entities (which are tautological in ecology), but as the shared evolutionary histories of the assemblage. Each particular *when* is the outcome of the overlapping evolutionary trajectories of all of the interacting species (including humans) and the resultant reef is recognizable as the effect of this “intra-action”[[14]](#footnote-9325). Thus, to return to the question of what makes an oyster reef beyond simply an abundance of oystersand why is this distinct from, and more desirable than alternatives, like a living shoreline; we can say that

Returning to the restoration of oysters to the Baliles Center...

1. See: https://storymaps.arcgis.com/stories/35e5f5efa68a4e9faa8a20db82d079fb [↑](#footnote-ref-12104)
2. Wilberg et al. (2011) [↑](#footnote-ref-10129)
3. Oyster rock is colloquial term for oyster reef habitat (see examples in Schulte 2017). [↑](#footnote-ref-27144)
4. Despite historically supporting oyster populations, the creeks are only rated as “moderate” candidates for restoration due to the lack of nearby oyster populations to supply propagules and degraded environmental conditions (Virginia Oyster Restoration Atlas, 2009). [↑](#footnote-ref-9688)
5. Specifically in the case of oyster reefs, no one living has been witness to the pre-exploitation oyster populations of the Bay. There were already significant declines and warnings of their imperilment in the mid-nineteenth century (Schulte 2017), so our only evidence comes from oral and written histories. [↑](#footnote-ref-13762)
6. There is a failure to ask this question in the “10-billion Oysters” program of the Chesapeake Bay Oyster Alliance. [↑](#footnote-ref-26407)
7. https://www.oed.com/dictionary/reef\_n2 [↑](#footnote-ref-19957)
8. p. 23, Tsing (2015) [↑](#footnote-ref-31446)
9. p. 23, Tsing (2015) [↑](#footnote-ref-23921)
10. p. 257, Ellison (2019) [↑](#footnote-ref-26381)
11. “The branch of biology that deals with the relationships between living organisms and their environment. Also: the relationships themselves, esp. those of a specified organism.” OED https://www.oed.com/dictionary/ecology\_n [↑](#footnote-ref-308)
12. This distinction is illustrated by the plan to introduce the pacific oyster (*Crassotrea gigas*) to the Chesapeake Bay in an effort to establish a disease-resistant population of oysters. This introduced oyster would have come far closer than any living shoreline to mimicking the structure and function the reefs of the native eastern oyster (*Crassotrea virginica*) but there was widespread agreement that this system would not be a true *restoration* of the oyster reefs of the Bay. [↑](#footnote-ref-22722)
13. Gould [↑](#footnote-ref-20024)
14. Barad (2007) [↑](#footnote-ref-9325)