

Bioregional Learning Journey Launches Seagrass Conservation in Gulf of Maine: A Case Study of Governance Response to Ecosystem Change

By: Glenn Page*, Sam Matey*, Yasmin Johnston*, Mik Schulte*, Lauren Hayden*, Sigrid Knag*

*CEO of SustainaMetrix and Global Lead of COBALT. Maine, USA.

*COBALT Fellow and Geospatial Analyst, Maine, USA.

*COBALT Fellow and Social Worker for Refugees. Nantes, France.

*COBALT Fellow and Law Student at the University of Maine School of Law. Maine, USA.

*COBALT Fellow and Marine Sciences Masters Student at the University of New England. Maine, USA.

*COBALT Fellow and Data Science Masters Student at NMBU. Norway.

Corresponding author: Glenn Page, gpage@sustainametrix.com

Keywords: Seagrass, Bioregional Learning Journey, Community Science, Governance Response to Ecosystem Change

Abstract

In response to the polycrisis, a case study of governance response to ecosystem change by civil society is presented with a focus on seagrass meadow conservation and restoration as a globally important nature-based solution to the climate emergency. A week-long bioregional learning journey was launched in August 2022 as the culmination of a two-year community-engagement process to examine governance response to one of the most rapidly warming systems on earth, the Gulf of Maine. While government and market forces have played essential roles in this bioregion (Casco Bay Watershed, Gulf of Maine), civil society has played an outsized role since the 1970s. It has the potential to contribute significantly to navigation in the decades ahead through mapping multi-scale and multi-phase responses to dramatic ecosystem change. Results illustrate the paramount importance of integrating indigenous wisdom and western science, confronting issues of colonization, collective ‘seeing’ of complex systems through transformative experiences such as bioregional learning journeys, and strong support for the launch of Team Zostera in Casco Bay, Gulf of Maine, USA. Casco Bay contains some of the largest expanses of seagrass habitat in the western North Atlantic. It allows civil society to enable governance response to ecosystem change further.

Introduction

As we confront the reality of our global polycrisis (Morrin and Kearns, 1999, Kunstler 2005, Homer-Dixon et al., 2015), there is a growing urgency for greater governance response to ecosystem change, particularly from civil society (Olsen et al., 2009). This paper describes the power of a global network called COBALT (Collaborative for Bioregional Action Learning & Transformation) and the design of a custom bioregional learning journey as a social innovation to help communities better see and navigate local pathways for transformation and commit towards stewardship action. The weeklong bioregional learning

journey was a culmination of a two-year process led by COBALT inviting local community members to examine governance response to the growing global polycrisis through a novel bioregional macroscope (Olsen et al., 2009, Page et al., 2021).

According to a recent white paper by the Cascade Institute, “a global polycrisis occurs when crises in multiple global systems become causally entangled in ways that significantly degrade humanity’s prospects” (Lawrence, Janzwood, and Homer-Dixon, 2022). They say the risks to humanity are profound, spreading like “some sort of contagion in a network...that disrupts other systems.” In the Nobel Prize Summit, *Our Planet, Our Future*, Folke, et al., 2021 describe the state of the planet as “a critical juncture for humanity.” They emphasize the importance of social innovations that align with windows of opportunity to unlock broader levels of change within a governance system.

We offer a case example of a holistic, science-based seagrass conservation effort as a seed that is ‘planted’ during a process of a bioregional learning journey to better see interrelationships of food systems, wastewater treatment and estuarine health of Casco Bay, Gulf of Maine, USA across micro, meso, and macro scales of governance. By applying the phases of the transformation model (Figure 1), a mapping framework was used to visualize how isolated, small-scale experiments can fuel large-scale narratives that underscore values and visions in support of coalescing systems change (Geels et al., 2002, Olsson et al., 2004, Pereira et al., 2018). The pathway can be mapped as three phases of transformation and served as the template for the learning journey and launch of Team Zostera, a holistic science-based seagrass conservation program as part of the first phase of transformation. This first phase is the preparation phase. It begins with a deeper seeing of niche-level innovations which was the focus of the bioregional learning journey in light of the likelihood of rapid, large-scale ecological change. In essence, as the climate and biodiversity crisis worsens, people are demanding. They will continue to demand better governance of our ecological heritage, creating an opportunity to institute more culturally and ecologically intelligent landscape and seascape management regimes. While it is equally possible that attempts at such new forms of governance will be “captured” by the dominant power structures and eventually vanish, narratives of hope are essential for social resilience (O’Brien, 2015, Lamont, 2019, Herrrfahrt-Pähle et al., 2020). Working to develop better solutions is critical, and we must not let fear of failure prevent us from trying at all.

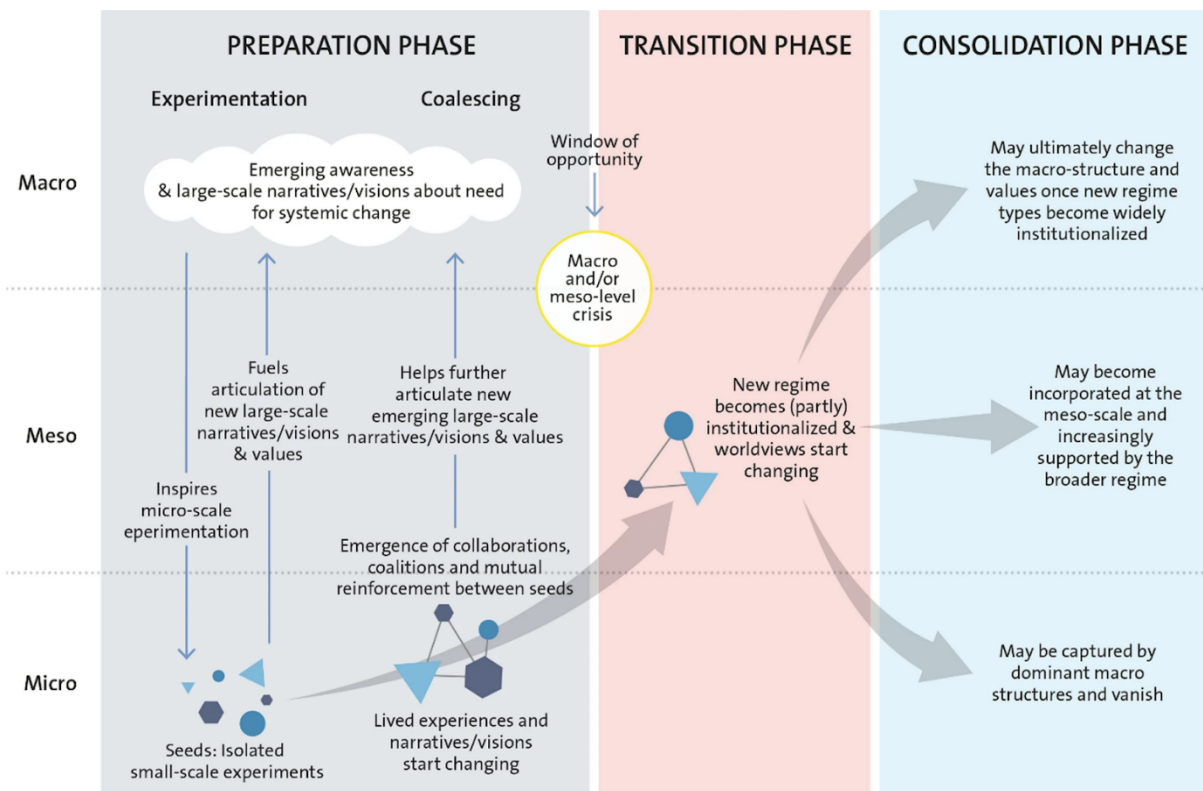


Figure 1: Transformations as a multi-scale and multi-phased process whereby a seed of social innovation may mature to the extent that the broader initiative is more prepared for change. As change happens, windows of opportunity are essential to track.

Response to Ecosystem Change in the Gulf of Maine

The Gulf of Maine is one of the best-studied systems in the world. Yet, management efforts remain fragmented across two countries since colonization which has had dramatic consequences for many tribal nations that have lived in the region for thousands of years. For example, the past 200 years of fisheries management from the governments of the U.S. and Canada across the Gulf of Maine has followed historical patterns of fishing-down food webs (Jackson et al., 2001, Olssen et al., 2017) linked to the depletion of the once significant cod fishery. The absence of cod enabled the expansion of species lower in the food web, such as lobsters, what has become a high-value and culturally important fed monoculture along the Northeastern U.S. coastline, particularly Maine (Grabowski et al., 2010). As sea surface temperatures of the northwest Atlantic continue to warm dramatically, as they have over the last several decades, the Gulf of Maine faces ecological crises. Warming and loss of functional diversity in the marine system threaten livelihoods and cultural identity weakening the social-ecological system as it becomes highly vulnerable to disturbances. Under higher temperature regimes, the valuable and iconic lobster becomes at greater risk for epizootic shell disease (Rheuban et al., 2017). Suppose such a ‘lobster crisis’ does occur. In that case, New England’s dominant fishery could be decimated, perhaps triggering a shift into a different social-ecological system in which coastal waters no longer provide a viable livelihood for local fishermen (Steneck et al., 2011).

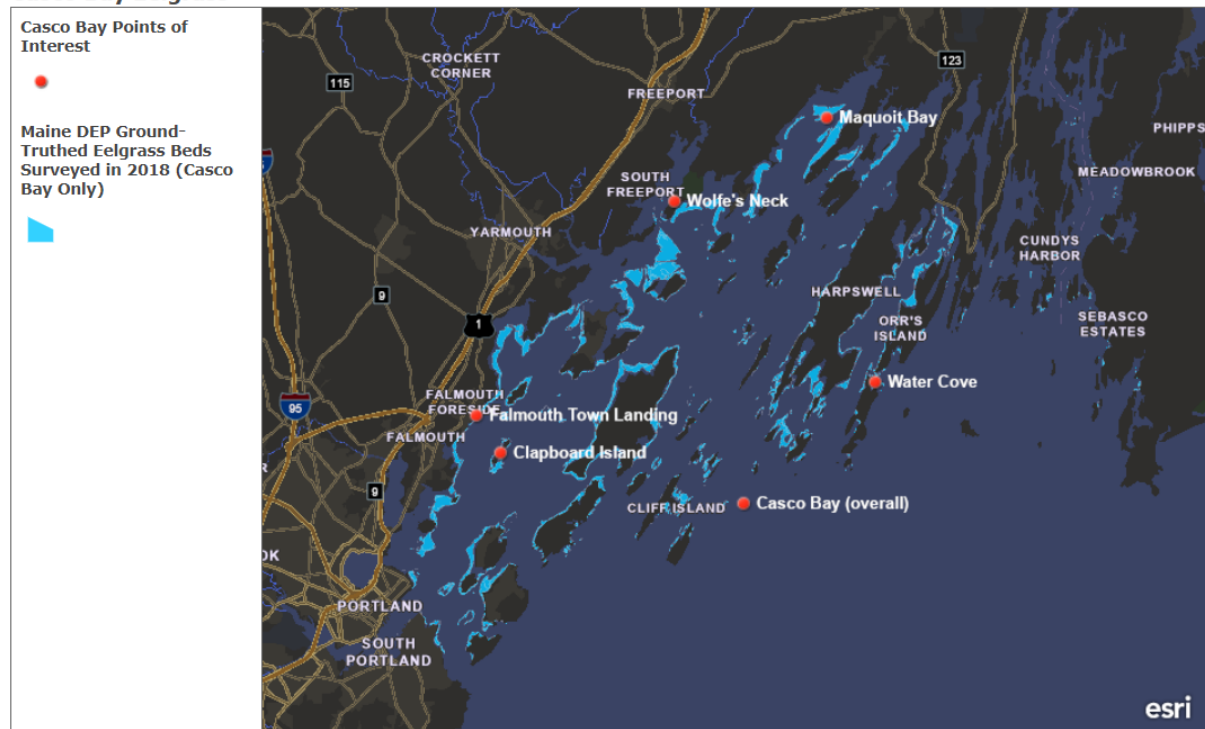
The Casco Bay National Estuary Partnership describes Casco Bay as remarkably healthy compared to many other U.S. estuaries yet warns of a series of major changes “underway that warrant a timely response to protect the Bay and the many people whose livelihoods and quality of life depend upon it” (Casco Bay National Estuary Partnership 2021). Holistic, science-based mapping, monitoring, and restoration of seagrass meadows is a social innovation emerging in locations around the globe, such as Wales, Australia, and Chesapeake Bay in the USA (Unsworth et al., 2015, Unsworth et al., 2022). Such community-based response could be a window of opportunity for direct action while lobster fishing remains central to regional identity. When healthy, seagrass meadows contribute a wide range of ecosystem services and can bioengineer their environment by slowing the flow of water, thus trapping particles as a positive feedback loop to improve the quality of water (P. S. Maxwell et al., 2017) and are considered essential fish habitat (20% of the world’s largest finfish fisheries have some known relationship to seagrass meadows (Unsworth et al., 2017). Conservation efforts offer a major opportunity for nature-based solutions to the polycrisis. Yet, without intervention, they are on a trajectory of global decline throughout the next century and will likely follow the same path in Casco Bay. The pathway to net gain is based on major conservation action that requires a response from all three sources of governance to halt and reverse seagrass loss and degradation. Key seagrass conservation actions to prioritize include legal instruments to halt bottom trawling, advanced mooring systems to allow recovery from boat damage, and active replanting to replace losses where appropriate habitat conditions exist (Unsworth et al., 2022). Governance response from civil society may have outsized potential to scale deep, including increasing awareness, fostering critical thinking, creating a community of like-minded people, reconnecting people to nature, empowering people at risk of social exclusion, and integrating different kinds of knowledge (Lam et al., 2022).

Casco Bay is an ideal location to co-create a grand social innovation effort as Team Zostera. Nested within the wider Gulf of Maine, Casco Bay covers 985 square miles. According to the Casco Bay Estuary Partnership, this represents 4.4% of Maine’s land area and includes 48 municipalities, 25% of the state’s population, 32% of active employment, and 38% of economic productivity, as measured by GRP. Casco Bay is a tidally dominated ecosystem with 575 miles of shoreline over 360 islands, receiving fresh water from Presumpscot River, Royal River, Kennebec River (indirectly), and 31 smaller tributaries (Casco Bay Estuary Partnership, 2021).

Morphologically, Casco Bay is unique in the Gulf of Maine because of the abundance of islands, many of which have shallow tidal and intertidal habitats ideal for seagrass meadows. Eelgrass (*Zostera marina* L.) is the dominant seagrass species in Casco Bay, a marine angiosperm in shallow coastal waters. Seagrasses worldwide form some of the most productive ecosystems on Earth; it is estimated that seagrass meadows cover just 0.2% of the ocean’s bottom yet account for more than 10% of yearly estimated organic carbon sequestration in the ocean (Fourqurean et al., 2012). As discussed in a recent study in Nature Z. (Olsen et al., 2016), the marina provides a vast array of ecosystem services. These include but are not limited to wave attenuation (protecting coasts during storms), erosion control, nutrient retention (thus helping to avoid toxic algal blooms), provisioning and sheltering of high-value edible fish and invertebrate species (including cod, still recovering in New England after decades of overexploitation) and highly effective carbon sequestration.

The Maine Department of Environmental Protection (DEP), which has statutory authority to document seagrass meadows in the state of Maine, conducted surveys of eelgrass extent in Casco Bay in 2013 and 2018 (see Figure 2 below) using on-the-ground surveys and aerial photography analysis (Barker, 2018). This produced highly valuable datasets of eelgrass extent and density in Casco Bay for these years. However, the surveying was laborious and thus a rare event. In 2021, a team from COBALT (Collaborative for Bioregional Action Learning & Transformation) met with leaders of Maine DEP and other organizations interested in seagrass conservation. It explored the potential of launching a community science effort dedicated to mapping and documenting the health and restoration of eelgrass meadows that were feasible in Casco Bay. In spring/summer 2021, meetings were held with leaders from the Friends of Casco Bay/Casco Baykeeper, and Casco Bay National Estuary Partnership, as well as from Maine DEP and seagrass researchers who had experience in the region. Recognizing this was a pilot exploratory effort, the COBALT team named themselves Team Zostera and coordinated a series of SCUBA diving sessions with Maine DEP to contribute to their long-term data collection based on a set of key management questions. This collaborative work was successful, and a more formal launch was planned as part of a Bioregional Learning Journey.

Casco Bay Eelgrass



Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA

Figure 2: Maine Department of Environmental Protection (DEP) Ground-Truthed Eelgrass Beds Surveyed in 2018 in Casco Bay, Maine

Results: A Bioregional Learning Journey That Revealed Opportunities for Transformative Change

While watershed characteristics are useful, COBALT designed a learning journey to focus on the concept of a “bioregion” as a more appropriate scale for this collective seeing of interconnected systems that integrates the results of applying a bioregional macroscope (Page 2021). As an action research network, COBALT dedicated two years to understanding better governance response to ecosystem change through two different cohorts comprised of members of the community to learn how to see complex interactions through a “bioregional macroscope” (Page et al., 2021) to understand better how to nurture the collective capacity to generate governance response to ecosystem change (Olsen et al., 2009). Bioregion refers to geographical terrain and “a terrain of consciousness—to a place and the ideas that have developed about how to live in that place” (Bergman and Dasmann, 1977). Human or political factors do not fix a bioregion’s boundaries, but rather ingrate flora, fauna, climate, rivers, lakes, mountains, and valleys. It is a place-based organizing structure most suited to understanding the potential mechanisms to support resilient communities (Thayer, 2003). A key focus was bringing together diverse participants to examine linkages, cross-scale dynamics, traps, tipping points, governance dimensions, and transformation systems. Looking at interconnected systems through a bioregional lens reveals nested and often fragmented forms of governance that occur at the municipal, regional, state, and federal scales and the critical need to better see the power dynamics of market forces and civil society interact with government. Recent research suggests such bioregions are a ‘sweet spot’ where climate and sustainability actions are suitably scaled. Bhowmik et al. (2020) indicate that prioritizing the appropriate actions that weave between community and urban scales and where global and local issues converge, such actions “can help catalyze and enhance individual, household and local practices, and support national and international policies and finances for rapid sustainability transformations.”

Through the analysis of governance response to ecosystem change in the bioregion over the two-year process from 2020-2021, the COBALT team identified the lack of community-based seagrass conservation and thus decided that the bioregional learning journey would launch an initiative dubbed ‘Team Zostera’ to holistically map, monitor and restore seagrass meadows in Casco Bay. The COBALT team also felt this launch required deep local engagement across cultures (particularly indigenous peoples), disciplines, sectors, ages, and genders. The two-year analysis explored the interrelationships of food systems, wastewater treatment, and estuarine health, all with a lens to better understand governance response, transformation systems, and issues of amplifying “green shoots” of innovative change.

For example, the Learning Journey revealed the early stages of transformative change being planned by a critical actor in governance response to water quality issues in Casco Bay. Through the Learning Journey, we learned that the Portland Water District intends to contribute new ecosystem governance management actions to reduce the flow of nitrogen-laden wastewater. Nitrogen is found in sewage, animal waste, fertilizers, rainwater, snow melt, and air pollution from burning fossil fuels. Excess nitrogen in our coastal waters may lead to harmful algal blooms, slime-covered coves, and more acidic conditions, all of which stress our coastal critters. The effluent from approximately 65,000 Portland residents and visitors and commercial facilities in the city passes through the East End Wastewater Treatment Plant. With a planned \$12-million upgrade to the plant, the Portland Water District

aims to reduce nitrogen in the effluent water by 20-40% within five years. That could prevent 500 to 1,000 pounds of nitrogen from entering Casco Bay daily.

The Portland Water District's Director of Wastewater Services worked diligently for nearly a year on an agreement to reduce nitrogen in treated wastewater from the East End sewage treatment plant. The Maine Department of Environmental Protection recently issued a five-year wastewater discharge permit for the plant that incorporates their recommendations. It is noteworthy that the Casco Baykeeper and Portland Water District's head of the East End Wastewater Treatment Facility forged an agreement to significantly reduce nitrogen in the treated wastewater released into Casco Bay from Portland's East End Wastewater Treatment Facility. This example of civil society forging partnerships with municipal leaders is evidence of the power to amplify the response to ecosystem change as the Portland Water District plans to:

- Work towards major reductions in nitrogen in the treated wastewater it releases into Casco Bay.
- Test nitrogen levels in its effluent water weekly to measure progress toward meeting the goal of a 20-40% reduction within five years.
- Collaborate with the City of Portland and other stakeholders in a coordinated effort to reduce nitrogen pollution from multiple sources.

We see this action as a type of 'transformation system' that intends to 'speed up,' but through the Learning Journey can see windows of opportunity for 'scaling deep and scaling up.' Figure 3 below illustrates the typology of Amplification developed by Lam et al., 2022 that the COBALT team applied in the Learning Journey. As described by Waddock et al., 2022, the COBALT team is a Transformation Catalyst (T.C.) who "works to connect, cohere, and amplify the work of actors and initiatives, who generally work independently, into coherent transformation-systems." A transformation system is the "totality of initiatives, people and organizations who are collectively seeking to transform a particular issue or geography in a common direction, when they attempt to align their efforts for greater effectiveness, as a result of that growing identity and self-awareness" (Waddock et al., 2022).



COBALT Amplification Processes and Action

Categories	Processes	Analytical questions	Action defined (*actions inductively generated during data analysis; ** actions not found in the data)
Amplifying within an initiative	<p>Stabilizing</p>	Does the initiative try to have longer impact?	<ul style="list-style-type: none"> • Building an organizational structure • Getting new partners • Getting new members • Looking for financial resources • Making members stay longer • Adapting to the system dynamics*
	<p>Speeding up</p>	Does the initiative try to have faster impact?	<ul style="list-style-type: none"> • Securing access to financial resources • Increasing number of people involved** • Developing a work routine** • Setting clear goals and deadlines** • Developing ready solutions or products* • Providing mentoring/consulting*
Amplifying out an initiative	<p>Growing</p>	Does the initiative increase its impact range (in a similar context)?	<ul style="list-style-type: none"> • Reaching more people • Covering larger areas • Diversifying in portfolio • Covering larger share of market
	<p>Replicating</p>	Does the initiative replicate the existing initiative (in a dissimilar context)?	<ul style="list-style-type: none"> • Opening local groups, entities, franchise in other locations
	<p>Transferring</p>	Has the initiative been transferred to create a similar initiative (in a similar context)?	<ul style="list-style-type: none"> • Another independent initiative emerges with similar profile
	<p>Spreading</p>	Has the initiative spread principles or approaches to create a new initiative (in a dissimilar context)?	<ul style="list-style-type: none"> • Spreading principles/approaches to create a new initiative
Amplifying beyond an initiative	<p>Scaling up</p>	Does the initiative impact higher institutional levels?	<ul style="list-style-type: none"> • Influencing rules and laws** • Influencing policy** • Influencing dominant norms, customs, tradition, practices • Advocating/lobbying • Connecting across scales and engaging with key individuals
	<p>Scaling deep</p>	Does the initiative impact values or mind-sets?	<ul style="list-style-type: none"> • Increasing awareness • Fostering critical thinking** • Creating a community of like-minded people (networking) • Reconnecting people to nature • Empowering people in risk of social exclusion • Integrating different kinds of Knowledge

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Figure 3: Summary of the typology of amplification processes, analytical questions, and specific actions described by Lam et al., 2022 that the COBALT team applied to the initiatives in the Casco Bay Bioregional Learning Journey.

Launching Team Zosteria by Confronting Colonization and Weaving Both Indigenous and Western Wisdom

To establish lasting local engagement, Team Zosteria was officially launched at the 2022 Casco Bay Bioregional Learning Journey so that diverse participants can see linkages, cross-scale dynamics, traps, tipping points, governance dimensions, and transformations systems. The Bioregional Learning Journey itinerary required 10 months to develop and was hosted at the Southern Maine Community College (SMCC) in Portland, Maine. The COBALT Learning Journey began with a major focus on the realities of colonization and the near genocide of indigenous peoples. The Passamaquoddy Language Keeper and Chief of the Peskotomuhkati Nation were core participants of the Learning Journey. They explored the ramifications of the Doctrine of Discovery as the starting point for the Bioregional Learning Journey. According to the Legal Information Institute of the Cornell Law School, the doctrine of discovery refers to a principle in public international law under which, when a nation ‘discovers’ land, it directly acquires rights on that land. This doctrine arose when the European countries discovered non-European lands and therefore acquired special requests, such as property and sovereignty rights, on those lands. This principle disregards that the land is often already inhabited by another nation. This doctrine legitimized the colonization of lands outside of Europe.” (Cornell Law School, 2022).

By starting with such profound realities of brutal colonialism, the 100+ people engaged in the process of truth and reconciliation with wider cultural realities of the bioregion as a “starting point” for the Learning Journey. The five-day interactive journey further explored the intersection of food systems, wastewater treatment, and the current health and future trajectory of seagrass meadows in Casco Bay. COBALT Learning Journeys focus on the importance of stewardship action and good governance across many dimensions.

During the Casco Bay Learning Journey, we explored the inter-relationships between three very dynamic systems: food systems (both terrestrial and aquatic), water and wastewater treatment, and the critical importance of seagrass meadows as indicators of bioregional health. We did this through various experiences, learning about actions and initiatives, and creating transformative change. We reflected on these experiences through different perspectives, examining the issues and working together to understand better what actions these initiatives are taking to amplify their impact to realize transformative change. While amplification may seem evident and essential to sustainability transformations, the amplification process is a bit more complex. When embedded in a system that perpetuates injustice, erodes equity, and decreases ecosystem services, amplification can subvert transformative change (Lam et al., 2022). We chose a set of experiences that focus on ‘green shoots’ of transformative change that took into consideration the systems they are embedded in to consider dimensions of amplification that enhance justice, equity, and ecosystem regeneration. We discussed three specific amplification processes of speeding up (i.e., accelerating impact), scaling up (i.e., influencing higher institutional levels), and scaling deep (i.e., changing values and mindsets) as described by Lam et al., 2022

Principles That Guided The Learning Journey

Over 150 people experienced some aspects of the bioregional learning journey, and 29 people participated in the whole weeklong experience, bringing a diverse range of gender, ethnicity, expertise, age, and cultural perspectives to the table. Of the 29 participants, 100% committed to explicitly adhering to the following COBALT Principles for high-quality collaboration during a bioregional learning journey:

Principle 1: *Unity in Diversity of Perspectives.* We trust that we are all on this Learning Journey to serve a common purpose to see better the interrelationships of food systems, wastewater, and seagrass meadows in Casco Bay. In pursuing these goals, we must learn to see together and find strength in our different views and experiences. We honor such differences and share a group commitment to understanding perspectives, different welcome ways of interpreting the same problem, and working cooperatively toward deep listening that may offer opportunities for work ahead.

Principle 2: *Collective Learning.* By attending with curiosity, compassion, and courage, we advance collective learning and understanding beyond the ‘ego systems’ that easily dominate. Even with the best intentions, our words and actions may impact others in unintended, harmful ways. We show up willing to take responsibility and to be curious and compassionate with others. We also assume good intentions and listen for mutual understanding.

Principle 3: *Moving at the Speed of Trust.* High-performing learning networks are those characterized by high levels of trust and mutual vulnerability. We will become a learning community that is willing to share openly with one another. We acknowledge that exposure provides access to generative collective power for our communities. Yet, we also acknowledge that we operate in a world structured by often oppressive power dynamics and uneven distribution of risk and privilege. As such, we are mindful of these unconscious patterns and go forth “moving at the speed of trust,”; being careful to honor confidentiality and practice consent.

Principle 4: *With Gratitude.* When we openly share ideas and resources in a co-creative environment, it is easy for us to forget where an idea originated and go forth as if it is our own and run with it. This is especially true for those with more institutional power. By actively practicing gratitude – both by expressing our appreciation for a gift and attribution for those who gave it – we not only foster healthy relationships and build on our collective strengths, but we also experience abundance and other benefits of gratitude practices. This also includes awareness of the larger flow of conversation and which voices and perspectives may dominate. Help ensure that all voices, including your own, are encouraged to step up or step back as needed.

Examples of Participant and Sponsor Feedback

Feedback from participants was gathered to help contribute to the further development of learning journeys. The resulting quotes, by a Participant and a Sponsor, illustrate the profound impact of the Casco Bay Bioregional Learning Journey:

“The Casco Bay Learning Journey was an amazing expedition into the complex interfaces between the ocean and land food systems. This immersive experience connected all of us to the power and importance of seagrass, not only as a climate solution but as a holistic intervention with potential benefits that go far and beyond climate solutions. The bioregional learning journey was very complete from the perspective of ‘understanding’ with amazing food and vistas, camaraderie, and even stand-up comedy at the New England Ocean Cluster! One of the most transformative hands-on learning experiences I have ever experienced — real bioregional depth — BRAVO!”

– Federico Bellone, (UNFCCC Climate Champion, Lead for Food and Agricultural Systems and Learning Journey Participant).

“Too often we are meeting with the same people. COBALT and [COBALT Global Lead] Glenn Page have brought together an entirely new group of stakeholders. Everyone in the group was committed, experienced, and engaged, and importantly, they are from disciplines or sectors that don’t normally come together to talk. This allows for discussion about these issues in a way where we can share ideas and learnings and allows for synchronizing efforts.”

– Peter Handy (CEO of Bristol Seafood and sponsor of the event), in an [interview with Seafood Source](#)

Dimensions of Governance Response to Ecosystem Change

During the Bioregional Learning Journey, the nascent Team Zostera learned about and compiled a summary of the critical governance dimensions regarding response to ecosystem change that has important implications for the stewardship of seagrass meadows. Under the Clean Water Act (CWA), the federal Environmental Protection Agency (EPA) regulates ‘point sources’ of discharge into the waters covered by CWA, such as wastewater treatment plants, through the National Pollutant Discharge Elimination System (NDPES). The EPA works with state and local partners through a regulatory permitting process to apply technical guidelines and the permitted sites' limitations in the form of permit conditions. In Maine, the EPA has delegated the administration of the NDPES program to the Maine State Department of Environmental Protection.

Additionally, in 1990, Casco Bay was designated an ‘estuary of national significance’ and included in the EPA’s National Estuary Program, a 1987 program under CWA that protects nationally significant estuaries threatened by pollution, development, or overuse. This designation protects the Casco Bay estuary itself and allows for additional regulatory actions in the watersheds feeding it to meet water quality and other regulatory targets. In practice, the bioregion is protected by the following critical categories of legislative, quasi-legislative, and regulatory authorities:

- (1) CWA powers under navigable servitude doctrine including:
 - a. CWA municipal wastewater management targets;
 - b. the Submerged Aquatic Vegetation designation under CWA;
 - c. the Clean Water Rule;
 - d. Army Corps of Engineers rules for structures on navigable waters;
 - e. Biosolids regulation under CWA;
 - f. National pretreatment program standards under CWA; and,
 - g. Specific protections for Casco Bay under the National Estuary Program.
- (2) Other relevant federal regulatory schemes
 - a. Rivers and Harbors Act of 1899, Section 11; CWA § 404;
 - b. Federal market-based incentives, such as tax credits, to incentivize upstream pollutant reduction;
 - c. Endangered Species Act;
 - d. Mussels and Shellfish Control Scheme (USDA); and,
 - e. Fisheries management regulations.
- (3) Federal and state laws, treaties, court cases, and regulatory decisions concerning tribal sovereignty
- (4) Maine’s state definition of “Waters of the State,” which enables:
 - a. Maine DEP regulation of waters not covered by the above authorities;
 - b. Maine state regulations for subsurface wastewater management; and,
 - c. Establishment and empowerment of the Portland Water District.
- (5) Municipal and other local ordinances

Conclusion

With over 150 people attending events associated with the Bioregional Learning Journey and the Launch of Team Zostera in Casco Bay Gulf of Maine, the two events coupled have the potential to be a major social innovation. In Casco Bay, seagrass meadows enhance life below water. Still, this combined approach can transform how the community engages in the stewardship of a seagrass system that also improves life on land. The biodiversity dimensions within seagrass meadows, the ecological processes, and functions, and their relatively easy access also provide educational opportunities for the broader community. The Bioregional Learning Journey launched the initiative of Team Zostera by underscoring the importance of strong partnerships between communities, governments, nongovernmental organizations, and the private sector. Without this dual strategy, any social-ecological systems intervention, such as seagrass conservation and restoration, will not work effectively. Bioregional Learning Journeys have the potential to be increasingly more critical forms of social innovations for transformation.

While only a ‘seed’ of potential transformation, Team Zostera is committed to a holistic and science-based approach to mapping, monitoring, and restoring seagrass meadows in Casco Bay. The work requires broad community engagement, scaling deep to impact values and mindsets while integrating traditional ecological knowledge and wisdom associated with conserving seagrass meadows in the Gulf of Maine. The work will also require scaling up to impact higher institutional levels, including influencing policy, rules, and laws; shaping norms, customs, traditions, and practices; connecting across scales, and engaging with key individuals. Collectively, this process can be mapped as part of a governance response to ecosystem change by civil society and tracking the process and outcomes scaling deep and

scaling up. At a bioregional scale, community-based initiatives such as Team Zostera coupled with community-based experiences such as the bioregional learning journey may be a “sweet spot combination” for governance response to ecosystem change as we face the realities of the polycrisis.

Acknowledgments

The authors would like to thank the many participants, presenters, and sponsors of the Casco Bay Bioregional Learning Journey. The latter were pivotal in the launch of Team Zostera, including Bristol Seafood, Adapt Agency, Maine Standard Biofuels, Southern Maine Community College, The Osher Map Library of the University of Southern Maine, Seafood Literacy with Barton Seaver, Battery Steele Brewing & Cold River Distillery, Becky’s on Hobson’s Warf, Friends of Casco Bay, German Consulate General Boston, Wolfe’s Neck Center for Agriculture and the Environment, and Portland Paddles.

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