Chapter 18
A Variety of Approaches for Incorporating Community Outreach and Education in Oyster Reef Restoration Projects: Examples from the United States

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Abstract There is a growing body of science to suggest that there is a mutualistic relationship between habitat restoration projects and community volunteers and participation. Restoration projects and programs benefit from community participation via an added labor force and by fostering community investment and support, which is critical for project success and future restoration investments. Community participants gain physically and psychologically rewarding experiences from being a part of restoration projects, while fostering an environmental ethos. Oyster restoration serves as particularly ideal opportunities for engaging community volunteers

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and participation. These additional values provided to a community where oyster restoration is taking place is an important additive benefit that oyster restoration provides. The nature by which many oyster restoration projects are implemented offers satisfying opportunities for community members to participate in physically rewarding, hands-on work. Many oyster restoration programs are also ideal for incorporating student or citizen science, or broad-scale education and outreach. Despite the growing science to support the value of volunteer and community participation, coupled with increased oyster restoration, there is a paucity of information for project managers to turn-to for guidance as to how community participation can be built into oyster restoration projects and programs. This chapter presents five cases from the United States to demonstrate the broad, and often unique, opportunities to incorporate community and volunteer participation into oyster restoration.

Abstract in Chinese 摘要:越来越多的证据表明,生物栖息地恢复项目与社区相应活动和志愿者参与之间存在互惠关系。栖息地恢复项目得益于社区劳动力和资金支持,这对项目的成功和未来的栖息地恢复项目投资至关重要。参与者从这类项目中获得了生理和心理上的愉悦以及相应的项目经验,同时也培养了环境保护意识 。牡蛎礁恢复为社区和志愿者们参与活动提供了机会,由此带来的社会价值比恢复的生物量所带来的经济价值重要的多。许多牡蛎礁恢复项目的实施为社区成员提供了令人满意的收益,包括物质奖励和实践工作经验的积累。牡蛎礁恢复项目也是兼顾学生参与互动、公民科学素养培养、全民教育和拓展的良好方式。尽管越来越多的科学项目肯定了志愿者和社区参与越来越多牡蛎礁恢复的价值,但是项目管理人员却缺乏如何将社区参与纳入牡蛎礁恢复项目的经验和信息。本章介绍了五个来自美国的典型案例,介绍了如何将社区和志愿者与牡蛎礁恢复项目进行有机结合。

Keywords Oyster restoration · Volunteers · Community participation · Education

关键词 牡蛎礁恢复 • 志愿者 • 社区参与 • 教育

18.1 Introduction

Restoration practitioners, ecologists and researchers tend to cite the value of shellfish restoration projects in terms of the ecosystem services they provide (Coen et al. 1999; 2004, 2007; Coen and Luckenbach 2000; Brumbaugh et al. 2006; Grabowski and Peterson 2007; Beck et al. 2011; Grabowski et al. 2012). These ecological services are often cited as the primary motivation behind a restoration project. Rarely cited is the ability for shellfish, particularly oyster, restoration projects to serve as ideal opportunities for education and outreach to a variety of groups of citizens of all ages and abilities. Community involvement in restoration has been suggested to be a mechanism for reconnecting communities with their landscape, empowering citizenry, and fostering an environmental ethos (Leigh 2005; Lee and Hancock 2011), while providing the volunteers with a psychologically rewarding experience (Miles et al. 2000). Thus, these additional values provided to a community where

restoration is taking place is an important additive benefit that restoration can, and does, provide. Volunteers of ecological restoration projects become advocates for environmental restoration and their participation is motivated by a desire to learn more about nature, while engaging in a fun, social experience (Grese et al. 2000; Ryan et al. 2001).

In the United States, shellfish restoration occurs in every coastal state (e.g. www.projects.tnc.org/coastal and https://restoration.atlas.noaa.gov/src/html/index.html). In the United States, incorporating volunteers in shellfish restoration projects is often standard practice. For example, since 1995 the Office of Habitat Conservation, Restoration Center of the National Oceanic and Atmospheric Administration have implemented over 600 shellfish restoration projects, and documented 68,792 volunteers and over 393,000 volunteer hours through their Community-based Restoration Program (NOAA Restoration Center, personal communication). At these rates of volunteer engagement per restoration project, it's clear that shellfish restoration can change the landscape by returning lost ecological services, but maybe more importantly, shellfish restoration has the ability to transform, through education and hands-on participation in rebuilding nature, how local communities value and perceive the ecological landscape in their own backyards.

The method of how shellfish restoration projects are typically implemented makes them inherently interesting opportunities for volunteers, and serve as education and outreach opportunities. Many shellfish restoration projects tend to utilize implementation techniques that rely on a relatively substantial human workforce. For example, projects often involve collecting shell, bagging shell, or building reefs from consolidated or unconsolidated material that require many hands to lighten the work. These unique volunteer-labor opportunities are also efficient education opportunities since those involved in the labor will be eager to learn how their efforts are contributing to restoring habitat, and what the role of that habitat is in nature (Schroeder 2000; Ryan et al. 2001). Oyster shell collection efforts, perhaps especially, have a wide educational reach, often involving education and collection points at the locations at which the public widely interact with the oysters in their everyday life, such as at restaurants. That said, every restoration activity involving volunteers provides an opportunity to educate the public regarding the benefits of shellfish restoration, and has the added benefit of also fostering a strong sense of ownership and engagement in the volunteers which is valuable in its own right. Furthermore, because a large workforce is required in some instances, using volunteers is often incorporated into projects out of financial necessity (Propst et al. 2003). According to the Independent Sector (https://www.independentsector.org/volunteer_time) the value of volunteer time in 2015 was $23.56 per hour. Using a theoretical example of 35 volunteers and an average of 6 h per volunteer, a project could not only save approximately $5000 in labor, they can also designate these hours towards matching funds that many federal restoration grants require. The restoration project benefits from the volunteer workforce, while the project serves as an ideal and extremely effective platform for engaging and educating local citizens, of all ages, by offering a highly unique opportunity to literally get their hands dirty and become a part of restoring nature.

Experiencing nature through physical interactions encourages humans to understand and connect to the natural world, which is the foundation of environmental stewardship (Van der Werff et al. 2014). As our world is increasingly urbanized, combined with a continued increase in indoor technological activities, there is a growing subset of the human population, especially youth, whose health is at risk from the increasing separation from nature (Sandercock et al. 2010, 2011, 2012; Aggio et al. 2012). It is clear, however, from observing shellfish restoration projects in the U.S, that there is no shortage of volunteers, or willingness to participate. For example, in 2011 The Nature Conservancy organized 600 volunteers over a two-day event to construct the Helen Wood Park oyster restoration project in Mobile, Alabama (Fig. 18.1). In other words, the willingness of volunteers to participate in shellfish restoration demonstrates that the projects themselves serve as a superb opportunity for community engagement. While bivalve populations, particularly oysters, have been highly degraded in the U.S. and nearly extirpated in some locations (Beck et al. 2011; zu Ermgassen et al. 2012), a strong cultural connection still exists to these animals in most coastal communities. This cultural connection elicits a high degree of excitement and the desire to become a part of the restoration project in their community. The implementation method of most shellfish restoration projects, as mentioned above, typically involve out-door, in-water, hands-on work, which can lead to improved self-confidence, teamwork, and a sense of satisfaction from doing "important work" (Miles et al. 1998, 2000). Furthermore, a successful restoration project requires more than just ecological knowledge. Because most shellfish restoration projects happen in public waters, and often with public monies, community investment, and community support are critical to the overall success of a restoration project, as has been documented in other types of ecological restoration (Geist and

Fig. 18.1 Over 600 volunteers were organized in Mobile Alabama for the Helen Wood Park restoration project. (Photo: © Erika Nortemann/The Nature Conservancy)

Galatowitsch 1999). The community at large: individuals, local governments, businesses – all have a stake in the health of their local ecosystem. Involving them directly into the project through community outreach and education will generate more interest in and support for continuing additional restoration investments.

While there is a growing body of literature that evaluates the impacts and benefits of using volunteers in ecological restoration, there is a paucity of published information available to restoration practitioners and project managers describing the breadth of methods of how to incorporate community participation into shellfish projects. To serve that need, here we present five very different cases in the United States to provide examples of the variety of approaches that different shellfish restoration projects and programs have used to incorporate volunteer or community participation into their projects. This is clearly not meant to be an exhaustive list, as there are many noteworthy examples in the U.S. not mentioned here. These examples were chosen based on their uniquely different method of incorporating community participation. We are not attempting to comment on the quantitative or qualitative success or restoration output in terms of goods and services provided from the restoration, but rather describing how the projects each successfully incorporated community participation that provided benefits to both the restoration project, and the participants.

18.1.1 Case I – A Community Gives Back: The Role of Community in Restoring Oyster Habitat in the Charlotte Harbor Estuary, Punta Gorda Florida

Over the past century, the health of the oyster habitat in Florida's bays and estuaries has dramatically declined (Beck et al. 2011). An estimated 85–90% of oyster reefs have been lost in the Charlotte Harbor Estuary, and with it a corresponding loss in the ecosystem services the habitat once provided (Geselbracht et al. 2013; CHNEP 2013). The Nature Conservancy's (TNC) experience working on oyster restoration in Florida shows that, without exception, once a community understands the plight of oysters and the benefits oysters and their habitat offer, they are eager to be involved and help their community thrive. This is the case for the TNC-led restoration project -Trabue Harborwalk Oyster Habitat Project (Trabue) in the City of Punta Gorda – where the success of this project, and future restoration, depends on supportive, active, and committed volunteers throughout the Charlotte Harbor community.

The Trabue project blends science-based restoration with community engagement. The goal of the project is to test three different intertidal oyster restoration methods and purposefully engage volunteers in all phases of the restoration project to stimulate widespread community support to advance future oyster habitat restoration. Two of these methods, oyster mats and oyster bags, provide excellent opportunities for volunteer involvement, both in the construction and deployment in the

Fig. 18.2 Volunteers unload oyster bags in preparation for constructing an experimental reef in Charlotte Harbor, FL. (Photo: Ann Birch)

water (Fig. 18.2). Oyster bags are created by filling tube-shaped plastic netting with fossilized shell material and tied at both ends. The bags are approximately 40–60 cm in length and 4.5 km in weight, which makes the bags easy to lift by adults. Oyster mats are created using 36 individual oyster shells, drilled with one hole near the hinge, and secured to the mat with a cable tie. Each mat, made of aquaculture grade plastic 'mesh' material, is 40.64 cm^2 in size. This size is easy to construct, transport, and arrange during construction of reef beds. Oyster mats have been used in other Florida estuaries for intertidal, low profile reef restoration and have been shown to be successful in providing substrate for oyster larvae to attach and grow, but have also proven to be an ideal technique for volunteer participation, regardless of age or ability of the volunteer. When using oyster mats in restoration, volunteer help is indispensable to complete every stage of mat construction: from cutting the mat material into squares, bundling cable ties, drilling shells, attaching shells to the mat, and deploying the mats in the water to create a reef bed. Even very young children can help when guided by an adult. It's an opportunity for children and adults alike, who may never have seen an oyster, to handle the shell and learn about the oyster's role in an estuary. Making mats in the classroom serves as a quasi 'field trip' for teachers and their students, especially when budgets for travel are sparse. The teachers can weave the activity into their science lessons. Counting out shells and cable ties needed to attach the shell to the mat uses simple math. Attaching the shells to

the mat in a random pattern teaches visual skills. And the activity is dirty enough for the kids to have fun but clean enough for the classroom.

Over the course of 2 years (2014–2015), community groups and individuals volunteered their time and expertise in constructing both the materials and the reefs. TNC contracted with the Charlotte Harbor Aquatic Preserve, a state agency, to hire a part-time volunteer coordinator. The coordinator recruited volunteers of all ages from the local community to take part in the project. These included students from kindergarten to college, Girl and Boy Scouts, local fishing and boating clubs, Big Brothers and Big Sisters, non-profit organizations, a local CrossFit business, and realtor and construction companies. Local businesses offered their services that included the use of their forklifts and backhoes, transporting the material and delivery of shell material, and helping promote the project to the community. Private donors and foundations support this project financially, and oyster restoration in general, particularly because of the high level of community involvement. The coordinator either traveled to the groups or volunteers came to the location to construct the bags and mats. An educational presentation introducing the project, its partners, the importance of oysters, and what each of the participants can do to help was provided to each new group of volunteers as an orientation to the project. The presentation was followed by detailed instructions on how to properly construct an oyster mat or bag. In all, an estimated 1300 community volunteers contributed more than 3000 h over the course of 24 months. A total of 900 mats and 1600 oyster bags were constructed during 18 mat-making events and 11 oyster bagging events and deployed over the course of a few weeks.

Conducting science-based pre-and post-reef construction monitoring to determine if the project objectives are met is an essential part of any restoration project. Yet funding to cover monitoring costs can be difficult to find. Likewise, once a project is constructed there is typically little to no opportunity for continued volunteer involvement, even though most community volunteers have been 'hooked' by their experience with oyster restoration and want to stay involved. The Volunteer Oyster Habitat Monitoring Program (VOHMP) in the Charlotte Harbor estuary was established to fill these gaps. The Friends of the Charlotte Harbor Aquatic Preserve received a public grant in 2015 to start-up the VOHMP. A hired volunteer coordinator is responsible for training and organizing a cadre of citizen scientist volunteers to learn science techniques for monitoring the success of the restored reefs. TNC provides oversight of the program, engaging the volunteers ready to help monitor future oyster projects already being planned in the estuary by TNC and partners. In this way, the VOHMP provides a valuable service in an engaging way that keeps the community involved in the project over the long-term, and thus maintains continued investment into their local estuary and ecosystem.

The Trabue project has been embraced and adopted by the City of Punta Gorda and Charlotte Harbor community at large. Working with a community involves not only engaging volunteer citizens but also cultivating relationships and partnerships with the community's decision makers, government agencies, community organizations and businesses; these are the entities that know and care deeply about their community and invest in its quality of life. Investing the time to connect with people,

foster trust, show the value a restoration project offers to the community, and to thank them for the opportunity to be part of their community's vision are invaluable and essential ingredients of any project.

It's a rarity for citizens to have easily accessible and inexpensive opportunities to work with marine scientists and actively participate in restoring a marine species and habitat. Shallow water oyster restoration offers both; people of any age or ability can be involved with no other investment but their time, getting their hands dirty or feet wet alongside scientists. The Trabue project is a prime example of how citizens from all walks of life and varied interests joined together for a common cause to help make a difference in their community. TNC is committed to involving communities in restoration activities. Our oyster restoration projects generate a sense of ownership with many volunteers, which is exactly what we hope for; community support and stewardship for their project in their estuary.

To learn more about this project visit https://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/florida/explore/floridas-oyster-reef-restoration-program.xml.

18.1.2 Case II – Billion Oyster Project: Oyster Restoration Through Public Education in New York Harbor

The Billion Oyster Project (BOP) is based on the belief that direct engagement and interaction with wild animals and functioning ecosystems has a transformative effect on young people. As our world is increasingly urbanized there is a growing subset of our human population that is coming of age separate from nature. Simultaneously, efforts abound aimed at increasing student engagement in school to improve outcomes for millions of young people. Too often, these interventions exist in the vacuum of school without the real-world, hands-on implementation that leads to improved self-confidence, authentic problem solving, teamwork, and the belief that anyone and everyone has the power to effect change.

BOP is an attempt to brings these too often separate issues together. It has grown from the belief that if we are to continue living, working, teaching and learning on this planet we must fundamentally change how humans learn about and interact with nature. Our solution began in a high school Aquaculture class and has grown into a region wide initiative involving 70 restaurants, 65 schools, thousands of students, millions of oysters and a dozen active restoration and research sites.

New York Harbor is a massively degraded natural system, oysters are functionally extinct, and every time it rains billions of gallons of untreated household wastewater enter the system. The visibility is very low, often less than a foot. Currents are strong and commercial traffic is constant. To overcome these challenges, it is essential to engage the entire metropolitan community in the work of growing and restoring oysters. Community engagement has become central to the work of Billion Oyster Project. This work is executed through four core programs: Shell Collection, Reef Construction and Monitoring, Schools and Citizen Science and Public

Engagement. Each of these programs is designed to advance the work of growing and restoring oysters while simultaneously building a community of environmental stewards and advocates who will no longer stand for a polluted harbor that lacks its native keystone species.

The Project began at the New York Harbor School, founded in 2003 by Murray Fisher and a small group of passionate educators. The Harbor School aims to prepare students for college and careers by immersing them in New York City's maritime experience. Students at Harbor School first began interacting with oysters as part of an oyster gardening program led by the New York/New Jersey Baykeeper. For its first 7 years, Harbor School was located in Bushwick, Brooklyn, New York's most land locked neighborhood. It was not until 2010 that the school relocated to Governors Island, a stone's throw from lower Manhattan and right in the center of New York Harbor. This move allowed for the development of six Career and Technical Education Programs. Through these programs students have learned to SCUBA dive safely, raise oyster larvae, operate and maintain vessels, build and maintain commercial-scaled oyster nurseries, design underwater monitoring equipment and conduct long-term authentic research projects all in the murky, contaminated, fast moving waters of one of the busiest ports in the country (Fig. 18.3). For these students, Billion Oyster Project provides a complex problem that requires them to practice the skills they are learning and collaborate with their peers from other disciplines. These students are the primary workforce for the Reef Construction and Monitoring Program. Students in individual programs work to produce the raw materials of restoration and research. Together, they plan and execute complex installation and monitoring missions throughout the Harbor. These activities would

Fig. 18.3 Students in the New York Harbor School Aquaculture Program monitor oyster growth and survival at the Billion Oyster Project Community Reef site in Brooklyn Bridge Park. (Photo: Vonwong)

not be possible without the diverse expertise of students in various programs. They are joined by a growing group of industry professionals, divers, captains, welders, advocates, scientists and marine technicians. These BOP Professionals work alongside Harbor School teachers to facilitate the participation of students in all aspects of Reef Construction and Monitoring.

Harbor School students are now joined by students at 65 public middle and high schools and dozens of citizen scientists throughout the five boroughs of New York City. The work of the BOP Schools and Citizen Science Program is built around Oyster Restoration Stations. These small wire cages hold live oysters, settlement tiles and a trap for mobile invertebrates. These components are monitored separately to assess species diversity, succession, and oyster growth and survival. Partner schools contribute by monitoring these stations and supporting breeding colonies at various locations around the Harbor that add to the reproductive potential of the Harbor each spring. These Oyster Restoration Stations also serve as access points that bring math and science classes out of their buildings and down to the water's edge. Through this oyster restoration and research, students learn the science of the estuary and the math of aquaculture and ecosystem restoration. In this way, young people become active stewards of the Harbor. The data collected by these school groups forms a Harbor-wide oyster growth and survival study and a growing water quality data set that together help inform future restoration work. Each year 5000 new students participate in these programs.

A primary challenge of engaging communities and volunteers in the work of oyster restoration in New York Harbor is the physical lack of access to the water. Walk to the water's edge and most often you will be met by fences and steep or vertical bulkheads. There are, however, a few places where access is possible. The Public Engagement Program takes advantage of these access points and is now working with community groups, schools and volunteers in collaboration with the Reef Construction and Monitoring Program to build reefs in communities. These new reefs, for the first time, allow for volunteers and schools to regularly enter the water to participate directly in oyster restoration.

All the above programs require a consistent source of cured oyster shells. Because the oyster industry on the East Coast is dominated almost entirely by the restaurant half shell market, there is no available source of oyster shells besides those that are generated by restaurants. In New York City, a full 35 tons of oyster shells are generated every week. The vast majority of these are, unfortunately, landfilled. The Shell Collection Program currently operates at 70 restaurants, 5 days per week and averages four tons of shell per week. These shells are transferred to a location on Staten Island where they spend a year out of water before they can be returned to the Harbor.

To date, through the implantation of these four programs, BOP has collected over 180 tonnes (400,000 pounds) of shells, engaged over 600 volunteers on Governors Island and at community reef sites and worked with over 10,000 students. All of the 20 million oysters restored to date have been grown and installed by high school students. We are just at the beginning of our journey towards a recovered New York Harbor, and still a long way from understanding what the best strategies are for

scaling up our restoration efforts. However, if we are able to restore a sustainable oyster population and build a program that allows teachers and students to be successful in their work of restoring the natural environment, then we will have created a model that is replicable in any city in the world that happens to exist on or near a degraded natural system.

18.1.3 Case III – Building an Engaged Community Program Through Shell Recycling: Creating a Win-Win-Win Strategy

There is widespread interest by lawmakers, environmental groups, commercial growers and the oyster-eating public to have more oysters in the Chesapeake Bay. In the late 1800s, Maryland used to supply the nation with oysters, however, due to historical overfishing, disease, silt and sediments and poor water quality, the oyster population has been reduced to a fraction of its historical peak.

Interest in rebuilding the Maryland's iconic shellfish industry began in the early 1990s through a state-sponsored Oyster Roundtable and the formation of a Maryland-based non-profit, the Oyster Recovery Partnership (ORP) that was dedicated to the implementation of reef restoration. An Environmental Impact Statement completed in 2008 further evaluated oyster restoration alternatives and together with strategies recommended by a state-mandated Oyster Advisory Commission culminated in the large-scale recovery and aquaculture efforts underway a decade later. Scientific advancements and increased production capacity are demonstrating that oyster reefs can be successfully restored on a large scale. Harris Creek, a tributary on Maryland's Eastern shore, was the first of ten tributaries to be restored in the Chesapeake Bay with 350 acres of new oyster reefs.

Oyster shell was found to be most effective and most accepted material for reef recovery efforts – whether to harden bottom or used as substrate for natural or hatchery produced larvae to attach to. Due to a limited availability of shell from traditional sources and rising acquisition costs, the Oyster Recovery Partnership was forced to explore other solutions for its restoration efforts. At the suggestion from local Baltimore oyster shuckers, ORP created the Shell Recycling Alliance and one of the first large-scale, urban-based shell recycling programs in the country. The program launched with two dozen participating restaurants and collected a few thousand bushels in its first year. Six years later, the program has collected more than 100,000 bushels (3500 tons), enough shell to plant 450 million oyster spat (Fig. 18.4). The program now accounts for 25% of the organization's annual shell needs, has grown to 300 active restaurants in the mid-Atlantic region at a cheaper cost that procuring and transporting shell through traditional sources. The average cost to recycle a bushel of shell is $2.70 as compared to $3.50 to $4.75 being spent to purchase and deliver shucked shell from processors to the organization's primary shell processing facility in Cambridge, MD.

Fig. 18.4 Freshly shucked oyster shells from local mid-Atlantic restaurants are collected by the Oyster Recovery Partnership's shell recycling staff and taken to a nearby landfill in Grasonville, MD where it is aged for 1 year before being used for restoration. (Photo: Stephan Abel)

When ORP first began the recycling program, they had no idea as to how popular the program would become. They found that while the general public cares about the environment and health of the Chesapeake Bay, many do not have the time to volunteer or support a specific cause. The value of this program is therefore that it is easy to participate in, and a win for everyone. The public can engage simply by eating oysters, the restaurants reduce waste costs while supporting a local sustainable fishing industry and the non-profit benefits by getting much needed shell coupled with increased public awareness.

Initially, ORP treated the shell recycling program as a logistics business, much like a waste management business, and were fortunate in that they were able to secure private and government grant funds to operate the program. They experimented with various strategies to optimize the city collection route and hauling methodologies. The organization assumed that restaurants would opt to participate in the program in order to reduce their waste removal costs while benefiting from a State-sponsored shell recycling tax credit. However, the tax credit which offers $5 for every bushel recycled has been utilized by only a few dozen restaurants and individuals. While cost savings do play a role in adopting the service, the primary motivator appears to be that the restaurants themselves are eager to do their part by becoming environmental stewards and it often ties into their menu of serving locally sourced, fresh food. When the program first started, ORP staff would regularly go to restaurants and meet with their manager or chef to encourage them to recycle

their shell. Now that the program has matured, restaurants proactively contact ORP directly to become members.

When restaurants become Shell Recycling Alliance members, they are provided with a "welcome aboard" package that includes various marketing materials to educate their patrons on why oyster reefs are important and why oyster shell is needed. ORP also approached local County landfills and waste stations and placed dumpsters and trash cans at 70 locations around the state so that residents could also contribute by recycling their used shell.

Over time the restaurants have become more engaged, and many now regularly promote their efforts via social media and/or proactively host an oyster fest 'fundraiser' with proceeds going to ORP. This has proven to be an unanticipated added value of the program. Other partners, like Flying Dog Brewery, now produce an oyster stout and provide a percentage of proceeds back to the Oyster Recovery Partnership for its oyster restoration programs. As the program has gained traction, the media has in turn started to cover the effort more, resulting in the public becoming more educated and engaged. Today, when ORP supports a community event, adults and students ask how oyster restoration is doing, offer to solicit new restaurants for the recycling program, inquire how they can personally recycle their shell or offer to volunteer. This has clearly proven to be a fantastic way to both further the restoration of oysters in the Chesapeake Bay, and to engage and educate the general public about these very efforts.

For a summary of other shell recycling projects around the Country, visit http://oysterrecovery.org/

18.1.4 Case IV – Conservations Corps and Community Engagement: Creating Conservationists with Jobs

Franklin D. Roosevelt created the Civilian Conservation Corps in 1933 to provide jobs for unskilled laborers, who were put to work conserving the land and natural resources owned by Federal, State and Local Governments. While Job Corps and other Government work programs still exist today, many conservation and workforce development corps are managed by non-profit organizations and range in size from thousands of Corpsmembers to one small corps of 12 members or less. Corps crews take on a variety of project types that range from disaster relief, to ecosystem restoration, to community engagement, and much more.

Many Conservation Corps (CC) pay their crewmembers stipends at or near minimum wage and will often offer full or partial tuition for secondary education opportunities after the member completes a timed service period. While the wages are low, joining a CC often leads members to higher positions within the CC, or better outside job opportunities since CC's typically require members to participate in regular training programs that cover soft and hard skills. Of the many societal sectors that they operate, CC's are well-adapted and critical tools for community

engagement. Most CC programs are developed locally, by diverse stakeholders who have identified a population of at-risk, young adults, and/or minority groups that are willing and able to work, yet have little economic resources. Many crewmembers originate from the low-income communities in which their CC's operate, and often have never had the opportunity to experience nature and conservation in a meaningful way.

Additionally, CC's engage communities through the projects they undertake. Project types range widely and many have CC's working great distances from human habitation and camping in remote wilderness areas for extended periods of time. Many CC projects, however, have crewmembers working alongside community members and volunteers to build oyster reefs along the coast (Fig. 18.5), providing aid to a disaster-struck community, or going door-to-door to educate residents about risks and how to respond to them. CC's are limber and flexible enough to drop what they are doing and provide rapid assistance as they are needed. Disaster relief, for example gives CC's opportunities for crews to not only do the heavy lifting, including clearing roads and using chainsaws on fallen trees, but also to cook and provide fresh water for displaced residents, or educate them about disaster preparedness or how to receive disaster assistance.

Conservation Corps have been used in oyster restoration efforts on the Atlantic Coast, and in particularly, the Chesapeake Bay area for many years. CC's that

Fig. 18.5 The Conservation Corps of the Forgotten Coast in Apalachicola, Florida bagging oyster shells to be used in a living shoreline. (Photo: Holden Foley)

operate in the Gulf of Mexico, however are just beginning to work on oyster projects as funding from the Deepwater Horizon Oil Spill is released for restoration efforts. An example is a Conservation Corps 2015–2017 initiative in Apalachicola, FL where a partnership with the Corps Network, a local workforce training NGO, and The Nature Conservancy (TNC), worked together to help the Conservation Corps of the Forgotten Coast hire and sustain Corpsmembers for 2 years.

All the Corpsmembers were recruited from areas around Apalachicola, where most families fall into low-to-moderate income levels. The crewmembers on this CC grew up in Apalachicola, and have had a deep understanding of the role that oysters play in their lives and in the health of the Bay for most of their lives, but in many cases this was the first experience that many had with oyster restoration and regulation.

In 2016, the Conservation Corps of the Forgotten Coast, located in Apalachicola, Florida, helped with the construction of a 450-foot long oyster reef living shoreline and have worked with the Florida Fish and Wildlife at oyster monitoring stations to track harvest volumes and oyster sizes. For the living shoreline project, the 8-member crew worked in the Apalachicola National Estuary Research Reserve to improve oyster habitat by placing a lime rock foundation of 50 tons of riprap, which was topped with several layers of bagged oyster shell. Over 900 labor hours were invested in the project. Crew members plan to return to this site in 2017 and plant marsh grass behind the shoreline structure. This CC also worked for the State of Florida's Fish and Wildlife at their oyster monitoring stations where they helped track harvest volumes and ensured that the product meets the minimum of 3 inches in size. The CC is on schedule to have served 4500 h by the completion of the project.

The CC crew in Apalachicola has a unique opportunity to not only conduct oyster restoration in the community that they live for the purpose of ecosystem restoration, but they are also engaged in projects that give them exposure to commercial oyster fishers and the regulatory agencies that manage the oyster resources.

To learn more about a Conservation Corps on the Gulf of Mexico Coast, visit http://www.nature.org/ourinitiatives/regions/northamerica/areas/gulfofmexico/restoration/gulf-of-mexico-stream-assessments.xml.

18.1.5 Case V – Olympia Oyster Restoration in Fidalgo Bay, Washington: How a Single Phone Call Catalyzed the Growth of Community-Based Oyster Restoration in Puget Sound, WA

Olympia oyster restoration in Fidalgo Bay, Washington is an example of how place-based restoration builds community, in unexpected and ever-expanding ways. From its inception, the project has been both an outgrowth of and a catalyzer of

community outreach, with community engagement growing in perfect step with a resurgence of the native oyster population.

Olympia oyster restoration in Fidalgo Bay began with a phone call from a local community member. In 2001, an article in the Seattle Post-Intelligencer (*"Rare Shellfish is Sought for Spawning,"* May 30, 2001) reported on Puget Sound Restoration Fund's search for Olympia oysters (the West Coast's only native oyster) in Samish Bay, WA. The article prompted a reader, and local community member, to call and report an Olympia oyster sighting in Fidalgo Bay. The caller provided very specific instructions as to where the native oyster (previously unreported in Fidalgo Bay) could be found. At the time, Puget Sound Restoration Fund (PSRF) was trying to identify restoration sites to help the state of Washington implement an Olympia oyster stock rebuilding plan. PSRF enlisted the help of Bill Taylor, a local business owner of Taylor Shellfish whose family had been growing Olympia oysters for generations, to verify the oyster sighting. Until the call from the community member, though, Fidalgo Bay was not recognized as a potential location to find existing Olympia oysters, or even as a location to support rebuilding efforts. Unexpectedly, Bill spotted perfect habitat conditions for Olympia oysters (but no oysters) during the 2001 trip to Fidalgo Bay and this provided the basis for Olympia oyster seeding efforts that began in Fidalgo Bay in 2002. PSRF partnered with a variety of private, tribal, municipal and nonprofit partners to move forward with

Fig. 18.6 Community volunteers counting and measuring Olympia oyster seed prior to planting in north Fidalgo Bay, Washington. (Photo: Paul Dinnel)

Olympia oyster restoration in Fidalgo Bay. In the beginning, there was just a small nucleus of people involved in the project. One of the first partners to jump on board was the Skagit County Marine Resources Committee (MRC) (a volunteer-based Committee). The MRC recruited volunteers to implement a range of restoration actions, including spreading oyster seed, monitoring the growing population, and assessing natural recruitment to the site (Fig. 18.6). State and private business cooperation was essential from the outset. Washington Department of Fish & Wildlife guided efforts to ensure consistency with their state stock rebuilding plan, and Taylor Shellfish produced seed oysters required for rebuilding oyster stocks. Since then, the effort has attracted a growing galaxy of volunteers, researchers, Tribes, nonprofits, and government agencies. As of 2016, the effort has resulted in an estimated 3.1 million Olympia oysters covering approximately 3.5 acres of habitat. In addition, the Fidalgo Bay population serves as an important broodstock source, enabling the production of hatchery seed for other areas of North Puget Sound where Olympia oyster populations have plummeted from thousands of acres of oysters in the early 1900s to just a few small remnant populations.

From 2001 to 2016, over 25 organizations and over 130 volunteers have participated in various aspects of Olympia oyster research and restoration in Fidalgo Bay. Activities span genetic analysis, tideland authorization, broodstock collection, seed production and spreading, field monitoring, shell spreading, chemical fingerprint analysis, and all of the enabling funding that makes this work possible. The role of the community, particularly groups like Skagit County MRC, has helped Olympia oyster restoration efforts spread to many other locations across Puget Sound and the state of WA.

The story of Fidalgo Bay is a perfect example of building community around resources. The story began with a single phone call from an interested, knowledgeable resident – which led to burgeoning interest and a growing collaboration of non-governmental, state governmental, private industry and community volunteers. As Olympia oysters have been recruiting to Fidalgo Bay over the last 15 years, so too, people have been recruiting to Fidalgo Bay to study and monitor the growing population and habitat, and strengthen our human connections to shellfish resources. And although we couldn't have expected any of this, we shouldn't be at all surprised. Human communities have been attaching themselves to coastal resources for longer than any of us can remember.

To learn more about PSRF, visit: http://restorationfund.org

Information about Skagit MRC and their Olympia oyster work can be found at: http://www.skagitmrc.org/about-us/ (see "Projects").

18.2 Conclusion

Community outreach and education through shellfish restoration can come in many different varieties and forms – and there is no one-size-fits-all formula. The method of engaging citizens and offering outreach and education opportunities should be

designed on a case-by-case basis to serve the needs of the individual project, as well as those citizens willing to participate in the project.

There is a growing body scientific literature that documents the motivations of volunteers and the physical and psychological benefits they derive from their participation in ecological restoration (e.g. Miles et al. 1998, 2000; Grese et al. 2000; Schroeder 2000; Ryan et al. 2001; Leigh 2005; Clewell and Aronson 2006; Lee and Hancock 2011; Jacobson et al. 2012). As well as evidence that suggests restoration projects benefit from community participation. It has been suggested that scientific knowledge alone cannot ensure success of an ecological restoration project, and ongoing human participation and commitment are critical to ensuring the long-term success and sustainability of restoration projects (Geist and Galatowitsch 1999). Others suggest that without public support and participation, governments may be unable to generate the political support to undertake programmatic restoration (Clewell and Aronson 2006).

Restoring oyster habitat has become an accepted practice along U.S. coasts, with projects increasing both in number and in scale. As the practice of oyster restoration matures in the U.S., so too does the complexity of projects. To date, there is no evidence to suggest this has reduced the rate of community participation in oyster restoration projects. For example, the currently largest oyster restoration project in the world, Harris Creek, Virginia restored 350 acres of habitat and seeded over 2 billion oysters, while utilizing volunteers in shell planting, shell recycling and other aspects of the project. As projects increase in cost, size and scale and incorporate more engineers and professional contractors, it is unclear whether this mutualistic relationship between the project and community will remain. However, one thing remains clear from observing decades of oyster restoration projects and volunteers in the United States: If you build it, they will come.

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