rewild

granton

EDUCATION

PLACEMAKING *COMMUNITY*

GATEWAY TO REWILDING

ESALA–THE UNIVERSITY OF EDINBURGH, 2021

URBAN STRATEGIES & DESIGN PROJECT B

LILLY ALLEN

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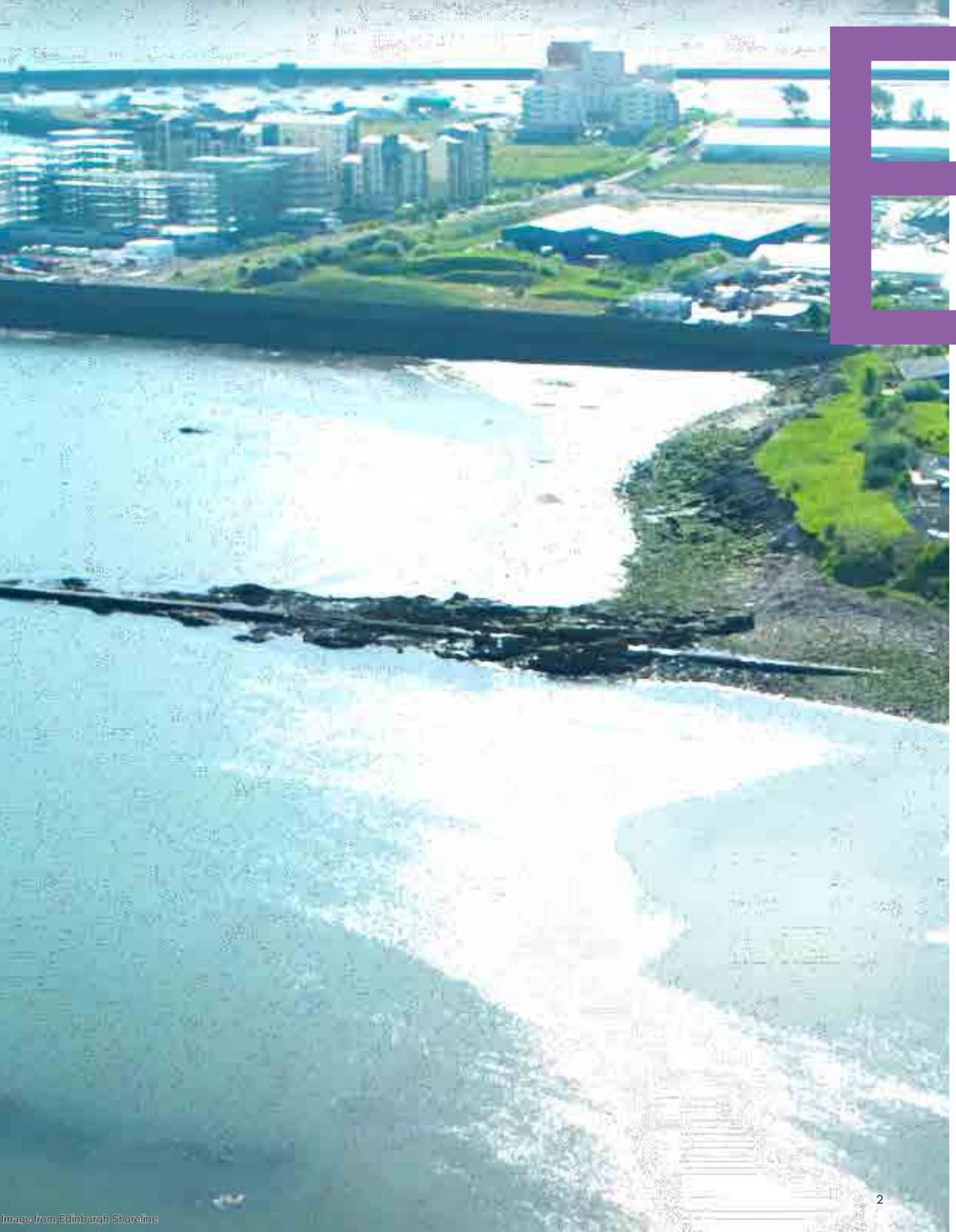


Image from Edinburgh Shoreline

Enlivened by resilience

EXECUTIVE SUMMARY

Granton's history is marked by disconnection and resource exploitation, as remote landlords wrested resources from the community but it is also enlivened by resilience and reinvention. Now, as Granton enters a period of renewal, that same energy can be devoted to creative repair and rewilding, reconnecting the community to its coastal environment, to the city, and to the larger ecological and cultural possibilities inherent in its legacy. Though this creative repair work will take time, resources, and interdisciplinary action, investing now will ultimately benefit existing and future residents alike.

Nature-based solutions available in Granton present chances for local distinctiveness while reconnecting the community to the Firth of Forth and its own history. Linking these solutions, which can also address mounting threats from climate change, to the community can amplify the effects, deepen community knowledge, and set the groundwork for building an engaged citizenry. This project's focus is on one critical set of such interventions - reintroducing oyster reefs to the Firth in and around Granton's waterways, in a project marked by sustained community engagement. This intervention both addresses practical issues, like flooding and water quality, and deepens community engagement through themed interventions including art, educational connections, and community visioning that can provide a lasting sense of place. The reintroduction of oysters in Granton, both re-wilding its exploited coastline and providing new economic and educational opportunities rooted in the community, is the keystone connection that motivates this paper.

Oyster reintroduction can tie Granton to its history. Oysters are intwined with culture, interwoven with economic and social history, and provide ecosystem benefits. As far back as the 13th century, and as recently as the 1900s, oysters have been central to the Granton / New Haven area. Oysters were a mainstay on local tables and were the economic driver behind many pay checks. The reefs they created were critical habitats for fish and other sea creatures which make up the delicate ecosystem of the Firth of Forth. Oysters' massive filtration ability cleaned the water from the ever-growing cities.

Tragically, oysters have been extinct in the Firth of Forth since the 1920s. Granton's coastline was part of the story of their loss, as industrial extraction converted a natural coast to one marked by a massive, constructed harbour and an industrial gas plant, with even Granton's distinctive castle quarried away from its headland. Oysters were swept away in the fossil-fuelled boom

Granton is entering a period of renewal and regeneration

Image taken by author

of the 1900s. But even as the consequences of that boom come due, in a fragmented community confronted by sea level rise, it's time to face the future by looking back to ecological history. Granton is strained by flooding, increasing storm surges, ecosystem collapse and water quality issues. These physical complications will only become more severe in the future under climate change. Oysters are the sustainable solution to all of them. Oyster reefs create natural breakwaters which address flooding from storm surges and large storms, clean an enormous volume of water per day, and build complex reefs which support complex ecosystems which drives the fishing economy.

Citizens of Granton love and appreciate their access to nature, as discussed in Project A. Wild swimming is increasing in popularity, cycle rides are common, and people feel that nature is what sets Granton apart from other neighbourhoods. Listening to the community and finding connections between their organic interests, development, and sustainability is critical. Building that into the future planning decisions will respect Granton's unique sense of place.

Addressing these diverse requirements is a complex problem, but one scientists and community organizers are working on. Both have landed on reintroducing oysters as a successful strategy to address many of the physical problems facing the Firth of Forth. What they need is support from the government and a planning department canny enough to draw the many links between this hidden, subtidal species and the broader community. Drawing these links is best done from the urban strategy framework because of the interdisciplinary, forward looking, connective nature the planning framework. Urban designers can help rejuvenate communities organically by listening to ideas from the community, then seeing links with the built environment and the cultural infrastructure.

Through an urban design lens, I therefore propose a network of oyster reintroduction ideas which are surrounded by ways to connect oysters to Granton with history, community, ecology, futurism, and education. This strategy takes an urban acupuncture approach, suggesting many diverse treatments that focus on integrating the community and realizing the many benefits to health and wellbeing which blue infrastructure provides. The range of treatments spans from soft-touch, small scale to large scale, from educational programming to guided walks. All of them build on oysters as a nature-based solution to today's problems and invite citizens to interact with the Firth of Forth, deepen their local knowledge and sense of place, and to get healthy while addressing the pressing environmental problems of our time.

Image credit Atkin, 2011

KEY STRATEGY

The key strategy I propose focuses upon nature-based solutions, especially oyster restoration. Incorporating oysters into the current planning framework would help address storm surge, a big problem for the harbour, and create connections with the community by incorporating community engagement into oyster restoration. Integrating the mostly affluent harbour community and the existing community in Granton will create a more vibrant and cohesive sense of place. Four physical suggestions for the built environment are outlined below, they seek to fill gaps in the plan from the frame of oyster rewilding. These suggestions are expanded on below.

1) Harbour oyster nursery. Incorporating an oyster nursery at the harbour is a successful approach to rewilding oysters more generally, and building local community and education. Currently, the harbour is planned to hold 400 berths which could successfully host an oyster nursery alongside the boats. This approach to oyster rewilding has been done by the Scottish charity Seawilding at Ardfern Yacht Centre in Lochgilphead. This project worked with the marina to hang oyster housing under harbour pontoons.

2) Living breakwaters. The numerous flooding problems highlighted above can begin to be solved by oyster reefs, though that takes time to grow. Subtidal hills absorb wave and erosion energy which help address flodding and coastal erosion. Planning now will help alleviate future issues, and should be considered.

Figure 1, photo credit Edinburgh Marina

3) Biogenic building materials. There are many locations in the GCDL and along the shore of the GWDF where shoreline protection is prescribed. This type of bank protection, as seen in figure taken from the GCDL plan is fraught with negative environmental consequences. Concrete slabs and erosion protection like what is shown in figure 1 discourage human interaction with the coastline and prevent marine organisms from establishing communities. This limits wide ecological diversity and connection with the coast.

A first step should be reconsidering and modelling where this protection is absolutely needed. Once the minimum length of this severe bank protection is established, biogenic concrete should be used. Biogenic concrete promotes growth of marine organisms by providing speciality moulding topography to promote establishment. Engineers would be involved in substituting conventional building materials for biogenic ones, scientists would help locate successful ecological locations, and citizen scientists and higher grade level classrooms would monitor effectiveness.

Image credit Edinburgh-marina.com, 2019

4) Nature Centre. The Old Gunpower Store building (pictured left) which sits on the Middle Pier of Granton harbour would make an excellent nature and community centre. The developer behind the Marina development, Kevin Fawcett has offered to restore the building then return it to the community for a yet-to-be determined purpose. He said "The building is of significant historical importance to the local and wider community and has been allowed to deteriorate for decades; its renovation is long overdue. Once the various Edinburgh Marina developments at Granton are complete our ambition is for the building to be adopted for use by the local community." (Urban Realm, 2018). The nature centre would be the anchor for the rewilding project, allowing community members to see science and engineering up close, and providing scientists and engineers easy access to oyster nurseries and living breakwaters.

Replenishing locationally extinct oysters will take careful planning, community support, patience, and time. Oyster populations that once flourished in the Firth of Forth created robust ecological reefs which protected shorelines from erosion, dampened flooding from storm surges, and kept water clean. Eradicating them has brought increased flooding decreased ecological complexity, and increased water quality issues. Increasing urbanization magnifies stressors on the Forth in a variety of way such as increased contamination and sediment starvation. Happily, oysters can mitigate these stressors while actively educating and engaging the community. Figure 2 on the following page outlines oyster focused strategies, and figure 6 maps community interventions.

Image from Edinburgh Shoreline

These benefits are rooted in the ecological history and current community values of Granton. For centuries, Granton and the surrounding areas were economically supported by oyster fishing. The Firth of Forth once had some of the largest oyster beds in Europe, stretching for miles. Sadly, oysters have been locationally extinct for over a century - indeed, the very industrial and fishing history that made Granton what it is today wound up contributing to the loss of its oysters. When oysters were plentiful, they protected the shore from erosion, cleaned the water, created habitat for marine life, and dampened storm surges. These benefits are needed now more than ever because of stressors from climate change and increased urbanization. Rebuilding oyster reefs in the Firth of Forth is at the heart of this strategy as a successful nature-based solution to problems the region faces. Connecting oysters to urban regeneration is central to the proposed treatments that build off this nature-based solution.

This strategy begins with two approaches for oyster rewilding 1) an oyster nursery in Granton harbour and 2) living breakwaters off the coast. Branching from oyster rewilding come many treatments designed to be the connective tissue between these subtidal sessile creatures and the community of Granton. Each of these is expanded on in the key strategy.

Education	Physical improvements	Community involvement	Placemaking
Curriculum engagement	Harbour oyster nursery	Citizen science	Mirror transect
Local history	Living breakwaters	Nature walks	Themed play structures
In-classroom oysters	Biogenic building materials	Art installations	Themed cycle racks
Field trip opportunities	Nature centre	Informational signs	Public exercise equipment

These proposed treatments emerge organically from an examination of Granton's history, current community values, and stressors from urbanization. Current planning documents miss these opportunities by overly focusing on new development that is disconnected from Granton's history and environment, rather than on what the community values and on climate change resilience that's needed. Reimagining the coast from a border where water meets land to a complex ecosystem, as this paper proposes, creates opportunities to reconnect communities to their history while benefiting the ecosystem. Rather than treating the coast as a thin boundary between two separate and disconnected systems, this analysis views the undersea landscape adjacent to Granton as a part of the community - and a part that can revitalize the whole. The vision I offer begins in the subtidal area of the Firth of Forth and extends equally far onto land, reconnecting the aquatic environment to the shore and beyond. This approach is grounded in history as well as current theory of urban design and multiple conversations with community members.

Understanding the current community environment is foundational to this strategy. Elevating community needs is crucial to delivering an organic, locally grounded, strategy.

Oyster rewilding builds the groundwork for many connective strategies that blend the boundary between Granton and the Firth of Forth, deepen community, enhance education, and increase health. The basis for this understanding is expanded in the Community Roots section of this proposal below, and is supported by current research into health and wellbeing.

Strategies I propose are helpful additions to the two current local planning documents, the Granton Central Development Limited plan and Granton Waterfront Development Framework. Often, these documents prematurely stop when they should be looking to the coast to expand on community development and create a sense of place. The Local Planning Environment section examines gaps in these plans and offers solutions in line with rewilding. Details and theory behind this strategy are discussed in depth in the Key Strategy section.

The Implementation section analyses how oyster rewilding fits within the national governance and regulatory framework. After demonstrating

the concept's feasibility from a broad regulatory and planning viewpoint, I further prove its practicality by analysing habitat needs for oyster rewilding, including a general overview of the oyster lifecycle and sizable contribution to water quality.

After establishing both policy feasibility and ecological suitability, I then focus on three case studies, chosen to highlight different successful approaches to implementation. Each case study has strengths, though none of them frame this strategy through an urban design lens. This strategy thus makes a unique contribution. Recommended next steps follow with a rough timeline. This work will take years to implement and decades to build a sustainable oyster population. Laying the groundwork now coincides well with current local development plans, and national policy guidance

Building on the community perspective, I interviewed nine experts related to this strategy. They ranged from the head of Wardie Bay Beachwatcher, a prominent and successful local advocacy group, to experts in oyster restoration in Scotland and Europe, as well as a University of Edinburgh professor of geology who incorporates Wardie Bay into his field trips because of the unique palaeontology. Though these different conversations appear near the end of the report, they were conducted in the beginning of the research, helping to frame all the strategies as I developed them. A brief literature review with a list of further resources follows, providing references for those interested and additional theoretical grounding.

This strategy aims to provide a cohesive proposal that is grounded in theory, fills in gaps left by current plans, and builds off the ideas and strengths of the existing community.

COMMUNITY ROOTS

When considering community engagement, developers, planners, and governments need to be flexible enough to see how disparate community interests and ideas interact with the current framework. In planning theory, understanding public perception, and working with the existing community to develop areas together is imperative. Often, the difficulty is finding people who will engage with the planning process and ensuring enough people and the right voices are at the table. The goal of participatory planning is to make sure the community is participating. As outlined in the Scottish Government's planning policy guide revised December 2020. The spirt of this guidance is to engage with local communities' ideas about their space and urban form. Building and seeing connections between typically siloed areas is key to helping deepen existing community and locally focused placemaking.

Rewilding Granton through oyster restoration, consistent with this view, is a community-created concept. Local community leaders are currently drafting a proposal to begin oyster reintroduction in the Firth of Forth. Their initial proposal (which I have been asked not to describe in more detail as it remains in a very early development stage) hopes to secure funding to "[e]nabl[e] coastal communities to restore and sustainably manage their local natural marine heritage". This strategy is a grassroots idea, with broad community support, and is hopefully implementable. Many agencies and charities are supportive.

What is missing from this important and developing community work, is the link with the local plans, including the Granton Waterfront Development Framework and Granton Central Developments Limited plan. The onus of drawing this connection should not be on charity and volunteer groups. Rather, the onus should be on the Council and developers to listen to the community and help them integrate their vision, when feasible, into a broader planning framework. This strategy attempts to help fill in this gap and do just that, by building off the community plan through an urban design lens to create links with the urban fabric.

HARBOUR OYSTER NURSERY AND LIVING BREAKWATERS

Figure 3 created by author

The Granton marina is well suited as an oyster nursery. Creating multiple oyster housings there based on the Seawilding approach can begin rewilding. Each housing can hold around 100 juvenile oysters and cost less than 200 to purchase. Operation and maintenance are minimal, requiring usually 2 person days per month, but provide an excellent opportunity for local schools and residents interested in citizen science.

Harbour pontoons are excellent hosts for oyster nurseries because they offer easy monitoring access while remaining secure from vandalism. They also offer strategic partnerships between the marina and boat owners and restorationists. This is a win/win for both parties: Oysters clean the water helping mitigate water quality impacts from increased development and marina traffic and allow restorationists deep and accessible locations to grow oysters. For instance, another Scottish oyster effort, the Ardfern project has successfully engaged slip renters in sponsoring cages at very reasonable costs (£130 for the first year and £60 thereafter) which cover equipment and maintenance. In return, they can be listed on a community board.

To be sure, the harbour isn't the only possible location along the Granton shore for oyster nurseries and might be complicated by the presence of harmful chemicals. Adding a few other locations during the early stages of the project will add data to help identify the most successful location for oyster nurseries, as outlined in figure 3.

Wherever they are reared, after 3-6 months, when oysters have grown into adults, they should be relocated to living breakwaters to settle permanently, slowly building up populations all along the shore, and providing continuing mitigation of coastal flooding.

Living breakwaters are subtidal hills that calm water before it reaches the shore, absorbing energy from large waves, and reducing their size. Living breakwaters increase benefits from oyster restoration by adding new advantages like ecosystem engineering, coastal resiliency, and improved water quality filtration. Building a subtidal reef will reduce flooding risks from storm surges while encouraging sedimentation, which strengthens the shore. Subtidal reefs lower wave velocity from storm surges, which reduces risk to coastal communities and investments. This strategy has been adapted for coastal communities across the western world, from New York State to the Netherlands. Building living breakwaters near the coast, but outside of navigation channels, as seen in figure 3 will strategically jump start further reef building allowing engineers and scientists to choose where to place it for maximum coastal benefit.

This nature-based solution would be a marked improvement from engineered alternatives. Due to the loss of natural oyster reefs, engineers seek to "protect" and "stabilize" the dry portion of the coast with rip-rap and large concrete slabs, creating an unwelcoming physical barrier between the water and the land. In reimagining the coastline, these barriers can be softened and the relationship between the water and the land becomes more nuanced and natural. Removing this unwelcoming barrier creates many more opportunities

local inspiration


Image credit Firth of Forth Lobster Hatchery 2021

A similar concept has been successfully implemented in North Berwick at the Firth of Forth Lobster Hatchery. This hatchery began as one demonstration and education container full of a few lobsters but has grown into a full blown hatchery which supports the fishing industry. This successful model is a partnership between the hatchery, schools, and fishermen who bring the hatchery lobsters to breed. Though peer reviewed research on their impact is thin, it is likely that this hatchery and the partnerships with the fisherman has prevented local extinction and heavily contributed to the sustainable population of lobsters in North Berwick. This local example shows that building a partnership between fishermen, conservationists, and the community is a successful approach to conservation, and can be adapted for native oysters. However, this model should be taken a step further and considered through an urban planning lens, as this project attempts for Granton. This perspective will allow a broader community view with a multidisciplinary approach which can expand benefits.


Image credit Firth of Forth Lobster Hatchery 2021

"Hatch, rear, and return to the sea"

Image taken by author

Image taken by author

for engagement with the shore which have deep education, health and wellbeing benefits, as well as ecosystem advantages. Coastal erosion is also an issue along the Granton shoreline and can be addressed with living breakwaters. Under increasing pressure from urbanization and impervious surfaces like streets and roofs, rain runoff will increase. As this water runs to the shore, it gathers particles where possible to transport to the shore causing erosion. Water which cannot move sediment is called "hungry water" and maintains this energy. With increased energy the water erodes more particles further into the Firth. In Granton, this can mean faster erosion from the land. Under natural systems particles would be deposited at the beach, but with hungry water, they get transported further. Building a living breakwater would provide a backstop to this erosion by creating a place where sediment instead would fall out and can be reclaimed. The breakwaters would further slow or reverse this process by blocking large waves, which also have erosional properties, pulling sediment deeper into the Firth. Again, living breakwaters can address this problem by dissipating wave energy so less sediment gets eroded, and more falls out for reclamation.

Image credit European Native Oyster Habitat Restoration Handbook

Environmental benefits would be abundant as well. Many organisms besides oysters benefit from living breakwaters. By designing these breakwaters in the likeness of native oyster reefs, then repopulating with native oysters, designers would be reintroducing an extinct habitat type. Other filter feeders such as the fan worm (Serpula vermicularis), mussels, clams, and various aquatic plants thrive in the high energy zone a living breakwater creates. Other species, such as fish, enjoy the rest and food source living breakwaters provide. The differing energy regions create space for different species to get their needs met. Living breakwaters not only provide different energy environments for different species, they also provide different topologies and depths, increasing biodiversity ecosystem needs again. Exploring partnerships between local fishermen, and fishing groups, could engage the broader region. Educating and publicizing how living breakwaters contribute to larger fishery populations may encourage fishermen to financially contribute to this concept.

Living breakwaters should be constructed from ECOncrete, an environmentally innovative concrete designed specifically to encourage marine growth. The concrete is cast in bio-enhancing shapes to promote marine growth designed with the right-sized nooks for local species in mind. The cement mixture is speciality engineered to have a 30% smaller carbon footprint than regular cement. By encouraging marine species to grow, this also encourages natural carbon sequestration from the numerous shells and other biogenic accumulation. ECOncrete is available through a local UK supplier Moore Concrete which delivers UK-wide. This material should be considered for all GCDL projects.

Building living breakwaters from ECOncrete will kickstart oyster replenishment and will have positive effects, but once oysters are able to establish and construct their own reefs even larger benefits will be realized. Substantial water quality benefits from oysters' native filtration capacity. One adult oyster can filter around 240 litres of water per day, removing pollutants such as nitrite, nitrates, sediment, and harmful chemicals. As filtration continues, water clarity increases and light penetrates further into the water column, promoting recovery of aquatic plants like sea grass. This ecosystem repair-based approach allows for benefits well beyond oysters alone.

As oyster populations increase on the living breakwaters, the reef will shift from a rock-type reef to a biogenic reef which promotes biodiversity. Biogenic reefs are reefs constructed from organisms, typically made from oysters, mussels, or tubeworms

in the UK. These reefs are strong but delicate and collect sediments in the cracks, enhancing the habitat value for other species, and encouraging aquatic plants. As shelled species multiply, they also act as a carbon sink, moving CO2 from the ocean into shells. (This interaction is rather complex, and should not be the main driver for restoration, but is an added benefit).

Ultimately, oyster restoration can set off a virtuous cycle, creating conditions which will steadily enhance aquatic life near Granton, while protecting the community. But this ecological intervention is only the beginning of this proposal; to bridge gaps in current plans and strengthen the ecosystem/community connection, there is much interconnected work to be done, as the next section discusses.

COMMUNITY CONNECTIONS

Linking this regenerative nature-based solution to the community offers a plethora of further benefits. Developing community connections would greatly benefit from support from the government, both at a local level (the Council) and a national level (NatureScott). Planners at the local level have the expertise to bridge disciplinary conversations while appropriately focusing on the broader community and their identity. Acknowledging the vast physical and ecological benefits from oyster rewilding, next I examine how planning can add benefits into the community through collaboration, the additions to the built environment, education, and engagement.

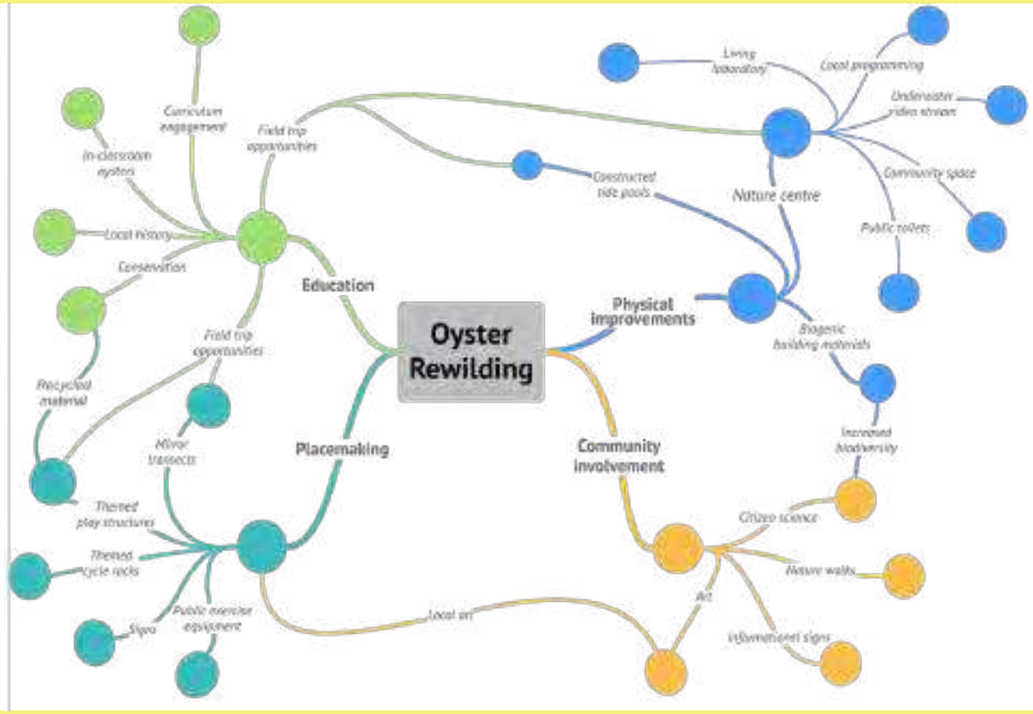


Figure 4 created by author

Community connections have been divided into four umbrella categories for reconnecting Granton with oysters: education, placemaking, physical improvements, and community involvement as shown in figure 4. These categories are interconnected, and build off each other. This figure illustrates many of the main connections between different categories, but, for clarity does not show them all. For example, citizen science would connect well with education, and placemaking would work well around the nature centre.

To weave these connections into the community, a range of treatments are available at a range of efforts. Figure 5 illustrates size of the impact for each treatment and an estimate of the effort. Impact is a rough measure of how many people, and at what level, people will be engaged with a proposed treatment. Effort considers construction (or development), implementation, operation, and maintenance for each treatment. Text colour corresponds to treatment categories listed in figure 4. Some treatments, such as in-classroom oysters, are relatively high effort with medium impact because each installation will only be in one classroom for about one week and be relatively high effort to set up and take down. Other treatments, such as a nature centre require higher effort but higher impact. Running a nature centre is an ongoing community project and takes continued resources for operation and maintenance, beyond construction. However, thoughtfully creating this space can provide enormous benefits to the community if designed correctly by allowing for community meeting rooms, integration with classrooms, public bathrooms and other necessities. Some treatments are relatively low effort but relatively low impact, like nature walks because they are simple to implement, require minimum operation and maintenance, but likely don't engage as many members of the community Below, I'll give more detail about connecting treatments organized by category.

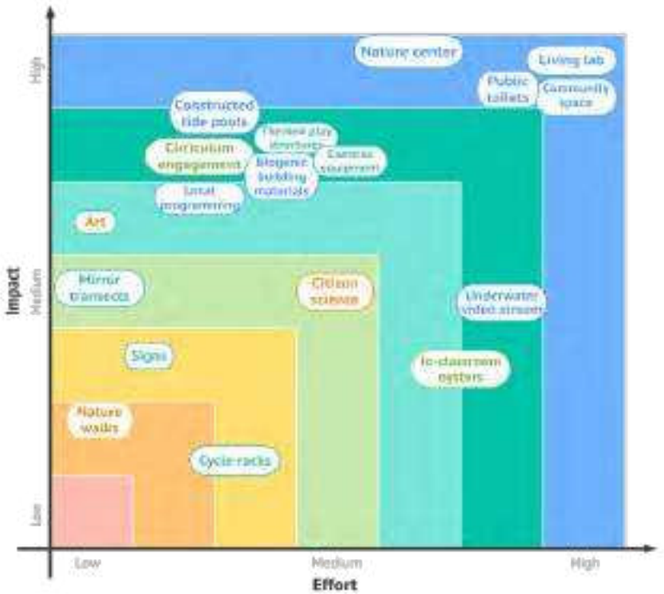


Figure 5 created by author

EDUCATION

Integrating oysters into existing education curriculum is important to restoring community knowledge, history, science, and instilling a sense of place. There are nine schools in Granton, seven of which are primary schools. This is an excellent age to engage students in science, nature, conservation as well as begin lessons on local history. Because of the rich history oysters have in Granton, it is easy to meet many curriculum requirements through the lens of oysters in an engaging and age-appropriate way.

Many oyster restoration charities are already developing curriculum for schools. Native Oyster Restoration Alliance (NORA) is a European group of scientists, agencies, charities, and organizations focused on restoring native oyster habitat. They have a subcommittee which is developing curriculum for schools which will meet local requirements, aimed at age groups from 7-14 years old and 14+. They are actively meeting and hope to have materials created and translated in the next few years. Even better, the Zoological Society of London (ZSL) has worked with local UK oyster charities to develop curriculum which is currently available here, and included in the references. This material is created for students aged 8-11 and 11-14 and focused on providing knowledge of native oysters and their ecosystem benefits, marine habitat and ocean literacy, conservation.

Building off this strong foundation, curriculum could be developed to tie into local history and field trips to the nature centre, constructed tide pools, or mirror paths. Provided the right resources, teachers could even bring oysters into their classroom for about a week at a time, to watch them feed and learn about their life cycle. This classroom work could also be built into the educational programming at the nature centre. To implement this, stakeholders involved would include the education subgroup of NORA, local schools, the nature centre, environmental education specialists to integrate curriculum with the nature centre, and local historians to further ground the curriculum in local history.

Oysters as Storytellers

Image credit Science Photo Library

Oyster shells are made from calcium carbonate, $CaCO_3$, which degrades slowly – making them literal and metaphorical repositories of history. This quality adds an intriguing lens to the project, allowing it to connect Granton back to millions of years of time – doubtless an intriguing point for school children and residents. This section gives a flavour of lessons students and citizens can learn.

Image credit Pinterest, n.d.

The average native oyster shell shell takes centuries years decompose under natural circumstances. They are also an old species, dating back to the Miocene (23 million years ago to 5 million years ago, conveniently named by a Scotsman, Charles Lyell). The Miocene is an era of time full of creatures similar to ones we see today, such as relatives of elephants and pigs, and some strangers like the Glyptodon which looks like a cross between a balloon and an armadillo; or the Pachyrukhos which is a cross between a cat and a rabbit.

Oysters are constantly growing, much like trees, which make them one of the perfect recorders of chemical history. As they grow, they write the chemistry of the environment in their shells, tracking ocean conditions, climate, glaciation, and other environmental factors. Through carbon dating oyster shells have been instrumental in helping scientists understand ocean conditions back to the Miocene. The methodical recording of information, preserved by their slow decomposition rate, and cemented in the fossil record, makes oysters poetic historians. Their sessile nature embodies "grow where you're planted" and creates a hyper local history.

There are seven species of oysters in the world, but only Ostrea edulis is native to Scotland, and for many centuries they were very abundant. Recordings from the 13th century suggest that oysters were widely consumed by common people in the Edinburgh area. The first record of oyster stocks declining was in the 16th century mostly due to commercial European exports. The Town Council of Edinburgh was perhaps the first government entity to regulate oyster fishing in 1660. They prohibited export to European countries to protect the oyster reefs but, unfortunately, this was not enough to prevent depletion of oysters in the Firth of Forth. By 1768 catches had fallen to around 500 per boat per day, down from a few thousand. When population recovered, restrictions were lifted, beginning a cycle of depletion and restoration, regulation and deregulation. By the late 1800's oyster stocks had rebounded.

Photo credit Wellcome Collection

During the early 19th century oysters supported a profitable fishery. The map to the right, an excerpt from Olsen's (1883) Piscatorial Atlas of the North Sea, shows how prominent oyster populations were in 1883. Archival research done by Ruth H. Thurstana et al. helps infer a scientific baseline for biogenic populations of oysters. In 1800, Granton was owned by Walter Francis Montagu Douglas Scott, 5th Duke of Buccleuch and 7th Duke of Queensberry and and J.D. Boswall of Wardie, Esq. He also owned the oyster fishing rights. Geopolitically, the estate fell within the Parish of St. Cuthbert's (Urban Project A). During this time, the Firth of Forth was the most abundant oyster fishery in Scotland (Thurstana et al. 2013). As Thurstana et al. describes:

"oyster beds that extended 20 miles (Philpots 1891) and were up to 6 miles wide (Fulton 1896). At the beginning of the 19th century Forth oyster beds were so productive that one boat could frequently drag up 6,000 oysters in one day (Fishery Board for Scotland 1890). Boats from Preston-pans on the south coast of the Firth of Forth would ship 30–40,000 oysters to Newcastle 3 or 4 times during the season (Sinclair's Statistical Account of Scotland, taken from Fishery Board for Scotland 1890)."

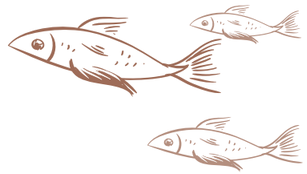
This abundance did not last forever. By the early 1900's oysters were declining again. Dragnets and dredging were the primary methods used in oyster collection and his method of fishing has always been incredibly environmentally destructive, destroying delicate underwater ecosystems. Oysters create reefs similar to corals, and, like corals, they create complex and biologically diverse habitat for many species. As fishermen dredged the reefs, they would destroy the reefs, destroying habitat for many species. The last oysters commercially fished on the Firth were in 1920, and surveys conducted in 1957 and again in 1996 did not find any oysters.

PHYSICAL IMPROVEMENTS

Four key physical improvements ground this category: a nature centre, constructed tide pools, broad use of biogenic building materials in coastal development, and oyster nursery. Together, these improvements would strengthen the connection between the community and oysters, and improve the general ecosystem in the area. Biogenic building materials and oyster nursery were discussed in detail earlier, this section will focus on the nature center and constructed tide pools. Collaboration between scientists, ecologists, education experts and the public will help make the most of these recommendations.

1) Nature Centre: Locating the nature centre on the pier in the Old Gunpower Store building would create a community anchor in a popular and accessible area. This building dates back to 1842 and is a B-listed historic warehouse which is registered as a Building at Risk. Revitalizing this historic building to host the rewilding project would fit well. The nature centre focusing on environmental education should:

- host a living laboratory with creatures like starfish and sea urchins which do well in teaching environments
- host a multipurpose community space to further community engagement
- provide changing exhibits focused on community history and events
- feature exhibits on oysters and their benefits to the ecosystem and physical environment
- stream live videos for underwater cameras showcasing life under the water
- provide public restroom facilities



The nature centre would be the anchor for the rewilding project, allowing community members to see science and engineering up close, and providing scientists and engineers easy access to oyster nurseries and living breakwaters.

Working with education specialists to develop exhibits in line with curriculum requirements will boost education programming by providing on site context as well as hands on experience. This will also allow easier curriculum assimilation, providing a destination for classroom fieldtrips. Integrating bathroom facilities will help teachers plan longer and more varied trips where students can become immersed in lessons, as well as benefit the public.

One successful local model is the Scottish Seabird Centre in North Berwick. This centre is run by a conservation and education charity and offers exhibits and seasonal boat tours. Entrance tickets cost £11.95 for adults and £7.95 for children, and annual membership is £30. North Berwick is an affluent town and comparable ticket prices in Granton would exclude much of the local community, which is unacceptable. The Granton Oyster Centre therefore should be supported by national and regional museums, a small added tax on marina slips, donations, outside fundraising, and grants. Fundraising ideas abound with nature centres, and ideas such as sponsoring an oyster would work well. The Firth of Forth Lobster Hatchery has a similar 'sponsor a lobster' fundraising practice. Grants are unstable funding sources and would be paired with scientists who are answering specific questions; grants would not cover operation and maintenance of the centre. However, grants will be somewhat easier to secure with an established environmental study site and research housing such as the Granton Oyster Centre.

Many stakeholders would be involved in the nature centre, some playing a supportive fiduciary role such as the National Museum, and perhaps the National Lottery Community Fund which has provided funding for similar projects around the nation. Other stakeholders would play a development role, such as education specialists who understand local curriculum requirements, combine with scientists who can help inform the curriculum. Local volunteers and charity organizations would help staff the centre and provide suggestions for local engagement and activities. The Council would provide a coordination role, helping fill in gaps and deliver the concept .

2) Constructed tide pools: Building inviting and changing landscapes encourages citizens to engage with the landscape. Kevin Lynch, the pioneering urban designer understood the environment through legibility. By inviting citizens to interact with the coast and explore the tidal zone constructed tide pools are increasing the legibility of the coast; legible spaces are remembered spaces, and interesting spaces. By inviting citizens to interact with the coast these tide pools are inviting citizens to engage with their landscape in a new way.

Exploring tide pools is an economically equal activity where citizens don't engage in commerce to create community. Activities like this are rare, and should be prioritized, especially in deprived communities. Thoughtfully designing tide pools to create safe walking areas at different depths is a unique opportunity to engage students in hands on marine learning. Though it is unlikely people will find oysters in these tide pools (because they are subtidal) increasing marine literacy is valuable.

A constructed tide pool will not be out of place in Granton. Many areas up and down the coast have extensive tide pools. Most tide pools in this area are formed by lava flow thousands of years ago. It is by chance which areas have igneous outcroppings along the shore. There are a few outcroppings along the coast of the Granton Framework Area, and adding some strategic ones is unlikely to have negative environmental consequences.

Constructed tide pools provide habitat for marine species. Long-term studies are still underway, but existing data suggests constructed tide pools are better habitat than conventional cement or sand. Ecologists and scientists would collaborate with planners from the Council and community to find the most suitable location for this treatment. Education experts would be consulted on creating engaging and educational signs for the public.

Image created by author

PLACEMAKING

This proposal is supported by a broad body of research emphasizing the value of deeply connecting people to their coastlines. Recent research confirms that there are numerous health and wellbeing benefits associated with water and aquatic environments (blue health citation). Visiting blue spaces, such as the coastline or rivers have substantial mental and physical health benefits (Elliott et al., 2020 Research Note: Residential distance and recreational visits to coastal and inland blue spaces in eighteen countries). Researchers have measured a positive relationship between visiting blue spaces once a week and better mental health. A study done by BlueHealth, a pan-European research initiative focused on understanding benefits to health wellbeing from living near water, has found that people living withing 5km of the coast had better mental health outcomes than those living farther away.

Notably, the Granton area, including its most deprived areas Pilton and Muirhouse, are within this distance. However, the current quality of the coast is low, and access is very limited. In principle, the GWDF creates high-quality access to blue space, but further steps, like those proposed here, should be taken to ensure local residents feel welcome. Providing blue health and wellbeing benefits to the most deprived community will have the biggest effect on their health and wellbeing. Steps should be taken to ensure these communities are welcomed to high quality coastal areas.

Dr Mathew White, an Environmental psychologist at University of Exeter, highlights the importance of spending time at blue spaces like the coast. He spoke with BBC Radio 4 on July 1, 2020 saying:

> "it seems to be the margins where water meets green space. It's the banks, it's the beaches, these are the places that seem to confer the most benefits and one of the crucial things is you know we find three pathways really, the first is physical activity when we're thinking about positive outcomes of mental health spending time by the water is associate with more physical activity, longer walks for example than other types of physical activity so people are exercising longer. The one that really gets me every time is that blue spaces as social spaces…. Most people meet up friends and family and they go play on the beach, have picnics on the banks. Now we all know how important strong social bonds are for mental health and bleu spaces are great spaces are a great social leveller. The nation data says things like woodlands promote mental health but predominantly used by the middle class. By contrast, blue spaces are used by all sectors of society and given the rates of poor mental health are highest in poorer communities than this make blue spaces even more important for helping reduce inequalities in mental health." (White and Garrett, 2020).

Given the deep benefits people get from being connected the water, achieving them should be a top priority. The Granton Waterfront Framework is making good progress here, however further effort should be focused on inviting these communities to the coast. With this research in mind, below are urban acupuncture approaches aimed at engaging the most deprived communities in the Granton area with the hopes of encouraging them to engage and spend time at the coast. Drawing people from these communities to the coast to gain these benefits should a key strategy in the framework. Many of the benefits of the coast are related to the time and frequency people spend there. Lowering barriers to engagement with the coastline and offering a variety of engagement opportunities will have increased benefits. Reimagining the coastline from a border with the Firth of Forth to a dynamic, interesting, and free district will encourage residents to spend time there which will have positive mental and physical health outcomes.

Below are four suggestions focused on placemaking, with the goal of drawing under-served residents to the coast to improve their health and wellbeing while engaging them with the coast.

1) Mirror Transects: Subtidal and intertidal zones are full of history and life, but are often inaccessible because they are submerged. Granton is very lucky to have a large tidal range paired with a relatively flat tidal shelf. Together, this creates a lot of area in the intertidal zone. A visitor walking a line perpendicular to the shore into the Firth of Forth would discover lots of interesting creatures, local history, geology, and marine processes. Mirroring this transect back onto land enables people to learn and engage with these different concepts on a similar imaginary walk on land, and refines their knowledge of marine space in relation to their neighbourhood. Interesting markers on these paths could be represented in a large variety of ways, both large and small. Some of these transects intersect with schools, which provide further opportunities for engagement.

Photo taken by author

These transects would be drawn strategically in the region, intersecting with schools and other well-loved places, and revealing what lies off the coast the same distance these places are inland. This playful intervention would further integrate the Firth within the community, illuminating their history, environment, and neighbourhood. Interventions would vary widely. Some would be children and community drawings, paintings, and sculpture, like the image to the left. This kid's sculpture is mounted in North Queensferry. Interactive sculpture, like this one, could mimic the tactile experience of starfish, and artistic water fountains could showcase the water quality benefits of oysters, Poetry could be carved into sidewalks, just as it is in Old Town. Examples of small interventions are found around the region and aligning them in this way would strategically incorporate knowledge and interest in the shore, where large health benefits can be realized. The goal of this intervention is to remind residents how close they are to the coast while educating them about the marine environment.

These transects can be visited by people, groups, or classrooms, intentionally or through serindipity. Providing teachers more tangible opportunities to engage students in local history and their environment while getting outside the classroom is beneficial. Schools near transects could walk along the paths on their way to the coast, engaging with the exhibits. Different experiences and treatments would welcome different learning styles helping to engage all students.

Creating mirror transects is a simple and cost-effective way to integrate and educate the most deprived communities about local place-based history and the environment. Inviting community members to explore and imagine a different place, or this place in a different way subtly sparks creativity. Highlighting rewilding efforts to bring oysters back from extinction opens the creative door for residents to further consider what else can change. Imagining the future is a creative and inspirational act. Providing subtle cues for residents to dream of their larger environmental setting and history embeds imagination and possibility in a daily walk, offering chances for discovery and reflection. Planners from the Council would work with local artists, school children, historians, and marine ecologists to implement this treatment.

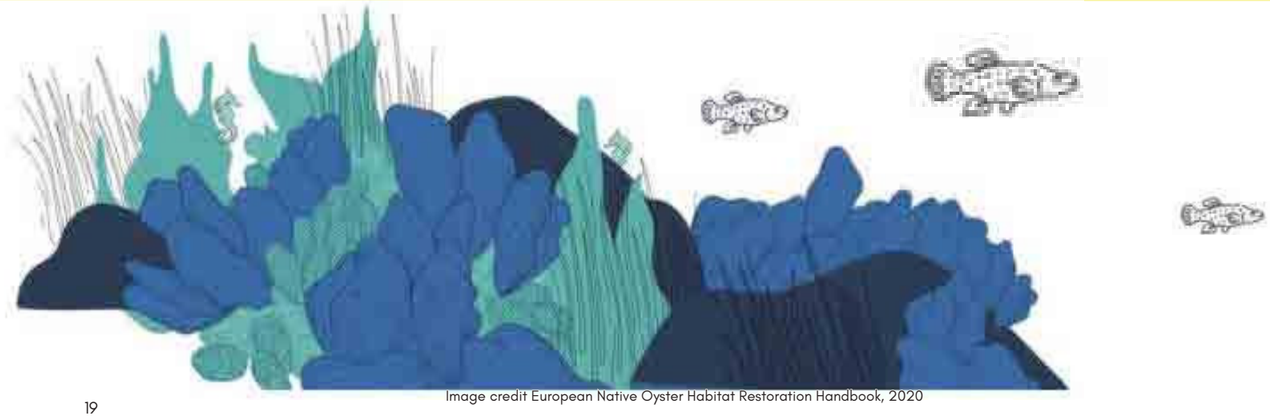


Image credit European Native Oyster Habitat Restoration Handbook, 2020

2) Themed cycle racks: Integrating art into everyday objects and street furniture creates more unique and memorable spaces. Engaging local artists in this work uplifts them, and provides a more vibrant and local sense of place. These should be provided near areas of interest such as: green space, business, nightlife, and tram stops. Each cycle rack should be unique and relate to the local area. For example, along the coast there could be racks shaped like oysters or boats. There are opportunities to partner with business to share some of the financial cost associated with themed cycle racks, such as coffee shops, dentists, and churches, as seen here. These functional designs add art to everyday landscapes. The Council would work with and facilitate discussions between local artists and business to implement this treatment.


Image credit Gina Rossi


Image credit Gina Rossi

3) Public exercise equipment: In line with extending the amount of time people spend at the coast, providing a variety of activities along the waterfront will further this cause. Providing public exercise equipment is a successful global strategy to encourage citizen to be active. Working with local artists to help decorate the equipment will further the health benefits while deepening Granton's identity.

4) Themed play structures: In coastal towns along the Firth, playground designers have gone out of their way to incorporate aspects of local history and life into playgrounds, and the same should be done here. For example, small playground along the coast in Dunbar, much of the play equipment is made of large ropes giving it the feeling of a ship and connecting it to the ocean, and the regions identity as a coastal community. In Granton, this could be taken a step further by not only designing local play structures around an environmental theme, but could be focused on using recycled materials, especially plastics as building materials. Building conservation and stewardship into themed play structures would add an educational element and community identity to an everyday element.

COMMUNITY INVOLVEMENT

Building community involvement into rewilding creates a more sustainable program with more successful outcomes for the environment. Welcoming the community to engage directly with nearly every aspect of the strategy is encourages a sense of ownership in the strategy. The overall goal of this strategy is to address real challenges the coast is facing with sustainable nature-based solutions that have health and wellbeing benefits for current and future residents. Community involvement is a cornerstone of the entire strategy.

Thankfully, the Granton area is already rich with an engaged community. Local groups like WardieBay Beachwatch, WardieBay Residents, Social Bite homeless village, Granton Hub, Friends of Granton Castle Walled Garden, North Edinburgh Arts, and Thriving Green Spaces City of Edinburgh Council, among others have been actively engaging in the community. Through my interviews, I've learned that WardieBay Beachwatch has joined with the Royal Botanical Garden and Edinburgh Shoreline to propose oyster rewilding in the Granton area - a proposal which this project is intended to support and enhance. Embracing organic community led ideas and finding ways to support and implement them enables urban designers take a less prescriptive role in planning. Research shows that community driven ideas have more public support and are more sustainable (Minkler et al. 2003). Granton's existing community and propensity for nature make it well suited for community lead rewilding, and Project A highlighted how residents valued nature.

Below are two of many recommendations to deepen community involvement and understanding of place. Other recomendations include informational signes and public art.

1) Citizen science: Citizen science is a multi-benefit solution which builds community while deepening scientific data. This is science, often data collection, that is conducted by everyday citizens and often students. This effort enables public participation in science and educates the community about the scientific method and the subject of investigation. Public participation in scientific research allows for larger scale projects, more diverse perspectives, and better communication between scientists and the community.


Image credit Billion Oyster Project

In this strategy, citizen science would be used to monitor oyster nurseries, once established, and species diversity on the living breakwaters. This work pairs well with current practices in the community. WardieBay Beachwatch began organizing a quarterly trash survey and collection day on the beach; they were so successful that soon the community picked up trash of their own accord so often that the formal collection days were almost redundant. They still organize trash services, a type of citizen science. Since then, they have grown their stewardship to include many successful campaigns such as #WardieBay4BathingWater and #SaveOurSeals. Their #WardieBay4BathingWater campaign gathered over 1,500 signatures and was unanimously granted swimming water status for the bay at the Edinburgh Council April 22, 2021 (Transport and Environment Committee, 2021). This designation will change some the maintenance responsibility for cleaning the beach from volunteers to the Scottish government.

Citizen science also goes hand in hand with education. Monitoring oyster nurseries in the marina is a task well suited for students or volunteers. Danny Renton of Seawilding offered his help in arranging this.

2) Nature walks: The current Granton Waterfront Development Framework calls for much green space. Incorporating existing community ideas and projects, such as the Granton Walled Castle Garden into this green space will uplift existing local projects. The Granton Walled Castle Garden is a community-led project close to the coast aimed at protecting the valuable nature and heritage of this site. They are an active group and have developed robust plans for the garden, which would fit well with the overall Waterfront Development Framework. The heritage which has been researched and cultivated here would work well being brought outside the garden as appropriate.

Working with local experts to highlight local history, botany, and ecology helps deepen community and decrease social isolation. Creating volunteer lead nature walks allows experts to showcase their knowledge and hard work, while sharing it with the community. Nature walks would be donation based to allow everyone from the community to join. This provides many regularly scheduled events for community interaction. Nature walks could be expanded to neighbourhood walks by working with the Granton Hub, an organization that works with underserved community members. Often, these community organizations are experts in their clientele and have creative and strategic approaches to community engagement. For example, a different Hub located in neighbouring deprived neighbourhood has helped residents form community work groups where they can participate in the economy in ways that will be successful for them. One such idea is, perhaps consistent with revitalized coastal paths and connections, a bicycle repair shop where many members of the community learn bicycle repair skills which are flexible, low hours and requiring few tools. One idea which might work well here are tours given from the local perspective, where residents who are already experts of their area provide tours of the local history. One charity, Invisible Cities, is doing this in Edinburgh. Working with them to broaden their guides to the Granton area could increase the benefit to both Granton and the tour guides.

Summation on Interventions and Integration. Nearly all of the above treatments are directly aimed at improving integration and trying to create spaces for social integration. Enabling interactions between community members and residents of different socio-economic backgrounds helps curb social stratification (J. Ruiz-Tagle, 2003) by creating opportunities for interaction outside of an economic frame. Constructed tide pools, a free nature centre, and public exercise equipment place people of all economic backgrounds on equal footing. Exploring a constructed tide pool, turns residents, young and old, rich and poor into people who are learning and discovering, and gives people common ground to build a connection. These personal and casual interactions become building blocks of a socially integrated society. One with less "imaginary construction of otherness" and less denied participation (Barry, 1998).

Integration can be understood more broadly than relationships between people. For over 30 years, people have made the argument that best conservation practices are grounded in people's understanding of history. Curt Meine published an editorial in Conservation Biology calling for history as a crucial aspect of conservation, saying "far from being an esoteric concern, the development of an historic sensibility ought to be considered fundamental to conservation biology. In fact, any teaching or practice of conservation biology that neglects history is incomplete." (Meine, 1999). During this period of rapid climate change, this is more important than ever. Providing people opportunities to understand how their local landscape developed, how it may change, and their impact upon if is an important aspect of integration.

This concept applies to urban areas as well, through the lens of heritage (L. Veldpaus, 2013). Incorporating both history and ecology helps spur interaction between people and their environment, and each other. As Meine puts it, "both [history and conservation] liberate us by allowing us to understand more fully the forces that shape our lives and the lives around us" (Meine, 1999).

This strategy also promotes integration between people and the environment and local history. The land and the estuary should not be separated from the humanity of the people, past, present and future, which engage with it. Heritage and engagement with the land should be rehumanized, reconnecting people to their surroundings. Both current plans unfortunately overlook the opportunities to develop these concepts, and in doing so become weaker.

This sense of connection can also be understood through Kevin Lynch's five elements of design, first outlined in his ground-breaking book, *Image of the City* (1960). In his book, he underscores the importance of urban design from the ordinary person's perspective rather than experts, bringing community experience to the forefront for the first time. This work democratized planning by focusing on outreach and people's experience of place. He introduced the idea of legibility and reading and understanding an urban form. Applying the concept of legibility to Granton's Waterfront design, it is clear the Council views the coastline as an edge rather than a district. Edges are "boundaries between two phases, linear breaks in continuity." (Lynch, 1960) whereas districts are "Areas an observer enters "inside of" with recognizable character." (Lynch, 1960). This distinction is important, and shapes the relationship Granton has with the Firth. This point is well illustrated both in the plan's discussion of the Firth, as well as the graphics, which treat the Firth as a blank space, rather than as a landscape itself. Developing the relationship from an edge to a district would increase the legibility of the region, by increasing the character. Plans should not consider the boundary with the Firth as a "break in continuity" just because it's wet, rather they should radically engage with the Firth as a district with recognizable character to be explored, studied, understood, and incorporated-- just like it has been in the past. Incorporating both the history and the breadth into the design with the waterfront is critical to creating the most legible landscape.

Providing many integration points for people to understand the forces which shape their lives, either historical, ecological, social or other, allows people to live more vivid lives. To be clear, implementing this strategy will not magically enlighten residents of Granton and solve their problems. It will provide people numerous, easy to access, free, opportunities to engage with the world around.

CONCLUSION

Granton's modern history begins with resource extraction, which, as industries later closed, left it a marginalized community. Its future can begin with repair, rooted in the ecology and social connections of Granton as a vibrant and recovering place. If Granton chooses now to nourish its coastline, its community, and the potential therein, it can begin to reintegrate into the city and region, building upon a proud and complex history to create a creative future.

Granton has an engaged community where coastal progress is underway and more is wanted. In planning for Granton, officials need to build on community developed ideas and interests. The need for oyster rewilding has come from the community and the benefits are broad and known. Access to coastlines like the Firth of Forth encourage longer walks, more socio-economic integration, and better mental health. The largest benefits will be felt in the most deprived communities, and this strategy is focused on drawing these communities to the coast to realize these benefits. What is needed is local planning frameworks to catch up and support.

Reimagining oyster rewilding through a planning lens allows for connections outside of restoration, such as community engagement, placemaking, and education. Plans should focus on reconnecting residents with the coast by revisioning the boundary between the Firth and Granton from an edge to a permeable entrance for further exploration. Reimagining the coast through this lens will help create a vibrant neighborhood for existing and future residents.

This strategy fundamentally bridges disciplinary expertise between the community, scientists, educators, urban planners, regulators, businesses, and others. Interdisciplinary strategies, like the one outlined here, produce more holistic and creative solutions. Granton deserves this attention, and its residents deserve to have their voices heard. By adapting their current plans to an urban planning frame, this strategy bridges gaps in current plans while honoring the values and interests of residents. After listening and researching Granton, I hope that this report can ultimately give back to Granton, rather than contribute to the history of exploitation.

Photo credit author23