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Streams of Nurture - A Sustainable Aquaculture Game

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MQP MBJ-1703

STREAMS OF NURTURE: A Sustainable Aquaculture Game

A Major Qualifying Project Report
Submitted to the Faculty of
WORCESTER POLYTECHNIC INSTITUTE
in Partial Fulfillment of
the Requirements for the Degree of
BACHELOR OF SCIENCE
in Interactive Media and Game Development
by
Michel Sabbagh and Liam Miller

April 27, 2017

Brian Moriarty and Ralph Sutter, Advisors

Abstract

Streams of Nurture is a kinetic visual novel that explores the practices and socioeconomic implications of aquaculture (fish farming) and salmon industries. Supported by extensive research and an iterative development methodology, our project team leveraged the Ren'Py game engine and AI-controlled Style Transfer technology to weave a visually and narratively authentic experience. The authors argue that portraying a niche topic through the gaming medium can make for an engrossing experience when dramatic storytelling and a detailed treatment of real-world issues are seamlessly blended.

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- Our families, for constantly supporting us throughout the academic year.
- David Allen '18, for providing us with the audio necessary to bring the experience to life.
- Our playtesters, for taking the time to try out the vertical slice of our game and share with us their valuable feedback.

1. Introduction

Streams of Nurture is a kinetic visual novel that tackles the topic of salmon aquaculture (fish farming), as well as the socioeconomics and cultural factors surrounding the species and the communities who depend on it as both a food source and a symbol of their historical roots.

The game relates the fictional tale of a New Englander who relocates to Washington State to attend Labrador Institute and continue the work of their father, who mysteriously vanished when the protagonist was a toddler. One day, a salmon crisis breaks out, and the plucky Northeasterner and their new friends set out to make things right by adopting sustainable rearing practices that will preserve the wild fish stocks. Along the way, they encounter the quandaries associated with pursuing innovative but potentially beneficial ventures.

At a certain point in the game, players must choose between three different branches that correspond to the farming methods proposed by their in-game allies. Following that decision, the player proceeds through the various stages of the salmon's life cycle in a controlled environment, learning how to take proper care of the fish with regards to feeding them and monitoring the conditions in which they are being kept.

The goal of this project was to present an important topic seldom explored by the video game medium, while weaving a dramatic and personal narrative that touches on the flaws and relationships of the game's characters.

1.1. Conceptual origins

The idea of creating this project came about when we were contacted by IMGD Professors Brian Moriarty and Ralph Sutter in early August 2016 about designing a visual novel for our Major Qualifying Project (MQP), the possibility of which they had pitched to the IMGD community the previous academic year (2015-16).

Around that time, we were pondering the idea of creating an educational entertainment (“edutainment”) title that covered topics which had occupied our attention for several years: food production and nutrition. As children, we had developed an interest in pursuing a healthy and varied diet, leading us to visit the supermarket as well as food processing factories in our spare time (see Figure 1).



Figure 1. Salmon curing plant (H. Forman & Son).

<http://soundsofmaking.com/portfolio/forman-son-salmon-curer/>

We had also become conscious of the “wider cultural, economic, political and economic processes” (Mansvelt and Robbins) surrounding our dietary choices, and had begun practicing “green consumerism” by researching the food items we purchased on a daily basis, paying particular attention to the way their ingredients were harvested (see Figure 2).



Figure 2. Farm-raised Norwegian salmon for sale.

<http://www.npr.org/sections/thesalt/2014/02/28/283946905/peak-salmon-may-be-unlikely-but-threats-to-farmed-salmon-loom>

By the time we were invited by Moriarty and Sutter to partake in their proposed project, we felt confident in our ability to do justice to our chosen topic by building a game that would inform players of the methods and practices by which our sources of sustenance are obtained.

1.2. Brainstorming

Following conversations with our Professors, we proceeded to generate potential concepts for a visual novel based on our interests in the food industry and healthy eating.

Over the course of a week, we came up with several potential premises for the MQP (see Appendices A and E). These ranged from a jet-set adventure that would see players learn more about the various food groups anthropomorphized as eclectic deities (akin to Sheogorath from the *Elder Scrolls* video game series, and his obsession with cheese), to an experience that would revolve around consumers pressuring companies to seek deforestation-free sources of palm oil.

After much deliberation, however, we settled on a topic that we felt would be unique enough to stand out from similar edutainment titles. That topic was aquaculture (fish farming), more specifically the type that deals with the year-round rearing of salmon (see Figure 3), especially given that the “global production of seafood has more than doubled over the past [few] decades.” (Asche and Bjorndal)



Figure 3. Norwegian aquaculturist holding an Atlantic salmon.

<http://www.fao.org/fao-who-codexalimentarius/roster/detail/en/c/462841/>

There were several reasons we chose this topic from the others we brainstormed. First, the team grew up eating all kinds of seafood, and salmon happened to be one of our favorites for its “beneficial omega-3 content that provide potent antioxidation” (Gallagher), and the broad range of species that span the Pacific and Atlantic Oceans.

Second, the industry around that specific fish was the subject of much interest and criticism surrounding its practices and geographical reach, with “main producing regions such as Norway, Scotland, Chile, Australia and Canada” (FAO Fishery Statistics) harboring farming operations dedicated solely to salmon.

Finally, salmon possess an extensive commercial and cultural history that can be traced back to numerous fishing communities around the globe. We particularly looked at native populations in the Arctic and North America, whose heavy consumption of seafood led to increased awareness of their health benefits, as well as their impact and influence on “the cultures, intertribal interactions, fishing technologies, and very religions of the tribes.” (CRITFC)

1.3. Research

After deciding the topic for the MQP, we dedicated the latter half of August 2016 to researching the methods, socioeconomics, ethics and history of aquaculture. These ran the gamut of “hatchery programs in coastal basins” (Stouder, Bisson, Naiman), salmon species, real-life fishing towns, and the various corporations that specialized in raising salmon such as “Marine Harvest, Cermaq, and Greig” (Horsfield and Kennedy).

For the setting, we gathered information on coastal regions that emphasize the value of seafood to their communities such as New England, Alaska, and the Canadian Maritimes.

Ultimately, though, we focused on the Pacific Northwest (see Figure 4) for its wide variety of fish stocks and farming sites, with “countless rivers, creeks, and streams offering spawning beds to five salmon species.” (Townesley)



Figure 4. Picturesque view of the Pacific Northwest.

<https://www.americanrivers.org/region/pacific/>

The Pacific Coast is also the homeland of Native American populaces whose history and culture are defined by their environment and the fauna that inhabit it. These include salmon, a species prized by tribes such as the “Coast Salish peoples of Puget Sound and the Strait of Georgia” (Lichatowich) who once depended on the fish as a source of food, wealth, trade and identity (see Figure 5) and “came to identify themselves as the ‘salmon people’”(Miller). Their traditional fishing practices were deeply shaped by their reverence for salmon, which were seen "as gift-bearing relatives, and were treated with great respect"(Indigenous Foundations), since all living things were once people according to traditional Coast Salish beliefs.



Figure 5. Salmon on a stick, a time-honored Native American cooking method.

<http://www.tulalipnews.com/wp/tag/blackfish-salmon-grill/>

<http://digitalcollections.lib.washington.edu/cdm/ref/collection/loc/id/1482>

In addition to collecting research notes, we frequented local grocery stores and restaurants, including Price Chopper and the Sole Proprietor, to purchase and assess the taste profiles of different kinds of commercially available salmon such as Atlantic and Pacific king salmon (see Figure 6). Given the impact different farming practices have on the juiciness and flavor of the fish, we believed this hands-on experience would allow us to better understand and communicate the multifaceted nature of salmon from both a commercial and gastronomical standpoint.



Figure 6. Ora King Salmon, as served by the Sole Proprietor, Worcester MA.

Original photo by Michel Sabbagh.

1.4. Design document

By the time we returned to WPI to begin the 2016-17 academic year, we had completed our research on salmon aquaculture, presented our findings to Professors Sutter and Moriarty and began working on the project's game design document (GDD). This served as an outline of the game's storytelling aspects (synopsis, characters, themes, etc.) as well as the technical elements that would shape the MQP's overall design and structure (see Appendix C). Our experience goal, which distills the narrative and educational intent of the visual novel, was summarized as follows:

“Inform the player on the economic, environmental and sociocultural value of salmon so that they can experience, through virtual decision-making and option-weighting, the methods for harvesting the fish in a sustainable manner that will best benefit both the people that depend on it as well as nature in the long term. The emotional arc of the story will include feelings of shock/conscientiousness, perseverance/ingenuity, and pride/redemption. The player should feel as if they are on a moral and personal journey, coming to terms with both regional and personal crises in an attempt to replenish endangered salmon stocks. By the end of the experience, the player should have the knowledge needed to choose sustainable seafood, and also gain an appreciation for sustainability as an indispensable aspect of nature and the human/animal life it harbors.”

1.5. Reference items

Along with the documentation the team gathered in August 2016, we decided to get our hands on various items and publications pertaining to seafood sustainability, hoping to further educate ourselves on the details of salmon farming and sourcing.



Figure 7. Sustainably farmed and fished salmon.
Original photos by Michel Sabbagh

The first products we purchased were smoked Atlantic and canned Pacific salmon at Price Chopper (see Figure 7), with the former serving as a major inspiration for one of the routes the player may take in the final game. In fact, the Norwegian farms of Kvarøy and Selsøyvik from which Blue Circle salmon originate are at the forefront of sustainable aquaculture. Their innovative use of

lumpfish allows them to keep their farming sites clean and “remove deadly parasites such as sea lice” (Bruno, Noguera and Poppe) without resorting to pesticides or chemicals. Their use of In the Blue fish feed, which reduces pressure on marine resources and minimizes environmental contaminants, inspired us to get our hands on a few samples of actual salmon farming equipment. We acquired a bag of feed pellets from Skretting (see Figure 8), a firm which “specializes in the manufacture of high energy pelleted fish feed for commercial fish farms.” (Chiarini, Found, Rich)



Figure 8. Skretting fish feed bags and pellets.

<https://www.gumtree.com/p/other-fishing-equipment/skretting-pellets-bulk-25kg-sack-carp-trout-feed-pellets-various-sizes-available-/1168912929>

<http://www.jambofish.com/fish-feed/>

We also obtained other publications and objects pertaining to seafood to bolster the realism of our visual novel. Plush toys representing three of the most popular commercial salmon proved genuinely helpful (and cuddly) in assessing the general anatomy and physique of the different species (see Figure 9). A variety of books detailed the history, habitat and preparation of the fish, with “the taste profiles and nutritional facts for each of the salmon species” (The Editors of Seafood Business)

being explicitly described in one of the seafood handbooks. Information and inspiration from these reference items found their way into the story and dialog of our game, adding to the authenticity and “flavor” of the player experience.

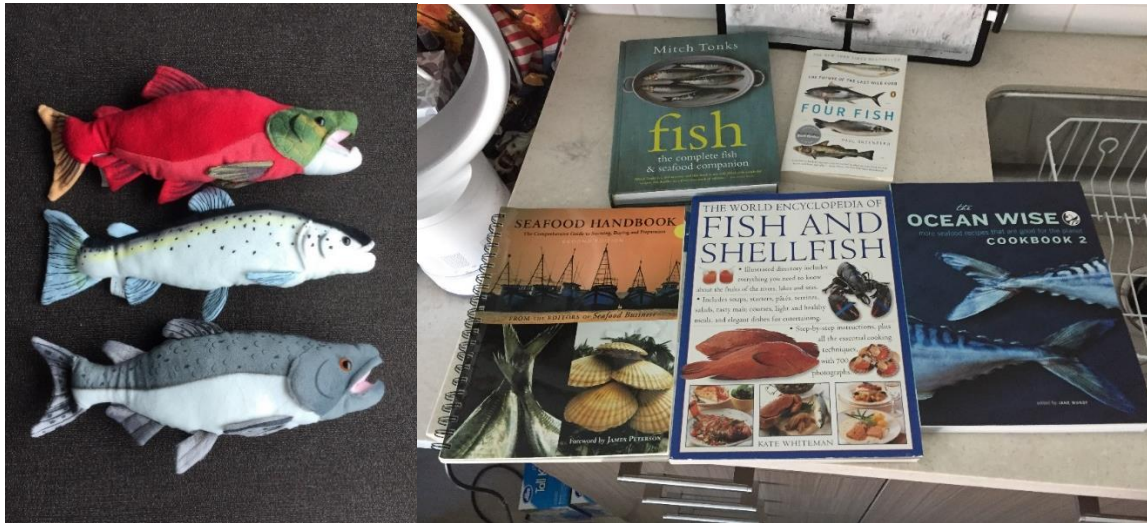


Figure 9. Sockeye/Atlantic/King salmon plush toys and seafood books.

Original photos by Michel Sabbagh

1.6. Priority list

As our research notes became broader and more elaborate, we realized that we would have trouble fitting all of the aquacultural information we had scavenged into a single game. Both the potential scope of the project and various routes the player could take to learn more about the farming methods had to be taken into account to understand the implications of fitting all of our findings into the game. It became clear that we needed to prioritize some facts over others to get across the essential facts about salmon farming, or risk the story becoming obtuse or hollow.

As a result, the team decided to create a priority list with Excel to sort and color-code our research according to its relevance and importance in the game’s prologue and branching paths (see Figure 10).

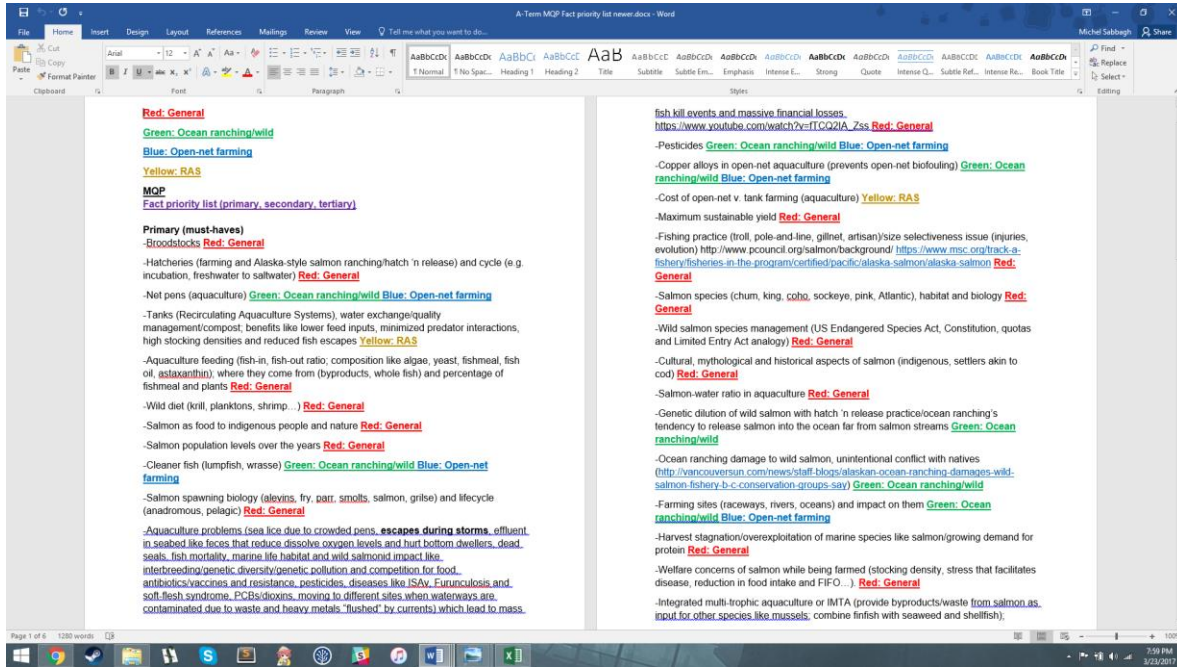


Figure 10. Priority list with color-coded facts.

Original image by Michel Sabbagh

Many facts were general enough to be applied to the story regardless of which route the player took in their play-through (e.g. “handling and management of Atlantic salmon brood stocks” (Kincaid)). Other details were either restricted to particular branches, or deemed too esoteric (e.g. “average water temperature maintained at 15-16°C” (Davidson)).

We eventually divided our research into primary, secondary and tertiary categories. All primary and (when possible) secondary elements were prioritized for incorporation into the story to ensure that players would understand the basic processes of raising salmon. Tertiary information was

assigned to optional dialog trees or in-game reference sources. This priority list helped us manage the scope of the MQP, which might otherwise have become bloated with unnecessary detail that would hamper both the development and pacing of the story.

1.7. Ren'Py

Of all the design choices made before development of the MQP began in earnest, the choice of game engine was the most straightforward. Because we wanted *Streams of Nurture* to be a simple-to-navigate title that would lucidly depict its subject matter, we agreed that the Ren'Py visual novel engine would effectively suit the technical and narrative needs of the project (see Figure 11).

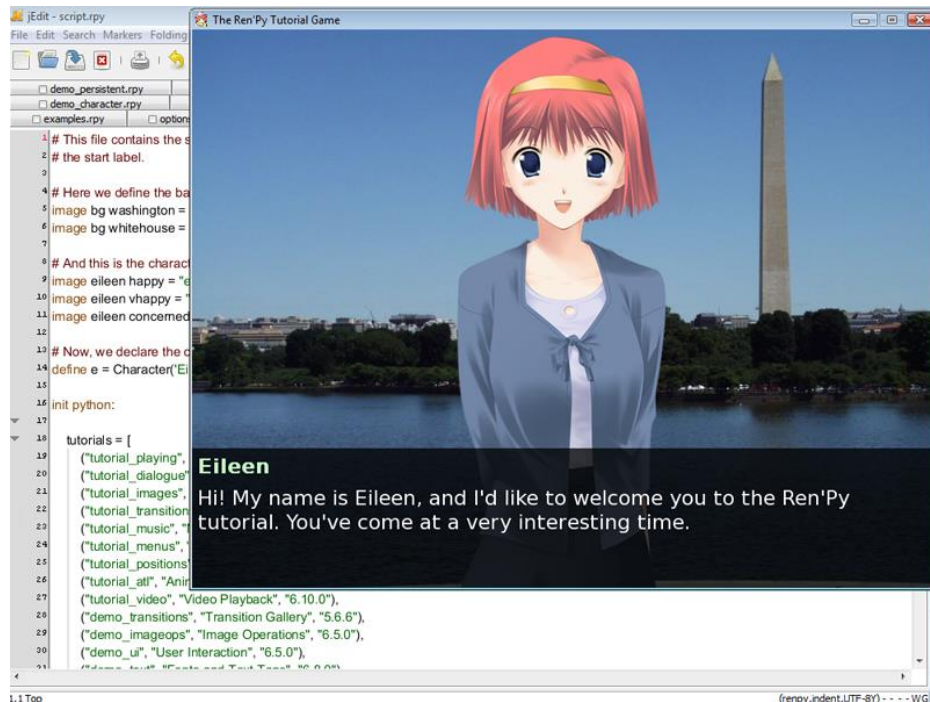


Figure 11. Sample Ren'Py tutorial screen.

<http://media.moddb.com/images/engines/1/1/193/renpyscreen.jpg>

There are two reasons Ren'Py was selected as the engine for our MQP. Based on prior classroom experience, we knew it was one of the most forgiving and malleable game engines available for the development of visual novels. Its screenplay-like scripting syntax, combined with ample documentation and tutorials available both online and in the engine itself, would greatly ease the creation and editing of content.

The other reason we chose Ren'Py was that one of our team members, Michel Sabbagh, had gained substantial familiarity with the engine by using it to single-handedly develop an original visual novel, *Make Love, Not Politics* (see Figure 12) during the summer of 2015.



Figure 12. Screen shot from *Make Love, Not Politics* (2015).

Original image by Michel Sabbagh

1.8. Preparation

From the outset, we knew that our project was ambitious. Its complex, wide-ranging subject matter, combined with a dramatic, multi-branching storyline exploring the intimate traits and relationships of several characters, would be impossible to implement without careful planning.

Our decision to begin the brainstorming, research and documentation processes before the start of the 2016-17 academic year proved essential in solidifying a manageable structure for the project. Without this preparatory period, the MQP would have suffered from a lack of visionary focus that would undoubtedly have compromised the efficiency of the production phase and quality of the final delivery.

2. Narrative design

As an IMGD major with significant writing experience gained by writing numerous game design articles and a previous visual novel, Michel saw the task of weaving *Streams of Nurture's* narrative as an opportunity to hone his storytelling skills. With the preparation completed before the formal beginning of the MQP in A term of 2016, Michel felt ready to flesh out the characters, settings, and themes that would constitute the visual novel's structural framework.

2.1. Characters

Logically, the personalities the player would be interacting with throughout the game had to be prioritized in order to properly determine the kinds of scenarios and story arcs that would drive the experience and complement the aquacultural topic with a dash of dramatic tension. As with the priority list of farming facts, Michel initially concentrates on building and enriching the physical, sociological and psychological facets of the main characters, more specifically the player character and the following individuals who comprise their circle of friends (see Figure 13):



Figure 13. Game characters Daphne, Joshua, and Olympia.

Original images by Liam Miller

- **Daphne Crosby**, the chipper if somewhat aloof daughter of the town's mayor who is an advocate of open-net farming.
- **Joshua Norton**, a wayward but well-meaning Native American student who embraces artisanal fishing practices.
- **Olympia Crammer**, an eloquent workaholic hoping to realize a salmon tank project.

For each of these characters, as well as secondary ones utilized for the game’s prologue and branching paths, personality templates provided by IMGD Professor Lee Sheldon were used to detail the unique traits, quirks and flaws of the entire cast (see Appendix B). The goal was to make each major character seem unique in both their appearance and demeanor. Devising and thoroughly documenting their characteristics in advance allowed Michel to keep their behavior and development consistent throughout the game.

2.2. World design

In addition to creating the characters for the visual novel, Michel was responsible for coming up with the in-game setting and lore for world-building purposes. Given the time and scoping constraints of the MQP, a “less is more” approach was adopted that prioritized density over scale.



Figure 14. The City from *Thief*: a small but highly detailed game world

[http://www.wallpaperup.com/382381/THIEF_adventure_stealth_fantasy_warrior_\(59\).html](http://www.wallpaperup.com/382381/THIEF_adventure_stealth_fantasy_warrior_(59).html)

Luckily, Michel was familiar with a commercial game series that serves as a consummate example of a compact virtual environment combining a rich backstory with uniquely-designed locales. The City from the *Thief* series (Eidos/Square Enix, 1998-2014) embodied many desirable qualities for the visual novel’s setting, from the dialects and cuisine that vary across different social classes to the town’s governmental framework (see Figure 14). *Thief*’s elliptical approach to storytelling avoids explicit explication, with “designers hinting at the backstory, but letting players uncover it for themselves” (Macgregor). Although the structure of the visual novel format meant that a lot of explaining would have to be done through dialog, the concentrated design of the City suggested that the world-building needed to complete the MQP need not be as time-consuming as we initially thought.



Figure 15. Maps of the game’s fictional island, incorporating the town of Duntale.

Original images by Michel Sabbagh

Following this realization, it was decided that the game’s setting would need to be as thoroughly documented as its characters. For *Streams of Nurture*’s primary location, the town of Duntale, a comprehensive document that detailed the history, geography, culture and economy of

the tight-knit fishing community was authored (see Appendix D), supported by maps of the local geography (see Figures 15 and 16). Although not all of this creative detail made it into the final game, the fact that it was available for reference meant that the team had a firm basis for determining how the Duntale populace would behave and interact with the player.

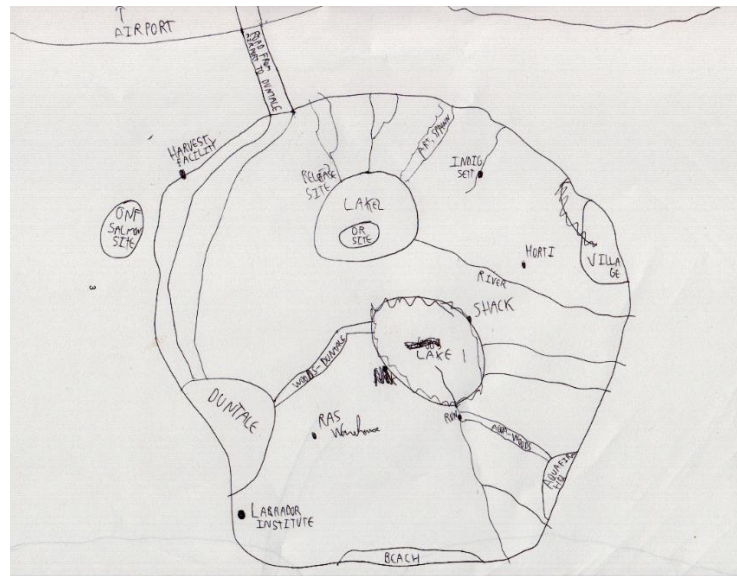


Figure 16. Sketch of the game's island.

Original image by Michel Sabbagh

Additionally, other real-world and fictional were studied as inspiration for the atmosphere emblematic of coastal settlements (see Appendix G). Fictional worlds such as *Morrowind*'s Solstheim and *Grand Theft Auto*'s Los Santos provided suitable templates for the layout and shape of *Stream of Nurture*'s island setting. As for actual towns, Bar Harbor, ME, with “its rugged coastline and Norwegian-like fjord” (Shettleworth and Vanderbergh), and Gloucester, MA, with its reputation as “the oldest fishing port in Massachusetts” (Harris), gave the team a concrete idea of the types of public and residential areas an actual fishing village might be expected to contain (see Figure 17).

Michel mixed and matched these components to construct Duntale with the verisimilitude needed for players to accept it as a cohesive, lifelike environment.

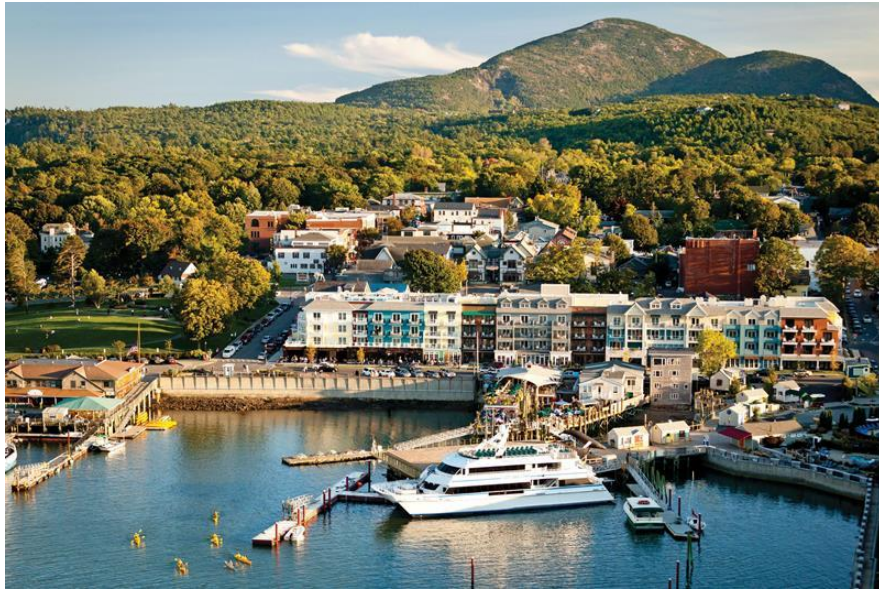


Figure 17. Bar Harbor, ME and City Hall, Gloucester, MA.

Bar Harbor: <http://www.theweststreethotel.com/gallery/>

Gloucester: Original photo by Liam Miller

2.3. Themes, issues and farming methods

With the game world and its inhabitants fleshed out, Michel focused on incorporating the themes and issues that would define the scenarios the player will find themselves in, including the major plot points highlighting the story's moments of crisis (see Appendix F).

With regards to the Duntale community and their ambivalence towards aquaculture, Michel drew inspiration from several protest organizations around the world such as the “Salmon Farms Protest Groups” (Girling) who wish to raise awareness about the ecological woes of salmon farming in regions such as Canada and Ireland (see Figure 18). Sea lice that “infest the external surfaces of marine and brackish-water fish” (Boxshall), overfishing, and pollution are other examples of the real-life factors pertaining to the salmon industry that cause public outrage across the world. Michel also looked at historical events such as the 1992 cod crisis which led to fish becoming “increasingly scarce in the once-rich waters off the Canadian province of Newfoundland” (Kennedy) to emulate the kind of negative economic impact that can result from mismanagement of marine resources on the part of both the government and its constituents.



Figure 18. Salmon farming protests and sea lice.

[http://www.irishtimes.com/news/march-over-proposed-100m-aran-islands-salmon-farm-](http://www.irishtimes.com/news/march-over-proposed-100m-aran-islands-salmon-farm-1.1317006)

[1.1317006](http://www.irishtimes.com/news/march-over-proposed-100m-aran-islands-salmon-farm-1.1317006)

<https://savegalwaybay.org/the-proposed-salmon-farm/>

This anti-aquaculture mindset was baked into the personalities of the visual novel’s characters, who either eke out a living through fishing or wish to seek an alternative to the cheap but irresponsible open-net farming sites run by the fictional in-game fish farming firm, “BioSalar”, which was inspired by real-world companies such as Marine Harvest, Cermaq, and Cooke Aquaculture.

The theme of “nature vs. nurture, economy vs. environment” also led to the exploration of the strife between both sides of the aquacultural debate in terms of the species featured in the story, and even having the fish symbolize the farmers and commercial/artisanal fishermen (see Figures 19-21). The Atlantic salmon, which is universally farmed (according to Stead, “only about 1% of the species is produced from the wild”), stands in stark contrast to the unadulterated Pacific varieties, such as sockeye and pink, which were threatened by BioSalar. Coupled with the ethics of having Atlantic and Pacific species intermingle with one another and polluting the gene pool of the latter, “forcing out wild salmon” (Islam), the inclusion of different types of salmon provides a subtle metaphor to the troublesome coexistence between industrialism and artisanship.



Figure 19. Atlantic salmon.

http://www.fisheries.no/aquaculture/aquaculture_species/farmed-salmon-atlantic-salmon-and-rainbow-trout-/#.WOrMYvnyuUk



Figure 20. Pink salmon.

http://www.fisheries.no/aquaculture/aquaculture_species/farmed-salmon-atlantic-salmon-and-rainbow-trout-/#.WOrMYvnyuUk



Figure 21. Sockeye salmon.

<http://www.roughfish.com/content/bois-brule-river-northern-wisconsin>
http://gallery.nanfa.org/v/members/Nate+Tessler/nativenorthamericanfreshwaterfish/Salmonidae/Oncorhynchus/nerka/Sockeye_salmon_3_+Strawberry+Reservoir_+9-10-13_+NT.JPG.html?g2_imageViewsIndex=1

Along with the conflict surrounding the issue of salmon farming and fishing, the themes of compromise and responsible stewardship are highlighted through the choice of three branching paths the player can take following the visual novel’s prologue. These routes correspond to the different farming methods practiced around the world to raise and harvest salmon in a potentially sustainable fashion (see Figures 22-24). Recirculating aquaculture systems — tank-based farming that “allow for year-round growth of fish in temperate climates” (Engle), semi-wild ocean ranching, the “objective of which is to increase the ocean abundance of the [salmon] species for harvest by recreational fishermen” (Arnason), and a more efficient version of open-net fish farming, a traditionally huge problem of which is “the waste that flows out of the fish pens” (Suzuki) — are the three fish-rearing techniques that can be explored within the game, each offering a unique mix of appliances, processes, opportunities and implications. The branches are written in a way that attempts to highlight their advantages and disadvantages equally, to avoid favoring one approach over others.



Figure 22. Open-net pens.

http://fsi.stanford.edu/research/search_for_sustainable_solutions_in_salmon_aquaculture



Figure 23. Salmon tanks.

http://fsi.stanford.edu/research/search_for_sustainable_solutions_in_salmon_aquaculture



Figure 24. Ocean ranching.

<http://marineharvest.ca/about/blog-marine-harvest-canada/2014-container-blog/march-13-2014/>

The salmon’s cultural and historical importance to the Native American characters featured in the game was also taken into consideration. Extensive research was conducted on artisanal fishing methods such as the dragnet, “a possible forerunner of the reef net used by Salish groups” (Matson), in order to accurately portray their usage. Rituals and events like the “First Salmon Festival” (Clark) were also incorporated into the narrative to highlight the salmon’s status as a traditional symbol of prosperity, nature’s gift to the indigenous people of the region.

2.4. Storytelling framework

With the storytelling elements in place, it was time to assemble everything into a comprehensive framework that would serve as the foundation for an initial, functionally complete iteration of the project — the alpha build. Throughout this process, an overarching narrative composed of smaller events that would comprise the scenes featured in the game was brainstormed.

A detailed document outlining all of the interactions and plot points a player would encounter was produced to better visualize the framework (see Figure 25). Potential ideas such as flashback sequences and a subplot surrounding a college-funded VR program were considered and recorded (see Appendix L). The narrative framework also allowed the incorporation of the research data gathered before *A term* into the relevant scenes. These included details such as the composition of the fish feed used in farming operations, and the physical logistics of the farming methods featured in the three branches (e.g. artificial spawning channels for ocean ranching).

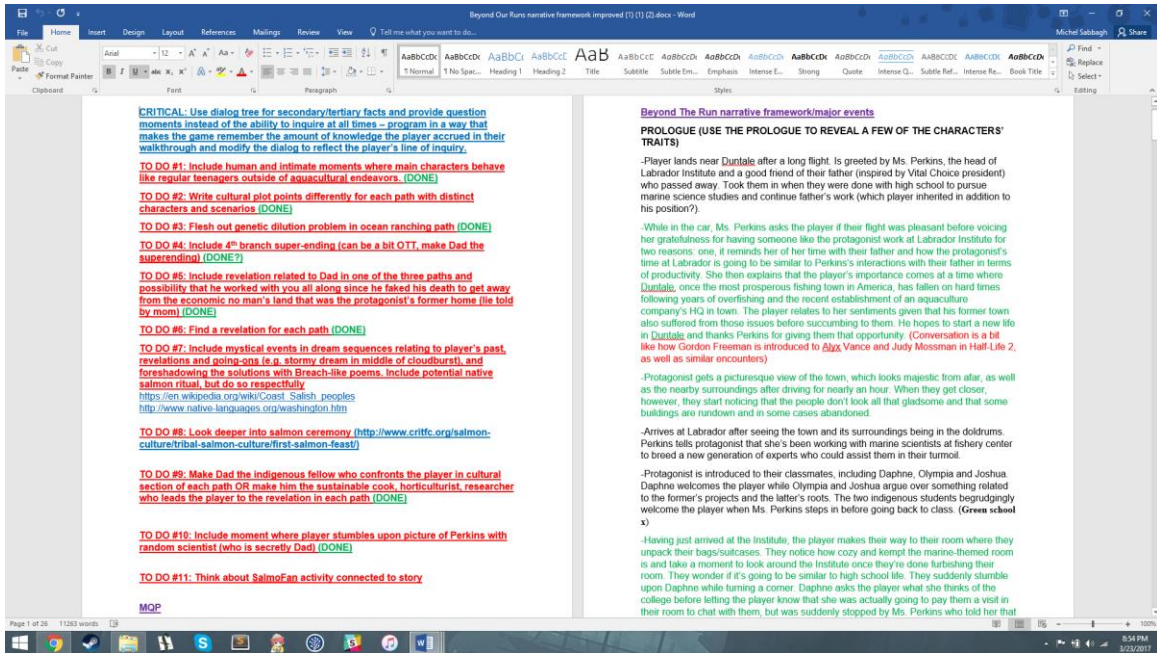


Figure 25. Word document containing all of the assembled in-game events.

Original image by Michel Sabbagh

2.5. Narrative modularity and kinetic design

With all of our research and story information collated, we realized that many of the aquacultural facts we wanted players to encounter overlapped across the three farming branches. This suggested modularizing the narrative as a strategy for streamlining the writing process. It was decided that common features of the three farming methods, such as the pre-saltwater farming stages, could be implemented as shared scenes (using the same dialog, code and imagery) without compromising the unique challenges posed by each approach. This approach significantly reduced the amount of time it took to complete the project.

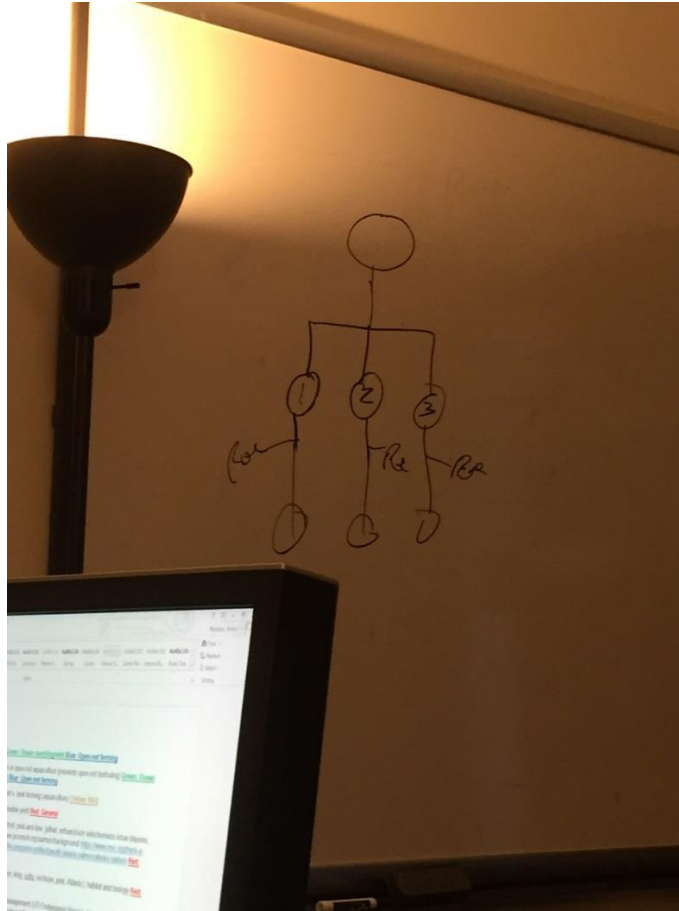


Figure 26. Whiteboard sketch of *Streams of Nurture*'s narrative structure.

Original photo by Michel Sabbagh

Additionally, the choice between providing a “kinetic novel” structure (highly linear, with little or no provision for player choice) as opposed to a more conventional visual novel structure (frequent dialog trees and many explicit choices) had to be made. Ultimately, the former approach was chosen to avoid potential plot holes and confusion among players with regards to understanding the issues differentiating each of the aquacultural processes being presented.

3. Art production

3.1. Artistic references

During A-Term 2016, the team got together to discuss audiovisual possibilities that would complement the story and setting of the game. A lot of time was spent brainstorming ideas for the graphical layout of the title (see Figure 27), which had to be both practical and stylish, and trawling the Web for reference images that could potentially be used to nail down *Streams of Nurture's* aesthetics and user experience (see Appendices H and J).

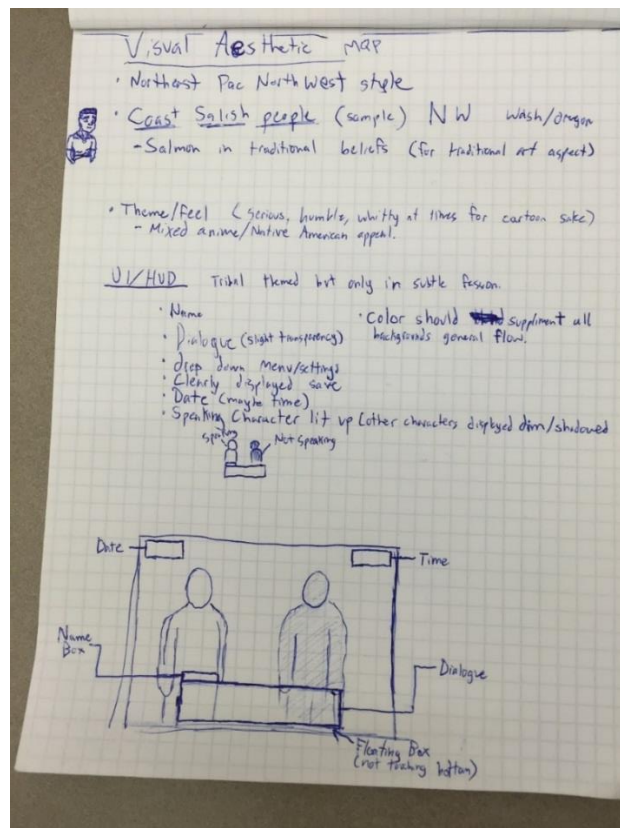


Figure 27. Notes detailing the MQP's visual aesthetics.

Original picture by Michel Sabbagh

Once all the pictures that closely matched our presentational vision for the visual novel had been gathered, the team winnowed the pool of references and ended up with artistic works that bore an experimental and/or ethereal style. Most of those pieces of art made use of oil painting, vivid lighting, and intermingling of color and shape to create a radiant image that effectively portrayed natural surroundings and the characters in it. This eventually led to the development of the tribal motif that adorned each of the visual novel’s backdrops and personalities.

3.2. Asset list

In order to uphold the audiovisual vision that the MQP team crafted at the beginning of development and ensure that it remained consistent, a comprehensive asset spreadsheet (see Figure 28) was created at the end of A-Term.

ID	Name	File Path	Description
4	plane	bg_p_plane_inside	The inside of a low-cost commercial plane viewed from a seat close to the aisle. Galley can't
5	airport_lobby	bg_p_airportlobby_carousel	A wide view of the airport luggage carousels with people waiting next to them for their bag
6	airport_lobby	bg_p_airportlobby_arrivals	A wide view of the airport arrival doors, both automatic and revolving. Vehicles can be seen
7	car	bg_p_car_inside	The inside of a compact and sumptuous SUV outfitted with latest tech. Viewed from the pas
8	car	bg_p_car_outdoors1	A view of the Pacific Northwest countryside from inside Perkins' car. Displays a wide landsc
9	car	bg_p_car_outdoors2	A view of the Pacific Northwest coast from inside Perkins' car. Displays a wide rendering of t
10	duntale_arrival	bg_p_duntalearrival_afarday	The town of Duntale seen from afar. Wide-ranging shot.
11	duntale_arrival	bg_p_duntalearrival_streets1day	A view of Duntale's more pristine streets. Features a lot of marine-themed buildings and bu
12	duntale_arrival	bg_p_duntalearrival_streets2day	A view of Duntale's more rundown quarters. Buildings are derelict and some graffiti hinting
13	labradorarrival_collegefrontday	bg_p_labradorarrival_collegefrontday	A wide-ranging picture of the front entrance to Labrador Institute's main building, with som
14	labradorarrival_collegefrontday	bg_p_labradorarrival_receptionday	A medium-range shot of the reception area in Labrador. Yellow-orange theme continues.
15	labradorrecon	bg_p_labradorrecon_dormcommonsday	A medium-range shot of the dorm commons in Labrador. Yellow-orange theme continues ar
16	labradorrecon	bg_p_labradorrecon_dormroomday	A picture of a single studio that's marine-themed. Bed, closet, desk with drawers and closet
17	labradorrecon	bg_p_labradorrecon_collegehallwayday	A medium-range picture of a college hallway that features classroom doors, bulletin board,
18	labradorrecon	bg_p_labradorrecon_collegecomerday	An upclose shot of a college hallway corner that bears the same yellow-orange motif as the
19	daphnetour	bg_p_daphnetour_libraryday	A medium-range shot of the Duntale library in broad daylight. People, streetlights can be se
20	daphnetour	bg_p_daphnetour_supermarketday	A wide ranging shot of the Duntale grocery store in broad daylight. People, cars, tables and d
21	daphnetour	bg_p_daphnetour_wharfday	A wide ranging shot of the Duntale wharf during daytime. People, boats, large pub and seag
22	daphnetour	bg_p_daphnetour_plazaday	Wide ranging picture of Duntale's plaza/shopping center in broad daylight. People, cars, stre
23	daphnetour	bg_p_daphnetour_pubday	Upclose shot of the pub in Duntale during daytime. Similar to Paddy's Whack.
24	daphnetour	bg_p_daphnetour_marinestoreday	Upclose shot of the marine store in Duntale. Fishing equipment, marine-themed souvenirs i
25	daphnetour	bg_p_daphnetour_marinecentroutsideday	Medium range shot of Duntale's marine center. Parked cars can be seen in the background. f
26	daphnetour	bg_p_daphnetour_townhalloutsideday	Wide range picture of Duntale's town hall from the outside. People can be seen in the backg
27	daphnetour	bg_p_daphnetour_townhallinsideday	Medium range shot of Duntale's town hall from the inside. Brownish in tone, and desks, cha
28	daphnetour	bg_p_daphnetour_mayorofficeoorday	Upclose of mayor's office door in Duntale. Door is wooden, has glass on it and a gold plaque
29	daphnetour	bg_p_daphnetour_mayorofficesideday	Medium range picture of mayor's office. Features chandelier, desk, large windows, file cabi
30	daphnebeach	bg_p_daphnebeach_beachafternoon	Wide range shot of Duntale beach in afternoon. Features some shabby on sandbanks and
31	daphneaquaculture	bg_p_daphneaquaculture_aquafirmhqsoutside	Medium range shot of Biosalar HQ from the outside during the day. Features lots of glass pa
32	daphneaquaculture	bg_p_daphneaquaculture_aquafirmhqsinside	Medium range shot of Biosalar HQ from the inside. Features a reception desk, cubicles and t
33	daphneaquaculture	bg_p_daphneaquaculture_aquafirmhqmanageroffice	Medium range shot of Biosalar HQ manager office. Features a desk, file cabinets, aquacultu
34	daphnetojoshua	bg_p_daphnetojoshua_aquafirmtowoods	Medium range shot of trail that leads from coastal side of island to woods. Lots of foliage a
35	joshuarun	bg_p_joshuarun_runday	Medium range shot of stream in Duntale woods. Stream is in the center and surrounded by t
36	joshuarun	bg_p_joshuarun_salmonupclose	Upclose shot of sockeye salmon in water. One is jumping out of the water and two others sv
37	joshuatoolympia_woodstoduntale	bg_p_joshuatoolympia_woodstoduntale	Medium range shot of trail that leads from woods to town. A bit of foliage and a few sign p
38	olympiawork	bg_p_olympiawork_garageoutside	Medium range shot of garage where Olympia works. Has an industrial and metallic feel to it
39	olympiawork	bg_p_olympiawork_garageinside	Medium range shot of garage inside where Olympia works. Has mechanical parts lying arou

Figure 28. Portion of asset spreadsheet itemizing the game’s art.

Original image by Michel Sabbagh

The asset list provided the in-game reference name, actual filename and a brief description for every piece of art created to implement the functional framework. URLs to images containing the intended features of each scene were also included, ensuring that *Streams of Nurture* would not suffer from incongruous-looking visuals that conflicted with the narrative.

3.3. Style transfer

As the label “visual novel” suggests, the artistic aspect of our game was critical, requiring a unique and compelling art style that would hold the attention of players and support the goal of educating them about sustainable aquaculture.

Some of the game’s characters are of Coast Salish descent, and many story situations make reference to the indigenous fishing practices “that maintained their communities throughout the year” (Zeller). For these reasons, respectful incorporation of Coast Salish aesthetics into the “look and feel” of our project seemed both desirable and appropriate. This goal was achieved through the use of a relatively new application of artificial intelligence (AI) known as *style transfer*.

The possibility of harnessing AI algorithms to apply the aesthetic style of one piece of art onto another was first brought to our attention by Professor Moriarty. We knew of no visual novel that had ever used this technology as the basis for its art direction, and decided to investigate its potential for our project.

Our first task was to identify a style transfer application that met the requirements of *Streams of Nurture*. Specifically, we needed an app with the following characteristics:

- The ability to work with original, customized style reference art;
- The ability to work with high-definition image files;
- High style-transfer quality, with useful processing options;
- Low per-image processing cost (preferably free), with reasonably fast turnaround.

Several style transfer applications were found, but most fell short in one or more of these areas. Many offered their services for free, but severely limited the size of image output, or did not support custom styling images. Others charged a per-image fee, utilized weak algorithms that produced inconsistent or unattractive results, or required a very long time (sometimes over a day!) to stylize each image due to overcrowded servers.

Eventually we discovered Alter, an Android app available on the Google Play store, which met nearly all of our requirements. It supported custom styling images, processed entire images (unfortunately not at full HD resolution), responded fairly quickly, imposed no limit on the number of images processed, and (most important) proved capable of producing visually stunning results. Alter was therefore chosen as the centerpiece of our MQP's art pipeline.

Using authentic Coast Salish art references, Liam created a single image that was used as the master styling reference for every background and character image used throughout the entire game (see Figure 29). Figure 30 shows the result of this style reference applied to an original photo.



Figure 29. Master source image for style transfer, influenced by Coast Salish art.
Original image by Liam Miller.



Figure 30. Example of a source photograph (left) after filtering and style transfer (right).
Original images by Liam Miller.

Figures 31-34 detail the steps used to transform an original photograph into a style-transferred background image ready for installation in-game.



Figure 31. Step 1: Original photograph.



Figure 32. Photograph pre-treated with Photoshop.



Figure 33. Filtered photograph after stylization by Alter.



Figure 34. Stylized image with depth blur applied by Photoshop.

Original images by Liam Miller

3.4. Art production

Once the team had the asset list of images and a method for processing them, it was time to get started on developing character models and gathering images to be used as backgrounds.

Primarily, the team needed to get out into the world and collect pictures, as over 200 environmental background images were required. These scenes would feature indoor offices, fishing markets, factories, Native American reservations, and fish farming sites. Liam took advantage of his trips home to Hawaii over the breaks to gather images that could not be taken back on the East Coast. He also traveled from Worcester to New York taking pictures, and undertook a photo-gathering pilgrimage to New England's archetypal fishing village, Gloucester, MA. After cropping selected photographs and applying style transfer with Alter, a blur was added with Adobe Photoshop to enhance the separation of background images and superimposed characters.

Collecting background images of the processes used in salmon farming and preparation for consumers proved challenging. Many such scenes would be impossible to acquire while attending courses full-time at WPI. To produce artwork for scenes that could not be photographed ourselves, Liam turned to the collage technique, where he took simple aspects of reference images, cropped, edited and fit them together like a puzzle to create an approximation of the required scene. Applying style transfer and post-processing to these images effectively concealed their Frankenstein-like construction, allowing them to fit seamlessly into the rest of the game (see Figure 35). Appendix N cites the sources of all non-original image fragments used to implement these backgrounds.



Figure 35. Example of collage-built scene, showing cropped ship over water with drawn platforms. Composite image by Liam Miller.

3.5. Character production

Michel's character templates supplied descriptions of how he envisioned their physical appearance and social tendencies. This made it relatively easy for Liam to produce character sketches for discussion and mutual approval.

One aspect Liam had to keep in mind while drawing these characters out was that some of them had true-to-life ethnic backgrounds and stories. For those who represented Coast Salish descendants, Liam strived to be both accurate and sensitive to avoid the possibility of offense. For those with impacting backstories, Liam had to capture the look and emotions of how someone in that position might appear (see Figure 36).

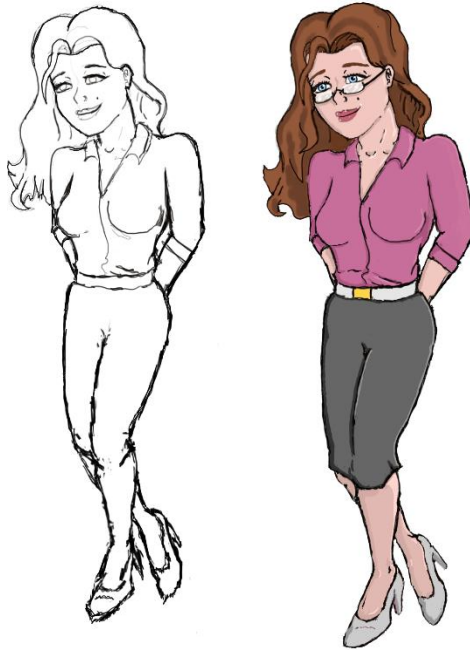


Figure 36. Original sketch of Daphne Crosby (left), and prepared for stylizing (right).

Original images by Liam Miller

A more tedious factor involved in creating these characters was the process of displaying them in at least three different positions: left, forward and right-facing. New to producing drawings of characters at multiple angles, Liam struggled to keep the characters looking the same at different positions. Defining a standard character size of 2160 x 800 pixels assisted him with controlling the relative size and height of the models.

Liam's early experiments with style transfer on both background and characters produced results that made it hard to visually separate the characters from the backgrounds. Eventually Liam developed a method of "dialing down" the style transfer effect on the characters to preserve the detail on their faces and clothing, keeping them distinct from the background. Specifically, using

percentages as strength levels of style transferring, the backgrounds usually ran from 16-23% strength and characters ranged from 11-17%, each depending on detail and depth of what was being portrayed (see Figure 37).

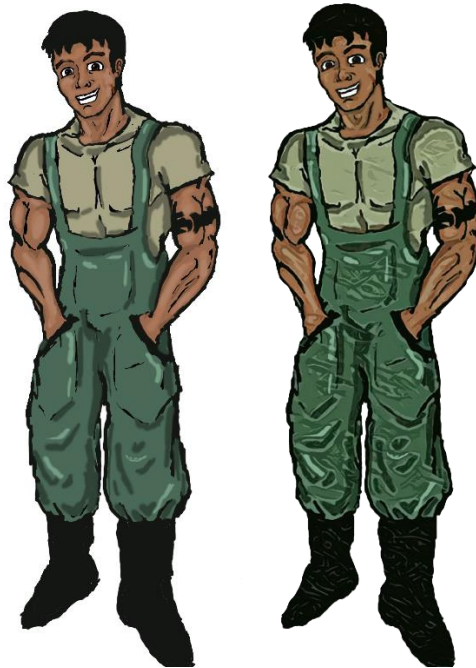


Figure 37. Joshua before (left) and after (right) application of style transfer.

Original images by Liam Miller

4. Sound design

When it came to creating the soundscape and music for *Streams of Nurture*, the team hoped to suggest the serene, tranquil atmosphere of fishing towns. We also wanted the audio to complement the visuals and narrative on display without overpowering them. To achieve these effects, we sourced and listened to various tracks spanning several genres such as New Age and minimalism.

It wasn't until the latter half of the spring semester that we managed to find an audio partner in Dave Allen '18, who was willing to lend his skills to the project as part of an ISP. Upon joining the team, Dave was provided with the audiovisual references we sought in 2016 as well as an asset list of sound effects he had to produce for the beginning sections of the visual novel.

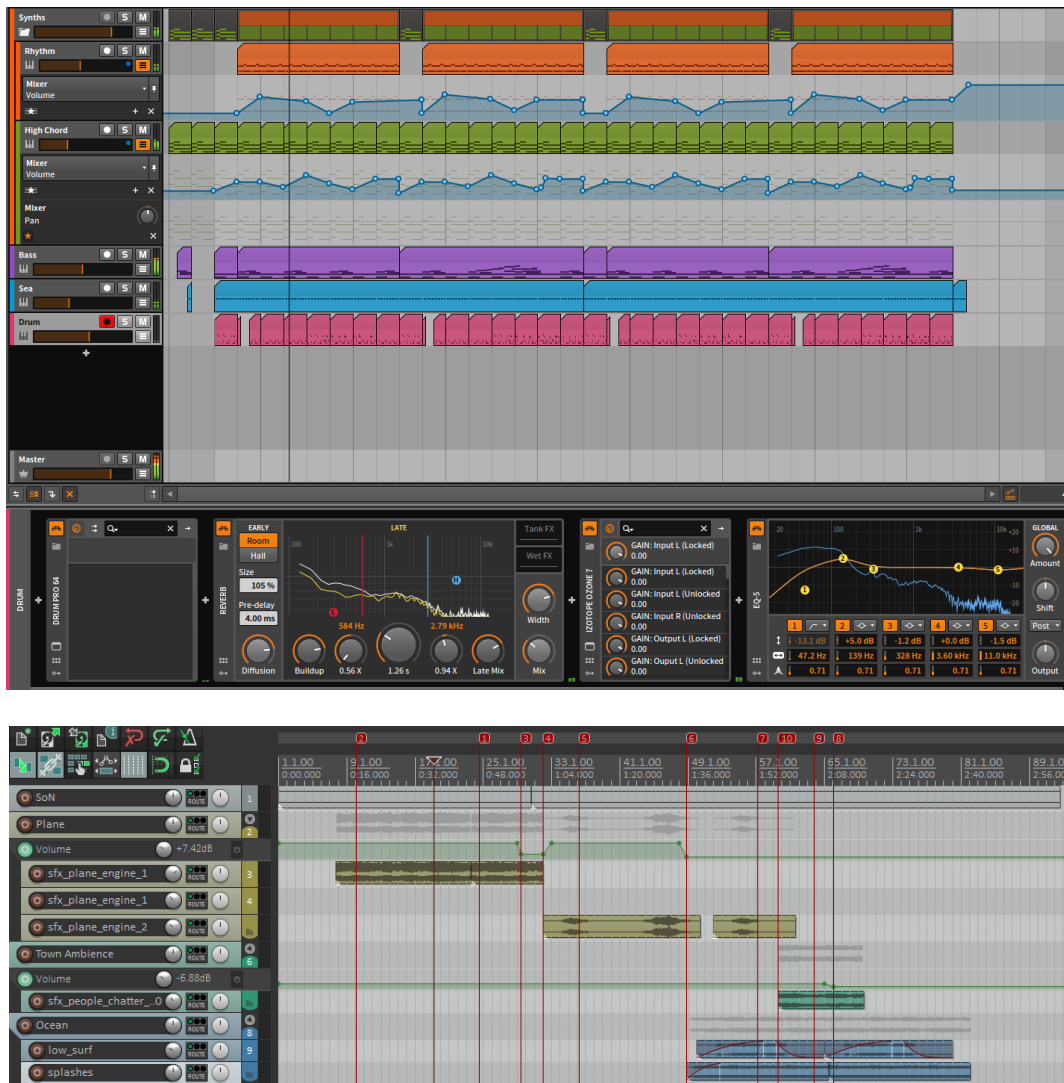


Figure 38. Screenshots of audio workstations.

Original images by Dave Allen

Given the scope of the MQP and the amount of time left in the academic year, Dave had to adopt a modular approach with regards to composing the tracks and sound effects for *Streams of Nurture*. Using digital mixers and synthesizers (see Figure 38), Dave wrote multiple pieces of original music, using a variety of strategies to capture the relaxed atmosphere of coastal life.

When writing the music and designing the soundscape, Dave found it important that the audio stayed in the background, as the visual novel format is focused more on narrative development than audiovisual spectacle. This led him to create a minimal soundscape based on layers of environmental ambiance, with each cue having its fade-in/fade-out values adjusted to properly reflect the change of locales.

5. Playtesting

As the project approached the end of the academic year, the need to share our work-in-progress with the gaming community to assess the quality of the game and apply any potential changes to the code or assets became increasingly urgent.

To facilitate this, we decided to focus our attention on the first ten minutes of the game, polishing this section extensively to create a “vertical slice” that players could quickly sample to evaluate our intended narrative and aesthetic effects. Over the course of several weekends, we worked with Professor Moriarty to thoroughly polish the dialog for each scene in the opening segment of the game’s prologue.

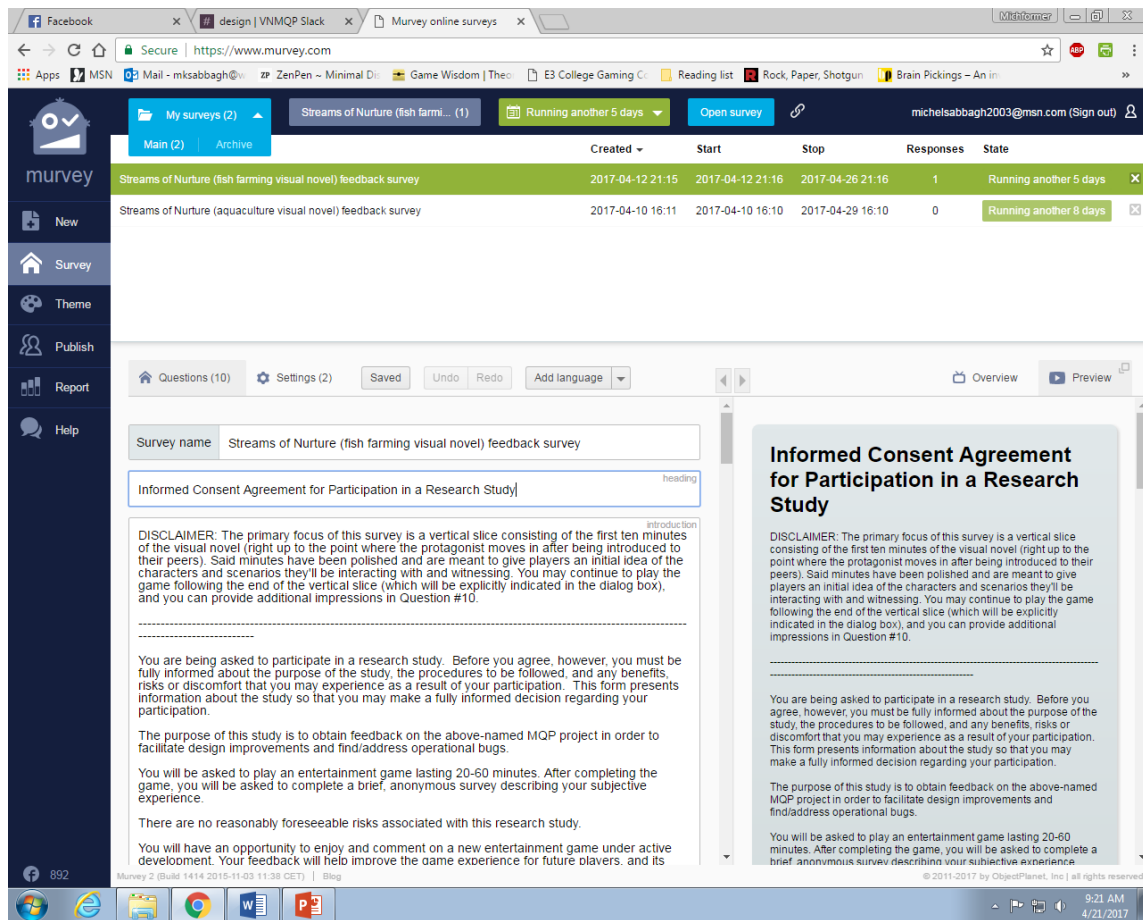


Figure 39. Screen shot of Murvey playtesting survey.

Original image by Michel Sabbagh

Once we had reached the point where virtually all of the major characters had been introduced to the player, we made use of an online survey builder called Murvey (see Figure 39) to pose questions about the title’s storytelling and audiovisual merits. We then reached out to nine gamers and developers via social media, and shared with them the vertical slice of the game that we had polished, inviting them to fill out the survey when it was completed. As of this writing, playtesting remains in progress, but we hope to receive all of the responses by early May 2017.

6. Development cycle

6.1. Project schedule

In terms of scheduling, *Streams of Nurture* shares some similarities with other MQPs conducted within and beyond the IMGD major, while still embodying its fair share of quirks. On one hand, most of the visual novel's major development milestones were set and achieved throughout three academic terms (A-Term 2016 to C-Term 2017). However, the individual parts that constitute it (story, art, sound, and playtesting) were not built concurrently. Instead, each of us worked full-time on the MQP without taking any classes across two different terms to plug in the major pieces, with the first half of the spring semester being dedicated to the polish pass.

For the narrative, Michel spent the entirety of A-Term 2016 organizing the documentation created for the game's story and subsequently writing the basic dialog that expounded details about the aquacultural process. The lines Michel penned also contained figments of his personality in the characters that he would further flesh out in future terms since he wished to get the practical details in first before finding ways to trim it and make the writing tighter and more coherent. In short, he adopted an iterative approach to storytelling so that the revisions to the dialog would not affect the overall structure and pacing of the narrative he wished to impart.

As for the art, the process of designing, developing and polishing was roughly planned to fit within each term the team was working on the project. A-Term was when ideas were being formed and set in stone for the following terms to collect photographs, produce drawings, complete the style transfer processes per each image and drawing, then finally polish what was needed. Liam was

not officially registered for the project until B-Term, but given the project being dependent on just two people, he felt the earlier the team began work, the better. The busiest terms were those consisting of developing and implementing the art (B and C-Terms), given the abundant number of scenes and characters. The workload proved more than anticipated, and lasted well into D-Term.

6.2. Source control and backups

To ensure that the work updated properly across different devices and would not get lost to hard crashes and corrupt drives, the team made use of a cloud-based BitBucket repository, using SourceTree as a Windows client (see Figure 40).

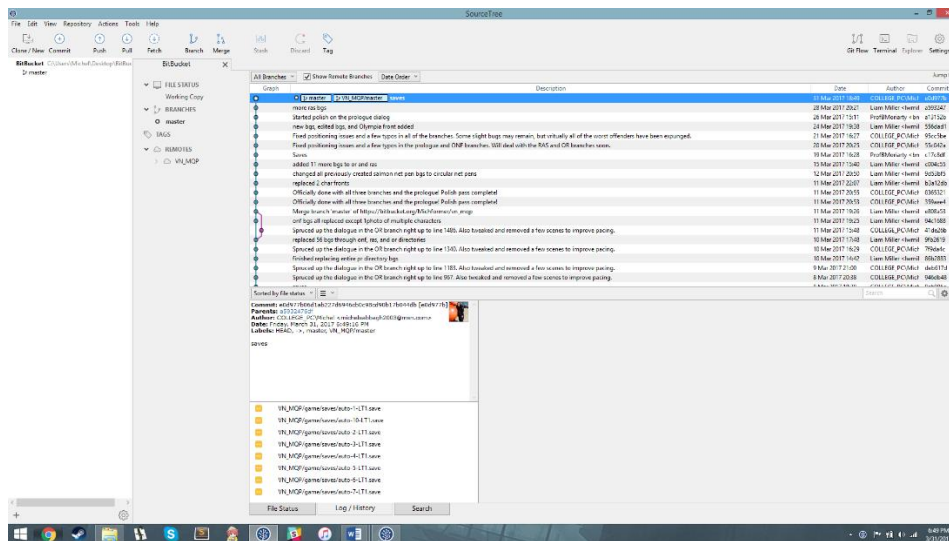


Figure 40. SourceTree, the Windows client used to manage source control.

Original image by Michel Sabbagh

These tools allowed us to upload (“push”) and download (“pull”) changes to the visual novel’s script and assets, based on files stored in a BitBucket folder maintained on our personal PCs. As an additional precaution, the team and advisors regularly backed up the project folder on several flash drives kept in different locations to minimize the possibility of having our progress vaporized by a mangled repository.

Thankfully, the data for *Streams of Nurture* worked seamlessly with BitBucket and SourceTree, and we never encountered any issues that stalled development of our MQP.

6.3. Communication

Along with updating changes to the game’s script and audiovisual assets, the team also met at least twice a week throughout the 2016-17 academic year to report any progress with the art, writing and other design elements. Such meetings occurred between the students and advisors in the IMGD suite in Salisbury Labs on weekdays and solely among the developers at the Gordon Library on weekends.

During those gatherings, we brainstormed potential ideas for our game that could be incorporated further down the line, such as additional visual flourishes and subplots that would flesh out the characters even more (e.g. flashback sequences hinting at the protagonist’s hazy relationship with their dad). The team also relayed concerns about hitting particular milestones within the term and academic year, such as getting rid of all the placeholder art and polishing all of the character lines to make them sound more natural and dramatic.

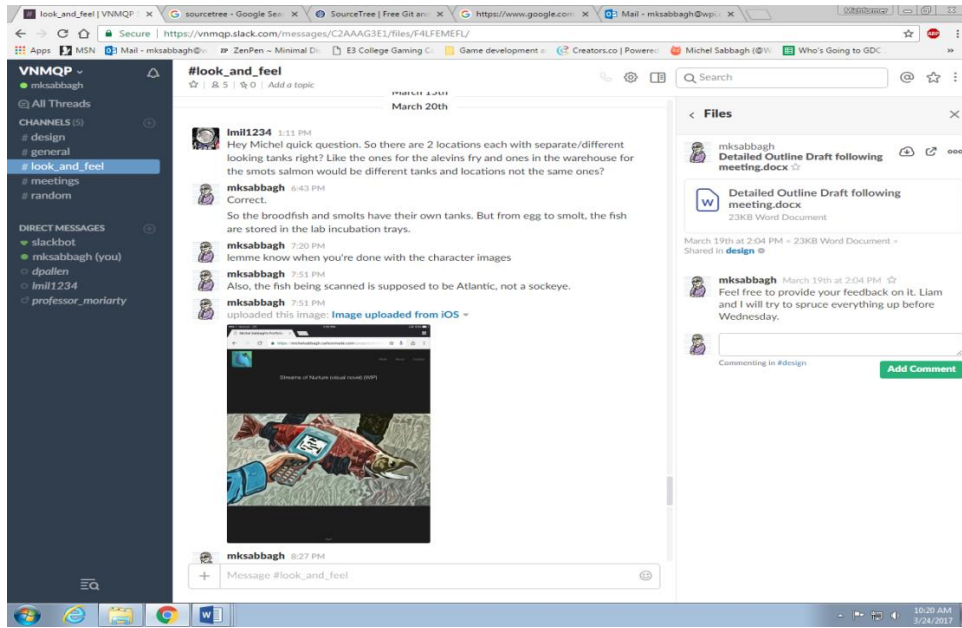


Figure 41. Slack, the project management service used for team communication.

Original image by Michel Sabbagh

Outside of the aforementioned meetings, the MQP team also made use of the chat service Slack (see Figure 41) to share updates and comments that would affect the final version of the game, such as last-minute changes to the art and additional information on the salmon industry. The channel we created for our purposes (VN_MQP) included several sub-channels: design, general, look-and-feel, meetings, random and audio. This allowed us to keep the chat box clean and relevant, which led to faster responses to questions about *Streams of Nurture's* condition.

6.4. Skeleton

During the fall semester, the entire team focused on building the visual novel from the ground-up using the research and references we documented to get a solid sense of how the game would look, sound, and feel as the player progresses through it.

Given the sheer size and scope of the MQP, we knew that we had to undertake an iterative approach to the development of our title. This meant that we first had to create rough versions of the art and script before we could polish everything so that they matched the vision we laid out from the beginning.

So before we got started churning out the audiovisual and written content for the MQP, Professors Moriarty and Sutter sat down with us to discuss the step-by-step process we would go through in terms of creating the basic structure and design for *Streams of Nurture*. This skeletal framework (see Figure 42), which served as the substrate upon which we would plug in more polished versions of the artworks and dialog, was comprised of placeholder assets and scripted scenes that made the visual novel entirely playable from start to finish.

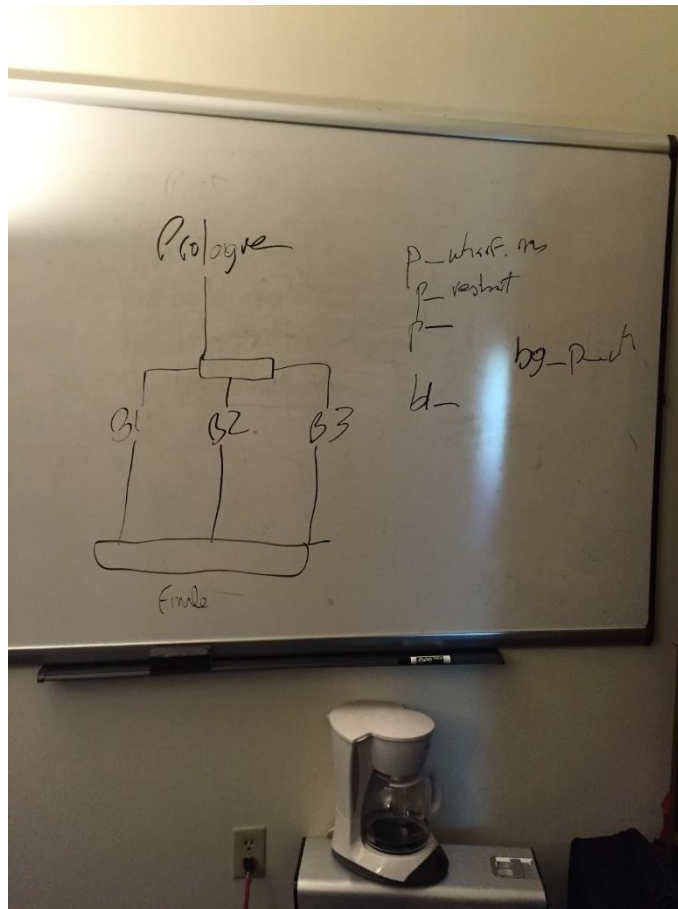


Figure 42. The game's skeletal framework, outlined on a whiteboard.

Original photo by Michel Sabbagh

For the art, we made use of Photoshop to generate grayboxes that had the names of the asset and their (sub)directories explicitly baked onto them. These files would allow us to substitute finalized artworks for the blank images that initially corresponded to the background scenes in *Streams of Nurture*. This approach also applied to the characters themselves, who were depicted as front-/left-/right-facing black silhouettes standing in their respective onscreen positions.

Narrative-wise, the key was to incorporate as much relevant information about the different farming methods and techniques the player would be exploring (see Figure 43), as well as the various

personalities inhabiting the game world. Macro and micro details about the aquacultural appliances such as the real-life “Thermolicer” (Steinsvik) and words denoting the kinds of emotions characters would feel rather than outright utter in the final game were par for the course in terms of producing functional dialog that advanced the plot, but had yet to possess more characteristic essence.

Having a skeleton from the outset proved most beneficial for future iterations of the MQP, as the team was able to make quick and effective modifications to the code without harming the visual novel’s overall story structure and artistic integrity.

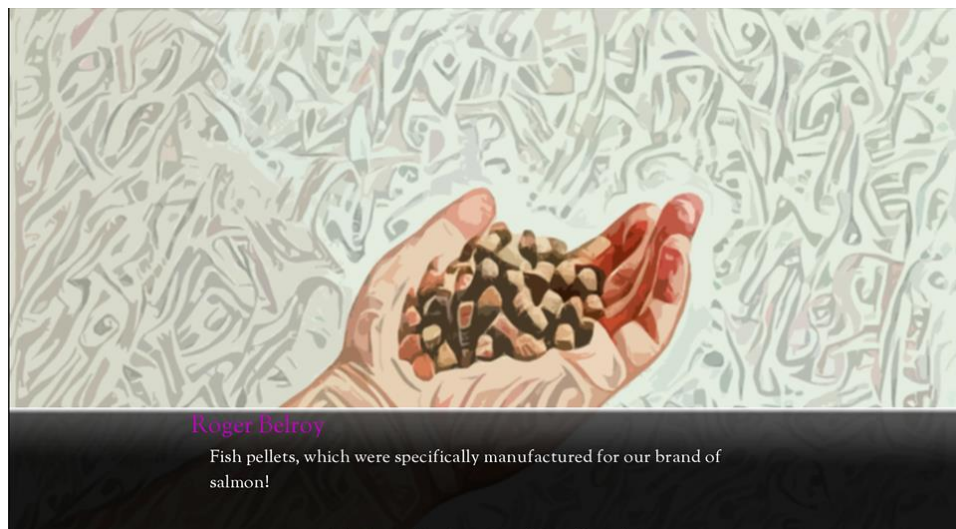


Figure 43. Expository scene explaining the use of fish feed pellets.

Original image by Liam Miller.

6.5. Polishing

During the holiday break, the team decided to proceed to the next stage in the development process: the polish pass. With the placeholders having served their purpose of getting the MQP to work from a technical perspective, the time came for us to bring the narrative and artistic components of *Streams of Nurture* up to a level that would make it attractive to the average player all across the board.

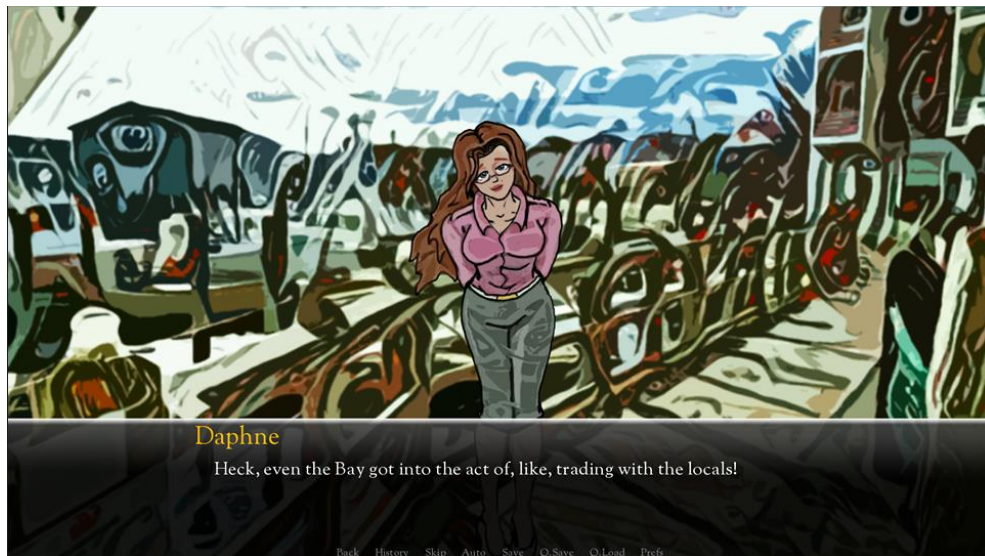


Figure 44. Daphne's character in the game's near-final iteration.

Original images by Liam Miller

In terms of dialog, the primary goal was to trim down any unnecessary lines and scenes that bogged down the pacing of the game and made the title feel bloated in parts. Not only that, but the team also wanted to alter the dialect for each of the characters so that they sounded more unique and convincing. Originally, their vernacular was too uniform and sophisticated for them to feel believable, instead sounding pretentious and unnatural. With the help of the character profiles, though, Michel was able to distinguish each individual from one another through their speech

patterns and general demeanors (see Figure 44). The process of doing so took a little over two months to accomplish, and the result was a considerably leaner and meaner narrative that communicated information more concisely and, in some ways, wittily.

With the art, polishing backgrounds and characters came down to adjusting minor yet vital details about the subject matter of the scene, tending more specifically to what was being portrayed through the dialog, and of course cleaning up any abnormalities in the illustrations for the sake of achieving a more professional look. To elaborate upon this, any feature in the backgrounds that either did or did not belong in the scene was either added or removed. One mentionable polishing factor that came into play twice while working on the art were the tweaks and changes that Alter was making, which would often change their resolution output or manipulate their algorithms to fine-tune how style was transferred. These changes produced noticeable differences in stylized backgrounds before Alter updates and changes, making it mandatory to redo each of the images we had already finished. Other than that, cleaning a few drawings of character borders was one small yet vital part of the polishing process to produce the most appealing visual novel we could.

For sound and playtesting, D term was when both components were being extensively worked on after several months of delay. Like the narrative and art, audio benefited from the same iterative process that defined much of the title's development cycle. By adding and fine-tuning musical layers for the game's main theme and sourcing references for the sound effects, Dave was able to put together a compact but potent soundscape that provided the right amount of atmosphere complementing the town of Duntale and its surroundings.

7. Postmortem

7.1. What went right

7.1.1. *Frequent communication and updates*

Given that virtually all of the collaborative work had to be done independently among the MQP team to remain flexible and meet the major project deadlines on time, the use of Slack and BitBucket/SourceTree became all the more crucial for us to assess the progress we were making. The successful integration of communication and workflow channels onto our portable devices allowed us to swiftly upload our updates to the cloud repository, and share our thoughts and suggestions on each other's work. From expounding and reading our opinions on the writing and audiovisuals in our spare time to uploading and downloading changes to the code during each work session, the team always remained up-to-date on what was unfolding on our respective ends. This, in turn, led to better coordination of our workflow.

7.1.2. *Enhanced productivity*

Perhaps the greatest assets the entire team had in the production phase of *Streams of Nurture* were the skeletal structure built prior to plugging in the dialog and art assets, as well as our sole dedication to the MQP during the terms in which each team member worked without any other academic endeavors to take care of. With A and B terms 2016 being reserved solely for the fundamental development of the narrative design and art style respectively, our team was able to work at a steadfast and much brisker pace that made us achieve our primary and minimum viable product goals far ahead of the deadlines we were assigned. Additionally, the modular nature of the story and efficient use of Style Transfer meant that our workflow was greatly expedited, leaving

more room for potential revisions and inclusions to the code. Such a routine wouldn't have been achievable if we worked on the title uniformly and concurrently with coursework across three terms in a spread-out fashion.

7.1.3. *Advanced planning*

Another benefit that helped streamline and bolster the development process with *Streams of Nurture* was the fact that a lot of time had been dedicated to cataloging and brainstorming topical references and ideas both before development on the MQP began in earnest and while the game was being built and tweaked. By beginning the research process on both the subject matter and dramatic narrative around it several weeks before the start of the 2016-17 academic year, the team was able to focus their attention on coming up with and appropriately scoping an experience goal we could see ourselves work with within the time we had to build the visual novel from scratch. From distilling and prioritizing facts about the salmon industry to finding an art direction that would complement the narrative and game world, all of our preparatory efforts led to a title that didn't suffer from unnecessary feature creep or misguided design.

7.1.4. *Iterative narrative and art processes*

With the documentation and scoping having been performed prior to the start of A-Term 2016, the team was similarly able to lay out a plan of attack with regards to gradually incorporating and sprucing the storytelling and artistic components that made up *Streams of Nurture*. With the writing, the initially leaden social banter and verbose explanation of salmon farming from the functional narrative stage morphed into more concise and natural-sounding dialog that balanced out emotional nuances and special characteristics with the aquacultural facts. As for the art, the employment and refinement of seafood-themed and tribal motifs on the environmental and

character artworks begot a visual style that distinguished *Streams of Nurture* from the anime aesthetics predominant in the visual novel genre. The result was a distinctive game that felt both cogent and comprehensive in its depiction of coastal and aquacultural life.

7.2. What could have been improved

7.2.1. Infrequent physical meetings

Although the advisors and students ensured that they would congregate every week of the academic terms to discuss the progress being made with the visual novel in A- and B-Terms 2016, unexpected developments and schedule changes (inclement weather, illnesses, critical non-MQP endeavors) throughout the spring semester meant that the frequency of the otherwise productive meetings took a bit of a hit. The sporadic nature of these circumstances didn't negatively impact the overall project, but it did lead to a lot of input pertaining to major additions to *Streams of Nurture* and best done in a face-to-face setting being put off at a later date. As a result, there was a slight disconnect among the team members that put us in situations where we feared that we would be missing important deadlines.

7.2.2. Limited playtesting

As much as the team has done to continuously work on the MQP and bring it to the level of quality we had envisioned from the get-go, the time actually spent playing the game and identifying issues not seen in the script or artworks themselves was ironically limited. The work sessions we partook in were solely dedicated to incorporating, uploading, and downloading additions and changes to the code we utilized and backed up. This engendered some technical quirks such as improper artwork positioning, incongruous or missing backgrounds and characters, and the occasionally improper spelling and assignment of dialog to particular personalities. Unfortunately, by the time we got to those issues, we were already well into C-Term 2017, meaning that we had to prioritize asset polish and finalization over brainstormed ideas that would further enhance the title's narrative and presentation.

7.2.3. Coordination of narrative and art

The independent and separate production of the art and narrative for *Streams of Nurture* proved to be a double-edged sword. On one hand, it did speed up development and allow us to add our unique touch to the content we churned out on a daily basis, making the visual novel even more compelling. On the other hand, however, this begot moments where both design components didn't properly align with one another. These included limited character figures that didn't reflect the broad cast of personalities featured in the game and misunderstandings about things like visual perspectives, lighting, framing and signs that needed to be portrayed onscreen at particular points in the game. The discrepancy between what was intended to be depicted and what was being displayed meant that unexpected revisions to our code had to be done to avoid having such errors affect the tone and vision of the visual novel, or other design facets such as the soundscape.

7.2.4. Late inclusion of audio

Originally, we expected Liam to produce both the art and audio for *Streams of Nurture*, and he happily agreed to handle both components. However, as time went on and the workload became increasingly intense, it was clear that we needed someone else who could dedicate their entire attention to the game's sound design. Although we found such a partner in Dave Allen, we did so at the tail end of C term 2017, meaning that he would only be able to start generating sound assets in D term 2017, a rather short timeframe given the scope and size of the visual novel. The same applied to playtesting since we first had to get the MQP up to an acceptable level of polish by early March before we could have outsiders analyze the narrative and artistic components of the title without being distracted by uncalled-for technical glitches. We think that adding both sound and playtesting at an earlier date would have resulted in a title that felt more complete and refined.

7.3. Missed opportunities

7.3.1. *Improved authenticity*

With our game taking heavy inspiration from tribal culture, coastal life, and the history of salmon fishing and farming, we knew from the get-go that the visual novel bore lots of potential with regards to topical authenticity. The idea of having our work both sponsored by various seafood and oceanographic organizations that “seek to advance sustainable global fisheries on market economic conditions” (Micronews) (e.g. Marine Stewardship Council, Monterey Bay Aquarium, etc.) and certified by actual natives sprang to mind and became one of our first goals besides materializing our experience goal and vision. However, due to unpredictable restrictions and occurrences throughout the academic year that necessitated more focus on the development of the MQP, we were unable to pursue the goal of sponsorship. The same could be applied to promotional online activity that would have spread the word about the title’s unique premise and look.

7.3.2. *Enhanced interactivity and personalization*

Over the course of development, the MQP team and advisors spent much of their time together brainstorming additional narrative and gameplay possibilities that, although not part of the minimum viable product, could be explored and experimented with further down the line to expand the story and give a more dramatic edge. These included dialog trees to bolster their knowledge of aquaculture, the world and the cast of characters, moral choices that could lead to multiple endings and affect the player’s standing with their allies and nemeses throughout the game, and subplots that would intensify the characters’ level of internal and external conflict (e.g. a flashback-based story arc that further explained why the protagonist’s father mysteriously vanished). There was also the

likelihood of creating mini-games the player could partake in to get a tactile feel of salmon farming (e.g. scanning electronic tags for salmon, extracting eggs, meting out fish feed).

As fetching as these character arcs, storytelling methods and gameplay mechanics were, they heavily depended on the skeletal framework and kinetic dialog that was laid out at the start of development. So what we did instead is put them off for later while gradually fleshing them out via documentation. Due to the intense and unpredictable spring semester, however, we decided to maintain our focus on the base game and refine its core features to the best of our abilities. Ultimately, we believe that the additions we wished to make to *Streams of Nurture* could still be realized after the MQP period once the visual novel has reached a high level of polish.

7.3.3. Audiovisual flourish

Narrative and gameplay were not the only areas that we brainstormed and fostered ideas for in the middle of development. The MQP students and advisors similarly looked at ways to enhance the title's aesthetics beyond the tribal and coastal motifs that made *Streams of Nurture* distinct. From graphical tricks such as camera panning and zooming that emphasized certain objects in the background, to “hero shots” (i.e. animated character silhouettes and particle effects accentuating the onscreen action), interactive objects, and seasonal changes that made the visuals more dynamic, there were sundry possibilities the team pondered and took note of to elevate the presentation to greater visual heights.

Unfortunately, some unexpected quirks in the artworks (e.g. transparency issues, limited range of assets, incorrect backdrops) led to various revisions and tweaks that, although beneficial, put the proposed graphical features on the back burner. By the time most of the art was finalized

and ready to be shown publicly, we were already well into D term 2017, leaving us with little to no time to get most of our additions in before Project Presentation Day and Showfest without rushing and compromising the artistic integrity of the title. However, such features have been well-documented enough for us to potentially revisit them in the foreseeable future.

7.3.4. Improved organization of assets

Although the BitBucket folder we leveraged to store the game files and our research notes was well-organized and had its (sub)directories function as intended, a modular approach to sorting written and artistic content would have further streamlined the structure and handling of the assets constituting the visual novel. Scenes could have been individually broken up to speed up the editing phases, artworks would have benefited from more chronological and categorized folders to determine what had to be incorporated into the MQP's script, and documentation could have been collated according to the design component they covered (art, sound, narrative). The team didn't have any major problems determining what needed to be stored where, but the addition of a few more folders and clearer nomenclature with regards to disciplines and time of creation would have gone a long way towards simplifying the process of updating and managing game assets even more.

8. Conclusion

8.1. Prospects

With an idea as ambitious and niche as that of *Streams of Nurture*, it is clear that the title represents a unique edutainment experience that can be iterated upon and even presented to the public in its current state as of writing. The proposed features we brainstormed in the middle of development and had to put in the back burner for potential inclusion can indeed become a reality outside of the academic environment we worked in. Should that possibility be unachievable in the long run, the premise and narrative themselves can still be leveraged and applied to various other game engines. Nevertheless, the first full incarnation of *Streams of Nurture* proved to be a refined and cogent title with themes that are both relatable and malleable.

Additionally, the team contemplated the idea of having the MQP showcased at sundry gaming conventions such as the Boston Festival of Indie Games, Games for Change, and Different Games, as well as sponsored by oceanographic and seafood sustainability organizations like the Marine Stewardship Council, Oceana, and Monterey Bay Aquarium. While the slightly protracted production cycle of the visual novel preempted us from achieving that particular goal during the academic year, we believe that bringing the game to a higher level of polish further down the line can enable us to share our realized vision with those environmental bodies and raise awareness about sustainable aquaculture.

8.2. Takeaway

Perhaps the most important lesson we can draw from our time developing *Streams of Nurture* is that crafting a narratively compelling game around a real-world topic as multilayered as salmon aquaculture not only necessitates a crystal-clear vision, but also a lucid understanding among developers from different backgrounds of how to realize such a concept. From the preparatory documents that outlined the core features and structure of the visual novel, to the actual creation of the story and audiovisuals, the MQP gave the team a taste of the iterative and lengthy process associated with game development. Close collaboration, constant communication and advanced planning engendered a smooth production cycle that enabled us to fully deliver on the experience goal we came up with from the outset.

As an educational tool, the visual novel acts as a consummate example of teaching an important issue and field through the video gaming medium, a way of leveraging the interactive qualities of play to make the act of learning more appealing. As an entertainment product, our MQP displays the ability to marry dramatic storytelling with an unexplored premise and beget a distinct experience that makes it stand out from the anime-influenced visual novels that populate the market. As a passion project, *Streams of Nurture* represents the culmination of years of engagement with a peculiar topic, one that could inspire other game creators to make their unique interests become an interactive reality. As Craig Hubbard, narrative director at Ubisoft Massive, once said:

“Creativity is recombinant, and the more inspiration designers take in, the more they have to draw from and the higher the chances they'll produce something with a distinct perspective.” (Hubbard)

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Appendix A: Design document

Title: Salt of the Sea (placeholder)

Intended game systems: Ren'Py-supported platforms

Genre: Kinetic (or branching) visual novel with anime (?) visuals

Target age of players: 13-18

Distinct modes of play: Single-player

What is it like: A seafood-themed visual novel with environmental undertones

Synopsis:

The player-created protagonist, who is the recently orphaned child of an august but downtrodden fisherman, moves to the fish capital of North America, Duntale, to attend Labrador Institute, one of the country's leading colleges in environmental science and ecology. The town, home to a prominent tribal culture and fishing community, has recently fallen on hard times as a major salmon farming corporation moved into the area to expand their operations, which in turn leads to local fisheries and wildlife being severely impacted by the net pens and waste that the farmed salmon produce. With the help of their friends and elders, the protagonist sets out to find a solution to the environmental quandary and restore Duntale to its former glory by way of sustainable farming, fishing, and the like.

Primary characters:

Protagonist. The child of a beloved but destitute fisherman who eked out a living through fishing various critters, mainly salmon, until an event akin to that of the Newfoundland cod collapse of 1992. Lives in the dorms and majors in Marine Science.

The protagonist is still reeling from the death of their father who raised them on his own and taught them to be independent and sustainable. Although they wish to maintain their father's

old-fashioned ways, the protagonist is also open to various technologies such as aquaculture and hatcheries as long as they are responsibly implemented and managed. They hope to take advantage of the situation in Duntale to honor their upbringing and have the town get a new lease on oceanic life. Is a bit discombobulated at first by the sundry fishing practices (a far cry from the predominant “fishing rod” approach), but they quickly adapt to their newfound environment as time goes on.

Daphne Crosby. A college junior and daughter of the region’s fisheries overseer. Having had experience with the management and production of seafood in and around Duntale, Daphne is well-versed on the craft of finding the best way to futureproof the sustainability of both the fishermen’s lifestyle and the life cycle of the fish species that populate the town and its outskirts. Lives in a small condo and majors in Farming & Food Systems.

Daphne is popular among her peers and professors for her ability to take her vocation seriously and making it sound especially exciting to them, which has earned her many friends and supporters within her academic circle. But she is not quite as beloved outside of college since the local populace hold a grudge against her father due to the ongoing aquacultural situation.

Joshua Norton. A college sophomore and the son of a local tribal chief. He has spent the bulk of his life as a tribesman who occasionally visited the town of Duntale and fished for salmon in the runs and tributaries flowing out into the ocean, and he’s an outspoken critic of technologically advanced fishing and aquacultural practices Lives in a fish house and majors in Field Ecology & Natural History.

Despite being hot-headed and reactionary from time to time, Joshua firmly believes that the welfare of the entire region can be improved and maintained through sound environmental practices and economic considerations (the triple-benefit system). He wishes to preserve the old-fashioned way to the best of his abilities, but the schism between the native tribe and urban Duntalers prevents him from realizing his dream in a civil fashion.

Olympia Crammer. A studious college senior and an orphan who lives under the custody of one of her professors. Having lived her early childhood with Joshua Norton before moving to urban life to learn the tools of the trade following the death of her parents and becoming a child prodigy in the process, Olympia is dedicated to combining her native roots with her intellectual and technological acumen to improve the lives of Duntalers and close the gap between the natives and the commercial fishermen. Lives in a workshop and majors in Sustainable Business. Despite being exceptionally erudite and astute with her line of work, Olympia doesn't have many friends since her dedication to the betterment of the Duntale community as well as her personal ambition of making peace with her native upbringing by leveraging it for aquacultural purposes precludes her from seeking social opportunities, which inhibit her ability to "sell the dream" in a downtrodden and pessimistic environment.

Secondary characters:

George Crosby. Duntale's maligned but well-meaning fisheries overseer. Supports his daughter's efforts to cure the ills of the town without resorting to desperate measures which he was forced to do when the salmon farming company rolled into town. Is cautiously optimistic about the situation in the face of public disapproval.

Bill "Chief" Norton. Leader and chief of Duntale's local native tribe. Is at odds with the commercial fishermen dominating Duntale and attempts to uphold his clan's traditional ways while adapting to the constantly changing economic and natural environment. Has a few reservations about his son's demeanor, even if he understands his concerns.

Deborah Perkins. The president of Labrador Institute. Cares greatly about her student and their efforts to improve and safeguard the environment and nature as a whole. Maintains a positive and sagacious demeanor in spite of Duntale's woes and assists the protagonist and their friends throughout the game by offering them sound advice and counseling.

Roger Belroy, the director of the salmon farming corporation that recently set up shop in Duntale. Wishes to get pressure off the wild salmon fisheries with aquaculture, but is reluctant to improve farming practices for fear of making the fish prohibitively expensive. Can be bullheaded when clashing with naysayers, but is willing to hear the opinion of those who embody somewhat similar interests.

Themes:

Salt of the Sea deals with the issue of salmon overfishing, aquaculture and environmental impact, as well as the relationships between the various communities and people whose livelihoods are impacted by those factors. A bit like *Lull of the Sea*, the Newfoundland cod fishery collapse of 1992 and British Columbia salmon disputes.

<http://kotaku.com/nagi-no-asukara-is-emotionally-heart-wrenching-and-them-1562047633>

<https://www.youtube.com/watch?v=L5wR8lu2Q00>

<https://www.youtube.com/watch?v=qSqDFT2z0b8>

The fact that the main characters attend the same college and harbor different philosophies pertaining to seafood sustainability and production mirrors real-life debates on optimal solutions for preserving fish and marine life.

Salt of the Sea's main message consists of the idea that you can have your cake and eat it too if you manage your resources sustainably and plan accordingly for the future instead of thinking in the short term and harvesting as much food as you possibly can.

The player has the ability to explore one or multiple paths to salmon sustainability and production (closed containment farming, sustainable net farming, hatcheries...) and cooperate with several characters in each of the paths.

The protagonist's past experience with economic downturn and environmental decay (mainly because of their father) causes them to relive unpleasant memories that will challenge them and push them to save Duntale from the same fate that befell their former home.

-Each sustainability path (e.g. tank farming, hatchery, net farming) will consist of an initiation stage (getting to know the practice and learning its intricacies after the salmon problem arises), building stage, challenge phase (facing the major obstacle of that particular path) and completion stage.

Depending on what path the player chooses, their relationships with other characters will be altered for the rest of the game, which will affect the outcome they will end up with.

Nature vs. nurture, economy vs. environment. Throughout the game, the player will have to figure out how to reconcile the two without necessarily neglecting one over the other with the various fishing/farming practices they will employ to save Duntale.

The salmon's cultural and social significance will also play a huge role in Salt of the Sea's environmental message, with tribal and commercial perspectives portraying the pelagic wonder as more than just sustenance. It is actually a symbol of nature's gift to the local populace, a sign of roseate prospects and perpetual prosperity.

The dialect in Duntale will be slightly peculiar and eccentric to reflect the overall character and nature of the town. Newfoundland English is a good start:

https://en.wikipedia.org/wiki/Newfoundland_English

The clash between commercial fishermen and native tribes is one of the many conundrums that the player will have to face. Reconciling the two will ultimately come down to finding a sustainable practice that will benefit both sides, further highlighting the sociopolitical impact overfishing and marine devastation has on the community.

Experience goal (what I want the player to do and feel):

Salt of the Sea's experience goal is to inform the player on the economic, environmental and sociocultural impact of salmon as a species so that they can deduce the best route for caring for and harvesting the fish in a sustainable manner that will benefit both the people that depend on it as well as marine life through decision-making and option-weighing.

The feelings of redemption (when environmental consequences impact Duntale and its surroundings), determination (when an effective solution to the salmon problem is found and adopted) and self-fulfillment (when Duntale is restored to its former glory) should define the experience (although moments of downfall and solace can be interspersed in those moments).

In layman's terms, the player should get the sensation that they are on a moral journey of sorts since they want to do right and erase Duntale's environmental crimes by replenishing the salmon stocks directly (hatcheries) or indirectly (farming). Said feelings follow a structure similar to that of the Hero's Journey (departure, initiation, return):

Before: Shock and conscientiousness.

During: Perseverance and ingenuity.

After: Pride and achievement

By the end of the experience, the player should have the necessary knowledge for conscientiously choosing sustainable salmon/seafood by basing their choices on the practices and ramifications they've been exposed to, and they should also better appreciate the salmon as an invaluable component that brings life to its surroundings and the entities that interact with it.

Appendix B: Character profiles

Character: Protagonist

Physical (What we see):

1. Sex, age: Female/male, 18
2. Height and weight: 5'10", 140lbs
3. Color of hair, eyes, and skin: Black, brown eyes, and fair skin
4. Posture: Straight
5. Appearance: N/A
6. Defects: Scar on left earlobe
7. Heredity: Stutter from mother who was diagnosed with HFA

Sociological (Background, present environment):

1. Class: Lower class
2. Occupation: N/A
3. Education: Currently attending the Labrador Institute as a college junior majoring in Marine Ecology. Performs exceptionally well in Farming & Food Systems and Sustainable Business, but isn't quite as adroit in Culture & Place and Ethnography & Documentary. Unique aptitudes include hyperfocus on any given tasks and having a highly structured, if somewhat rigid, schedule.
4. Home life: Lives in the Labrador dorms, albeit in a swanky single room.
5. Religion, race, nationality: Christian, Caucasian, American.

6. Place in community: Is initially seen as an outsider by most of the townsfolks and peers and professors (which turns into ambivalence following the crisis), but slowly wins their favor as they're making progress with their project.

7. Political affiliations: Centrist.

8. Amusements, hobbies: Enjoys sauntering about town and nature alone; loves perusing the minutiae of any given topic, especially culinary and political ones (hobbies); and likes to share their life experience with everyone on social media.

Psychological (how one thinks and feels):

1. Sex life, moral standards: Believes that compromise, above all else, is key to success and looking at both sides of an issue.

2. Personal premise, ambition: Comes from a rather downtrodden research/fishing family in New England. Wishes to become an entrepreneurial figure of sorts with regards to all things aquaculture by leveraging the work that their dad has done.

3. Frustrations, chief disappointments: Frustrated with the fact that they're constantly being hunted by the past despite trying to escape it; is disappointed that he confuses confidence with cockiness, something that the indifferent fishermen in their town embodied before paying the price.

4. Temperament: Usually hesitant, but sheer curiosity and determination later turn that demeanor upside down.

5. Attitude toward life: Somewhat pessimistic at first given past woes, but gradually takes initiative and leads the charge as the situation worsens.

6. Complexes: Can sometimes seem somewhat indifferent towards what is happening around them; hates being told to change their behavior and go with the flow since he's been struggling with his mother's condition and his town's past for years.

7. Extrovert, introvert, ambivert: Introvert.
8. Abilities: Is capable of brainstorming ideas on the spot when confronted with a problem, and is able to perceive imminent danger to their endeavors.
9. Qualities: Perceptive, reserved, conscientious.
10. I.Q.: A little over 140.

Character: Olympia Crammer

Physical (what we see):

1. Sex, age: Female, 22
2. Height and weight: 6', 170lbs
3. Color of hair, eyes, and skin: Black hair, brown eyes and slightly tan skin.
4. Posture: Straight
5. Appearance: Stout, high cheekbones, thin lips, eye bags.
6. Defects: Minor scar on her left eyebrow.
7. Heredity: Birthmark on her right shoulder, inherited from her father.

Sociological (background, present environment):

1. Class: Middle class
2. Occupation: N/A
3. Education: Currently attending the Labrador Institute as a college senior majoring in Sustainable Business. Performs exceptionally well in Climate Change & Energy and Marine Science, but isn't quite as adroit in Community Planning & Ecological Policy and Environmental Law & Politics. Unique aptitudes include working for long periods of time without being distracted and planning all of her academic endeavors in advance and swiftly.

4. Home life: Lives in a workshop near the wharf where she spends a lot of her time working on a secret engineering project; her parents died while she was still young.

5. Religion, race, nationality: Atheist, Native, American.

6. Place in community: Is considered to be the embodiment of a perfect amalgamation of Duntale and tribal values: her concerns for the environment and determination to improve its conditions through technological means has netted her respect from both Duntalers and natives.

7. Political affiliations: Slightly progressive.

8. Amusements, hobbies: Enjoys watching movies on environmental sustainability and agriculture; loves assembling makeshift miniature models using scrap metal; and likes to hang around the supermarket and looking at the variety of seafood on offer.

Psychological (how one thinks and feels):

1. Sex life, moral standards: N/A

2. Personal premise, ambition: Originally lived with the tribe, but moved to Duntale following the death of her parents; wishes to revolutionize seafood harvesting and production through technological and sustainable means.

3. Frustrations, chief disappointments: Doesn't like being interrupted while she is studying or working intensively; is disappointed that financial and economic constraints are preventing her from making much progress with her personal endeavors.

4. Temperament: Phlegmatic and placid, but becomes elated when she reaches a personal milestone.

5. Attitude toward life: Reclusive. Likes to keep to herself and avoids being bothered by anyone who stands between her and her ambitions.

6. Complexes: Can sometimes appear removed from society and real-life as a whole due to her highly introverted nature; has an obsession with the future and doesn't pay much attention to the present; hates talking about her past and upbringing.
7. Extrovert, introvert, ambivert: Introvert.
8. Abilities: Is capable of immaculately understanding the behavior pattern of farmed animals, and understanding both tribal and commercial practices with regards to fishing.
9. Qualities: Independent, hard-working, curious.
10. I.Q.: 125

Character: Joshua Norton

Physical (What we see):

1. Sex, age: Male, 20
2. Height and weight: 6'1", 160lbs
3. Color of hair, eyes, and skin: Brown hair, brown eyes, and slightly tan skin
4. Posture: Straight
5. Appearance: Well-built, slightly full lips, soul patch, wristband.
6. Defects: Scar on left cheek.
7. Heredity: Birthmark on neck, inherited from father.

Sociological (Background, present environment):

1. Class: Working class.
2. Occupation: Works part-time at the Tourism Center as an interpreter and guide every Tuesday-Thursday after classes are done. Earns \$15/hour for his work. Likes to expound the details and intricacies of each environmental and tribal landmark he presents to sightseers.

3. Education: Currently attending the Labrador Institute as a college junior majoring in Field Ecology & Natural History. Performs exceptionally well in Ethnography & Documentary and Culture & Place, but isn't quite as adroit in Farming & Food Systems and Sustainable Business. Unique aptitudes include presenting historical/cultural information with a passionate demeanor and translating textbook material on the fly.
4. Home life: Lives in a fish house next to a lake located just outside of town where he spends most of his time fishing. Sometimes visits his dad on weekends.
5. Religion, race, nationality: Tribal, Native, American.
6. Place in community: Is frowned upon by fishermen for his outspoken and somewhat catty view of commercial fishing, but people within his social circle perceive him favorably enough since he's seen as a well-meaning and kind-hearted fellow at his core.
7. Political affiliations: Progressive.
8. Amusements, hobbies: Enjoys spending some time on the river bank and fishing for salmon the old-fashioned way; likes to cook seafood for others and for himself; and loves swimming in the lake facing his humble abode.

Psychological (how one thinks and feels):

1. Sex life, moral standards: N/A
2. Personal premise, ambition: Spent most of his life living with the tribe outside of town and only occasionally visiting Duntale until recently; wishes to restore the fisheries to their original levels and promote sustainable fishing practices nationwide.
3. Frustrations, chief disappointments: Is frustrated by the fact that his ways and opinions are constantly being repudiated by the townsfolk in spite of the ongoing crisis; disappointed by the fact that he couldn't have prevented the ecological woes earlier.

4. Temperament: Can be hot-headed and reactionary at times, but he can appear quite winsome when he's in a particularly good mood.
5. Attitude toward life: A bit insubordinate given his opposition to the status quo; believes that society shouldn't rely solely or too heavily on technology for their everyday needs.
6. Complexes: Has an incredibly challenging time embracing modern fishing practices even if they can prove more efficient than his methods; is torn between appeasing his more open-minded classmates and staying true to his roots.
7. Extrovert, introvert, ambivert: Ambivert.
8. Abilities: Is able to anticipate the movement and routine of the fish swimming in the sea or streams; and can easily take them out of the water with grace and ease.
9. Qualities: Confident; strong-willed; perseverant.
10. IQ: 100.

Character: Mayor Crosby

Physical (What we see):

1. Sex, age: Male, 58.
2. Height and weight: 5'11", 190lbs
3. Color of hair, eyes, and skin: Gray, blue eyes, and fair skin.
4. Posture: Straight
5. Appearance: Plump, thick-rimmed glasses, Ivy League haircut, pocket watch.
6. Defects: N/A
7. Heredity: Cleft chin and dimples from his father and mother respectively.

Sociological (Background, present environment):

1. Class: Upper class
2. Occupation: Mayor of Duntale. Works there every day; earns \$100K a year. Recently struck a deal with BioSalar investors to have their operations relocated to Duntale (much to the dismay of the townsfolk).
3. Education: Dropped out of high school shortly before graduation in order to help his family eke out a living through fishing. Performed surprisingly well in fields of politics and business, but wasn't too fond of environmental science. Unique aptitudes include having a sharp-tongue when proposing ideal but unrealistic deadlines and milestones to his peers, and having a knack for crafting budgets on-the-fly.
4. Home life: Lives in a mansion located just behind the town hall.
5. Religion, race, nationality: Christian, Caucasian, American.
6. Place in community: Used to be well-respected by the townsfolk, but his popularity sank following the arrival of BioSalar on Duntale's grounds.

7. Political affiliations: Center-right.

8. Amusements, hobbies: Enjoys smoking a pipe and having cocktail parties on his estate with his cabinet; loves honing his putting skills in both the town hall and mansion; and likes playing darts in his office.

Psychological (how one thinks and feels):

1. Sex life, moral standards: Wife divorced him a long time ago; believes that business ought to be prioritized and fully leveraged in order to accrue more revenue that can potentially be used for good.

2. Personal premise, ambition: Comes from a fishing family whose business was in danger of falling apart. Wishes to attract more investors to Duntale in order to restore it to its former glory.

3. Frustrations, chief disappointments: Frustrated with the fact that townsfolk are just focusing on the negative effects of his policies instead of the positive ones; disappointed that he is incapable of finding an alternative with regards to economic policies that will benefit Duntale as a whole.

4. Temperament: Welcoming and humble, but can get a bit antsy whenever he's confronted with evidence of past transgressions.

5. Attitude toward life: Somewhat optimistic, but a gloomier side resides within him as well.

6. Complexes: Can sometimes appear careless despite his best attempts to cater to his constituents; hates having to deal with hecklers and dissenters who bombard him with criticism and vitriol.

7. Extrovert, introvert, ambivert: Extrovert.

8. Abilities: Capable of passing several bills and policies with little to no opposition from his peers; and is able to craft buzzwords and rhetoric to quell his constituents' concerns.

9. Qualities: Gladsome; hopeful; astute.

10. IQ: A little over 110.

Character: Daphne Crosby

Physical (What we see):

1. Sex, age: Female, 21
2. Height and weight: 5'9", 130lbs
3. Color of hair, eyes, and skin: Brown, blue eyes, and fair skin
4. Posture: Straight
5. Appearance: Svelte, full lips, thin framed glasses, finger wave hair
6. Defects: N/A
7. Heredity: Beauty mark on the left side of her lips, inherited from her mother

Sociological (Background, present environment):

1. Class: Middle-upper class
2. Occupation: Part-time researcher at Marine Research Center; works there on Mondays-Wednesdays-Fridays after classes are done. Earns \$80/hour for her work. Likes to have an organized but flexible schedule; is well-suited for both field studies and lab work, although the latter takes up a lot of her time.
3. Education: Currently attending the Labrador Institute as a college junior majoring in Farming & Food Systems. Performs exceptionally well in Environmental Law & Politics and Community Planning & Ecological Policy, but isn't quite as adroit in Culture & Place and Ethnography & Documentary. Unique aptitudes include taking notes swiftly every time the professor opens their mouth and memorizing them on the spot.
4. Home life: Lives in a cozy and prim condo near downtown on her own that also houses a fairly large library of books on ecology, but she sometimes visits her parents on weekends.
5. Religion, race, nationality: Christian, Caucasian, American.

6. Place in community: Is seen as the center of attention by her peers and professors for her intellect and status as the daughter of a prominent local public official, both positively and negatively depending on the demographic.

7. Political affiliations: Centrist.

8. Amusements, hobbies: Enjoys collecting and reading books on various forms of marine life; loves hanging around the wharf to get a closer look at the fish that's caught daily; and likes to fish by the harbor late at night when everyone is sleeping.

Psychological (how one thinks and feels):

1. Sex life, moral standards: N/A

2. Personal premise, ambition: Comes from a relatively well-respected family of Duntale fishermen who have moved up the ranks in recent years. Wishes to become a public official like her father or at the very least a researcher in the field of marine ecology.

3. Frustrations, chief disappointments: Loathes the idea of having to choose between doing what's best for the community and what she perceives to be the better solution (which sometimes conflicts with others' opinion); disappointed by the fact that her family name has gotten a bad rap as of late.

4. Temperament: Usually winsome, but can feel a bit doleful when things don't go according to plan.

5. Attitude toward life: Altruistic, wishes to contribute to society by fostering its betterment through market-based approaches to environmental and food sustainability.

6. Complexes: Can sometimes be aloof as to what is really happening in the community (a bit like her father); hates being questioned about her approaches to problem-solving, especially when it involves the fisheries and Duntale-tribal relationships.

7. Extrovert, introvert, ambivert: Ambivert.

8. Abilities: Is capable of making the distinction between several species of fish just by looking at them, and pitching ideas to her peers in a captivating fashion.
9. Qualities: Smart, ebullient, quirky.
10. IQ: A little over a 130.

Character: William Sanders

Physical (What we see):

1. Sex, age: Male, 51.
2. Height and weight: 5'11, 140lbs
3. Color of hair, eyes, and skin: Bald, brown, and black skin.
4. Posture: Straight
5. Appearance: Thin-rimmed glasses, rolled-up sleeves, goatee, red tie.
6. Defects: Small scars on neck
7. Heredity: N/A

Sociological (Background, present environment):

1. Class: Middle class
2. Occupation: Lead scientist at the Marine Research Center. Works there every day; earns \$40K a year. Responsible for setting policies regarding fishing quotas and techniques that ensure long-term sustainability, but are being ignored or neglected by the government.
3. Education: Graduated from Duke University with a PhD. Performed incredibly well in fields of oceanography and biology, but wasn't too fond of business and social science. Unique aptitudes

include collating ample amounts of information on a given subject; and finding connections between various biological and analytical contingencies.

4. Home life: Lives in an apartment in the northern parts of town.

5. Religion, race, nationality: Christian, African-American, American.

6. Place in community: Is being ridiculed by the government (who ostensibly tease him in an amicable fashion) and somewhat misunderstood by the fishermen, but his research has made him, along with Miss Perkins, one of the few voices of reason in town.

7. Political affiliations: Center-left.

8. Amusements, hobbies: Enjoys visiting thrift stores; loves cycling around the island; and likes collecting sea shells.

Psychological (how one thinks and feels):

1. Sex life, moral standards: Not married; believes that the world economy should all be about the triple bottom line, meaning that businesses should be beholden to the environment and community instead of just stock holders.
2. Personal premise, ambition: Comes from a family that held a ferry business in the South. Wishes to apply the research he and his colleagues do across the entirety of the fishing industry.
3. Frustrations, chief disappointments: Frustrated with the fact that officials and businesses are ignoring the recommendations he makes; disappointed that he is unable to do much without losing his job to put an end to the laissez-faire approach to food production.
4. Temperament: Petulant, but becomes more open when approached by people who genuinely wish to seek his advice.
5. Attitude toward life: Somewhat pessimistic, but he becomes optimistic once he realizes that the work the protagonist is doing is bearing fruit.
6. Complexes: Can sometimes be grumpy and obstinate when trying to make a point about dire economic and environmental state of affairs; hates having to wait for feedback from his research, governmental and business “colleagues” for longer than usual.
7. Extrovert, introvert, ambivert: Introvert.
8. Abilities: Is capable of determining the state of the waters just by combing them; and is able to attract sponsors from around the world to his collaborative projects.
9. Qualities: Insightful, earnest, reliable.
10. IQ: A little over 140.

Character: Roger Belroy

Physical (What we see):

1. Sex, age: Male, 45.
2. Height and weight: 6", 160lbs
3. Color of hair, eyes, and skin: Blond, blue eyes, and fair skin.
4. Posture: Straight
5. Appearance: Lissome, pocket book on chest, crew cut, sports watch.
6. Defects: N/A
7. Heredity: Widow's peak inherited from father.

Sociological (Background, present environment):

1. Class: Upper-middle class
2. Occupation: Manager of BioSalar in Duntale. Works there every day; earns \$125K a year. Recently struck a deal with the Duntale government to have their operations relocated in town (much to the dismay of the townsfolk).
3. Education: Graduated from Harvard Business School with an MBA. Performed surprisingly well in fields of economics, but wasn't too fond of environmental and social science. Unique aptitudes include outlining his research and business theories with little to no assistance from his peers; and dissecting every facet of the economic details associated with his major qualifying projects.
4. Home life: Lives in a house next to the aquaculture facilities.
5. Religion, race, nationality: Christian, Caucasian, American.
6. Place in community: Is loathed by virtually everyone in Duntale, save for the mayor and his cabinet, due to his disregard for traditional fishing.

7. Political affiliations: Right-wing.

8. Amusements, hobbies: Enjoys chatting with chefs about the quality of the salmon he is rearing; loves canoeing on the shores of Duntale; and likes watching disaster movies.

Psychological (how one thinks and feels):

1. Sex life, moral standards: Not married; believes that efficiency and productivity should be maximized with environmental concerns coming second in order to feed as many mouths as possible (and make a quick and larger buck).

2. Personal premise, ambition: Comes from a Boy and Girl Scout family. Wishes to turn BioSalar into a multinational leader into the largest food conglomerate in the world.

3. Frustrations, chief disappointments: Frustrated with the fact that petty activists and environmentalists are stalling his business efforts; disappointed that regulations force him to restrain his activities somewhat instead of having a laissez-faire model implemented.

4. Temperament: Good-natured, but can appear showy in positive circumstances and concerned in negative ones.

5. Attitude toward life: Somewhat optimistic, but he becomes increasingly pessimistic as the game progresses.

6. Complexes: Can sometimes be coy and secretive when dealing with sensitive matters in which he has a personal stake; hates the idea of having to find a balance between the environment and economy, both of which are constantly at odds with one another.

7. Extrovert, introvert, ambivert: Ambivert.

8. Abilities: Is capable of surreptitiously implementing practices in his operations that maximize his profits; and is able to woo politicians with his economic acumen.

9. Qualities: Shrewd, businesslike, organized.

10. IQ: A little over 120.

Character: Thomas Lane

Physical (What we see):

1. Sex, age: Male, 31.
2. Height and weight: 6'2', 220bs
3. Color of hair, eyes, and skin: Black, brown, and tan skin.
4. Posture: Straight
5. Appearance: Sideburns, ponytail, overalls, gloves.
6. Defects: N/A
7. Heredity: N/A

Sociological (Background, present environment):

1. Class: Lower-middle class
2. Occupation: Manager at the salmon ranch. Works there every day (except weekends); earns \$20K a year. Responsible for overlooking onsite operations and discussing farming techniques and details with equipment suppliers and researchers.
3. Education: Graduated from Duntale's high school, but no college education. Performed incredibly well in fields of economics and biology, but wasn't too fond of geography and history. Unique aptitudes include knowing the anatomy of every fish species he studied by heart; and constantly keeping a journal on his daily academic endeavors.
4. Home life: Lives in the indigenous settlement northeast of the island.
5. Religion, race, nationality: Atheist, Native American, American.

6. Place in community: Is seen indifferently by the townsfolk due to his relative lack of interaction with them, but is well regarded within the native community.

7. Political affiliations: Center-left.

8. Amusements, hobbies: Enjoys cooking barbeque with his family; loves hiking in the forest; and likes karaoke.

Psychological (how one thinks and feels):

1. Sex life, moral standards: Single; believes that man has a duty to take care of the environment and its resources through sound stewardship, i.e. a mix of nature and nurture, like his ranching operations.

2. Personal premise, ambition: Comes from a native family that used to fish artisanally. Wishes to preserve his ways through the use of modern technology that promotes natural conservation.

3. Frustrations, chief disappointments: Frustrated with the fact that some of his loved ones and people don't see eye-to-eye with regards to career choice; disappointed that hardly anyone is taking him and his beliefs seriously.

4. Temperament: Cocky, but becomes paranoid whenever he is confronted with damning evidence about his wrongdoings. Tries to maintain a straight face, anyway.

5. Attitude toward life: Optimistic, he becomes defeatist following the ranching crisis and then slowly regains his confidence towards the end of the game.

6. Complexes: Can sometimes forget to take into consideration some of the more minute details in his endeavors, which can trigger his bouts of anxiety; hates being blamed for problems involving his operations that he has no control over.

7. Extrovert, introvert, ambivert: Extrovert.

8. Abilities: Is capable of catching fish out of the water swiftly; and is able to keep track of everything happening in the ranch on the top of his head.
9. Qualities: Confident, forward thinking, approachable.
10. IQ: A little over 100.

Character: Donovan Lee

Physical (What we see):

1. Sex, age: Male, 43.
2. Height and weight: 6", 180bs
3. Color of hair, eyes, and skin: Bald (red for facial hair), blue, and fair skin.
4. Posture: Straight
5. Appearance: Horseshoe mustache, jacket, fishing hat, holding a clipboard.
6. Defects: N/A
7. Heredity: Portwine stain on his neck; inherited from his dad

Sociological (Background, present environment)

1. Class: Middle class
2. Occupation: Lead technician at the salmon warehouse. Works there every day (except weekends); earns \$25K a year. Responsible for overlooking onsite operations and discussing farming techniques and details with equipment suppliers and researchers.
3. Education: Graduated from Rochester Institute of Technology. Performed incredibly well in fields of engineering and biology, but wasn't too fond of economics and history. Unique aptitudes

include building machines briskly; and coming up with efficient algorithms for keeping systems functional and up-to-date.

4. Home life: Lives in a trailer located on the southern end of Duntale.

5. Religion, race, nationality: Atheist, Caucasian, American.

6. Place in community: Is well-liked by the researchers and academics in Duntale; but draws the ire of the fishermen and government for potentially creating a business that may either fully rob them of their jobs or deprive them of essential finances respectively.

7. Political affiliations: Center.

8. Amusements, hobbies: Enjoys going to the gym; loves playing simulation games; and likes to stream his operations.

Psychological (how one thinks and feels):

1. Sex life, moral standards: Married; believes that there can be a fine balance between industry and conservation by replicating natural conditions through man-made methods as a way of letting Mother Nature heal.

2. Personal premise, ambition: Comes from a family that used to be in the architecture business. Wishes to capitalize on sustainable seafood to promote both the fishing and construction industries.

3. Frustrations, chief disappointments: Frustrated with the fact that the government isn't doing much to support his costly endeavors; disappointed that he'll likely never reach the same level of success as his parents.

4. Temperament: Level-headed, but can display irritation whenever he receives flak from the fishermen, officials and everyone else who disapproves of his operations.

5. Attitude toward life: Cautiously optimistic; attempts to remain that way even though he experiences some deep remorse following the tank incident.

6. Complexes: Can sometimes nag his co-workers when he feels like they aren't doing a good enough job with the machinery; hates having to multitask since he is usually hyperfocused on just one endeavor.
7. Extrovert, introvert, ambivert: Introvert.
8. Abilities: Is capable of vetting the fish just by observing their behavior and movement; and is able to lay down a plan and to-do list for everything daily that he constantly fulfills.
9. Qualities: Forthright, detail-oriented, industrious.
10. IQ: A little over 115.

Character: Muriel Perkins

Physical (What we see):

1. Sex, age: Female, 56.
2. Height and weight: 6'1", 200lbs
3. Color of hair, eyes, and skin: Brown, brown eyes, and fair skin.
4. Posture: Straight
5. Appearance: Zaftig, ichthys necklace, bobcut hair, golden watch.
6. Defects: N/A
7. Heredity: N/A

Sociological (Background, present environment):

1. Class: Upper class

2. Occupation: She is Labrador Institute's president. Works there every day (except weekends); earns \$200K a year. Recently crafted a one-degree curriculum with the Marine Research Center in order to streamline academics and make them more selective.

3. Education: Attended college in the Northeast with the protagonist's dad, majored in Marine Science. Performed exceptionally well in all fields, save for music and philosophy since she wasn't quite as astute in the liberal arts. Unique aptitudes include referencing multiple sources in her works without breaking a sweat and picking out discrepancies in theories and analyses instantly.

4. Home life: Lives in a manor just outside of town. Is single.

5. Religion, race, nationality: Christian, Caucasian, American.

6. Place in community: Is seen as the voice of reason in town with regards to the salmon industry and its woes; everyone, with the possible exception of BioSalar, sees her in a positive light.

7. Political affiliations: Centrist.

8. Amusements, hobbies: Enjoys unwinding in her house by listening to audiobooks about environmental issues; loves interacting with the students on all kinds of matters, especially academic ones; and likes to cook seafood in her kitchen.

Psychological (how one thinks and feels):

1. Sex life, moral standards: N/A; believes that practicality and empathy are key to a sound community, and that resorting to illusions and greed can bring about chaos.

2. Personal premise, ambition: Comes from a humble but well-respected farming family. Wishes to turn Labrador Institute into the foremost academic center for marine research and ecology.

3. Frustrations, chief disappointments: Frustrated with the fact that the government and business aren't listening to her and the scientists' advice; disappointed that she couldn't expand the college's research nationwide through her knowledge and insight.

4. Temperament: Usually congenial and gregarious, but can get a bit nettled when things don't quite go according to plan.
5. Attitude toward life: Optimistic, even perseveres in the face of sheer opposition.
6. Complexes: Can sometimes crack too many a jokes with her peers and students (much to their annoyance); hates having to deal with individuals who neglect her advice and thoughts in favor of having their take on matters universally heard.
7. Extrovert, introvert, ambivert: Extrovert.
8. Abilities: Is capable of arranging ambitious projects with politicians and researchers alike quickly; and is able to keep track of them at nearly all times.
9. Qualities: Jovial, down-to-earth, magnanimous.
10. IQ: A little over a 145.

Appendix C: Duntale profile

Organizations:

Marine Research Center: A scientific body charged with assessing the health of the surrounding marine life and churning out theories and practices for its long-term sustainability and management, the MRC acts as an institutional bridge of sorts between the fishermen and the Duntale government whose relations have been strained as of late, and is seen as the last line of defense against overfishing and the eradication of marine ecosystems. Originally founded in 1971 shortly after the establishment of the EPA, the MRC conducts multiple field studies that are then fleshed out in their labs located just outside of town. Modeled after several oceanographic institutes such as the Monterey Bay Aquarium Research Institute

(https://en.wikipedia.org/wiki/Monterey_Bay_Aquarium_Research_Institute).

https://en.wikipedia.org/wiki/Category:Oceanographic_institutions

Labrador Institute: A private, liberal arts college that specializes in human ecology, the Labrador Institute was founded in 1981 by former MRC employees and scientists to provide the next generation with the skills and tools needed to partake in activities dedicated to the environmental sciences, and also to address the shortage of people who are eligible for scientific studies. The college is fairly small, with roughly 500 students and 30 faculty members (a third of which are part-time). The college's green approach to architecture and energy consumption makes it one of the main paragons of environmental virtues with regards to national academia. Modeled after the College of the Atlantic (https://en.wikipedia.org/wiki/College_of_the_Atlantic).

Council on Duntale Relationships: A non-governmental advocacy group formed by public officials and activists to safeguard the peace between both Duntalers and the local tribe, especially with regards to fishing practices. Founded in 1945, the CDR aims to promote civil discourse between the two communities as well as the subgroups within them. The organization's size and scope has increased over the past years in order to respond to growing societal tensions surrounding the depletion of the fisheries that contribute significantly to Duntale's economy. Modeled after the National Congress of American Indians (<http://www.ncai.org/>).

History:

-Originally a fish hunting spot for tribespeople and then a trading outpost for various goods around the time of the Homestead Acts, Duntale quickly became one of the foremost locations for seafood production and harvesting. However, a recent ecological downturn led to an economic slump, forcing the government to rely on the investments of non-local companies to accrue enough revenue to keep the town afloat, but at the cost of the livelihoods of its citizens as well as the sustainability of the marine life surrounding Duntale.

Major Exports:

- Seafood
- Agricultural crops such as potato, blueberries and apples
- Forestry products

Major Imports;

- Transportation equipment (mainly boats)
- Paper products

-Mining products (e.g. copper)

Social Structure:

-The town is economically modest but stratified with the median income for a household being barely above \$50K. Rich folks are outnumbered by commoners, but low cost of living and ease of access to marine food and cheap housing/infrastructure allays class tensions. Duntale is predominantly white, but a prominent tribal presence can also be felt. Aside from a few disputes pertaining to fishing and seafood production, both communities get along with one another fairly well. Most Duntalers spend the day downtown or in the wharf, and establishments such as bars and general goods stores usually stay open until 9pm.

Government:

Duntale serves as the county seat for Kessler County (fictional) in Washington State, but most of its functions are subordinate (with a few exceptions to its marine reserves due to the MRC and BioSalar) to the state's jurisdiction. It is governed by a Mayor, who convenes with a bipartisan, independent town council to handle investments, laws, public education and trade. The sheriff is in charge of the police force in town, but also oversees the island on which the town sits. The mayor/town council can be seen as the brains of the town's political structure, while the sheriff and his officers are the brawns.

Culture:**Religion:**Christianity (Catholicism):

The town is not particularly religious, with most Duntalers keeping their beliefs and morals to themselves, but its Protestant roots can be seen in the references to moral pretenses/subtext/five solae that the fishermen utter to justify their work. When settlers initially came to Duntale, they instilled such values in some natives and used them to forge the look of the town. Over time, those designs became more subdued, but traces of its past (Prohibition-era speakeasies, Reformist individualism passages, historical architecture) still remain. There's only one Christian church in the middle of town which is seldom attended, and religious symbols are kept to a minimum around town aside from the implied references to Protestantism.

Native religion:

Most natives in and around Duntale still cling to their traditional and spiritual roots around nature and the salmon. Scriptures, symbols and other imagery litter the native village on the other side of the island, and tribal imagery can be conspicuously seen in parts of Duntale thanks to the settlement's heritage, which contrast with the urban design of Duntale. Their culture espouses sustainability and respect for the environment, which is why they still make use of artisanal fishing techniques instead of opting for the commercial tools used by Duntale fishermen.

Language:

English is the main language spoken in Duntale, but its level of sophistication is stratified in sundry dialects. The fishermen, for instance, showcase idioms and linguistic tendencies/words that can be traced back to the settlers' French and Irish heritage, whereas the upperclassmen sound more contemporary and formal by comparison. Natives similarly employ English in Duntale, but mostly stick to their Coast Salish koine when conversing among kin. The dialect of Duntale is quite similar

to that found in other coastal communities such as Newfoundland and Maine, mostly due to their similar ancestral makeup (Irish, English, French).

Cuisine:

Given its coastal location, Duntalers and natives alike stick to a predominantly pescetarian diet.

Meals are usually cooked at home and bought from the supermarket/fished out of the ocean due to the lack of eating establishments aside from Getty's Pub (which mostly specializes in comfort food/greasy spoon fare like fish and chips along with its liquor offerings) and the Ivory King (which is upscale and only the wealthy few can afford to go there). There used to be more brick 'n mortar restaurants, but economic woes caused virtually all of them to shut their doors. The occasional food court is now the cheapest and most mobile option for Duntalers.

Salmon, while still the most popular fish in Duntale, has become scarcer as of late due to collapsing stocks, and is something that only the upper class and lucky fisherman can afford to eat. Forage fish such as sardines, herring, mackerel and sprats, which is seen as poor man's food, is mostly eaten by the working and to a certain extent, the middle class. In addition to salmon, big fish such as tuna and delicacies such as oysters are consumed by the rich. White fish is avoided by most townfolks due to its bland taste and lack of nutritional benefits, and is seen as a last resort for most Duntalers due to the town's affinity for full-bodied, oily fish. Natives mostly eat salmon and food that they hunt and harvest themselves, with trading and shopping being kept to a minimum (only if need be).

In the early days, food used to be communally eaten as a buffet among family and friends, as well as Duntalers and natives. But the rise of individualism and downtrodden state of the populace led to more solitary meals, with massive gatherings now only happening at the eating hubs. Fish, vegetables (both Pacific and starchy fare such as kale, mushrooms, peas, corn, and potatoes due to the state's proximity to Idaho) may be consumed with fruits (berries, for example).

Meat, although sparingly consumed and mostly game, is still present on some Duntalers and, to a greater extent, native plates. Deer, duck and rabbit are seen as adventurous meats by Duntalers, but standard fare by natives. The fishermen are less likely to consume it due to their attachment to their labor, but the upper class see it as a curiosity that may dazzle the taste buds.

Commoner: Forage fish (herring, sardines, mackerel...), starchy vegetables, and small fruits comprise the working class's diet, with the occasional salmon and rarely game. Preferred alcoholic beverage is beer and ale. Bread and cereals are heavily consumed by the hoi polloi due to their cheapness and abundance, making starch a diet staple.

Rich folks: Salmon, big fish (tuna), shellfish (oysters, shrimp) make up the protein of the upper class, with greens and non-starchy veggies (kale, wild mushrooms, broccoli) rounding out the culinary package. Game is sometimes consumed due to a need for gastronomical adventure. Wine from California is the alcohol of choice for the upper class.

Natives: Salmon, wild game (deer, duck, rabbit, wild vegetables (anything they can find in their natural surroundings) constitute the native diet, with frybread, tea and soup accompanying their main dishes. Alcohol is seldom consumed in everyday life.

Geography:

Getty's Pub

Ms. Perkins's House

Marine Research Center

Duntale Public Library

Olympia's Garage

St. Lawrence's Hospital

Seafarer's Wharf

Ivory King's

Settler Grove Plaza

Duntale Town Hall

Thalassophile's Wares

Labrador Institute

Daphne's Apartment Complex

Indigenous Engineer's Apartment Complex

Foodlot Grocery Store

The town of Duntale is a formerly prosperous fishing town that is located on the Pacific Coast. Founded around the time the Homestead Acts were enacted to encourage farmers and the like to occupy land in the West, the coastal settlement originally served as a critical outpost for the trading of goods and appliances, and its grounds were home to a sizable native tribe whose culture revolved heavily around the sea, especially the marine life it harbored. As time went on, Duntalers took note of that tribal belief and began fishing salmon and other species out of the ocean, runs and tributaries that adorned their surroundings. The town thus became one of the foremost exporters of

domestic seafood in the region and, eventually, the entire country. But all of that changed when the stocks started to dry up, forcing the local government to impose sporadic but sizable moratoriums that impacted the jobs of commercial fishermen and also the livelihoods of regular Duntalers and natives. This precarious situation has further been compounded by the arrival of a salmon farming corporation, which took advantage of the town's financially dire condition to set up shop in a nearby fjord (modeled after Hood Canal).

The city's structure suffers from a relative lack of societal and financial diversity compared to similar towns in the area. The main industry is fishing, accounting for more than half of the workforce living in Duntale, with the other lesser half being allocated to agriculture, lumbering, tourism, and research. The town is economically modest and frugal, with the median income for a household being barely above \$40K, but this is offset by the low cost of living that can be attributed to cheap housing and ease of access to food. Duntale is predominantly white, but a prominent tribal presence can also be felt. Aside from a few disputes pertaining to fishing and seafood production, both communities get along with one another fairly well. Most Duntalers spend the day downtown or in the wharf, and establishments such as bars and general goods stores usually stay open until 9pm.

Duntale is home to several important organizations, including the revered and highly selective Labrador Institute and the Marine Research Center. Both of them specialize in the sustainability of the aquatic environment, with the former also extending its focus to terrestrial issues such as agriculture and wildlife conservation. The town is not particularly religious, with most Duntalers keeping their beliefs and morals to themselves, but tribal spiritual practices remain largely intact. The dialect of Duntale is quite similar to that found in other coastal communities such as Newfoundland and Maine, mostly due to their similar ancestral makeup (Irish, English, French).

Appendix E: Story notes

SALMON VERSION:

Story inspired by The Nation's video on land contained farmed salmon, fifth Asterix comic, If My Heart Had Wings, World Economica, Elder Scrolls/Fallout side-quests, HU 3900 flicks, End of the Line (film), The Breach (film).

Revolves around freshman who recently enrolled at a green school in a coastal Pacific fishing town. They are greeted by several students as well as townfolks who are currently dealing with an economic and environmental crisis as a large aquaculture operation is killing the native salmon population with sea lice and PCBs (pollutants) from imported Atlantic salmon. Knowing that they can't let such a travesty impact the region any further, the protagonist and their friends team up to beat the company at their own game and/or resurrect traditional salmon fishing practices through environmental awareness.

Decisions regarding route taken (land containment, organic/more sustainable, Thermolicer, (lumpsucker) or wild fish), economic/environmental decisions (feed, fisheries, hatcheries) and so on will impact outcome of game as well as relationships with characters who support either land containment or tradition.

Add spiritual element/First Nations reference?

Modern day or fantasy?

Dams, salmon farms...

Story structure modeled after The Breach (film) or something else.

Pink, chum, coho, king, sockeye, Atlantic salmon.

Cod shortage in Newfoundland in 1992 and Senegal stock depletion (developed nations snag fishing rights) + surplus of one species because its predator disappeared.

1. Hatcheries/ranching
2. Land-based
3. Sustainable pen
4. Mining

Appendix F: Narrative framework

CRITICAL: Use dialog tree for secondary/tertiary facts and provide question moments instead of the ability to inquire at all times – program in a way that makes the game remember the amount of knowledge the player accrued in their walkthrough and modify the dialog to reflect the player’s line of inquiry.

CRITICAL: Make sure that at least one of the characters DEVELOPS in every scene.

CRITICAL: Give player the option to skip pre-smolt and harvest parts OR make them identical. No skipping first time through, though.

CRITICAL: Have a buildup to the crisis for each path (and for the personal/interpersonal conflicts).

Refer to Gamasutra article on storytelling for referential purposes.

TO DO #1: Include human and intimate moments where main characters behave like regular teenagers outside of aquacultural endeavors. (DONE)

TO DO #2: Write cultural plot points differently for each path with distinct characters and scenarios (DONE)

TO DO #3: Flesh out genetic dilution problem in ocean ranching path (DONE)

TO DO #4: Include 4th branch super-ending (can be a bit OTT, make Dad the superending) (DONE?)

TO DO #5: Include revelation related to Dad in one of the three paths and possibility that he worked with you all along since he faked his death to get away from the economic no man's land that was the protagonist's former home (lie told by mom) (DONE)

TO DO #6: Find a revelation for each path (DONE)

TO DO #7: Include mystical events in dream sequences relating to player's past, revelations and going-ons (e.g. stormy dream in middle of cloudburst), and foreshadowing the solutions with Breach-like poems. Include potential native salmon ritual, but do so respectfully

https://en.wikipedia.org/wiki/Coast_Salish_peoples

<http://www.native-languages.org/washington.htm>

https://en.wikipedia.org/wiki/Coast_Salish_people_and_salmon

https://en.wikipedia.org/wiki/Indigenous_peoples_of_the_Pacific_Northwest_Coast

https://en.wikipedia.org/wiki/Lushootseed_language

TO DO #8: Look deeper into salmon ceremony (<http://www.critfc.org/salmon-culture/tribal-salmon-culture/first-salmon-feast/>)

TO DO #9: Make Dad the indigenous fellow who confronts the player in cultural section of each path OR make him the sustainable cook, horticulturist, researcher who leads the player to the revelation in each path (DONE)

TO DO #10: Include moment where player stumbles upon picture of Perkins with random scientist (who is secretly Dad) (DONE)

TO DO #11: Think about SalmoFan activity connected to story, and minigames for physical aquaculture actions

TO DO #12: Use McKee's advice to flesh out scenes and make them meaningful, rework some scenes so they have a value change

TO DO #13: Learn more about thermolicer and how it operates

TO DO #14: Justify lumpfish unavailability (i.e. manager doing something with supplier that forces the latter to go out of business/be unavailable, forcing the manager to panic and use chemicals. Make it desperate, not malicious. Don't tell anyone for fear of retaliation) (DONE-ISH?)

TO DO #15: Use lobster tank (comment about temperature change as a way to lead to the thermolicer) as catalyst for research (DONE-ISH?)

<https://books.google.com/books?id=5ILUBwAAQBAJ&pg=PA98&lpg=PA98&dq=lobster+sudden+temperature+change&source=bl&ots=3IJa4J-ttz&sig=Q3J2sSmBxJ4YBppyp8KMSVCO1-I&hl=en&sa=X&ved=0ahUKEwj39dnH-vvOAhVYFMAKHYPqAtEQ6AEILTAE#v=onepage&q=lobster%20sudden%20temperature%20change&f=false>

TO DO #16: Include thermolicer and IMTA acquisition details

TO DO #17: Include RAS dual crisis (economic and biodiversity/cultural issues, people changing their salmon harvesting ways, dependence on farmed salmon), POWEROUTAGE, EARTHQUAKE, POTENTIAL TECHNOLOGY DEPENDENCE (DONE-ISH)

TO DO #18: Include social tension/jealousy/gossip among students and townfolks towards cast/may be involved in crises, tied to intimate moments and other social moments (e.g. Daphne and Olympia have a former boyfriend, peripheral characters/family members introduce tension, workaholic Olympia make her a social pariah that compounds her personal woes)

TO DO #19: Think about interpersonal and personal drama in paths and prologue (at least one subplot per path), pay attention to characters

-BIGGEST PLOT HOLE: THE SOLUTION OF THE CRISIS IS THE ACQUISITION OF MAJOR EQUIPMENT AND TIME TO INSTALL

THERMOLICER VR EXPERIENCE

SET UP CRISIS IN REAL LIFE TO AVOID TIMESKIPS, BUT MAKE THE SOLUTION IN VR/AR, TEST THERMOLICER AND IMTA VIRTUALLY. PRESENT SOLUTION TO OFFICIALS. DO IT LIKE STAR TREK. RESEARCH SYSTEM IN VR (HOW THEY FIND SOLUTIONS) - ALTERNATE AVATARS, INTERPERSONAL OPPORTUNITIES, ANONYMOUS ; MESS WITH PLAYER (i.e. to convince someone to do something in real world, demonstrate in VR. Convince tribal natives. Prof. Moriarty Star Trek Next Generation episode)

-Change characters age and make them older to get past time problem

Condensed narrative

PROLOGUE (USE THE PROLOGUE TO REVEAL A FEW OF THE CHARACTERS' TRAITS)

scene p_plane

bg_p_plane_startdream

bg_p_plane_inside

The player wakes up on an airplane that's about to land after experiencing a nebulous dream.

scene p_airportlobby

bg_p_airportlobby_carousel

bg_p_airportlobby_arrivals

ch_missperkins_v1

While waiting for their luggage by the carousel, the player is greeted by Ms. Perkins who welcomes them to the Pacific Northwest.

scene p_car

bg p_car_inside

bg p_car_outdoors1

bg p_car_outdoors2

ch missperkins

The player and Ms. Perkins break the ice and share their respective woes while driving to Labrador Institute where the former is going to be staying

scene p_duntale_arrival

bg p_duntalearrival_afarday

bg p_duntatearrival_streets1day

bg p_duntalearrival_streets2day

ch missperkins

The player gets a mixed taste of Duntale from afar/upclose, and are reminded of both good and bad times in their hometown, with Ms. Perkins relating to their feelings.

scene p_labradorarrival

bg p_labradorarrival_collegefrontday

bg p_labradorarrival_receptionday

ch missperkins

ch daphne

ch olympia

ch joshua

Ms. Perkins and the player arrive at the Institute, with the latter being introduced to some of their classmates who happen to be arguing near the visitor reception.

scene p_labradorrecon

bg p_labradorrecon_dormcommonday

bg p_labradorrecon_dormroomday

bg p_labradorrecon_collegehallwayday

bg p_labradorrecon_collegecornerday

ch daphne

The player checks out their dorm (room), unpacks their suitcases and walks around the college before being greeted by Daphne who invites them for a tour around town.

scene p_daphne_tour

bg p_daphne_tour_libraryday

bg p_daphnetour_supermarketday

bg p_daphnetour_wharfday

bg p_daphnetour_plazaday

bg p_daphnetour_pubday

bg p_daphnetour_marinestoreday

bg p_daphnetour_marinecenteroutsideday

bg p_daphnetour_townhalloutsideday

bg p_daphnetour_townhallinsideday

bg p_daphnetour_mayorofficedoorday

bg p_daphnetour_mayorofficeinsideday

ch daphne

ch georgecrosby

The player and Daphne look around town and then make their way to the town hall where the former is introduced to the mayor, who happens to be Daphne's father.

scene p_daphnebeach

bg p_daphnebeach_beachafternoon

ch daphne

Daphne and the player break the ice on the beach, with both of them sharing their personal interests and inner turmoils.

scene p_daphneaquaculture

bg p_daphnebeach_beachafternoon

bg p_daphneaquaculture_aquafirmhqoutside

bg p_daphneaquaculture_aquafirmhqinside

bg p_daphneaquaculture_aquafirmhqmanageroffice

ch daphne

ch rogerbelroy

Daphne shares with the player her passion for aquaculture, which was magnified with the establishment of an aquaculture firm near town that they visit to talk to the manager.

scene p_daphnetojoshua

bg p_daphnetojoshua_aquafirmtowoods

ch daphne

Daphne talks about the relationship between Joshua and Olympia while she and the player make their way through the woods to meet up with Joshua.

scene p_joshuarun

bg p_joshuarun_runday

bg p_joshuarun_salmonupclose

ch daphne

ch Joshua

Daphne and the player encounter Joshua admiring and contemplating the fish in the salmon run, which he expounds to the two.

scene p_joshuatoolympia

bg p_joshuatoolympia_woodstoduntale

ch daphne

ch joshua

Joshua and the player break the ice behind Daphne's back while making their way to Olympia's workshop.

scene p_olympiawork

bg p_olympiawork_garageoutside

bg p_olympiawork_garageinside

bg p_olympiawork_workshop

ch daphne

ch joshua

ch olympia

Daphne, Joshua and the player find Olympia in her workshop, hard at work on her academic project and pondering the idea of substituting intensive salmon farming.

scene p_protagtownstroll

bg p_protagtownstroll_streets2dusk

bg p_protagtownstroll_plazadusk

bg p_protagtownstroll_wharfdusk

bg p_protagtownstroll_pubdusk

ch randomfisherman

ch tourist

ch drunkard

ch daphne

ch joshua

ch olympia

The player explores the town all by themselves to better absorb its ambiance and confabulate with its people inquisitively.

scene p_restaurant

bg p_restaurant_outside

bg p_restaurant_inside

bg p_restaurant_table

bg p_restaurant_salmoncloseup

ch daphne

ch joshua

ch olympia

ch waiter

The four students head to a new seafood restaurant where they realize that the food they're being served doesn't correspond to what they're used to.

scene p_supermarket

bg p_supermarket_supermarket

bg p_supermarket_storeentrance

bg p_supermarket_cannedgoodsaisle

bg p_supermarket_fishmonger

bg p_supermarket_fishmongericeshelf

bg p_supermarket_fishmongerlowershelf

The group peruses the seafood selection at the grocery store, which similarly suffers from mislabeling.

ch daphne

ch joshua

ch olympia

ch fishmonger

scene p_homedinner

bg p_homedinner_dormcommonsnight

bg p_homedinner_dormkitchen

bg p_homedinner_stoveandcounter

bg p_homedinner_pacificcuisinetable

bg p_homedinner_dormroomnight

ch daphne

ch joshua

ch olympia

The four undergrads buy pre-cooked salmon and cook/eat dinner in the dorm kitchen in the vein of Pacific cuisine before being alerted to an incoming storm.

scene p_stormdreamwakeup

bg p_stormdreamwakeup_dream

bg p_stormdreamwakeup_dormdawn

bg p_stormdreamwakeup_balconydawn

ch daphne

ch joshua

ch olympia

The player wakes up from a foreboding dream and recollects their senses on the balcony, where they are subsequently flanked by Olympia (who had an all-nighter due to her project) and the rest of the gang.

scene p_aftermathshortterm

bg p_daphnetojoshua_aquafirmtowoods

bg p_joshuarun_run

bg p_aftermath_deadsalmoninrun

ch daphne

ch joshua

ch olympia

The group assesses the damage of the storm the following day, with the standout revelation being the presence of a dead Atlantic salmon in one of the salmon runs.

(timeskip)

scene p_aftermathlongterm

bg p_duntatearrival_streets1day

bg p_daphnetour_wharfday

ch daphne

ch joshua

ch olympia

ch randomfisherman

The group learns on the radio that the mayor imposed a moratorium on the fishery when it became clear that it collapsed, which greatly anger the townfolks.

scene p_aftermathaltercation

bg p_daphnetour_townhalloutsideday

bg p_daphnetour_townhallinsideday

bg p_daphnetour_mayorofficeinsideday

ch daphne

ch joshua

ch olympia

ch scientist

ch georgecrosby

The group heads to the mayor's office, where Mr. Crosby and a scientist are arguing over the bureaucratic conflicts that resulted in the crisis.

scene p_aftermathsolution

bg p_daphnetour_marinecenteroutsideday

bg p_aftermath_marinecenterinsideday

ch daphne

ch joshua

ch olympia

ch scientist

ch rogerbelroy

ch missperkins

The cast and scientist meet up with Ms. Perkins and Belroy at the Marine Center, where they discuss the situation and brainstorm ways to fix it, which the player will choose.

MAJOR DECISION (PLAYER CAN GO BACK TO THAT POINT IN THE STORY AT THE END OF THEIR PLAYTHROUGH) (USE THE PATHS TO REVEAL MOST OF THE CHARACTERS' TRAITS) (MAKE COMMENTS ABOUT TIDAL WAVE, EARTHQUAKE AND STORM RELATED TO FARMING PRACTICE)

If player chooses open-net farming (convincing the manager to implement Daphne's plan):

(INCLUDE DIVORCED PARENTS REFERENCE) (MAKE DAPHNE A BIT LIKE ME IN TERMS OF STATUS SECRECY)

(timeskip)

scene onf_research_prognosis

bg_onf_research_prognosis_office

bg_onf_research_prognosis_office_pc

ch_scientist

The player confabulates with the scientist about the state of the fishery as well as the decision they made pertaining to the panacea for the salmon crisis.

scene onf_dorm_relax_gratitude

bg_p_homedinner_dormroomnight

bg_p_stormdreamwakeup_dormdawn

ch_daphne

The player unwinds in their room, with Daphne subsequently stepping in their humble abode to thank them for siding w/ her and express her hope that things will pan out before the player goes to sleep and has another inauspicious dream.

scene onf_aquaculture_broodstock

bg_p_daphneaquaculture_aquafirmhqinside

bg_p_daphneaquaculture_aquafirmhqmanageroffice

bg_onf_aquaculture_broodstock_hatchery_freshwater_tanks

bg_onf_aquaculture_broodstock_hatchery_scan

bg_onf_aquaculture_broodstock_hatchery_egg_stripping

bg_onf_aquaculture_broodstock_hatchery_milt_mixing

bg_onf_aquaculture_broodstock_lab

bg_onf_aquaculture_broodstock_lab_incubators

ch_daphne

ch_joshua

ch_olympia

ch_rogerbelroy

The cast and aquaculture manager begin the process of sustainable open-net farming by harvesting eggs from the broodstock, fertilizing them with milt and incubating them in the labs.

(break and timeskip)

scene onf_socialize_town_lab_process

bg p_daphnetour_wharfday

bg p_daphnetour_plazaday

ch_daphne

ch_olympia

ch_joshua

The player and their friends unwind in the city and gossip about miscellaneous topics while waiting for the incubation process to be complete.

scene onf_socialize_school_lab_process

bg_onf_socialize_school_lab_process_classroom

bg_p_homedinner_dormroomnight

ch_daphne

ch_farming_professor

ch_joshua

The cast heads back to Labrador Institute to focus on their academic endeavors and take a respite from the daily routine they had to endure for several weeks now.

scene onf_aquaculture_alevins_fry

bg_onf_aquaculture_broodstock_lab

bg_onf_aquaculture_alevins_fry_closeup1

bg_onf_aquaculture_alevins_fry_feed

(break and timeskip)

bg_onf_aquaculture_alevins_fry_closeup2

bg_onf_aquaculture_alevins_fry_freshwater_raceway

ch_daphne

ch_olympia

ch_joshua

ch_rogerbelroy

The player and their peers go through the lab process with Belroy where the alevins are raised in lab conditions until their yolk sac is absorbed and they become fry, at which point they're moved to a freshwater raceway.

scene onf_miss_perkins_meeting

bg_onf_perkins_office

bg_onf_perkins_photo

bg_p_homedinner_dormroomnight

bg_onf_dream_infestation

bg_p_stormdreamwakeup_dormdawn

ch_miss_perkins

The player pays Ms. Perkins a visit to provide an update on the aquaculture project, and learns more about her and the potential future in the process.

scene onf_aquaculture_smolts_salmon

bg_onf_aquaculture_alevins_fry_freshwater_raceway

bg_onf_aquaculture_smolts_salmon_truck

bg_onf_aquaculture_smolts_salmon_site

bg_onf_aquaculture_smolts_salmon_nets

bg_onf_aquaculture_smolts_salmon_pellets

bg_onf_aquaculture_smolts_salmon_dispenser

bg_onf_aquaculture_smolts_salmon_lumpsucker

ch_daphne

ch_joshua

ch_olympia

ch_rogerbelroy

The player and their colleagues transfer the fish to the saltwater open-net farm where the smolts are dumped into pens, and fed/nurtured sustainably with no strings attached.

(break and timeskip)

scene onf_intimate_moment

bg_onf_intimate_moment_library_inside

bg_p_daphne_tour_libraryday

bg_onf_intimate_moment_building

bg_onf_intimate_moment_condo

ch_daphne

The player spends some quality and private time with Daphne in her condo, with the latter opening up to them after spending several months rearing the salmon and seeing the progress they're making.

(break and timeskip)

scene onf_hiring

bg_onf_aquaculture_smolts_salmon_site

ch_daphne

ch_joshua

ch_olympia

ch_rogerbelroy

Local and native Duntalers begin working onsite when it becomes clear that Daphne's plan is bearing fruit, which highlights the uptick in employment thanks to the aquaculture firm.

scene onf_warning

bg_p_daphnetour_wharfday

bg_p_daphnetojoshua_aquafirmtowoods

bg_onf_warning_settlement

bg_onf_warning_traditional_fishing1

bg_onf_warning_traditional_fishing2

bg_onf_warning_traditional_cooking

ch_daphne

ch_indigenous_fisherman

The player and Daphne are confronted by a concerned fisherman who shows them the indigenous and historical value of salmon, and what aquaculture may potentially entail.

scene onf_discussion

bg p_labradorrecon_collegehallwayday

bg p_labradorrecon_dormcommonsday

bg_p_homedinner_dormroomnight

bg_onf_discussion_dream_tool

bg p_stormdreamwakeup_dormdawn

ch_daphne

ch_joshua

ch_olympia

The player discusses with their peers the dreams they've been having over the past months and how they may be related to what they're doing to save the salmon, before experience another one.

(timeskip)

scene onf_salmon_growth

bg_onf_aquaculture_smolts_salmon_site

bg_onf_aquaculture_smolts_salmon_nets

bg_onf_aquaculture_smolts_salmon_pellets

bg_onf_salmon_growth_ocean

bg_p_homedinner_dormroomnight

bg_p_stormdreamwakeup_dormdawn

ch_daphne

ch_olympia

ch_joshua

The player and their friends contemplate the growth rate of the salmon, and also comment on the surprisingly ideal environmental conditions, while also wondering what the manager is doing right now given that he raised some financial concerns in the past.

(break and timeskip)

scene onf_panic1

bg_onf_aquaculture_smolts_salmon_site

bg_onf_aquaculture_smolts_salmon_nets

bg_onf_panic_dead_salmon

ch_daphne

ch_joshua

ch_olympia

The player and their peers have trouble fathoming the damage that was recently dealt to the salmon and surmise that the manager has something to do with it.

scene onf_panic2

bg_p_daphneaquaculture_aquafirmhqoutside

bg_p_daphneaquaculture_aquafirmhqinside

bg_p_daphneaquaculture_aquafirmhqmanageroffice

ch_daphne

ch_joshua

ch_olympia

ch_georgecrosby

ch_rogerbelroy

The player realizes that the manager reverted to chemicals due to lumpfish unavailability (he did something that caused the supplier to take its business elsewhere, close its doors or run out of fish, forcing the manager to desperately revert to his old ways without telling anyone for fear of retaliation) and was subsequently arrested for his crimes (and being replaced by a gov't official), but the damage was done and Duntalers revolt once more against the mayor and aquaculture firm.

(timeskip)

scene onf_thermolicer_discovery

bg_p_daphnetour_wharfday

bg_onf_thermolicer_discovery_pub_inside

bg_p_labradorarrival_receptionday

bg_onf_thermolicer_discovery_mis_perkins_office

ch_daphne

ch_random_fisherman

ch_bartender

ch_joshua

ch_miss_perkins

ch_olympia

The player and Daphne drown their sorrow at a seafood bar until they do some research on a Thermolicer that can more efficiently clean the waters after having an epiphany by watching lobster die of sudden temperature shock (knowledge the player got from the scientist regarding sea lice at

the beginning of the path), something they relay to their peers.

(timeskip)

scene onf_thermolicer_site

bg_p_daphneaquaculture_aquafirmhqinside

bg_onf_aquaculture_smolts_salmon_site

bg_onf_aquaculture_smolts_salmon_nets

bg_onf_thermolicer_site_vehicle

ch_miss_perkins

ch_daphne

ch_joshua

ch_olympia

The player and their friends finally get their hands on the Thermolicer and put it to good use on the partially restored net pens and stocks.

(break and timeskip)

scene onf_thermolicer_process

bg_onf_research_prognosis_office

bg_onf_intimate_moment_building

bg_onf_intimate_moment_condo

ch_daphne

ch_joshua

ch_olympia

The player takes Daphne back to her condo after working incessantly for the past couple of days, where they are greeted by their peers who thank the two for doing their best to restore the salmon stocks.

scene onf_hospital

bg_onf_dreamsuccess

bg_onf_hospitalroom

ch_nurse

ch_olympia

ch_perkins

ch_joshua

ch_daphne

The player passes out and ends up at the hospital. They are surrounded by their close ones, and discuss plans for the Thermolicer given the current lack of an operator, a position Joshua volunteers for.

(timeskip)

scene onf_thermolicer_site2

bg_onf_aquaculture_smolts_salmon_site

bg_onf_aquaculture_smolts_salmon_nets

bg_onf_thermolicer_site_vehicle

ch_miss_perkins

ch_daphne

ch_joshua

ch_olympia

Joshua gradually learns the ropes while manning the Thermolicer, with the player (having fully recovered) and the peers admiring his efforts in overcoming his technological skepticism and disdain for aquaculture.

(break and timeskip)

scene onf_harvest

bg_onf_aquaculture_smolts_salmon_nets

bg_onf_harvest_facility_outside

bg_onf_harvest_facility_inside

bg_onf_harvest_facility_belt1

bg_onf_harvest_facility_belt2

bg_onf_harvest_facility_packing

bg_onf_harvest_taste_room

bg p_restaurant_salmoncloseup

bg_p_homedinner_dormroomnight

ch_random_fisherman

ch_miss_perkins

ch_daphne

ch_joshua

ch_olympia

The cast finally harvests the fish after months and months of production, and literally puts it to the test by having a Duntale fisherman try it out (with positive results).

scene onf_ending

bg_p_stormdreamwakeup_dormdawn

bg_p_daphnetour_plazaday

bg_p_daphnetour_pubday

bg_p_daphnetour_townhalloutsideday

bg_p_daphnetour_townhallinsideday

bg_p_daphnebeach_beachafternoon

ch_miss_perkins

ch_daphne

ch_joshua

ch_olympia

ch_georgecrosbie

ch_random_fisherman

ch_indigenous_fisherman

ch_scientist

The protagonist celebrates their achievement with their peers and the townsfolk after spending the past few years trying to rid Duntale of its woes.

If player chooses RAS (turning Olympia's academic project into a full-blown, government-funded operation):

(timeskip)

scene ras_research_prognosis

bg_onf_research_prognosis_office

bg_onf_research_prognosis_office_pc

ch_scientist

The player confabulates with the scientist about the state of the fishery as well as the decision they made pertaining to the panacea for the salmon crisis.

scene ras_wharf_relax_gratitude

bg_ras_wharf_relax_gratitude_wharf_night

bg_p_homedinner_dormroomnight

bg_p_stormdreamwakeup_dormdawn

ch_joshua

ch_olympia

The player unwinds at the wharf, with Olympia subsequently joining them to thank them for siding w/ her and express her hope that things will pan out before the player goes to sleep and has another inauspicious dream.

scene ras_aquaculture_broodstock

bg_p_daphneaquaculture_aquafirmhqoutside

bg_p_daphneaquaculture_aquafirmhqinside

bg_onf_aquaculture_broodstock_hatchery_freshwater_tanks

bg_onf_aquaculture_broodstock_hatchery_scan

bg_onf_aquaculture_broodstock_hatchery_egg_stripping

bg_onf_aquaculture_broodstock_hatchery_milt_mixing

bg_onf_aquaculture_broodstock_lab

bg_onf_aquaculture_broodstock_lab_incubators

ch_daphne

ch_joshua

ch_olympia

ch_rogerbelroy

The cast and aquaculture manager begin the process of sustainable RAS salmon farming by

harvesting eggs from the broodstock, fertilizing them with milt and incubating them in the labs.

(timeskip)

scene ras_socialize_supermarket_lab_process

bg p_supermarket_supermarket

bg p_supermarket_storeentrance

bg p_supermarket_fishmonger

bg p_supermarket_fishmongericeshelf

ch_daphne

ch_olympia

The player and Olympia unwind at the grocery store and gossip about miscellaneous topics while waiting for the incubation process to be complete.

scene ras_socialize_school_lab_process

bg_ras_socialize_school_lab_process_library

bg_p_homedinner_dormroomnight

ch_olympia

ch_joshua

The cast heads back to Labrador Institute to focus on their academic endeavors and take a respite from the daily routine they had to endure for several weeks now.

scene ras_aquaculture_alevins_fry

bg_onf_aquaculture_broodstock_lab

bg_onf_aquaculture_alevins_fry_closeup1

bg_onf_aquaculture_alevins_fry_feed

(break and timeskip)

bg_onf_aquaculture_alevins_fry_closeup2

bg_ras_aquaculture_alevins_fry_freshwater_tank

ch_daphne

ch_olympia

ch_joshua

ch_rogerbelroy

The player and their peers go through the lab process with Belroy where the alevins are raised in lab conditions until their yolk sac is absorbed and they become fry, at which point they're moved to a freshwater tank.

Scene ras_miss_perkins_meeting

bg_onf_thermolicer_discovery_pub_inside

bg_ras_perkins_book

bg_p_homedinner_dormroomnight

bg_ras_dream_downturn

bg_p_stormdreamwakeup_dormdawn

ch_miss_perkins

The player goes out with Ms. Perkins to provide an update on the aquaculture project, and learns more about her and the potential future in the process.

(timeskip)

scene ras_aquaculture_smolts_salmon

bg_ras_aquaculture_alevins_fry_freshwater_tank

bg_onf_aquaculture_smolts_salmon_truck

bg_ras_aquaculture_smolts_salmon_warehouse

bg_ras_aquaculture_smolts_salmon_warehouse_tanks

bg_ras_aquaculture_smolts_salmon_warehouse_terminals

bg_ras_aquaculture_smolts_salmon_warehouse_blueprints

ch_daphne

ch_joshua

ch_olympia

ch_duntale_engineer

The player and their colleagues transfer the fish to the saltwater open-net farm where the smolts are dumped into pens, and fed/nurtured sustainably with no strings attached.

(break and timeskip)

scene ras_intimate_moment

bg_ras_intimate_moment_marine_store_inside

bg_p_daphne_tour_marinestore

bg_p_daphnebeach_beachafternoon

ch_olympia

The player spends some quality and private time with Olympia at the beach, with the latter opening up to them after spending several months rearing the salmon and seeing the progress they're making.

(timeskip)

scene ras_aquaculture_feed

bg_ras_aquaculture_smolts_salmon_warehouse

bg_ras_aquaculture_smolts_salmon_warehouse_tanks

bg_ras_aquaculture_smolts_salmon_warehouse_terminals

bg_ras_aquaculture_smolts_salmon_pellets

bg_ras_aquaculture_smolts_salmon_dispenser

ch_daphne

ch_joshua

ch_olympia

ch_duntale_engineer

The player and their friends learn more about the composition of the pellets they're feeding to the fish as well as its dispensing method. They also get a vague idea of the operation costs which will likely come back to haunt them.

(break and timeskip)

scene ras_hiring

bg p_olympiawork_garageoutside

bg p_olympiawork_garageinside

ch_olympia

Local and native Duntalers begin working onsite when it becomes clear that Olympia's plan is bearing fruit, which highlights the uptick in employment around the area.

scene ras_warning

bg_p_daphnetour_plazaday

bg_ras_warning_apartment

bg_ras_warning_salmon_ceremony

bg_ras_warning_salmon_environment

ch_olympia

ch_indigenous_engineer

The player and Olympia are confronted by a concerned engineer who shows them the cultural and environmental value of salmon, and what RAS may potentially entail.

<http://www.critfc.org/salmon-culture/tribal-salmon-culture/>

scene ras_discussion

bg_onf_socialize_school_lab_process_classroom

bg_p_labradorarrival_collegefrontday

bg_p_homedinner_dormroomnight

bg_ras_discussion_dream_tool

bg_p_stormdreamwakeup_dorndawn

ch_daphne

ch_joshua

ch_olympia

The player discusses with their peers the dreams they've been having over the past months and how they may be related to what they're doing to save the salmon, before experience another one.

(timeskip)

scene ras_salmon_growth

bg_ras_aquaculture_smolts_salmon_warehouse

bg_ras_aquaculture_smolts_salmon_warehouse_tanks

bg_ras_aquaculture_smolts_salmon_pellets

bg_p_homedinner_dormroomnight

bg_p_stormdreamwakeup_dorndawn

ch_daphne

ch_olympia

ch_joshua

ch_duntale_engineer

The player and their friends contemplate the growth rate of the salmon, and also comment on the surprisingly ideal environmental conditions, while also wondering what the engineer is currently thinking about given his solemn demeanor.

scene ras_panic1

bg_ras_aquaculture_smolts_salmon_warehouse

bg_ras_aquaculture_smolts_salmon_warehouse_tanks

ch_daphne

ch_joshua

ch_georgecrosbie

ch_rogerbelroy

ch_olympia

ch_duntale_engineer

ch_indigenous_engineer

The player realizes that the RAS operation has failed to turn a profit, which will result in it being shut down. This causes Olympia to pass out due to sheer disbelief and shock.

scene ras_panic2

bg_onf_hospitalroom

ch_nurse

ch_olympia

ch_perkins

ch_joshua

ch_daphne

Olympia wakes up at the hospital with her friends at her side, and laments the fact that her dream has been shattered by economic constraints.

(timeskip)

scene ras_imta_discovery

bg_ras_imta_discovery_lakeday

bg_ras_imta_discovery_hortihouse

bg_ras_imta_discovery_hortihouse_backyard

bg_ras_imta_discovery_hortihouse_closeup

bg_p_joshuatoolympia_woodstoduntale

bg_onf_hospitalroom

ch_daphne

ch_random_horticulturist

ch_joshua

ch_olympia

ch_nurse

Joshua and the player learn of IMTA from a horticulturist while unwinding outdoors, and they relay the fortuitous information to their peers.

(timeskip)

scene ras_imta_tanks

bg_ras_aquaculture_smolts_salmon_warehouse

bg_ras_aquaculture_smolts_salmon_warehouse_tanks

bg_ras_imta_tanks_equipment

bg_ras_imta_tanks_species_closeup1

bg_ras_imta_tanks_species_closeup2

ch_miss_perkins

ch_daphne

ch_joshua

ch_duntale_engineer

ch_indigenous_engineer

The player and their friends finally get their hands on the IMTA equipment and put it to good use inside the tanks

(break and timeskip)

scene ras_imta_process

bg_ras_imta_process_hospital_reception

bg_ras_imta_process_hospitalroom_night

bg_ras_imta_process_dreamsuccess

bg_ras_imta_process_hospitalroom_dawn

ch_nurse

ch_olympia

The player pays a bed-ridden and asleep Olympia a visit to share a peculiarly-delivered update on the IMTA process they implemented a while back before having another dream.

(timeskip)

scene ras_imta_tanks2

bg_ras_aquaculture_alevins_fry_freshwater_tank

bg_ras_aquaculture_smolts_salmon_warehouse

bg_ras_aquaculture_smolts_salmon_warehouse_tanks

bg_ras_imta_tanks_species_closeup1

bg_ras_imta_tanks_species_closeup2

ch_daphne

ch_joshua

ch_duntale_engineer

ch_indigenous_engineer

The player learns more about the IMTA process, and get another promising update on the current tank and stock conditions as well as a good idea of when the fish is ready to be harvested.

(break and timeskip)

scene ras_harvest

bg_ras_aquaculture_smolts_salmon_warehouse_tanks

bg_ras_aquaculture_smolts_salmon_warehouse

bg_onf_harvest_facility_outside

bg_onf_harvest_facility_inside

bg_onf_harvest_facility_belt1

bg_onf_harvest_facility_belt2

bg_onf_harvest_facility_packing

bg_onf_harvest_taste_room

bg_p_restaurant_salmoncloseup

bg_p_homedinner_dormroomnight

ch_indigenous_fisherman

ch_duntale_engineer

ch_miss_perkins

ch_daphne

ch_joshua

ch_olympia

The cast finally harvests the fish after months and months of production, and literally puts it to the test by having an indigenous fisherman try it out (with positive results).

scene ras_ending

bg_p_stormdreamwakeup_dormdawn

bg_p_daphnetour_wharfday

bg_p_daphnetour_marinestoreday

bg_p_daphnetour_marinecenteroutsideday

bg_ras_imta_discovery_lakenight

ch_miss_perkins

ch_daphne

ch_joshua

ch_olympia

ch_georgecrosbie

ch_rogerbelroy

ch_scientist

ch_indigenous_engineer

ch_indigenous_fisherman

The protagonist celebrates their achievement with their peers and the townsfolk after spending the past few years trying to rid Duntale of its woes.

If player chooses salmon ranching (siding with Joshua by leveraging the dwindling salmon fisheries using ranching practices) INCLUDE CUMULATIVE CLUE LIKE A DIPLOMA:

scene or_research_prognosis

bg_onf_research_prognosis_office

bg_onf_research_prognosis_office_pc

ch_scientist

The player confabulates with the scientist about the state of the fishery as well as the decision they made pertaining to the panacea for the salmon crisis.

scene or_beach_relax_gratitude

bg_or_beach_relax_gratitude_night

bg_p_homedinner_dormroomnight

bg_p_stormdreamwakeup_dormdawn

ch_joshua

ch_daphne

The player unwinds at the beach, with Joshua subsequently joining them to thank them for siding w/ him and express his hope that things will pan out before the player goes to sleep and has another inauspicious dream.

(timeskip)

scene or_ranch_broodstock

bg_p_joshuarun_runday

bg_or_ranch_broodstock_runday_salmon

bg_p_daphnetojoshua_aquafirmtowoods

bg_onf_aquaculture_broodstock_hatchery_egg_stripping

bg_onf_aquaculture_broodstock_hatchery_milt_mixing

bg_onf_aquaculture_broodstock_lab

bg_onf_aquaculture_broodstock_lab_incubators

ch_joshua

ch_rogerbelroy

ch_scientist

The player and Joshua catch some wild salmon (can be sockeye, king, coho, chum or pink) in a run and extract its eggs at the aquafirm to begin the incubation process.

(break and timeskip)

scene or_socialize_lake_lab_process

bg_or_socialize_lake_lab_process_bank1

bg_or_socialize_lake_lab_process_bank2

ch_joshua

ch_daphne

The player and Joshua unwind by the lake and gossip about miscellaneous topics while waiting for the incubation process to be complete.

scene or_socialize_school_lab_process

bg_or_socialize_school_lab_process_cafeteriabar

bg_or_socialize_school_lab_process_cafeteriatable

bg_p_homedinner_dormroomnight

ch_olympia

ch_joshua

The cast heads back to Labrador Institute to focus on their academic endeavors and take a respite from the daily routine they had to endure for several weeks now.

scene or_aquaculture_alevins_fry

bg_onf_aquaculture_broodstock_lab

bg_onf_aquaculture_alevins_fry_closeup1

bg_onf_aquaculture_alevins_fry_feed

(break and timeskip)

bg_onf_aquaculture_alevins_fry_closeup2

bg_onf_aquaculture_alevins_fry_freshwater_raceway

ch_daphne

ch_olympia

ch_joshua

ch_scientist

The player and their peers go through the lab process with the scientist where the alevins are raised in lab conditions until their yolk sac is absorbed and they become fry, at which point they're moved to a freshwater raceway.

Scene or_miss_perkins_meeting

bg_or_miss_perkins_meeting_livingroom

bg_or_miss_perkins_meeting_diplomawall

bg_p_homedinner_dormroomnight

bg_ras_dream_downturn

bg_p_stormdreamwakeup_dormdawn

ch_miss_perkins

The player shares with Ms. Perkins an update on the ranching project while chatting with her in her house, and learns more about her and the potential future in the process.

(timeskip)

scene or_aquaculture_smolts_salmon

bg_onf_aquaculture_alevins_fry_freshwater_raceway

bg_onf_aquaculture_smolts_salmon_truck

bg_or_aquaculture_smolts_salmon_site2

bg_or_aquaculture_smolts_salmon_nets2

ch_daphne

ch_joshua

ch_olympia

ch_rogerbelroy

The player and their colleagues transfer the fish to the saltwater open-net farm where the smolts are dumped into pens, and fed/nurtured sustainably with no strings attached.

scene or_intimate_moment

bg_onf_thermolicer_discovery_pub_inside

bg_p_daphne_tour_pub

bg p_joshuatoolympia_woodstodontale

bg_or_intimate_moment_fishingshack1

bg_or_intimate_moment_fishingshack2

bg_or_intimate_moment_fishingshack3

ch_joshua

The player spends some quality and private time with Joshua at the beach, with the latter opening up to them after spending several months rearing the salmon and seeing the progress they're making.

(timeskip)

scene or_aquaculture_feed

bg_or_aquaculture_smolts_salmon_site2

bg_or_aquaculture_smolts_salmon_nets2

bg_onf_aquaculture_feed_pellets

bg_onf_aquaculture_feed_dispenser

The player learns more about how the salmon is fed and nurtured in a ranching site, and also gets Joshua's insight on the diet of salmon when it is reared by man.

(timeskip)

scene or_hiring

bg_p_daphneaquaculture_aquafirmhqoutside

bg_onf_aquaculture_smolts_salmon_site2

ch_joshua

ch_indigenous_rancher

Local and native Duntalers begin working onsite when it becomes clear that Joshua's plan is bearing fruit, which highlights the uptick in employment around the area.

(break and timeskip)

scene or_warning

bg p_daphnetour_marinestoreday

bg p_daphnetour_marinecenteroutsideday

bg p_daphnetojoshua_aquafirmtowoods

bg_or_warning_village

bg_or_warning_village_house

bg_or_warning_village_books

bg_or_warning_village_wall

ch_joshua

ch_tribal_chief

ch_tribesman

The player and Joshua are confronted by the tribal chief (who happens to be the former OR latter's dad) who shows them the spiritual/environmental value of salmon, and what ocean ranching may potentially entail.

<http://www.critfc.org/salmon-culture/tribal-salmon-culture/>

scene or_discussion

bg_or_socialize_school_lab_process_cafeteriatable

bg p_labradorarrival_receptionday

bg_p_homedinner_dormroomnight

bg_or_discussion_dream_tool

bg p_stormdreamwakeup_dorndawn

ch_daphne

ch_joshua

ch_olympia

The player discusses with their peers the dreams they've been having over the past months and how they may be related to what they're doing to save the salmon, before experience another one.

(timeskip)

scene or_release

bg_or_aquaculture_smolts_salmon_site2

bg_or_release_site

bg_or_release_site_structure_closeup

bg_or_release_site_salmon_closeup

bg_or_release_river

ch_joshua

ch_indigenous_rancher

ch_daphne

ch_olympia

ch_scientist

The time has come for the player and their peers to release the salmon into the wild once they've grown mature enough to live alongside wild salmon.

(break and timeskip)

(ADD SCENE WITH SALMON IN RIVER)

scene or_panic

bg p_stormdreamwakeup_dorndawn

bg_or_panic1_river

bg_or_panic1_river_closeup

bg_or_aquaculture_smolts_salmon_site2

bg_or_release_site

ch_joshua

ch_olympia

ch_daphne

ch_rogerbelroy

ch_commercial_fisherman

ch_recreational_fisherman

ch_indigenous_fisherman

ch_tribesman

The player realizes that the salmon ranching has caused conflicts between recreational/commercial fishermen as well as genetic dilution/egg survival among the fish, causing Duntalers and natives to lash out at Joshua for his “unbridled recklessness”.

(break and timeskip)

scene or_spawn_discovery

bg_p_daphnebeach_beachafternoon

bg_or_spawn_discovery_stream

bg_or_spawn_discovery_stream_closeup

bg_or_intimate_moment_fishingshack1

ch_joshua

ch_olympia

ch_scientist

ch_indigenous_rancher

Olympia and the player learn of artificial spawning channels while noticing a few streams near them that the player didn't notice when he last visited the beach (which leads them to remember what the scientist/Joshua told them about salmon spawning).

http://www.afsc.noaa.gov/Publications/ProcRpt/PR1975_McNeil_Salmon.pdf

<https://www.watershed-watch.org/publications/files/AKhatcheries.pdf>

<http://www.wfga.net/issues.php?ID=60>

<https://icesjms.oxfordjournals.org/content/54/6/1188.full.pdf>

(break and timeskip)

scene or_spawn_construction

bg_or_aquaculture_smolts_salmon_site2

bg_or_spawn_construction_river

bg_or_spawn_construction_structure

bg_or_spawn_construction_salmon

bg_or_spawn_construction_map

The player and their colleagues begin setting up the artificial spawning channels for the salmon so that they don't overwhelmingly interfere with the wild population.

(break and timeskip)

scene or_spawn_process

bg_or_intimate_moment_fishingshack1

bg_or_intimate_moment_fishingshack2

bg_or_spawn_process_fishingshack1dawn

bg_or_spawn_process_fishingshack2dawn

ch_joshua

The player pays Joshua a visit in his shack, and notices that he's tinkering with a peculiar item that compels the former to pursue a line of inquiry with the latter before going to bed and having another dream.

When the fish are finally ready to be harvested, the player rejoices and they start finalizing production by slaughtering the fish and extracting its flesh. The moment of truth unfolds, and our heroes realize that the flesh is not only juicy, but also incredibly tasty. The farm starts churning out fish after fish to Duntale and over time, the town returns to its former glory. The protagonist saves the day and has done their legacy and father justice and the game ends. Joshua thanks the player for restoring Duntale and his tribe to their former glory, and he offers them his necklace (which the player previously commented on) as a thank you gift and a talisman. The four characters head back to the run where they first saw the salmon in action and contemplate the future.

scene_ras_imta_tanks2

bg_ras_aquaculture_alevins_fry_freshwater_tank

bg_ras_aquaculture_smolts_salmon_warehouse

bg_ras_aquaculture_smolts_salmon_warehouse_tanks

bg_ras_imta_tanks_species_closeup1

bg_ras_imta_tanks_species_closeup2

ch_daphne

ch_joshua

ch_duntale_engineer

ch_indigenous_engineer

The player learns more about the IMTA process, and get another promising update on the current tank and stock conditions as well as a good idea of when the fish is ready to be harvested.

(break and timeskip)

scene or_harvest
bg_or_aquaculture_smolts_salmon_site2
bg_or_spawn_construction_river
bg_or_spawn_construction_salmon
bg_onf_harvest_facility_outside
bg_onf_harvest_facility_inside
bg_onf_harvest_facility_belt1
bg_onf_harvest_facility_belt2
bg_or_harvest_facility_cannery
bg_onf_harvest_facility_cannedsalmon
bg_onf_harvest_facility_packing
bg_onf_harvest_taste_room
bg_p_restaurant_salmoncloseup
bg_p_homedinner_dormroomnight

ch_tribesman
ch_indigenous_rancher
ch_recreational_fisherman
ch_miss_perkins
ch_daphne
ch_joshua
ch_olympia
ch_scientist

The salmon return to the ranching site and are harvested by the cast before being served to skeptical natives and Duntalers.

(break and timeskip)

scene or_ending

bg_p_stormdreamwakeup_dormdawn

bg_p_daphnetour_supermarketday

bg_p_daphnetour_marinecenteroutsideday

bg_p_joshuatoolympia_woodstoduntale

bg_p_joshuarun_runday

ch_miss_perkins

ch_daphne

ch_joshua

ch_olympia

ch_georgecrosbie

ch_scientist

ch_joshua_father

ch_indigenous_rancher

The protagonist celebrates their achievement with their peers and the townsfolk after spending the past few years trying to rid Duntale of its woes.

IF THE CHARACTER COMPLETES THEIR THIRD WALKTHROUGH:

Ms. Perkins then approaches the player and lets them know that there's someone who wishes to speak to them. It turns out that their father (the one in the picture frame) was alive all along, which greatly surprises the player who also finds out that they're half-indigenous/metis (foreshadow that). It is revealed that his father faked his own death in order to work on a national level and escape the economic and political turmoil of his former hometown. He watched over his son/daughter ever since he enrolled at Labrador Institute and purposefully gave away his belongings to Ms. Perkins so that they could continue their work, which amounts to indirect nurturing. The player reunites with their dad and celebrates with their friends.

Appendix G: Audiovisual references

Music

https://www.youtube.com/watch?v=xFWLe9_R2Fc

<https://www.youtube.com/watch?v=tQVQMso5vp0>

<https://www.youtube.com/watch?v=NQobr4gGk5o>

<https://www.youtube.com/watch?v=rS3rTlrljGA&index=4&list=PL3d6JVeEHacii-N4QGhSzT78ZmaKQszC>

<https://www.youtube.com/watch?v=PITF1lzdjg&index=7&list=PL3d6JVeEHacii-N4QGhSzT78ZmaKQszC>

<https://www.youtube.com/watch?v=Ulr9JqhnLw&index=9&list=PL3d6JVeEHacii-N4QGhSzT78ZmaKQszC>

<https://www.youtube.com/watch?v=dsACpxdyuql&index=12&list=PL3d6JVeEHacii-N4QGhSzT78ZmaKQszC>

<https://www.youtube.com/watch?v=dfHfR1jAzWQ>

<https://www.youtube.com/watch?v=gwpri3-WdGo>

<https://www.youtube.com/playlist?list=PL0D7A1F33879258AE>

<https://www.youtube.com/watch?v=Fnx9FjKlAyw>

<https://www.youtube.com/watch?v=aRceRRuNo4w>

<https://www.youtube.com/watch?v=UP8titLUN7Y>

<https://www.youtube.com/watch?v=bl9dP0CJfbQ>

<https://www.youtube.com/watch?v=FWemPmvV8ZM>

<https://www.youtube.com/watch?v=nmcCd1eCJq4>

<https://www.youtube.com/watch?v=09zgMBrZQE4>

<https://www.youtube.com/watch?v=g27r8CHKaxw>

Visuals

<http://www.acdiamagic.com/images-map/acadia-map.gif>

http://www.klarix.de/tes5/images/TES5_klarix_Dragonborn_Solstheim_Map.jpg

[http://www.nathaliehaider.com/fr/images/nuns-island\[1\].jpg](http://www.nathaliehaider.com/fr/images/nuns-island[1].jpg)

<http://members.shaw.ca/rado907/maps/mw-vvardenfell-sw.jpg>

https://upload.wikimedia.org/wikipedia/commons/thumb/d/d3/1873_map_GloucesterMA_byFranklinLith_BPL_10186.png/626px-1873_map_GloucesterMA_byFranklinLith_BPL_10186.png

https://upload.wikimedia.org/wikipedia/commons/thumb/d/d3/1873_map_GloucesterMA_byFranklinLith_BPL_10186.png/626px-1873_map_GloucesterMA_byFranklinLith_BPL_10186.png

http://www.lamblionstudio.com/uploads/3/7/8/0/3780853/5159607_orig.jpg

http://vignette2.wikia.nocookie.net/farcry/images/5/50/Far_Cry_3_-_N_Island_-_with_Markers_Q60.jpg/revision/latest?cb=20130529042952

https://cdn0.vox-cdn.com/uploads/chorus_asset/file/6119717/2016-02-29_-_The_island_map.0.jpg

https://cdn0.vox-cdn.com/uploads/chorus_asset/file/6119717/2016-02-29_-_The_island_map.0.jpg

http://vignette1.wikia.nocookie.net/deadisland/images/8/8b/Dead_Island_Map.jpg/revision/latest?cb=20110912040554

http://vignette2.wikia.nocookie.net/gtawiki/images/6/69/Official_Map.jpg/revision/latest?cb=20130910190243

https://upload.wikimedia.org/wikipedia/commons/4/42/Nantucket_map-fi.png

<http://www.capecodchamber.org/sites/chamber/files/pages/0000/0028/MVMap-lg.jpg>

<https://i.ytimg.com/vi/aQZGyG5kCDw/maxresdefault.jpg>

<http://www.gamepur.com/files/images/2015/witcher-3-novigrad-map-location-of-vendors.jpg>

<http://cdn.wccftech.com/wp-content/uploads/2015/04/Witcher-Map-poster-bonus.jpg>

Appendix H: Art styling workflow

Backgrounds

In Photoshop:

1920x1080 as a .PNG

Filter Gallery

Artistic, Cutout

Num of Levels – 6-8

Edge Simplicity – 5-4

Edge Fidelity – 3

Brush Strokes, Ink Outlines (if needed)

Stroke Length - 1

Dark Intensity - 8

Light Intensity - 19

Then on Alter App:

Art Style: tribal3 at 30-70% depending on image

In Photoshop:

Filter Gallery

Artistic, Cutout

5

3

2

Image, Adjustments, Vibrance + 100

Filter, Box Blur – 2

Image, Adjustments, Brightness + , Desaturate as needed.

Characters

In Alter App:

Art Style - tribal3

Strength- 30-40%

In Photoshop:

Cutout – 5

-3

- 3

Appendix I: Art style references



Watercolor + anime aesthetic (notice the strokes on the windmill and the frame).

http://wallpaperswide.com/valkyria_chronicles-desktop-wallpapers.html



Nice interplay of light and shadow, and inspiration for shack scene,
color palette is also nicely warm.

<http://www.startlr.com/stylish-roglayk-the-flame-in-the-flood-will-be-released-on-ps4/>



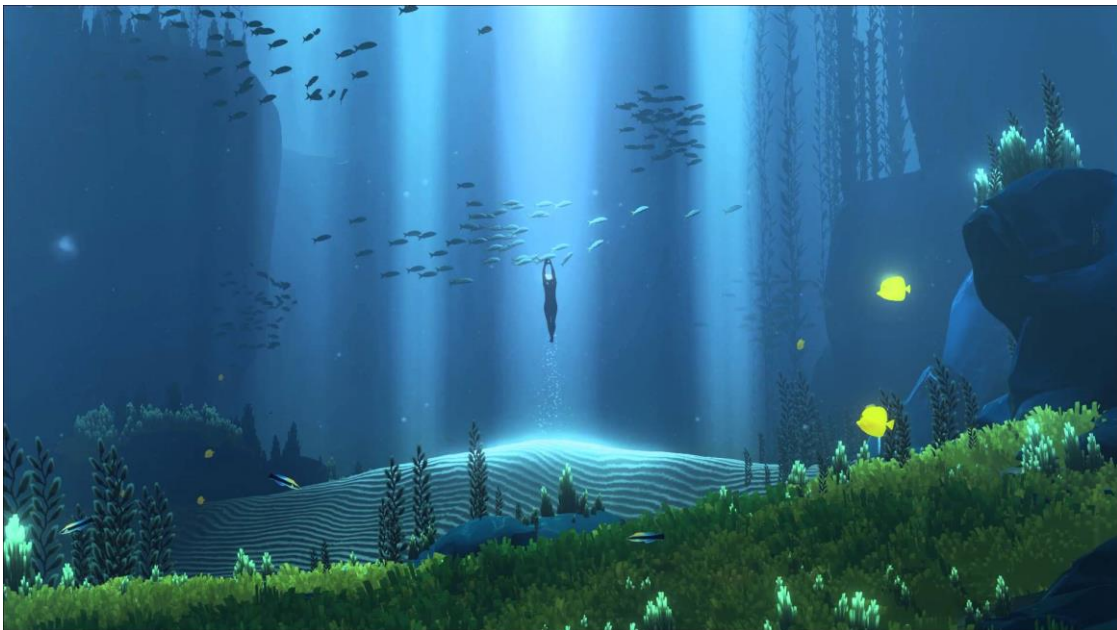
Atmospheric lighting and ambiance.

<http://aminomail.com/page/anime/5883363/life-is-strange>



Slightly muted color palette.

<http://www.gamingsymmetry.com/alan-wake/>



Dream inspiration, nice color contrast.

<https://www.destructoid.com/review-abzu-377951.phtml>



Watercolor, warm color palette.

<https://jp.pinterest.com/pin/475622410621027966/>



Nice use of color to define form and shape.

<http://rosemaryjolly.co.uk/coastal.html>

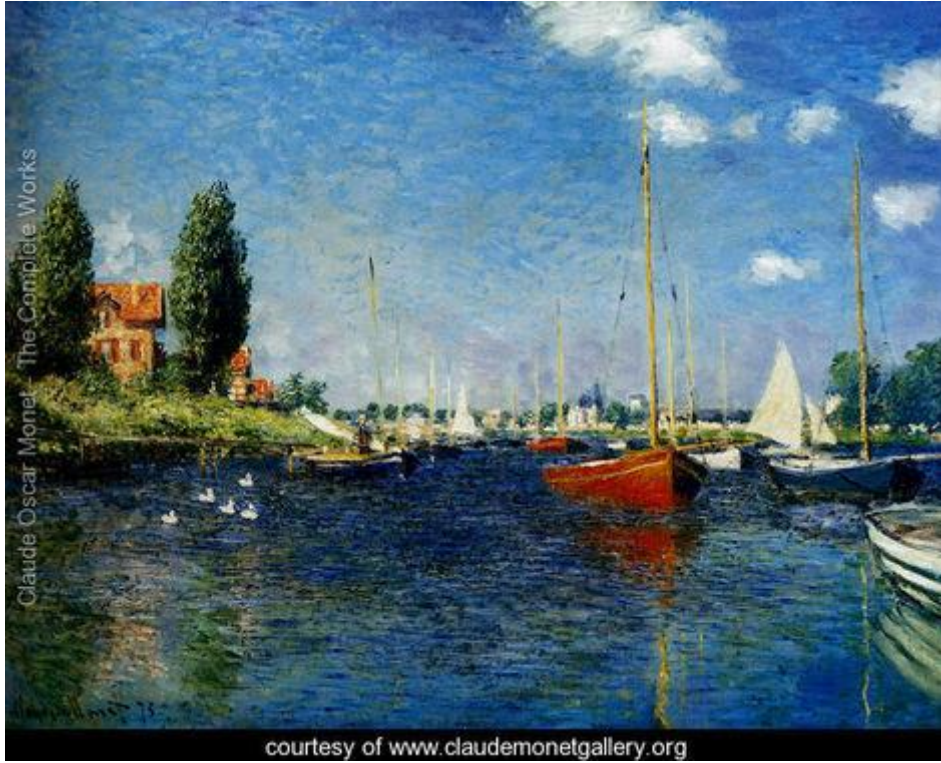


<http://www.imaginarymuseum.net/2015/06/thomas-cole.html>



Nice lighting and inspiration for native village.

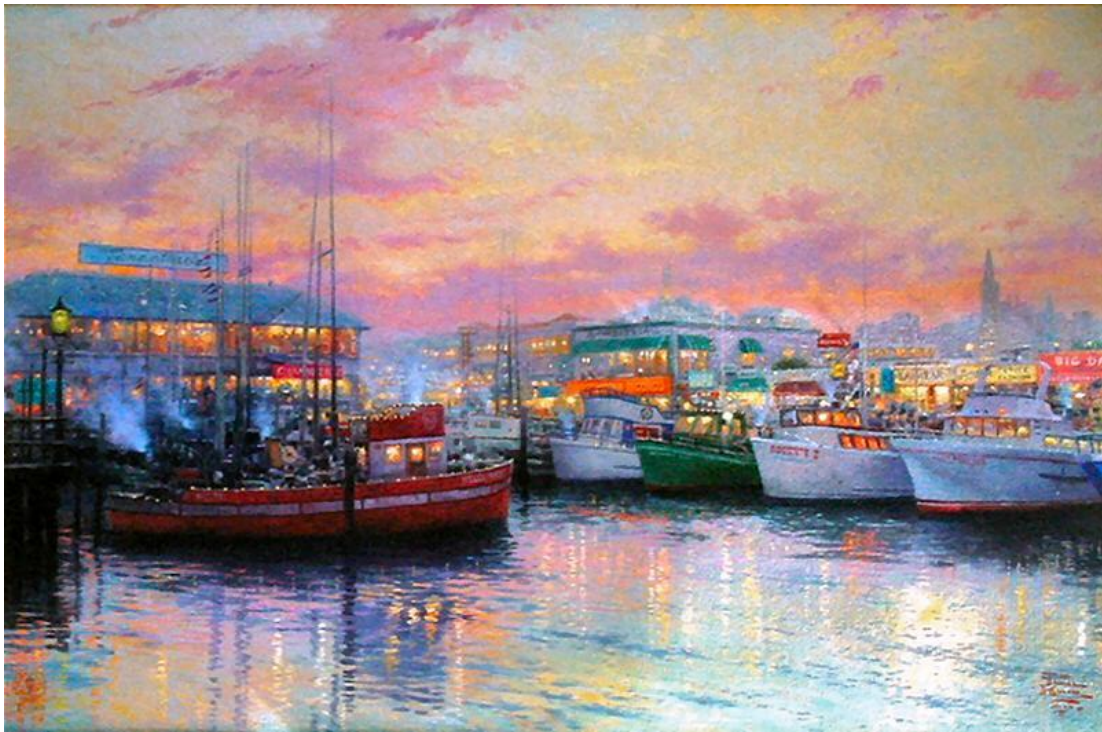
<https://www.nationalgallery.org.uk/paintings/joseph-mallord-william-turner-sun-rising-through-vapour>



Use of color to highlight lighting effects.

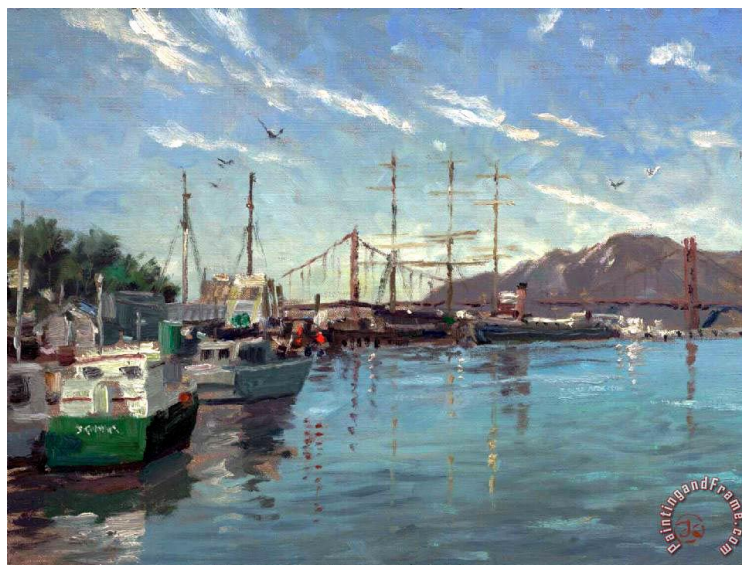


Streets inspiration, color palette reflects status of Duntale.



Wharf, pub inspiration and cool color palette makes the scene pop.

<http://www.thekinkadecollection.com/about-the-collection/>



Watercolor brushstrokes help bring life to scene, color and lighting-wise.

<http://www.thomas-kinkade-prints.com/p-9392-fishermans-wharf-marina-by-thomas-kinkade.aspx>



Clean art style, house layout/minimalistic design.

<http://judyscopespaintinggalleries.blogspot.com/2012/07/nova-scotia-fishing-village.html>



<https://kaizobi.wordpress.com/2015/08/29/a-lull-in-the-seanagi-no-asukara-end-of-series-roundup/>



<http://tenchithoughts.blogspot.com/2014/08/glasslip-episode-4.html>

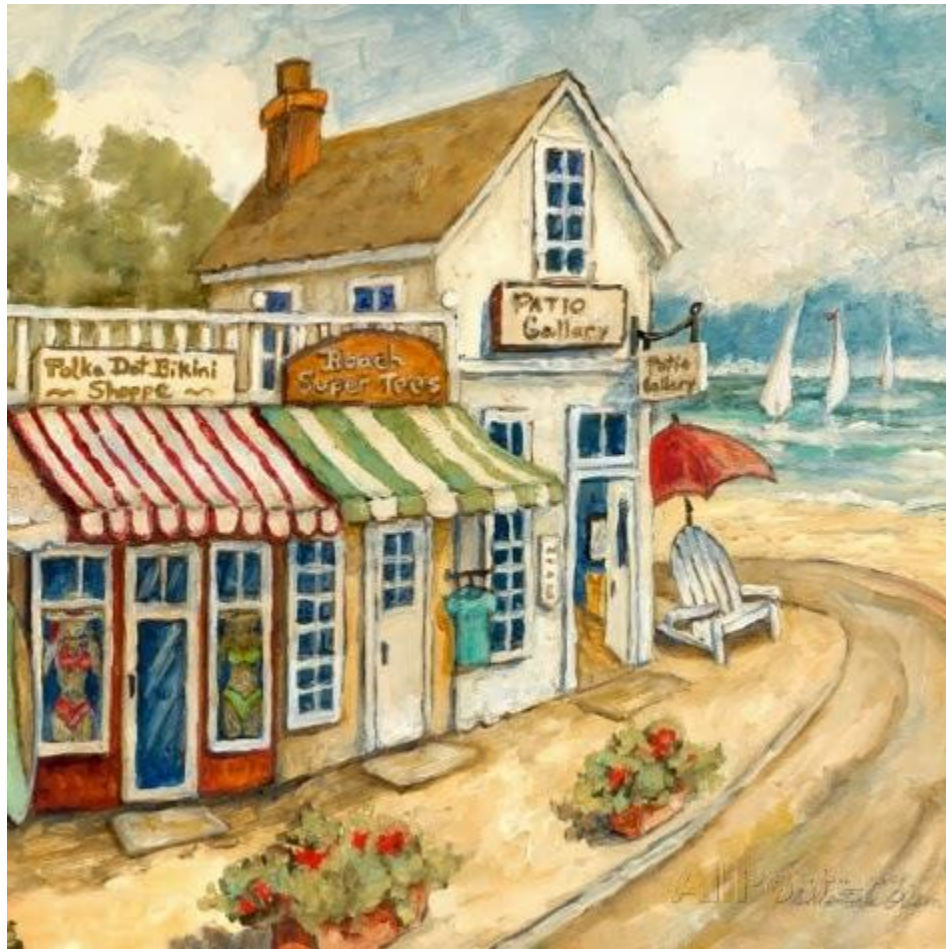


<https://infinitemirai.wordpress.com/2014/07/15/glasslip-episode-two-reflection/>



Bloom and use of color really enhance the artwork as a whole.

<http://anime-backgrounds.tumblr.com/post/56152168139/the-garden-of-words-%E8%A8%80%E3%81%AE%E8%91%89%E3%81%AE%E5%BA%AD-kotonoha-no-niwa-is-a>



Painting style and color palette give the scene a rustic feel.

<http://www.art.co.uk/products/p13241616-sa-i2354716/charlene-winter-olson-ocean-village-i.htm?sOrig=CAT&sOrigID=0&dimVals=5024641&ui=0EFBB10EB20D42F0980D1D47ADFB2181&ac=true>



Brush strokes, color palette make the scene stand out.

<http://pledent.deviantart.com/art/Autumn-151852993>



Short brushstrokes and bright colors make the scene look ethereal.

https://www.123rf.com/clipart-vector/oil_painting.html?mediapopup=35891733



Characters pop and stand out from the scenery, but both elements still mesh well together.

<http://www.animationmagazine.net/features/new-clips-from-expanding-the-wind-rises/>



<https://forums.anandtech.com/threads/the-vanishing-of-ethan-carter.2344846/>



<http://www.icxm.net/x/review-ethan-carter.html>



<http://www.savingcontent.com/2014/10/02/the-vanishing-of-ethan-carter-review/>



Dreary and cool colors mixed with atmospheric lighting.

<http://www.theastronauts.com/2015/09/the-vanishing-of-ethan-carter-redux-out-now/>



Lighting and colors enhance the atmosphere of the scene .

<https://www.giantbomb.com/forums/everybodys-gone-to-the-rapture-233465/everybodys-gone-to-the-rapture-a-beautiful-boring--1779801/>



Bright and dark colors attract the human eye to the most important elements really well.

<https://jp.pinterest.com/pin/478226054154245393/>



Delicate painting method and color palette complement uncluttered scenery

<https://jp.pinterest.com/pin/313000242828204520/>



Rural look and cool color palette mixed with variable brushstrokes

https://commons.wikimedia.org/wiki/File:Joseph_Mallord_William_Turner_-_Lake_Geneva_and_Mount_Blanc_-_Google_Art_Project.jpg



<https://www.artslant.com/ew/works/show/539208>



<http://www.invaluable.com/artist/turner-joseph-mallord-william-6vjnp35f0h>



Dark and light colors help give form to the dream-like scenery.

<http://www.tate.org.uk/art/artworks/turner-chichester-canal-n00560>



Warm color palette and layout encapsulate town feel quite well.

<http://onh.nl/nl-NL/verhaal/15844/denkbeeldige-stadsbeelden-van-adrianus-everesen>



Clean painting technique and dark/light colors make the picture appealing

http://admirersofbaroqueart.blogspot.com/2007_05_01_archive.html



<http://www.albanyinstitute.org/details/items/ruined-tower-mediterranean-coast-scene-with-tower.html>



Light and dark contrast help give the painting a foreboding feel or a feeling of hope.

<http://www.artwallpaper.eu/Paintings/archives/8031/joseph-mallord-william-turner-paintings-life-boat-and-manby-apparatus-going-off-to-a-stranded-vessel-making-signal-of-distress-1831>



Slightly dull (in a good way) colors give the scene a slightly “doldrums” feel.

https://commons.wikimedia.org/wiki/File:Johannes_Vermeer_-_Gezicht_op_huizen_in_Delft,_bekend_als_%27Het_straatje%27_-_Google_Art_Project.jpg



[http://www.hcn.org/issues/46.3/the-first-comic-book-with-an-all-native-american-superhero-team-](http://www.hcn.org/issues/46.3/the-first-comic-book-with-an-all-native-american-superhero-team-returns)

[returns](#)



Art style “pops” and gives characters lots of definition.

<https://forums.tigsource.com/index.php?topic=55369.0>



<http://www.sepeb.com/5-centimeters-per-second-wallpaper.html>



<http://www.behindthevoiceactors.com/movies/5-Centimeters-Per-Second/>



Atmospheric lighting and contrast between backgrounds and characters is heavenly.

<http://www.iamag.co/features/the-art-of-chong-feigiap/#jp-carousel-66651>

Appendix J: Aquaculture references

Open-net:

<http://www.northernharvestseafarm.com/salmonlifecycle.html> (30-36 months)

<http://www.tassal.com.au/sustainability/our-salmon/> (27-33 months)

<http://www.griegseafoodcanada.com/our-fish/life-cycle/> (22-34 months)

<http://www.mesa.edu.au/aquaculture/aquaculture13.asp> (long, but detailed)

<http://www.somuchtosea.co.uk/salmon> (detailed, but not highly descriptive)

<http://www.petuna.com.au/aquaculture/> (three years)

RAS:

<http://jurassicsalmon.pl/en/> (85 weeks = ~20 months)

<http://www.bigfallsfish.com/our-work> (2-3 years)

<http://www.danishsalmon.dk/pres3.php?id=1#> (detailed, but no time)

<http://tidscanada.org/wp->

[content/uploads/2015/12/Namgis_FN_and_ToBC_Capital_Cost_Comparison_Final_Report.pdf](http://tidscanada.org/wp-content/uploads/2015/12/Namgis_FN_and_ToBC_Capital_Cost_Comparison_Final_Report.pdf)

(detailed, but no time)

[http://www.kuterra.com/files/7314/0198/5738/2014-0220 - Josh Stiltz -](http://www.kuterra.com/files/7314/0198/5738/2014-0220_-_Josh_Stiltz_-_)

[_Fish_Farming_International.pdf](http://www.kuterra.com/files/7314/0198/5738/2014-0220_-_Josh_Stiltz_-_Fish_Farming_International.pdf)

<http://www.kuterra.com/facts/news/namgis-first-nation-open-land-based-fish-farm/> (18-27 months).

<http://www.tidscanada.org/wp-content/uploads/2015/03/D-2->

[5ChiefBillCranmerEricHobsonandJackieHild-eringNamgisFirstNationLand-Based-](http://www.tidscanada.org/wp-content/uploads/2015/03/D-2-5ChiefBillCranmerEricHobsonandJackieHild-eringNamgisFirstNationLand-Based-)

[AtlanticSalmonRASProject.pdf](http://www.tidscanada.org/wp-content/uploads/2015/03/D-2-5ChiefBillCranmerEricHobsonandJackieHild-eringNamgisFirstNationLand-Based-AtlanticSalmonRASProject.pdf)

<http://www.ottawacitizen.com/life/land+based+salmon+farm+vancouver+island+nears+economic/11677279/story.html>

<http://www.seafoodsource.com/news/aquaculture/land-based-salmon-aquaculture-a-future-with-potential/>

Ocean ranching:

<http://www.thefishsite.com/articles/905/cultured-aquaculture-species-coho-salmon/> (Coho salmon, 37 months)

https://en.wikipedia.org/wiki/Pink_salmon (2 year cycle)

<http://wdfw.wa.gov/fishing/salmon/pink.html>

<http://www.seattleaquarium.org/>

<http://www.seattleaquarium.org/salmon>

<http://escholarship.org/uc/item/2sb176kg#page-1>

https://en.wikipedia.org/wiki/Salmon_run

https://en.wikipedia.org/wiki/Juvenile_fish#Juvenile_salmon

<http://stanleycc.org/bright-red-fish/>

<http://www.alaskasalmonranching.com/what-is-salmon-ranching/>

<http://pwsac.com/faq>

<http://www.kodiakmaritimemuseum.org/v-museum/salmon.html>

Thermolicer:

<http://www.dailyrecord.co.uk/business/business-news/scottish-sea-farms-invest-4m-8428149> (3-4

million sterling pounds) Thermolicer

<http://www.thefishsite.com/fishnews/27941/scotlands-first-thermolicer-to-help-combat-sea-lice/>

Thermolicer

<https://www.nsf.gov/funding/aboutfunding.jsp>

<http://www.sams.ac.uk/search?SearchableText=IMTA>

<http://www.sams.ac.uk/kenny-black/irc-imta/?searchterm=IMTA>

<http://www.sams.ac.uk/news-room/news-items/scottish-salmon-company-starts-excellent-trials/?searchterm=IMTA>

<http://www.sams.ac.uk/maeve-kelly/integrated-multitrophic-aquaculture-research/?searchterm=IMTA>

<http://www.sams.ac.uk/news-room/news-items/scottish-salmon-company-starts-excellent-trials/?searchterm=imta>

<http://www.cimtan.ca/index.php>

https://books.google.com/books?id=P4w2AQAAMAAJ&pg=PA9&lpg=PA9&dq=salmon+spawning+channel+cost&source=bl&ots=J_Cf6kiV9Y&sig=pwPMSONdCLXkHM09BL1Y7mivrWU&hl=en&sa=X&ved=0ahUKEwiniuiylorPAhXDpB4KHXL2De0Q6AEINTAE#v=onepage&q=salmon%20spawning%20channel%20cost&f=false

https://books.google.com/books?id=ELyanGCHzOgC&pg=PA158&lpg=PA158&dq=salmon+spawning+channel+cost&source=bl&ots=phOotSk8do&sig=9PG1vyFIq61aFb1C_wLC1t2FPiY&hl=en&sa=X&ved=0ahUKEwio2YrhlorPAhVFbB4KHe8LDZo4ChDoAQhPMAk#v=onepage&q=salmon%20spawning%20channel%20cost&f=false

<http://www.certifiedorganic.bc.ca/rcbtoa/services/NAsept-oct-pgs14-15c.pdf>

<http://www.ccb.se/documents/LAXSE.pdf>

https://www.for.gov.bc.ca/hfd/library/ffip/Lister_DB1997.pdf

https://books.google.com/books?id=4w93EbtEFMYC&pg=PA91&lpg=PA91&dq=salmon+spawning+channels+cost&source=bl&ots=g_15OOA76j&sig=n1zJLCNMLtr8bbCBI7gCIQs74V0&hl=en&sa=X&ved=0ahUKEwiRqd7nyYrPAhWB1B4KHQD3C7Y4ChDoAQg6MAc#v=onepage&q=salmon%20spawning%20channels%20cost&f=false

<http://www.stewardship.foundation/lower-seton-spawning-channel-complexing-project-summary/>

Appendix K: Brochure references

<http://assets.mainetourism.com/MaineInvitesYouFlipbook/index.html>

<https://www.barharborinfo.com/CMSTemplates/LWS->

<BarHarborASPX/GuidebookEbook2017/html5forwebkit.html?page=0>

<http://www.acadiainfo.com/BarHarborChamber/media/Bar-Harbor-Media->

[Library/PDFs/Resources%20and%20Services/Relocating%20to%20Bar%20Harbor/2013ReloGui
de03-08-2013.pdf](Library/PDFs/Resources%20and%20Services/Relocating%20to%20Bar%20Harbor/2013ReloGuide03-08-2013.pdf)

<http://www.discovergloucester.com/wp-content/uploads/gloucester-ma-visitor-guide.pdf>

<http://gloucesterma.com/Guides/GloucesterPastPresent.pdf>

http://ptownchamber.com/wp-uploads/2016_ChamberBook-web1p2.pdf

<http://www.govlink.org/watersheds/8/news/2016/pdf/1609-living-with-salmon-brochure.pdf>

Appendix L: Map references



http://deadisland.wikia.com/wiki/Banoi_Island



<https://psnprofiles.com/guide/4744-the-elder-scrolls-v-skyrim-dragonborn-dlc-trophy-guide>



<http://www.bragitoff.com/2015/11/gta-v-maps-quad-ultra-high-definition-8k-quality/>



<https://www.imperial-library.info/content/southwestern-vvardenfell-concept-official>



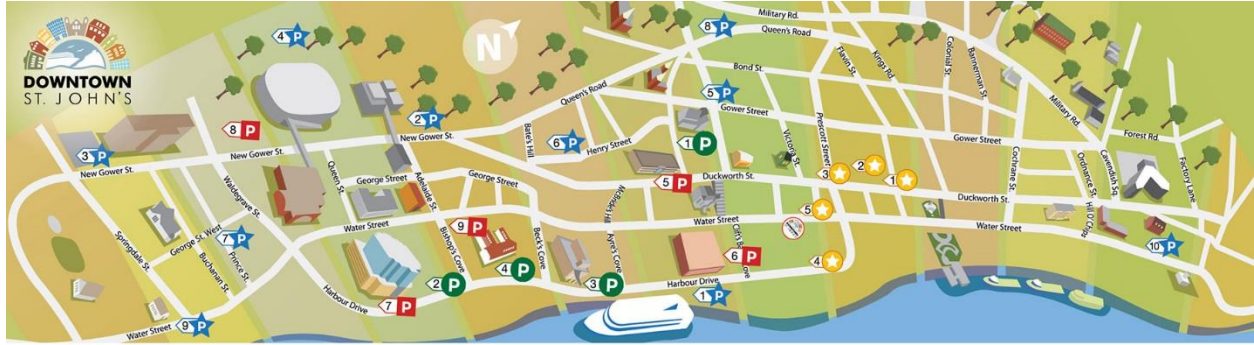
<http://orc2.com/Witcher 3: Novigrad - Map>



<https://www.flickr.com/photos/28601488@N05/4891563603>



<https://www.darkcreations.org/forums/topic/5964-anvil-developmentconcept/>



MAP LEGEND

P Permit parking only.

P Permit and hourly parking.

★ Free after 6^{pm} & weekends.

★ Daytime permit. Free after 6^{pm} & weekends.
Conditions may apply.



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downtownstjohns.com
FOR MORE INFORMATION!

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215 Water Street
- 2★** City Hall Parking Garage
L1, L3, L4 • 10 New Gower Street
- 3★** Delta Overflow
- 4★** Central/Livingstone Street
- 5★** Gower Street
- 6★** Henry Street
- 7★** Prince Street
- 8★** Queen's Road
- 9★** Springdale Street
- 10★** Water Street East

- 1P** Newfoundland Cathedral
22 Church Street
- 2P** Templeton RA Ltd.
343 Water Street
- 3P** Bowring Downtown Centre
277 Water Street
- 4P** Murray Premises
5 Beck's Cove
- 5P** Metro Park
330 Duckworth Street
- 6P** AP Garage
215 Water Street
- 7P** 351 Water Street
351 Water Street
- 8P** Cabot Place
100 New Gower Street
- 9P** Bishop's @ Water
Bishop's Cove @ Water Street

- 1★** Duckworth Street
Duckworth @ Holloway
- 2★** Prescott Street
Prescott @ Duckworth (E)
- 3★** Prescott Street
Prescott @ Duckworth (W)
- 4★** Harbour Drive
Behind Fortis Building
- 5★** Water Street
Water @ Solomon's Lane



<http://www.downtownstjohns.com/work/downtown-parking/>

Appendix M: IRB Protocol

Purpose of study

To obtain playtest feedback in order to locate/address operational bugs, and to identify opportunities for design improvement.

Study protocol

Participants are provided a computer on which to play the game. Investigators observe participants during play. Afterward, participants are asked to fill out a short survey to characterize their subjective experience.

Hazardous materials/special diets

No hazardous materials or special diets are involved in this study.

Opening briefing for testers

“Hello, and thank you for volunteering to test our game. Before we begin, could you please read and sign this Informed Consent form? [Tester signs IC form.] Thank you. When your session is complete, we will ask you to complete a brief survey about your play experience. At no point during your play session, or in the survey after, will any sort of personal and/or identifying information about you be recorded. Please begin playing when you feel ready.”

Playtest survey (full version)

1. How much do you think you learned about aquaculture?

(1 not much ,2 a little, 3 a sufficient amount, 4 a lot) Briefly explain why.

2. Who is/are your favorite character(s)? Briefly explain why.

3. Who is/are your least favorite character(s)? Briefly explain why.

4. How did the pacing of the story seem to you? (1 too slow, 2 a bit slow, 3 just right, 4 a bit fast, 5 too fast) Briefly explain why.

5. How did the length of the game seem to you? (1 too short, 2 a bit short, 3 just right, 4 a bit long, 5 too long) Briefly explain why.

6. How did the length of the dialog lines seem to you? (1 too short, 2 a bit short, 3 just right, 4 a bit long, 5 too long) Briefly explain why.

7. How many and which tracks did you explore? (1 ONF, 2 RAS, 3 OR) Briefly explain why.

8. How well would you rate the interactivity (1 nonexistent, 2 insufficient, 3 satisfactory, 4 satiating) Briefly explain why.

9. Did you think the tracks were distinct enough (1 identical, 2 a bit too similar, 3 somewhat distinct, 4 very distinct) Briefly explain why.

10. Did you find the art style to be garish/vivid? (1 too garish, 2 a bit overblown, 3 somewhat pretty, 4 very vivid) Briefly explain why.

11. Do you think there was a fine balance of social and aquaculture scenes? (1 too much aquaculture, 2 a bit heavy on aquaculture, 3 fine balance, 4 a bit heavy on social scenes, 5 too many social scenes) Briefly explain why.

12. Did you think the locations/scenes were varied enough? (1 little to none, 2 not enough variety, 3 a bit of variety, 4 lots of variety) Briefly explain why.

13. What is/are your favorite track(s)? Briefly explain why.

14. What is/are your least favorite track(s) Briefly explain why.

15. Did you think the dialog was too on-the-nose/unclear when it came to explaining the aquaculture process? (1 too on the nose, 2 a bit on the nose, 3 clear, 4 a bit unclear, 5 very unclear) Briefly explain why.

16. How cohesive do you think the art style between the characters and environment were? (1 not cohesive, 2 not cohesive enough, 3 cohesive enough, 4 very cohesive) Briefly explain why.

17. Any specific comments/feedback you may have on the game?

Appendix N: Image collage sources

6-sockeye-reproduction- <http://profishart.com/gallery/wp-content/gallery/salmon/6-sockeye-reproduction.jpg>

wegner_table_edge_banding- https://vintagefurnitureguru.files.wordpress.com/2010/01/wegner_table_edge_banding.jpg

Test-Beds_aerial05- http://newscenter.lbl.gov/wp-content/uploads/sites/2/2011/07/Test-Beds_aerial05.jpg

Seamless-Black-Asphalt-Road-Texture- <https://images.freecreatives.com/wp-content/uploads/2016/02/Seamless-Black-Asphalt-Road-Texture.jpg>

SalmonTuesbh32-XL- <https://photos.smugmug.com/Feather-River-Fish-Hatchery-5/i-HHMTsfw/0/XL/SalmonTuesbh32-XL.jpg>

product-500x500- <http://www.rf-id.com/images/PL3000UHFRFID.jpg>

photo-stripeggs- http://www.snh.org.uk/Salmonintheclassroom/project_when.shtml

PET 001_DetailEnlarge- http://mindsetonline.co.uk/ProductImages/ProductDetailEnlarge/PET%20001_DetailEnlarge.jpg

Pellet-2008-3- <https://commons.wikimedia.org/wiki/File:Pellet-2008-3.jpg>

gingin-concrete-community-directory_cement-floor_home-decor_western-home-decor-decorations-decorating-tuscan-decorators-coupon-inexpensive-pinterest-sincere-rugs- http://haammss.com/daut/as/m/g/gingin-concrete-community-directory_cement-floor_home-decor_western-home-decor-decorations-decorating-tuscan-decorators-coupon-inexpensive-pinterest-sincere-rugs_797x532.jpg

Feeding-672x372- <http://mysalmon.no/feed-salmon-production-running-behind-schedule/>

Fabulous-Portable-Pool-Above-Wooden-Style-Deck-design- <https://www.pinterest.com/explore/above-ground-swimming-pools/>

bucket_PNG7764- <http://karmakbrown.com/category/bucket-list/>

spring_15_aquaponics_4- <http://ediblemadison.com/articles/view/aquaponics-farming-wisconsin>

smolt-silvers_1782- <https://lewseportfolio.wordpress.com/smolt-student-work-and-assignments/>

pink-salmon-underwater- <http://www.eikojonesphotography.com/pink-salmon/>

empty warehouse floor2- <https://burkhardtental.files.wordpress.com/2012/05/floor2.jpg>

hospitaldesk- https://is.alicdn.com/img/pb/625/842/400/400842625_900.jpg

hospitaldesk2- https://is.alicdn.com/img/pb/808/522/400/400522808_099.jpg

bluemussels- <https://www.pugetsound.edu/academics/academic-resources/slater-museum/exhibits/marine-panel/pacific-blue-mussel/>

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