

# EN·CAP·SU·LAT·ING



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## Authors

Lucy Zakharova  
Ted Lu

## Degree Project Faculty

Eva Perez de Vega  
Gonzalo Carbajo

## HMS Faculty

Daniela Fabricius

## DPAC Advisors

Christian Lynch  
Meredith TenHoor

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**I - ME - MINE - YOU - YOUR - [ WE - OUR - THEY - THEIR ]**

Throughout our history, different forms of life have co-existed in one living environment. This includes insects, birds, mammals and aquatic life, but simultaneously – humans. Consequently, human settlements have always included a variety of other species as neighbors, whether in the form of help, food supply, or even enemies. While advancing our settlements and technologies, and evolving through science and education, humans have taken a path of a complete isolation from other species, focusing only on themselves. Consciously or unconsciously, the uncountable use of all available resources for human use, and the waste that has been created, have begun to harm the environment and all its living organisms, including people.

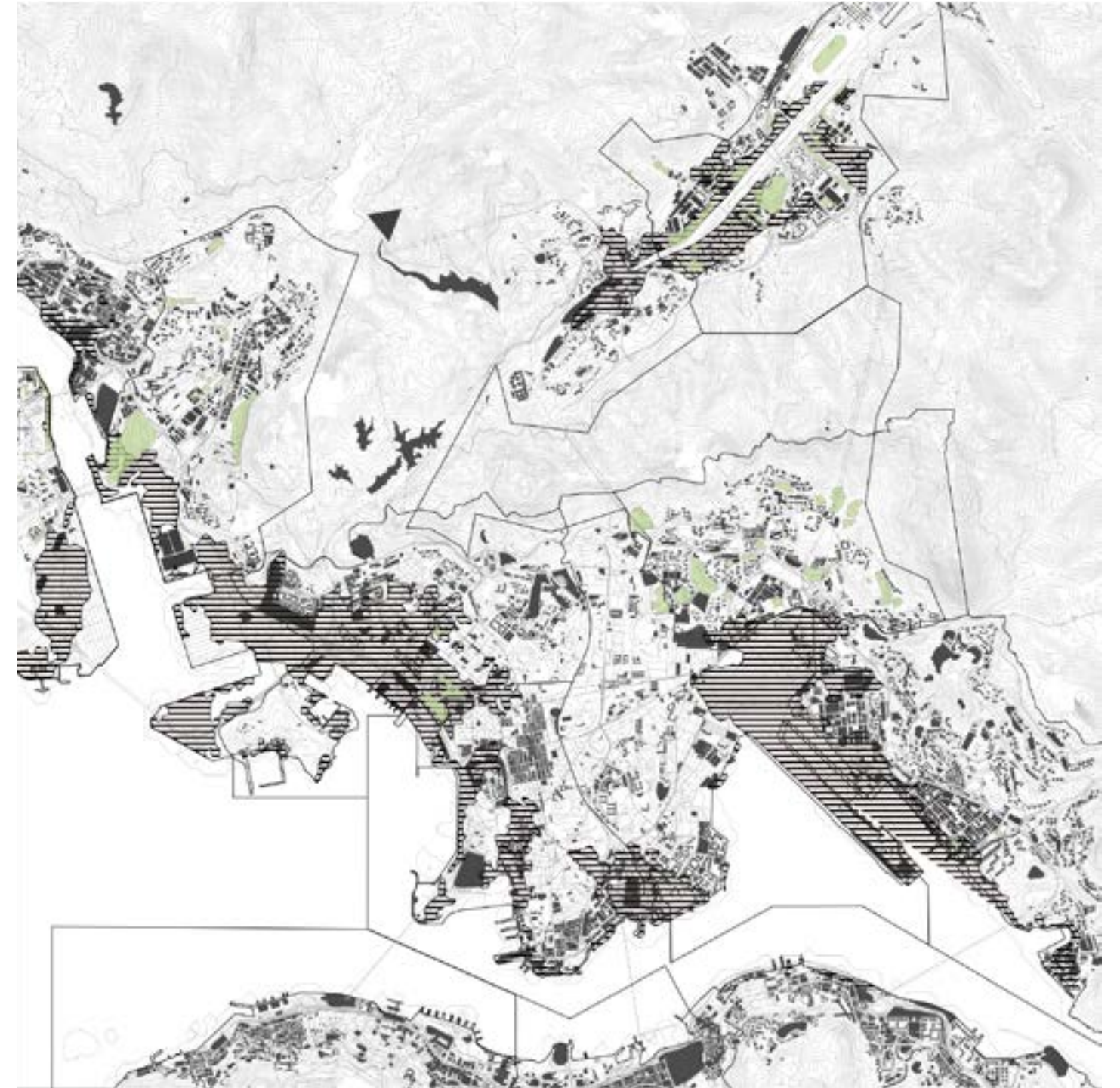
However, people are able to take great care of species that were harmed due to our activities, while creating an infrastructure that accommodates coexistence and includes well-being. Anything we do to salvage the ecosystem will benefit humans.



## THE WANDERING LANDS

The earth is made out of 29% of land and 71 % of water, and 97% of the water is stored in the ocean. The ocean plays a significant role in maintaining the balance of our ecosystem. The ocean is currently a no man's land that humans are eager to develop into our next habitat. However, by 2100 the sea level will rise by 40 inches. We will be losing 1.79 million square kilometer of land and there will be around 200 million climate refugees that are forced to leave their homes. This is in addition to people who are constantly affected by the natural disasters caused by global warming.

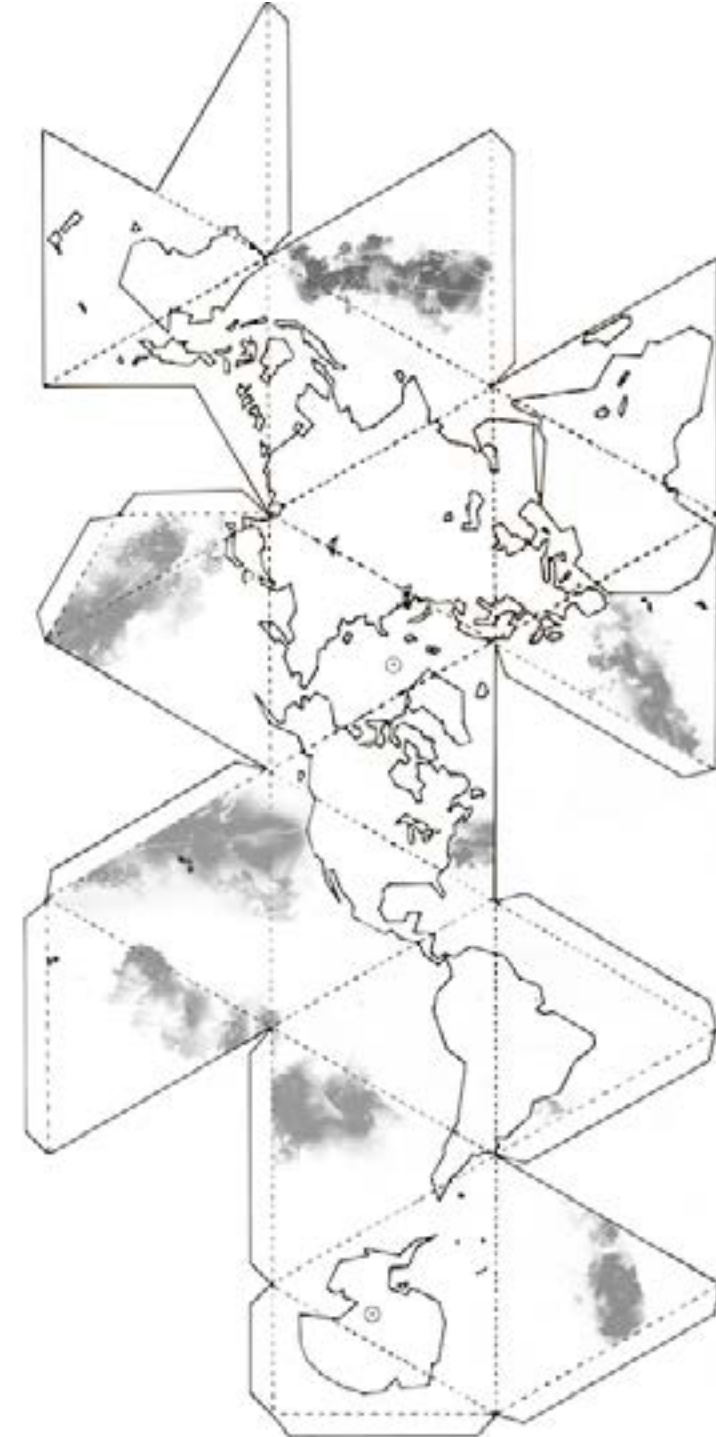
Human population is increasing at a tremendous rate. Due to the uneven distribution of population and rising sea level, some countries will soon be facing land shortage. Land reclamation becomes a choice for countries like Hong Kong. However, it is not a cost-effective decision and certainly not eco-friendly. I would like to propose a project on the ocean that will solve the issues of land shortage, food shortage, population hyperdensity, and the habitats of non-human species that are threatened by human development in the coastal area. Multifunctionality is the key for this architectural proposition. Architecture should be transformative and adaptive to different possible programs. We should not be satisfied with only one program within a single space. In this way we can utilize the less possible land to achieve bigger impacts. We will need to achieve multifunctionality of every single space in order to maximize the possibility and minimize the ecological footprint.



## OUR OCEANS - OUR HOME

Our Oceans are a unique and highly unexplored part of our planet. It is a known fact that more people have been to space than to the bottom of an Ocean. Therefore, its Deep Sea part (the zone starting at 1000 meters below the Sea Level line, where the sunlight can no longer reach) remains highly mysterious and unknown to humanity. Recent Deep Sea dives have resulted in the discovery of transparent living creatures, which emit their own light through their own bodies, occupying that darkness.

The three main Oceans -- the Pacific, Atlantic and Indian -- are chosen to be our site. Looking more closely, our site breaks up into five subcategories: the Pacific and Atlantic Oceans are subdivided into the North and South Pacific and North and South Atlantic Oceans, while the Indian Ocean remains as one. We have five main gyres (circular oceanic currents) that occupy those oceanic spaces simultaneously, which are also well known for circulating plastic waste that ended up in the waters. The gyres are located quite far from coasts in the International Waters, or in other words, in no man's land. None of the countries seem to care about this problem, so it becomes both a global issue that is both political and environmental.





The Great Pacific ocean has two main Gyres: the North Pacific Gyre and Southern Pacific Gyre. Both, unfortunately, are homes for the two Great Pacific Garbage Patches. The northern one is the largest and most well-known in the world. Garbage patches are extremely large areas of plastic garbage that are freely flowing in an ocean. Due to the physical properties of gyres, the major currents in the North and South Pacific, North and South Atlantic and Central Indian Oceans are circular. Therefore, garbage patches are rapped inside, forming islands out of plastic that are migrating alongside aquatic life. Unfortunately, due to the extreme amounts of plastic that have leaked into our oceans, garbage patches have expanded enormously, causing major damage to aquatic life and ecosystems.

Unrolled Globe with accurate relationships and proportions between the continents and Garbadge Patches in the Oceans.  
Computational Drawing, 18in x 36in [p.11]

Great North and South Atlantic Garbadge Patches in Atlantic Gyres  
Computational Drawing, 18in x 18in [p.12]

Great Indian Garbadge Patch in Indian Ocean's Gyre  
Computational Drawing, 18in x 18in [p.13]

Great North and South Pacific Garbadge Patches in Pacific Gyres  
Computational Drawing, 18in x 18in [p.15]



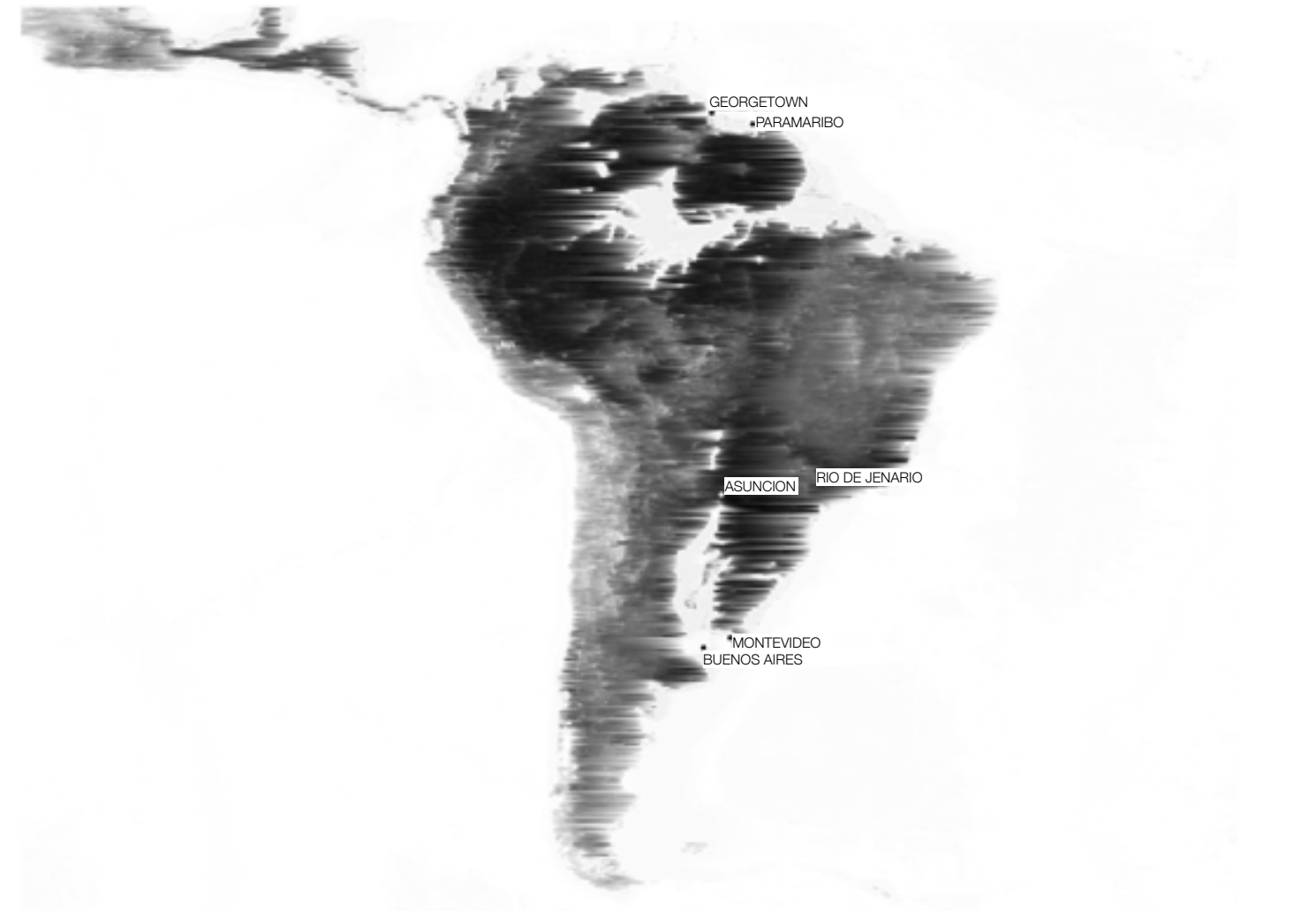


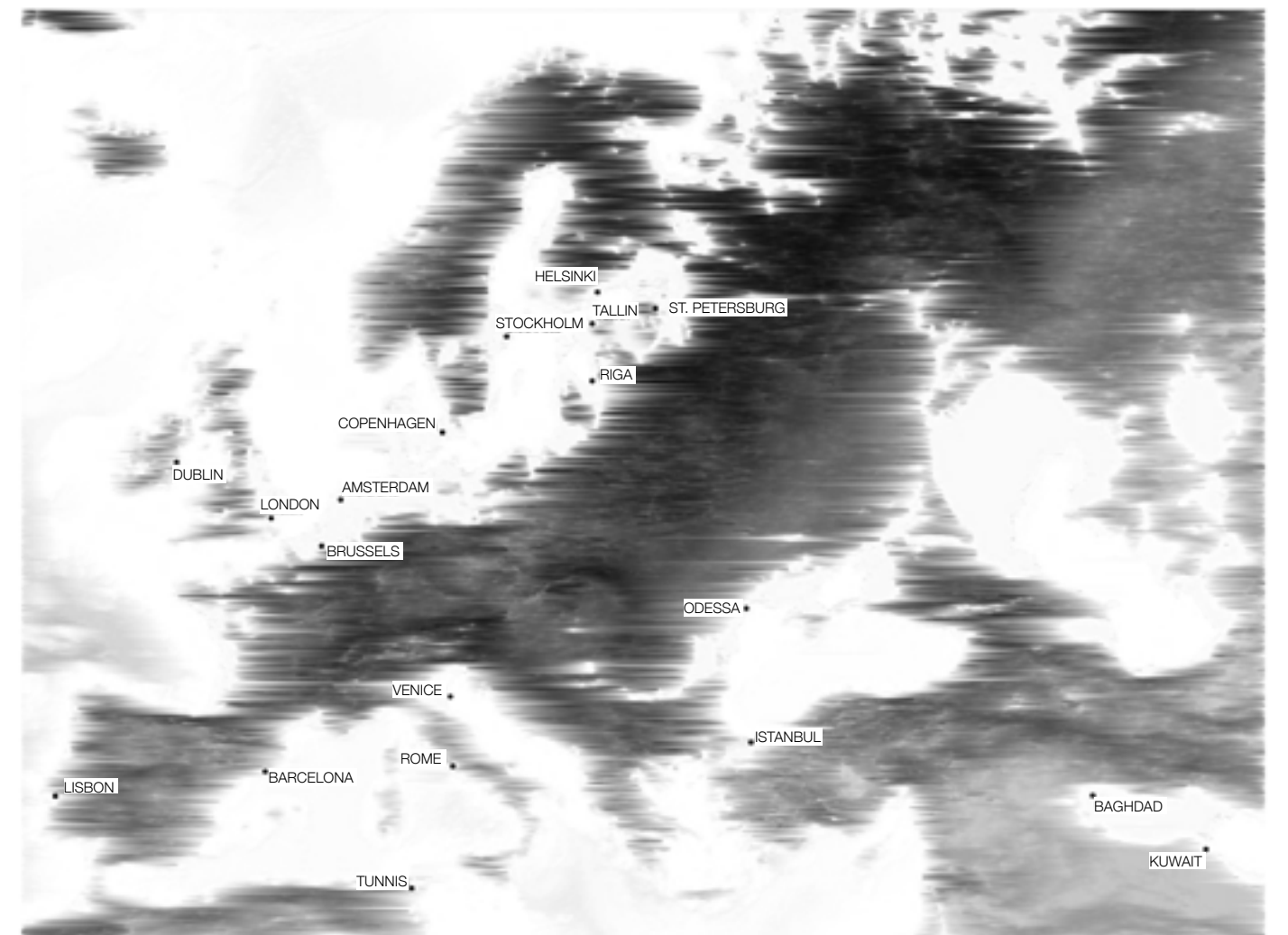
## COASTAL CATASTROPHE

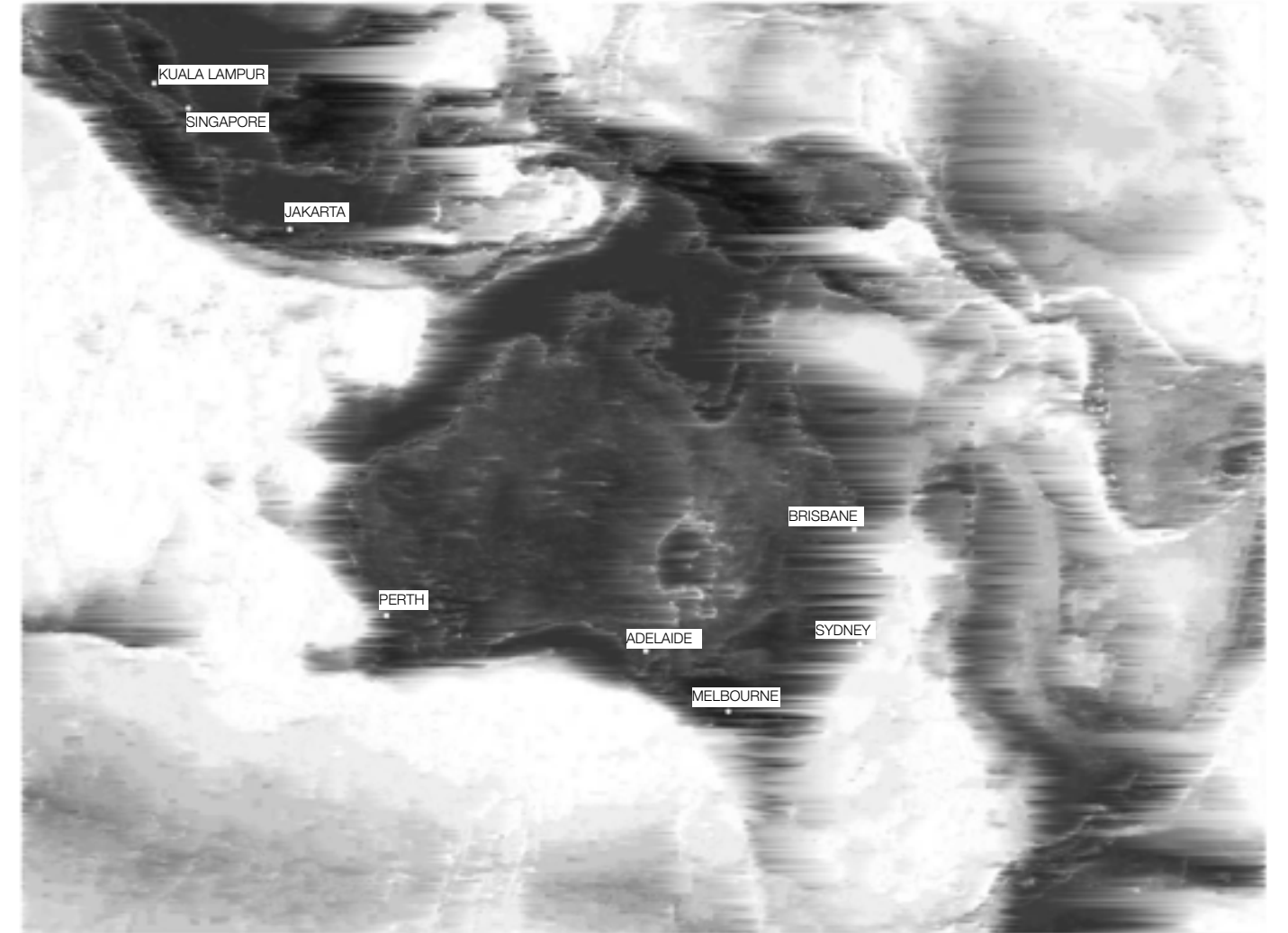
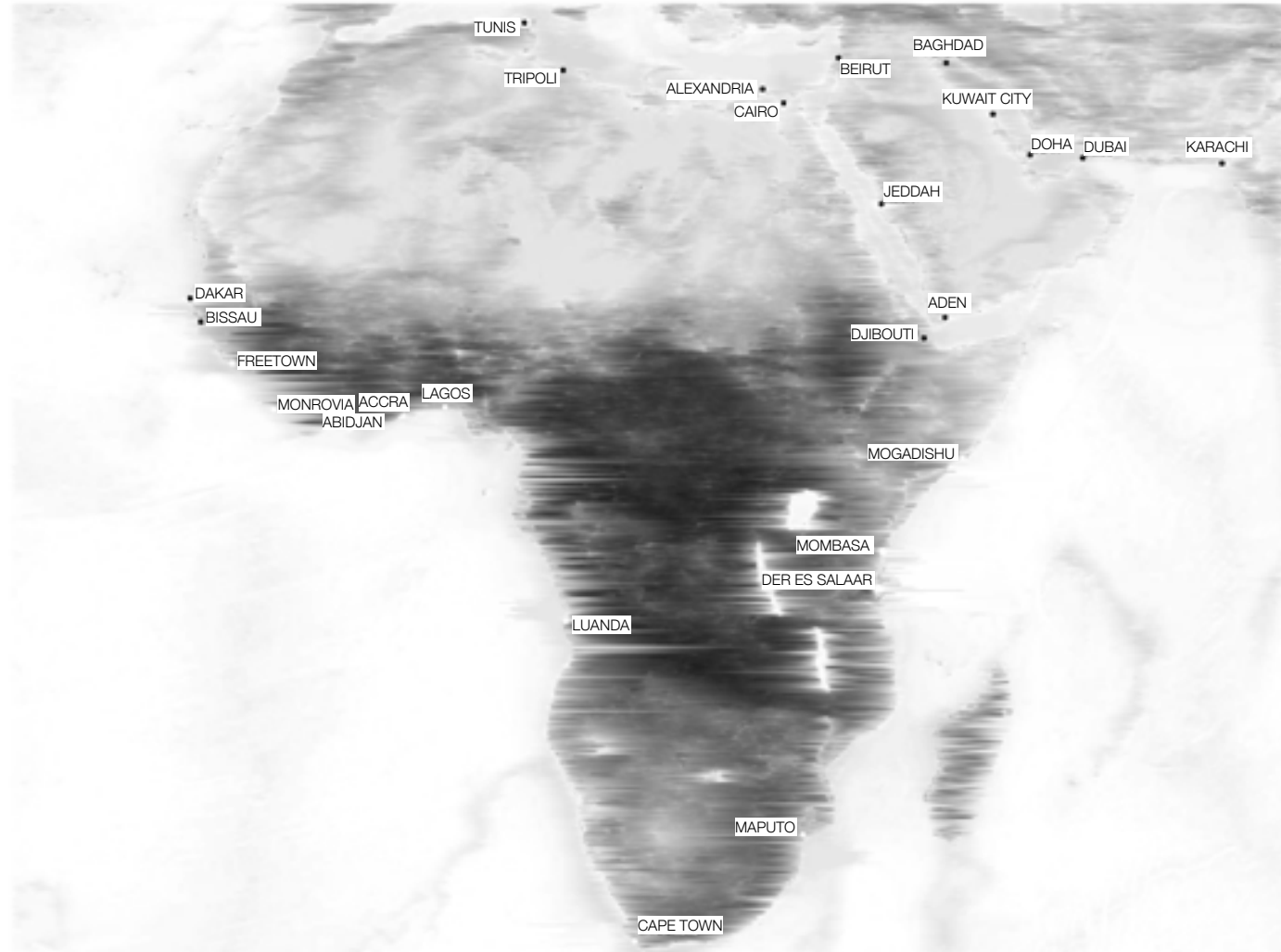
One of many global warming consequences is the sea level rise. It is a result of the melting of glaciers and icebergs at both the north and south poles.

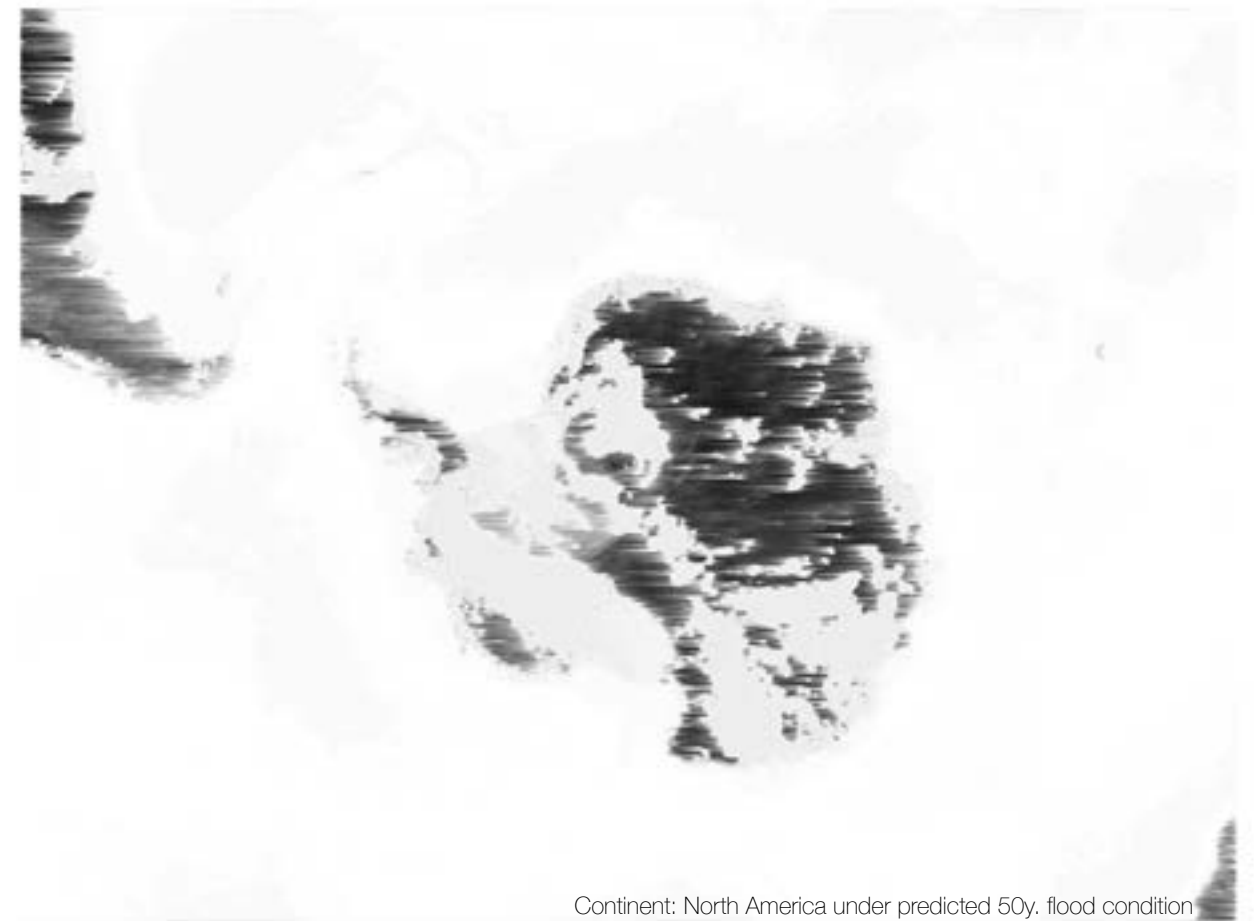
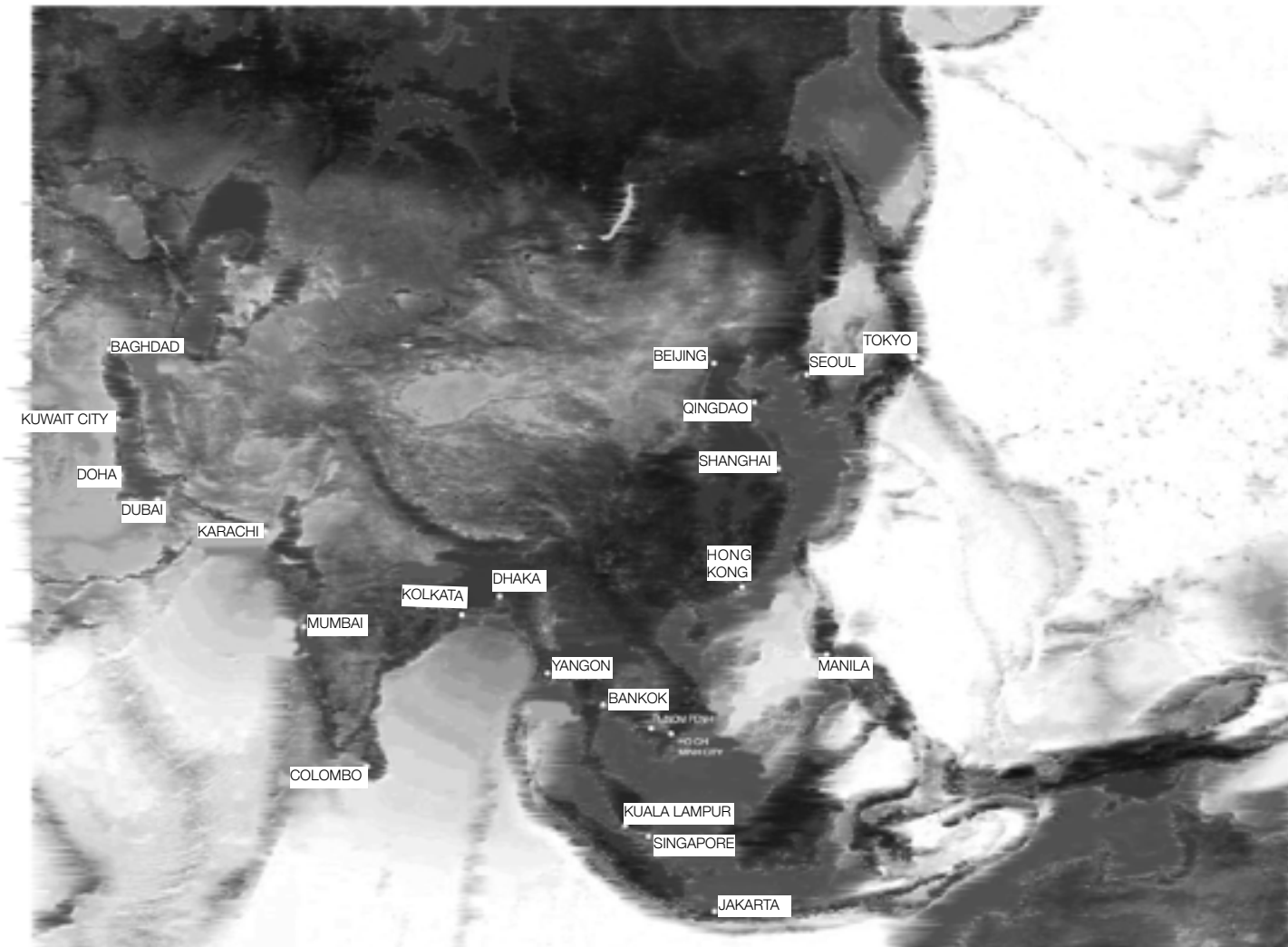
Once the water rises, it pushes the coastal line inland. This will change the profile of entire continents and major parts of the World, such as: Europe, Asia and Oceania. Therefore, all coastal cities are currently in a state of emergency due to sea level rise.

The entire population of important coastal cities would have to move inland, as it would be impossible to inhabit the flooded zones. People would have to come up with future solutions for either preservation or displacement of coastal ecosystems.









Continent: North America under predicted 50y. flood condition  
Computational Drawing, 18in x 18in [p.17]

Continent: South America under predicted 50y. flood condition  
Computational Drawing, 18in x 18in [p.18]

Part of the World: Europe under predicted 50y. flood condition  
Computational Drawing, 18in x 18in [p.19]

Continent: Africa under predicted 50y. flood condition  
Computational Drawing, 18in x 18in [p.20]

Part of the World: Oceania under predicted 50y. flood condition  
Computational Drawing, 18in x 18in [p.21]

Part of the World: Asia under predicted 50y. flood condition  
Computational Drawing, 18in x 18in [p.22]

Continent: Antarctica under predicted 50y. flood condition  
Computational Drawing, 18in x 18in [p.23]

## ESTABLISHING RELATIONSHIP BETWEEN LIVING AND NON-LIVING MATTER

Humans have a tendency to separate themselves from «Nature» and the «Natural World.» is thus ironic, that there is reference to nature in most of the works done by humans. Today, we have a very well-defined boundary between what is «natural» and «human-made». This brings up two major questions: «Is this separation right?» and «Why did it become so at first place?» Finding an answer to those questions will open a discussion on looking forward for a compromise, or ideally, a solution.

If everything produced by humans is categorized as a «non-natural» condition, why don't we say that everything created by all living creatures is a «non-natural» thing? Looking at this question from an architectural perspective, we can observe that almost all living creatures build their own homes. Whether those are birds that build nests out of grass, tree branches, mud, and many more other materials a bird can find, or insects like termites and paper wasp that build their houses out of mud and chewed wood. Mammals like beavers build dams, and block the entire river flow with their houses made out of logs, which causes flooding and breaks the path of fish flows in the river. Observing this from a distance we may see that all living creatures consume resources available to them in order to create their own «infrastructure» and build their own «habitat». Humans are no different.

Throughout our history, people have been withdrawing animals from their “scene,” but with the introduction of science and humanities studies, and consequences such as industrialization, it was set clear.

«By the early nineteenth (19th) century, to be «human» means to have been finally and definitively, separated from animals. To be a non-human animal during the same period means, in effect, to have been divested of physical autonomy and power in such a way that continued existence in the world becomes increasingly precarious. One could say that the animal, and animality, recedes from modernity as the human advances toward it and is, indeed, defined by it.»<sup>1</sup>

The ambition of science, alongside with developments in a variety of fields, highly elevated humans among other living species, which created a rigid boundary between humans and animals, such that a boundary was also created between humans and nature. Society started to globally focus on science and human supremacy; the topic of evolution starting from seventeenth (17th) century, became the main focus, and was highly developed in nineteenth (19th) and twenty-century (20) Europe. According to Philip Armstrong, «Evolutionary theory, which helped redefine the human in relation to the animal, never could have been formulated without Darwin's participation...»<sup>2</sup> Darwin established the understanding of the human ability to achieve a supreme power over not only other living organisms, but also through a competition that is always present in the human environment. This competition, in fact, has highly motivated societies to reach high achievements, firstly in science, and later in technological studies.

<sup>1</sup> Catherine Ingraham «Post Animal Life»

<sup>2</sup> Philip Armstrong «The Postcolonial Animal»

Inventions not only in architecture, but also in the technological spectrum, succeeded in overcoming all other creations developed by living organisms that occupy the Earth, or have ever occupied it in the past. The human connection to animals was transformed into a fully disputed sequence, ever since the beginning of the seventeenth (17th) century.

«Beginning in the late eighteenth (18th) century, architecture captures, specifically, human life, which is, as initially stated, in the process of gaining biological autonomy from animal life. Architecture captures this life in sophisticated structures composed in the midst of theories of time and space that have been both expanded and deepened by seventeenth (17th) and eighteenth (18th) century science.»<sup>3</sup>

These developments created a shift in the nineteenth (19th) century to perform studies and ask questions related to a variety of sociological and psychological conditions. A take from industrialization was the term «operation», which in the nineteenth (19th) century was applied to humans for the first time.

Transitions in society, co-joined with industrialization, created massive sociological shifts, which for the human aspect of the question brought up new conditions such as mental state. «Once we understand that «the human» and «the animal» are relics of a philosophical humanism that flattens the actual complexity and multidimensionality of what are, in fact...» Psychology was a discipline which started the studies of the mind's behavior. In order to create a broad understanding of the subject, both animals and humans were studied on a variety of levels. The data and performance collected after these analytical and psychological studies led to a greater separation between an animal and a human. The

<sup>3</sup> Catherine Ingraham «Post Animal Life»

<sup>4</sup> Ariane Lourie Harrison «Animal Interfaces for Post-Human Territories»

«Who is What?» a fragment from a Computational Drawing, 18in x 18 in [p.27]



term «Wild» was applied to animals, but occasionally was used to describe some abnormal human behavior as well.

«Human and animal retain reserves of «wildness». For animals, we have only this word and its slippery meaning; for humans, there are numerous words - schizophrenia, legendary psychastheria, claustrophobia, the uncanny, all the spatial phobias and aphasias such as autism, agoraphobia, attention deficit disorder, many of which had their origins in the nineteenth (19th) century clash of human life with mechanization and industrialization but all of which raise the specter of the animal and the animal caught by space.»<sup>5</sup>

While studying a variety of psychological conditions and shifts, the message was to find the particular balance between the restrained movement in space and the form, which as we have learned - both affect the mind. Architecture has produced a broad variety of manifestos, which hardly can be assimilated into static physical space, as architecture begins to deal with subjects such as an increasingly mobilized body (the outer life), and a more profound human psyche (the inner life). Architecture became a medium which linked mental (inner) and physical (outer) surroundings together. By studying and creating a space, people have learned to manipulate their own inner state and well being, and since the nineteenth (19th) century, people started to create architecture for animals as well. Formally, it was still under the regulations of human needs, but practically it was accommodating the needs of animals.

On the one hand, the act of creating architecture for animals interfered with all achievements of human society in terms of supremacy specie, but on the other, it confronted it. Yet, in the natural world (and I am separating it in this case from the

<sup>5</sup>Catherine Ingraham «Post Animal Life»

human environment), everything is known to be linked and joined together, where individually each species cares about itself first. The fact that people have created architecture for other living species announced the very beginning of a new era of psychological consciousness, which yet is known only to people. «A common antagonist can be recognized immediately in the continued supremacy of that notion of the human that centers upon a rational individual self or ego.» This, in fact, brings us back to the discussions of nature, in retrospective of human. The way in which we all (all forms of life) interact with nature, by using resources to help and develop ourselves, immediately separates us, but the fact that as in nature, our

All living organisms (including humans) use available to them resources and materials. People have the same habit as all living creatures on this Earth - to create and invent architecture, building their own surroundings and infrastructure, which serves the needs of the human community. None of the living creatures think of other species, but humans have gained an extreme consciousness, which rapidly made them an exception in this equation. Looking at this sociologically, and rather politically, people do have a larger, global, impact onto their surroundings, in a way that none of the other species do, and this is a critical point in all the discussions in a variety of fields, including history, art, ecology and science.

### Essay Bibliography

Catherine Ingraham «Post Animal Life»

Ariane Lourie Harrison «Animal Interfaces for Post-Human Territories»

Philip Armstrong «The Postcolonial Animal»

## HOW CAN WE ACHIEVE SYMBIOTIC RELATIONSHIP BETWEEN HUMANS AND NON-HUMANS FROM THE PERSPECTIVE OF POPULATION DENSITY

The population explosion is one of the major causes of the many issues that humans are facing nowadays, which can potentially lead to the extinction of many species. Global warming, hyperdensity, pollution, refugees, and unequal distribution of resources are the urgent topics that humans are addressing now. In *The Uninhabitable Earth: Life After Warming* by David Wallace-Wells, he discusses the impacts of the man-made disasters on humans and other non-human species. In *Hong Kong: Culture and the Politics of Disappearance*, by Abbas Ackbar he looks at hyperdensity in terms of the political impacts particularly in Hong Kong. The author raises a couple of interesting solutions to address overpopulation. The "Nature" exhibition in Cooper Hewitt Design Triennial holds inspiring inventions that forge meaningful connections with nature. These inventions can be significant in the design of future habitation. The space we have left to build along with the increasing population is emergent, we need to build in entirely different ways to utilize space at its maximum with minimum ecological footprint.

Overpopulation is leading to consequences that slowly make our Earth uninhabitable. Humans are emitting greenhouse gasses at a rate "one hundred times faster than at any point in human history before the beginning of industrialization." (Wallace-Wells 8) This emission is highly linked to some of the rare natural phenomena such as desertification, flooding, and excessive heat. Any of these phenomena can destroy a habitat completely. If we can not gain control of these emissions, these natural disasters can soon be normalized as "bad weather." (Wallace-Wells 13) Wallace-Wells describes the typical human mentality:

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<sup>1; 2; 3;</sup>  
David Wallace-Wells  
«The Uninhabitable Earth: Life After Warming»

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"I tend to think when you're at the top of the food chain it's okay to flaunt it, because I don't see anything complicated about drawing a moral boundary between us and other animals."<sup>1</sup>

Many people still possess this mentality. We tend to believe that these catastrophes will not happen in our generation, therefore we can let the generation figure out the solution. But in fact,

"Globally, pollution kills as many as nine million each year."<sup>2</sup>

and there are also climate refugees that seek to find a new place to restart their lives. Climate refugees also deepen the issue of hyperdensity in the city because most of them will aim to restart in the city. As we have more lands that are wiped out by natural disasters, we will soon be facing a shortage of space. Cities will soon be uninhabitable not because of disasters but because of how many people are sharing one tiny space.

The damage affects not only humans but the other non-humans species that do not contribute to the emission of greenhouse gasses. Animals are forced to move away from their original habitats because of something that is done by humans:

"Species individuated over millions of years of evolution but forced together by climate change have begun to mate with one another for the first time, producing a whole new class of hybrid species: the pizzly bear, the coy-wolf."<sup>3</sup>

These issues we have created also slow down our economic growth: "Every degree of warming, it's been estimated, costs a temperate country like the United States about one percentage point of GDP." (Wallace-Wells 29) We could have spent these resources on more important topics such as technology development.



Wallace-Wells mentions several potential solutions for separating humans from nature “Half-Earth” (originally proposed by E.O. Wilson) (Wallace-Wells 19). In these scenarios, humans will occupy half of the world while nature runs its rehabilitation. But this reorganization of habitat would still be problematic to some species that require specific weather and locations to live. There is also carbon capture technology and the ocean itself that extracts significant amounts of CO2 from the air, which could both slow down the rate of the catastrophe. Architecture is still one of the most polluting industries as “Concrete, production of which ranks today as the second most carbon-intensive industry in the world.” (Wallace-Wells 162) The materials we use, the way we plan our space, where we build, and why we build are critical questions we should ask ourselves. It is evident that humans can become extinct:

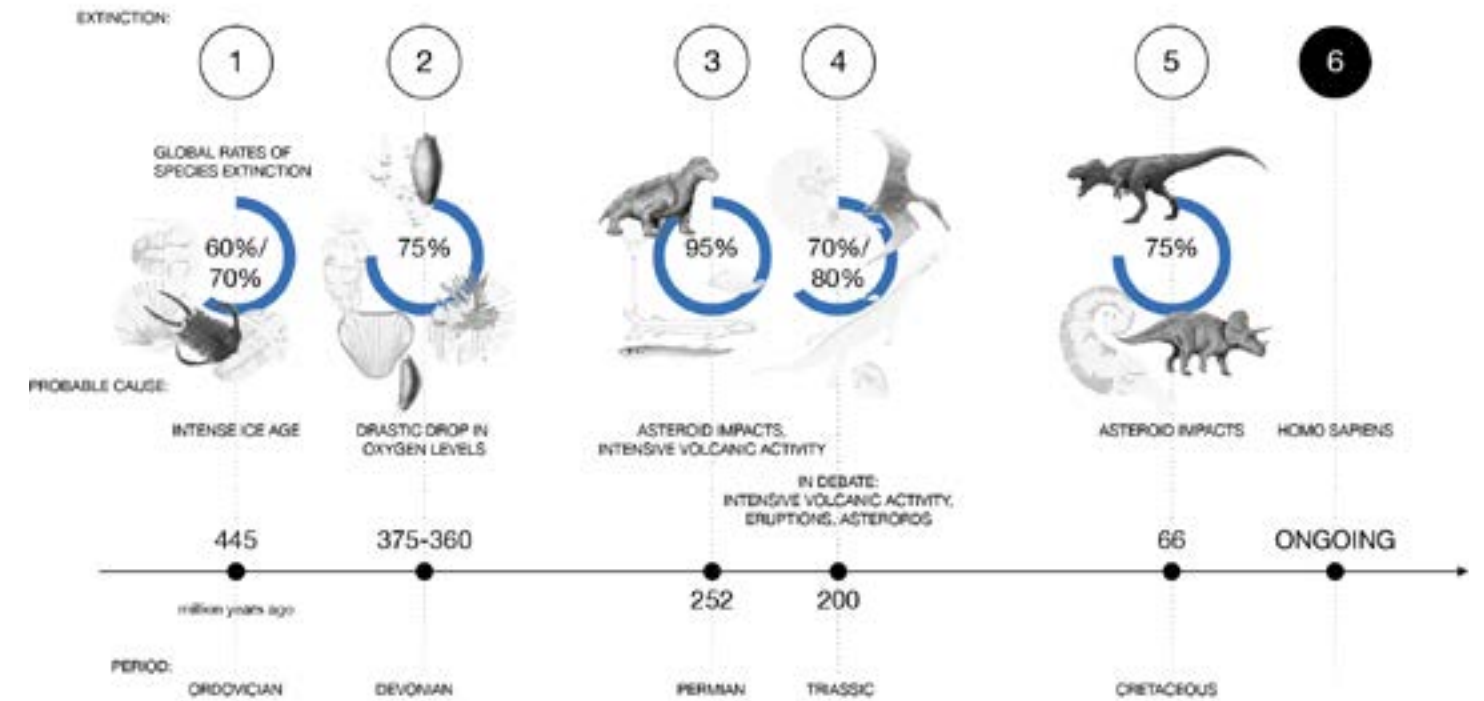
“The earth has experienced five mass extinctions before the one we are living through now, each so complete a wiping of the fossil record that it functioned as an evolutionary reset.”<sup>4</sup>

This is something that can happen within our generation. In fact, some cities are already at the edge of catastrophe.

Hong Kong, one of the most dense cities in the world “Estimated at more than forty thousand people per square mile,” (Ackbar 81) is currently facing the issue of overpopulation and inhumane living conditions. It is one of the most developed and busy cities in Asia that is at the edge of catastrophe because of human development. It is a city of transients because “Much of the population was made up of refugees or expatriates who thought of Hong Kong as a temporary stop, no matter how long they stayed. The sense of temporality is very strong, even if it can be entirely counterfactual.” (Ackbar 4) The location of Hong Kong is significant because of its connection with China both politically and geographically. It is a

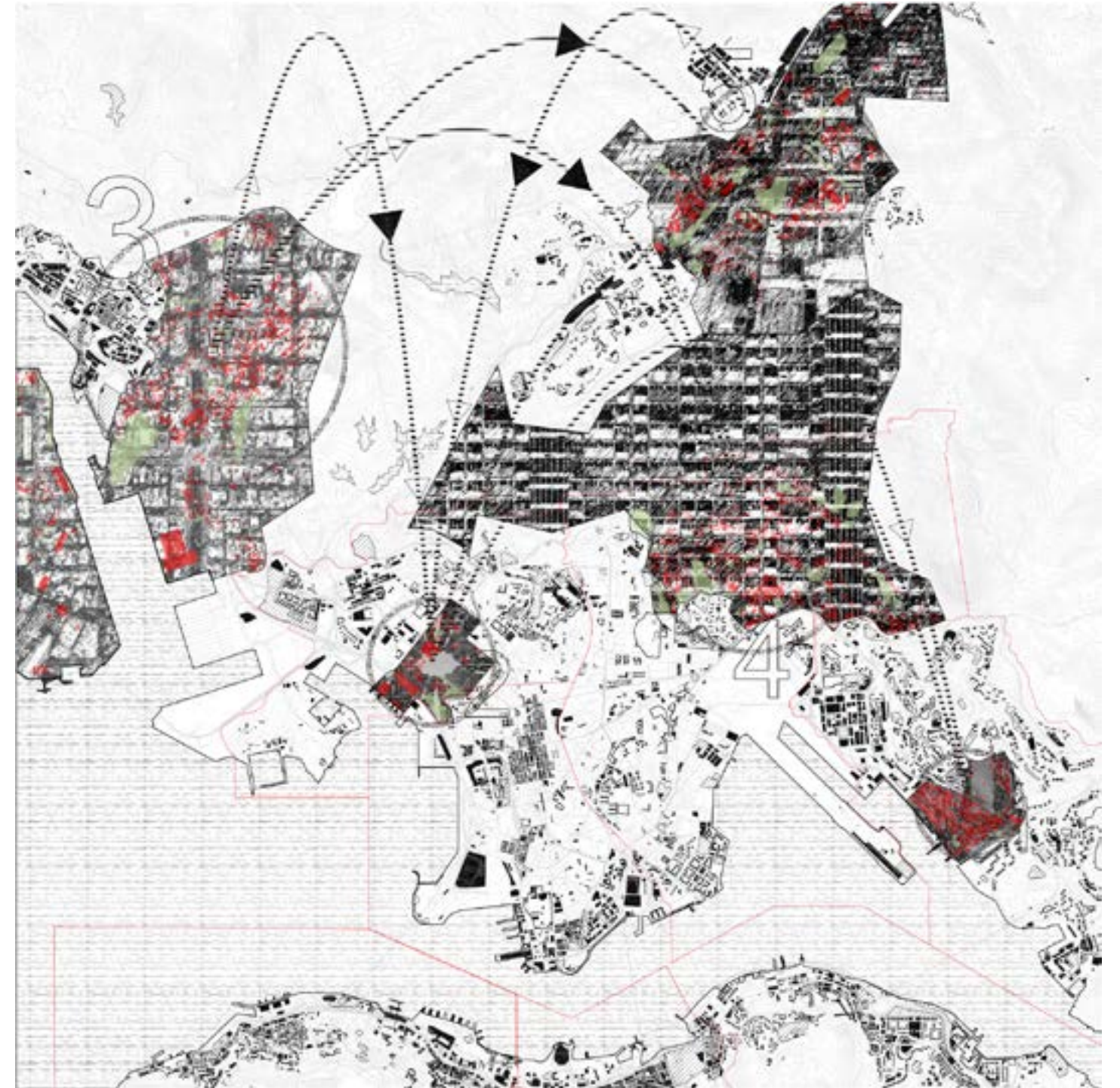
<sup>4</sup> David Wallace-Wells  
«The Uninhabitable Earth: Life After Warming»

Timeline of Global Extinctions  
Computational Drawing 11in x 17in [p.33]



space of facilitation. It can be seen as “A port city that is located at the intersections of different spaces,” (Ackbar 4) which is why this small city holds a massive amount of people. The characteristic of transiency also makes everything provisional: “Everything floats - currencies, values, human relations.” (Ackbar 4) Hong Kong’s government throws most of its energy toward the economic sphere, therefore the entire city feels commercial. This small city is ranked number eight for the busiest airport in the world: “The airport will be a kind of city within a city, but a city without citizens, a semiotic or informational city populated by travelers and service personnel.” (Ackbar 4) The city is developed into the direction of a tourist destination to a point that there is an absence of culture in the city.

Although Hong Kong does not have a long history of culture to look at, “The combination of British administration and Chinese entrepreneurship” (Ackbar 71) is certainly a way of looking at Hong Kong in its cultural context. However, there is a risk that architecture “Has the dangerous potential of turning all of us, locals and visitors alike, into tourists gazing at stable and monumental images.” (Ackbar 65) These monumental buildings should not be perceived or used as decoration, but something that has the potential to form a new hybrid. Absence of culture directly leads to commercialization, where everything is labeled with value, and that is why every inch of land in Hong Kong is so expensive, which leads to inhumane living conditions because people cannot afford it. Only 24% of the territory in Hong Kong is developed because the majority of the land is mountain. The government is aware of this situation and yet continues to build public housing: “At present, 2.8 million people live in government-subsidized housing, and the authorities are building forty thousand new flats a year to meet the demand.” (Ackbar 86) However, the government also utilizes these scarce lands to maximize its profits:



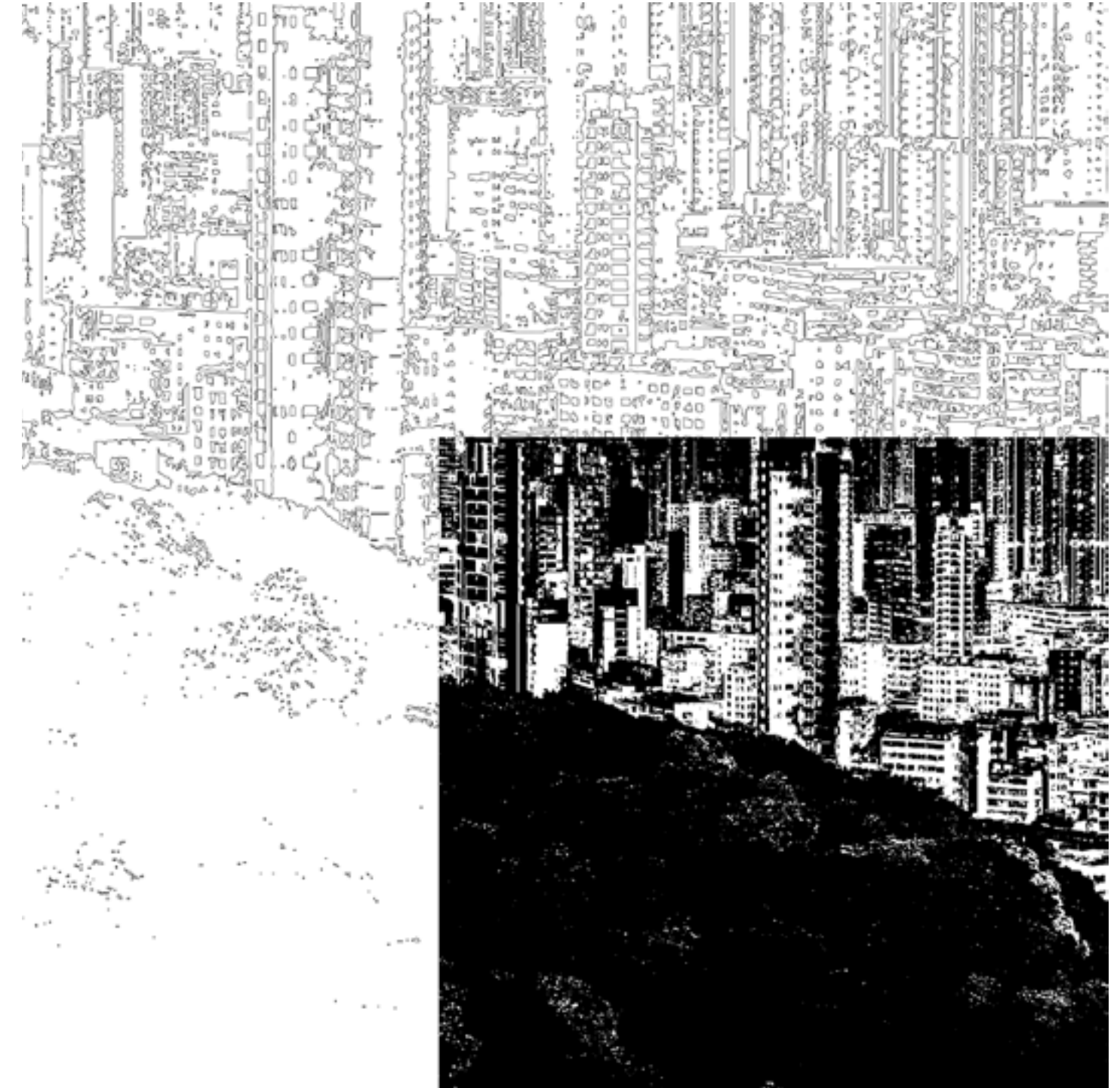
“Hyperdensity is partly the result of limited space, but it is also a result of how this limited space could be exploited for economic gain.”<sup>5</sup>

We can now rephrase the issue: How do we solve the problem of overpopulation and inhumane living conditions by incorporating the identity of this port city, and the cultural context of colonial development, to achieve a minimal ecological footprint? Some argued that “the only solution to the problem of hyperdensity was the instant high-rise and the enormous estate block,” (Ackbar 85) which has the problem of a complete separation from nature and the excessive materials required to build a high-rise. Another idea raised by the author is more interesting: “Dealing with hyperdensity is to transform the facades of anonymous apartment blocks... It is as if the flat surfaces of these anonymous buildings were now covered in pleats or folds, multiplying in volume and interest and providing a zone of mediation between inside and outside.” (Ackbar 89) Here he is talking about a tendency that is not toward specialization and separation, but toward the multiplication and concentration of different functions in the same space. This multifunctional space and skin can potentially save more space and generate less ecological footprint.

There are many designers today who are working on the idea of balancing between humans and nature. The “Nature” exhibition at Cooper Hewitt Design Triennial has an emphasis on materials that have less ecological footprint and more connection with nature. Material selection is crucial especially when concrete is one of the most polluted materials but you can still see it everywhere. There are some intriguing materials such as self-emitting plants and wool that is done by injecting the DNA of jellyfish to make them glow or a facade system that allows the habitation of different species. These materials further enhance the design in terms of lowering the ecological footprint and create a symbiotic relationship with nature.

<sup>5</sup> David Wallace-Wells  
«The Uninhabitable Earth: Life After Warming»

Hyperdensity  
Computational Drawing 18inx18in [p.37]



## EN·CAP·SU·LAT·ING

Humans have always been drawn to unknown mysteries of the night sky. We have invested large amounts of resources to explore beyond our planet. Those incredible clouds of light couldn't attract people more. But we know little about identical marvels that exist here on earth - the species that inhabit the darkest zone of the ocean. We don't need to leave our planet to observe these creatures. We know more about outer space than we know about our own planet, especially our oceans. Only 5% of the ocean bed has been discovered by humans, and only four people have traveled to the deepest part, the Mariana Trench in the Pacific Ocean. The surface of the ocean is familiar to humans. Long in our history humanity explored this world through sailing, and have learned about the currents and wind forces that exist in this incredible environment.

However, this free and open space without national borders has been gravely affected by humans. The Pacific Ocean is where the world's largest garbage patch is located. Due to the directions of global ocean currents, plastic is being concentrated into ocean gyres. There are five major garbage patches around the world. Two of them are within the Pacific Ocean; the one between Asia and North America is the largest one. Sea turtles think that the plastic is jellyfish and eat it. Other animals can entangle in the plastic and eventually drown. Algae is not growing as it should and the entire food chain is being affected negatively, including humans. Together, the garbage patches form new continents on the surface of the ocean, and create destroyed ecosystems on earth. It harms the ocean, the marine inhabitants, and also our coasts. Certainly the marine species that depend on the ocean.

part of Experimental Elevation  
Computational Drawing 11in x 17in [p.39]

Our project site is the dynamic and ever-changing Pacific Ocean - both its surface and its depths. We started by exploring the vertical and horizontal currents, and how they interact with the wind forces. We propose a constellation of 5 capsules built from the refuse of the Pacific Ocean garbage patch, deployed at different depths of the ocean to clean, mitigate, educate, research, conserve, restore and radically reconfigure human interaction with the ocean and its species. Our project is non-static, it moves cyclically through a dynamic and ever-changing Pacific Ocean. A cluster of vessels in international waters that work together to benefit not only humans but also other species that are important to this oceanic environment. We aim to detoxify the ocean by reconfiguring plastic pollution, while promoting knowledge of the oceans and teaching the public their duty to protect natural heritage.



Although we are encapsulating now to resolve the issues that humans have created, one day we will be decapsulating, then we can eliminate the barriers between all living species.

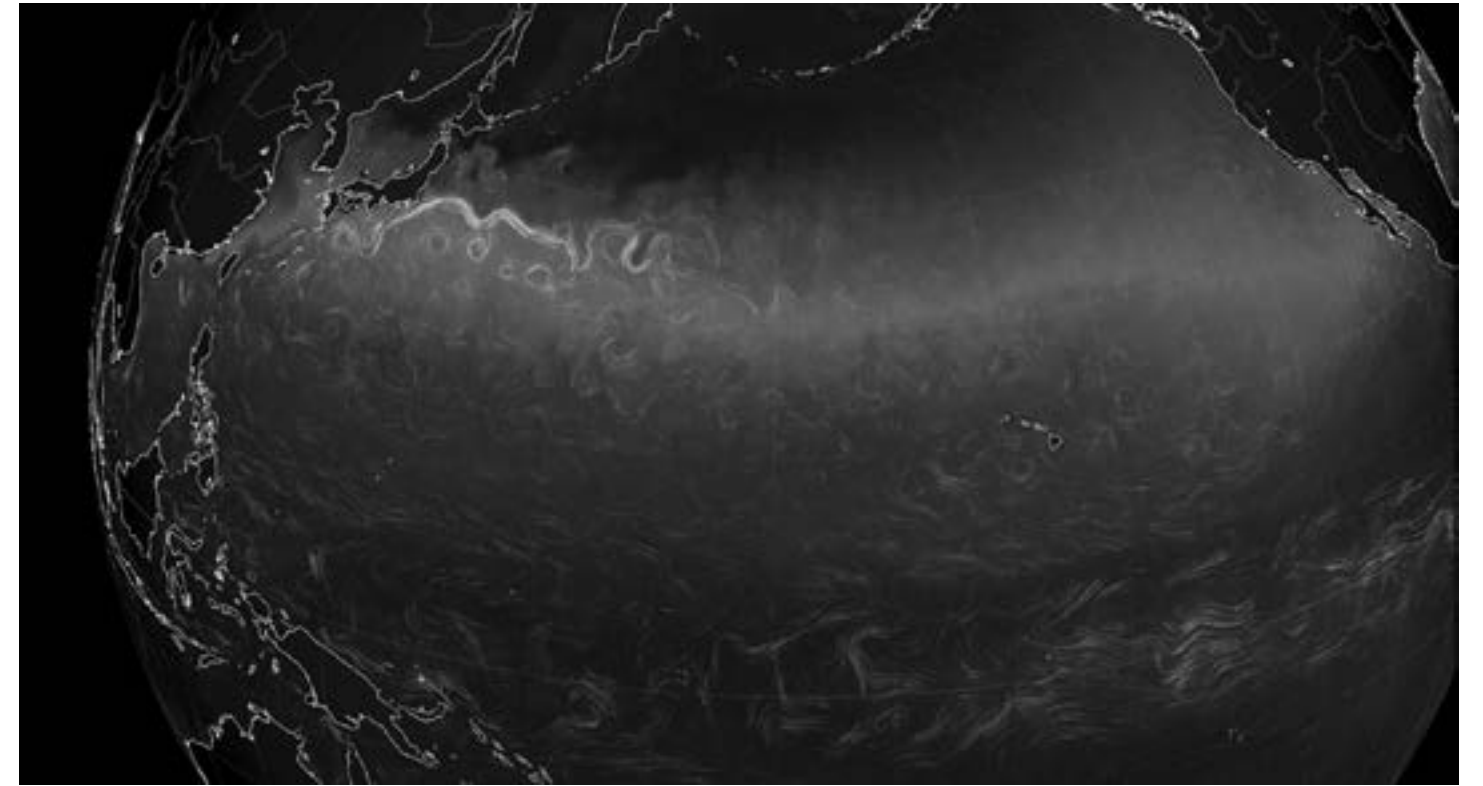
## Ocean Currents: Local Currents and Gyres

In our site research, we have looked into and analyzed data provided by NASA, which showed the real-time data of oceanic currents. Based on the information we found, predictions of the future changes in current flows were made, and this also found a response in the form studies of our proposal. The behavior of smaller currents located close to the coastal areas were analyzed individually, to find their relationship and response to the greater oceanic flows.

At the same time, the study of the currents led us to find a correlation between our early research of the oceans' depth and its topography. It turned out that the path the currents are taking is directly related to the change in the topography of the ocean's floor.

The oceanic currents will perform as guidelines for the movement of our architectural proposal. Just as in the performance of a sailing boat, the part of the program which is placed above the sea-level line, must be able to adjust and accommodate the wind current correspondingly. Our research showed that wind currents are less predictable than water currents. If water currents are more or less stable and have a clearly defined path and a direction to flow, wind currents perform vice versa. Wind may be blown from different directions, and can dramatically change on a daily basis. This research was accompanied with a variety of physical tests, where we decided that our architectural proposal, which will have a program placed above the sea-level line, must have a sail or an adjustable fin, in order to have a response to an unpredictable and constantly changing wind currents.

North Pacific Ocean. Digital 2-Dimensional and 3-Dimensional current analysis [p.41]



## Climate Change & Manufactured Landscape: Great Pacific Garbage Patch



The Great Pacific Garbage Patch is the world's largest collection of floating trash—and the most famous. It lies between Hawaii and California and is often described as “larger than Texas,” even though it contains not a square foot of surface on which to stand. It cannot be seen from space, as is often claimed. [source: National Geographic. Plastic or Planet. by L. Parker]

Harm to the environment can also occur from the presence of the garbage patch. Because the garbage blocks sunlight, algae is not growing as it should. With less algae, the entire food chain is experiencing a negative disruption. Harm to the environment can also occur from the presence of the garbage patch. Because the garbage blocks sunlight, algae is not growing as it should. With less algae, the entire food chain is experiencing a negative disruption. [source: BBC]

This rubbish-strewn patch floats within the North Pacific Gyre, the center of a series of currents several thousand miles wide that create a circular effect, ensnaring trash and debris. ... Moore first discovered the garbage patch when he crossed the Pacific in 1997 after competing in the Transpacific Yacht Race [source: Discover Magazine]

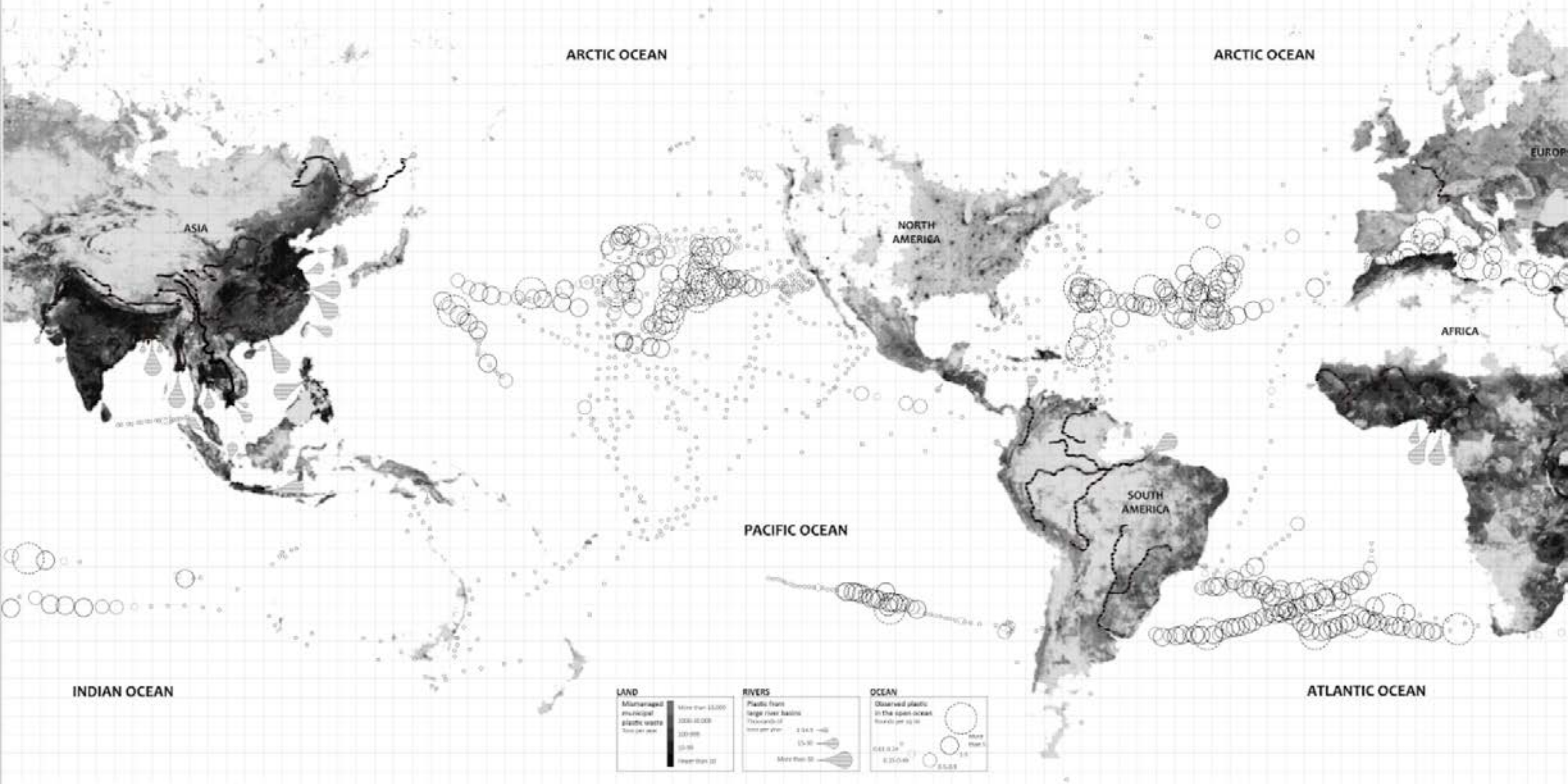
Great Pacific Garbadge Patch

Light-Activated Physical Model [p.42]

Photograph [p.43]

Leaks of Global Garbadge [p.44-45]





## PLASTIC

Plastic is a material that is now known to cause ecological collapse in part because it exists at a variety of scales (from large solids to microplastics). People have developed a variety of small-scale solutions for how to deal with this environmental problem, but on a global scale this issue remains unresolved. As only a tiny percent of global plastic waste is being recycled, the rest is burned (which causes an increase in CO<sub>2</sub> emissions), or moved to landfills, from where it saturates our oceans. Nevertheless, this material has some great qualities, which may be used for an architectural advantage, and actually turned into a solution for a variety of hard problems.

Oceanic plastic may be recycled to become strong architectural material, obtaining some important qualities that are required by the project's design. Since the site is the ocean, and since we have a "plastic problem," we may feed from it, performing on-site transformations of waste into built material. While the material is located in international waters, it does not belong to any of the countries, therefore it is absolutely free of charge, which highly reduces any economical issues regarding our project.

With an ability to have an almost unlimited amount of free building material, and a technology which allows us to perform on-site transformations, our project becomes extremely sustainable not only at a programmatic level, but also starting with its materials and use.

Plastic Pebles on the beach  
Photograph by Parley [p.47]





## PARLEY

Parley is an international organization where creators, thinkers and leaders come together to raise awareness for the beauty and fragility of our oceans and collaborate on projects that can end their destruction.

Company's Statement:

"We need to defend diversity on land and in the sea and we need solutions, and these solutions can only be realized by harnessing the imaginative side of human culture – the arts."

Parley collaborate with a variety of companies, to produce sustainable business models and goods,, while also actively participates in researches related to oceans and marine life.

Main topics of interest in Parley are:

Ocean Clean Up Program.  
Material Revolution  
Global Research

Parley Clean Oceans Program  
Photograph by Parley [p.49]

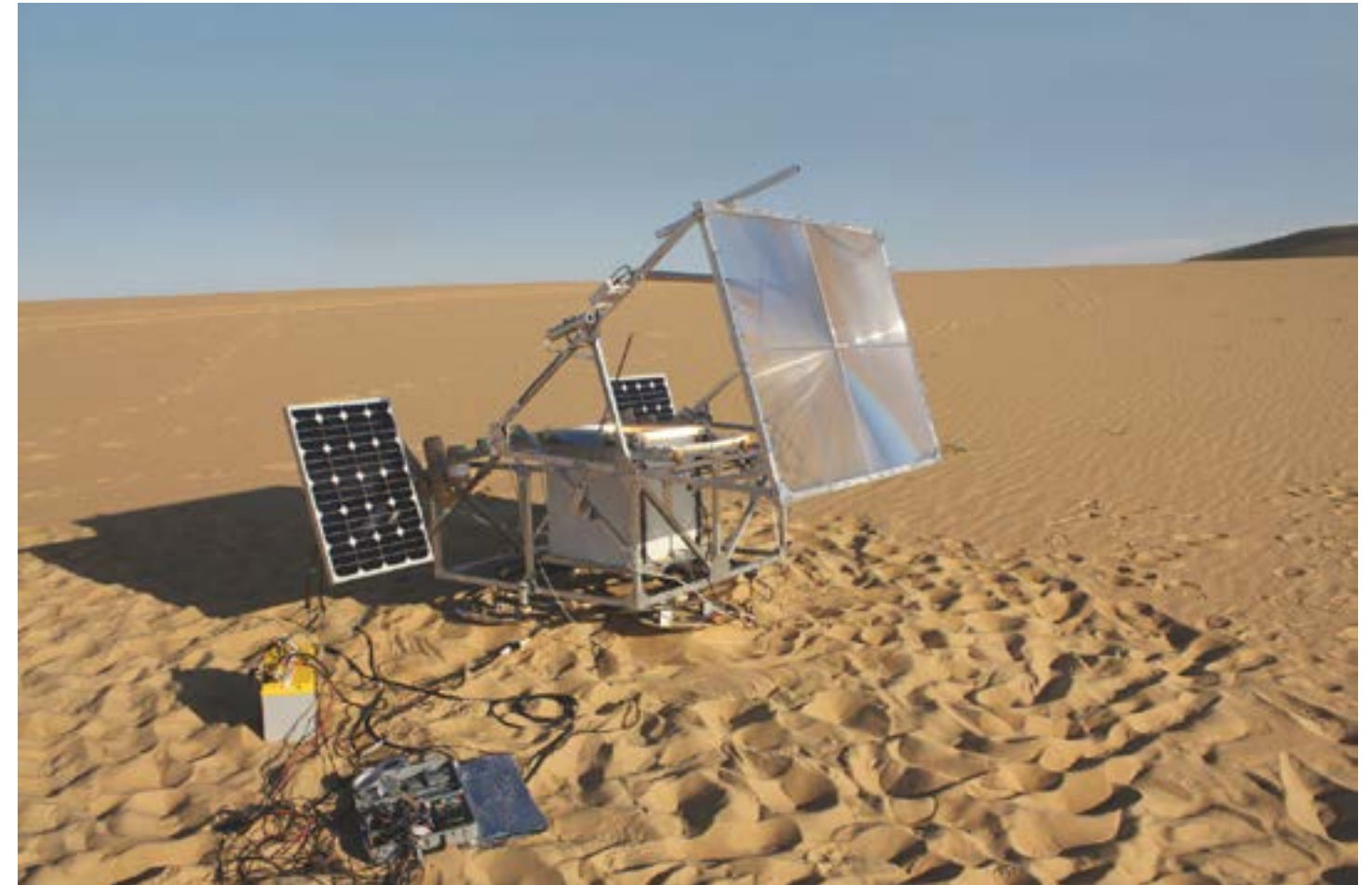


## SOLAR SINER

Project Name: Solar Siner  
Engineer: Markus Kayser  
Year: 2011  
Technology: 3D printing from sand

A Solar Siner, is a project of an innovative 3D printing technology, which allows to 3D print from sand. It is a new-negative energy project, since it uses solar pannels in order to operate itself. This is a project of a 3D printer located in a desert, that uses a set or mirrors in order to concentrate the ray of sun and melt sand, just as if it would be done by a nozzle of a 3D printer.

Sand 3D printing Facility  
Photograph [p.51]



**MIT: MEDIA LAB**

Field Research

Location: Museum of Modern Art (MoMA)

Topics: Material Ecosystems and Fabrication Technologies by MIT Media Lab

This Exhibition focuses on innovative design methods and materials. The research performed by Neri Oxman aims to solve issues that are related to our investigation. Specifically, the project names “Aquahoja”, as it focuses on inventing new ecological materials to replace the use of plastic. Its production method is solely robotic and requires no assembly. Other projects, performed as a part of this exhibition are also examples of innovative design methodology. The correspondence between the form and its function is present in all the work, and those qualities directly correspond to the goals of our thesis proposal. Our thesis deals with the questions of atypical architecture that works with the form in a way which does not support the typical “slab & beam systems”. It is an example and innovative way of building, which is highly new and not yet practiced widely in the field. Some studies performed by the Mediated Matter group are dealing with structural systems that have atypical construction as well. All the studies exhibited share the desire for the design to perform natural rather than just mimic natural forms and look. Studies “Material Ecology” show a direct correspondence to architecture, and theoretically may be applied to large scale projects, such as our thesis proposal.

MIT. USA  
Innovative Material Studies [p.53]



## MATERILA REVOLUTION: BIOLUMINESCENCE



Eliminating light Deep Sea Creatures  
Photograph by Parley Organization [p.54]

Eliminating light Recycled Plastic  
Protograph [p.55]

### Bioluminescence:

We have learned that several deep sea species use bioluminescence to communicate in order to attract prey or defend against predators. In order to simulate this, we used quinine, which has the physical property of glowing in the dark. We then mixed quinine with color pigments to produce glowing liquid in different colors.



## Deep Sea



60% of our planet is covered by water over 1,600m deep, and nearly half the world's marine waters are over 3,000m deep. The sea starts where the sunlight starts to fade, around 200m below the surface of the ocean. A twilight zone extends down to 1,000m after which almost no light penetrates. With no sunlight, plants cannot grow in the deep sea. And while animals and bacteria have been found wherever people have looked, we know very little about these dark, cold depths. More people have travelled into space than have ventured into the deep sea.

[source: WWF]

Consider that we've sent 12 people to the moon, since 1969 over a handful of missions; only 4 people have descended to the deepest part of the ocean in the Marianas Trench [source: Thar]

The oceans takes up about 71% of Earth space, yet a whopping 95% of that ocean is completely unexplored. [ source: NOAA]

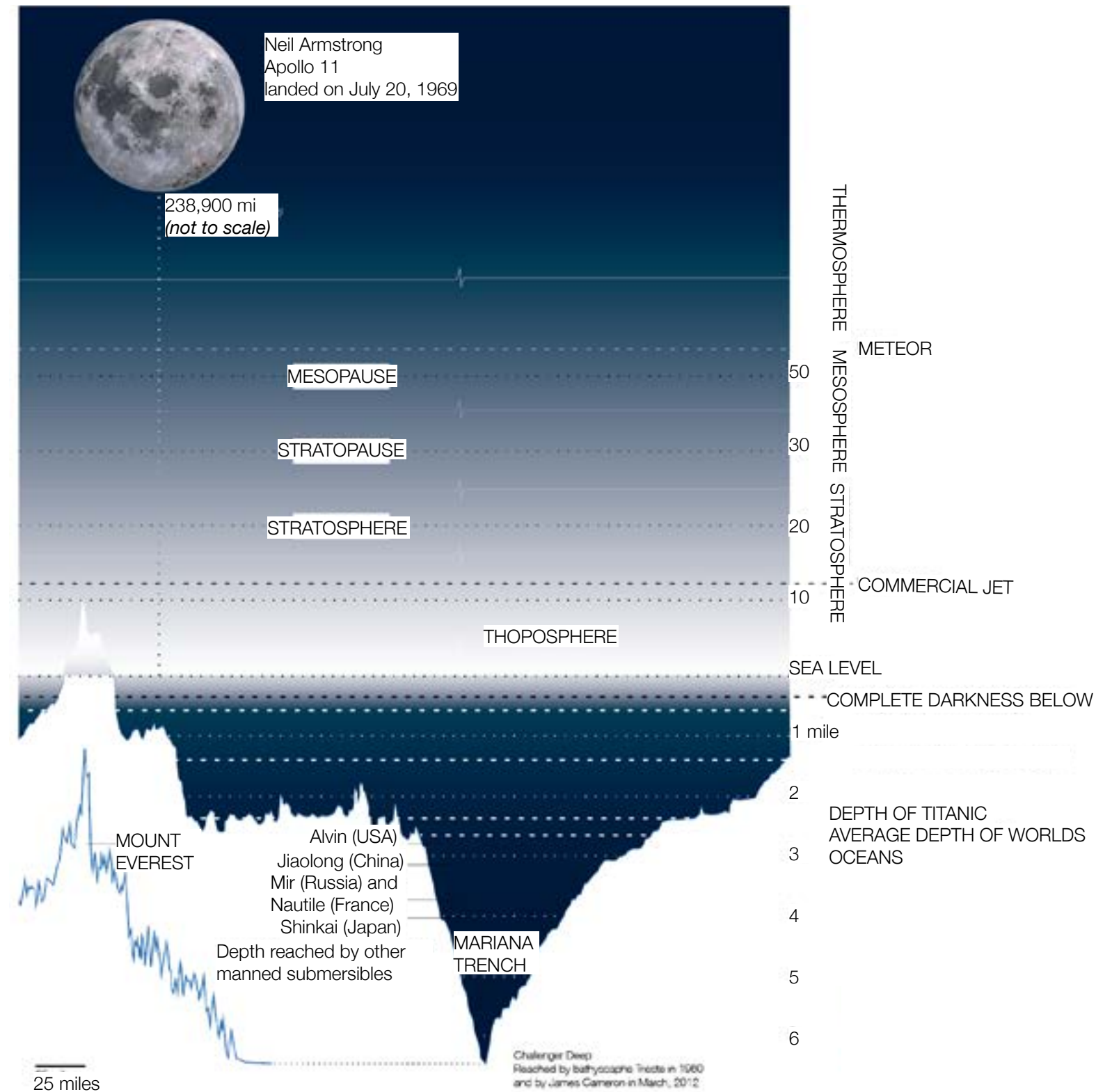
Eliminating light Deep Sea Creature  
Photograph by Parley Organization [p.56]

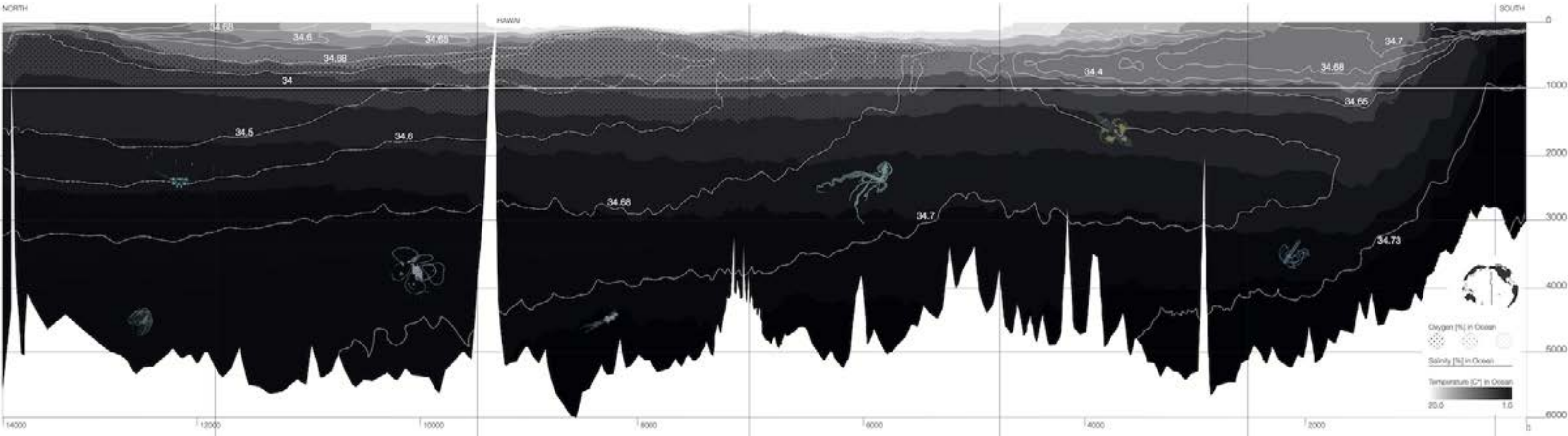
Marine Trench and Atmosphere  
Computational Drawing 18" x 18" [p.57]

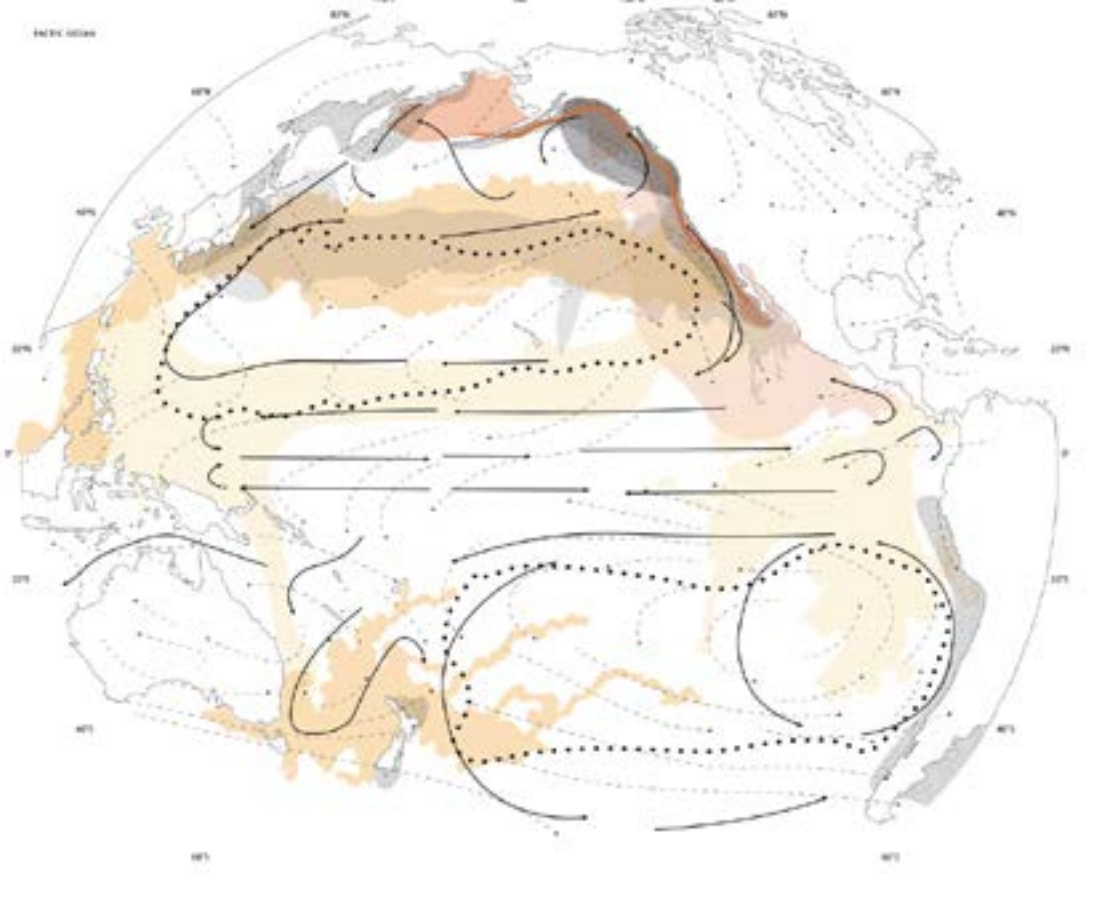
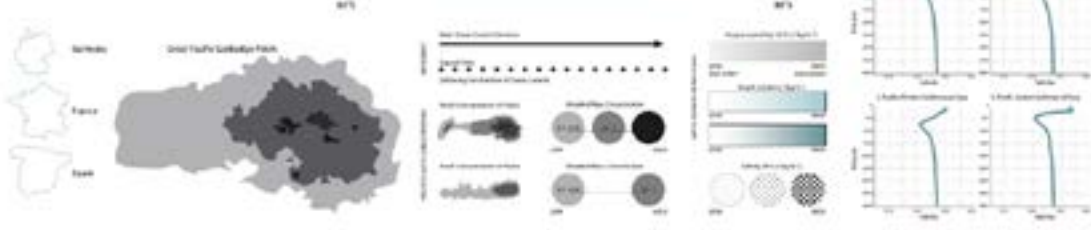
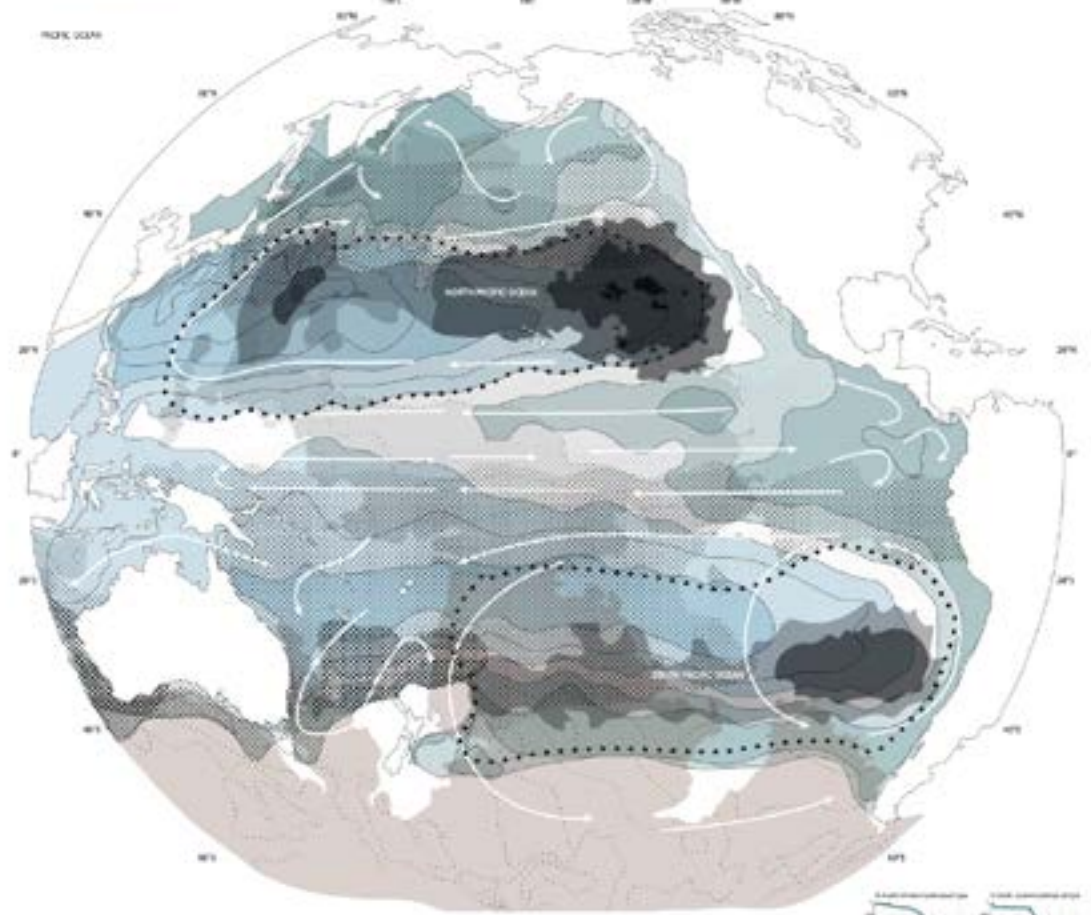
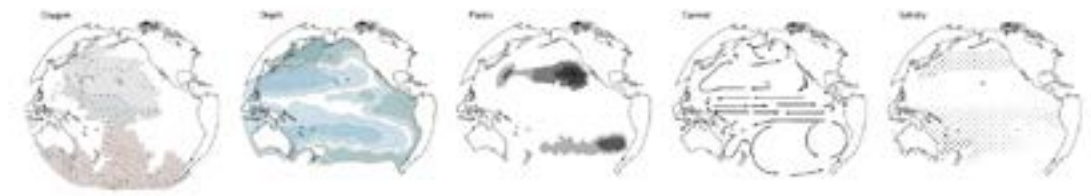
N-S Section through Pacific Ocean  
Computational Drawing 18" x 60" [p.58-59]

Physical Properties of Pacific Ocean  
Computational Drawing 40" x 36" [p.60]

Species Migration Path in Pacific Ocean  
Computational Drawing 40" x 36" [p.61]



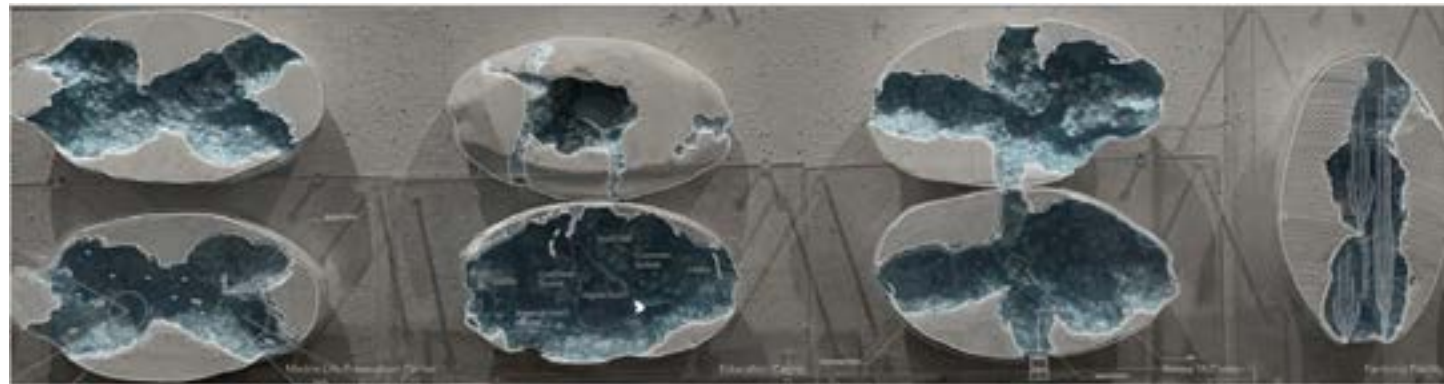




## OYSTER + MUSCLE

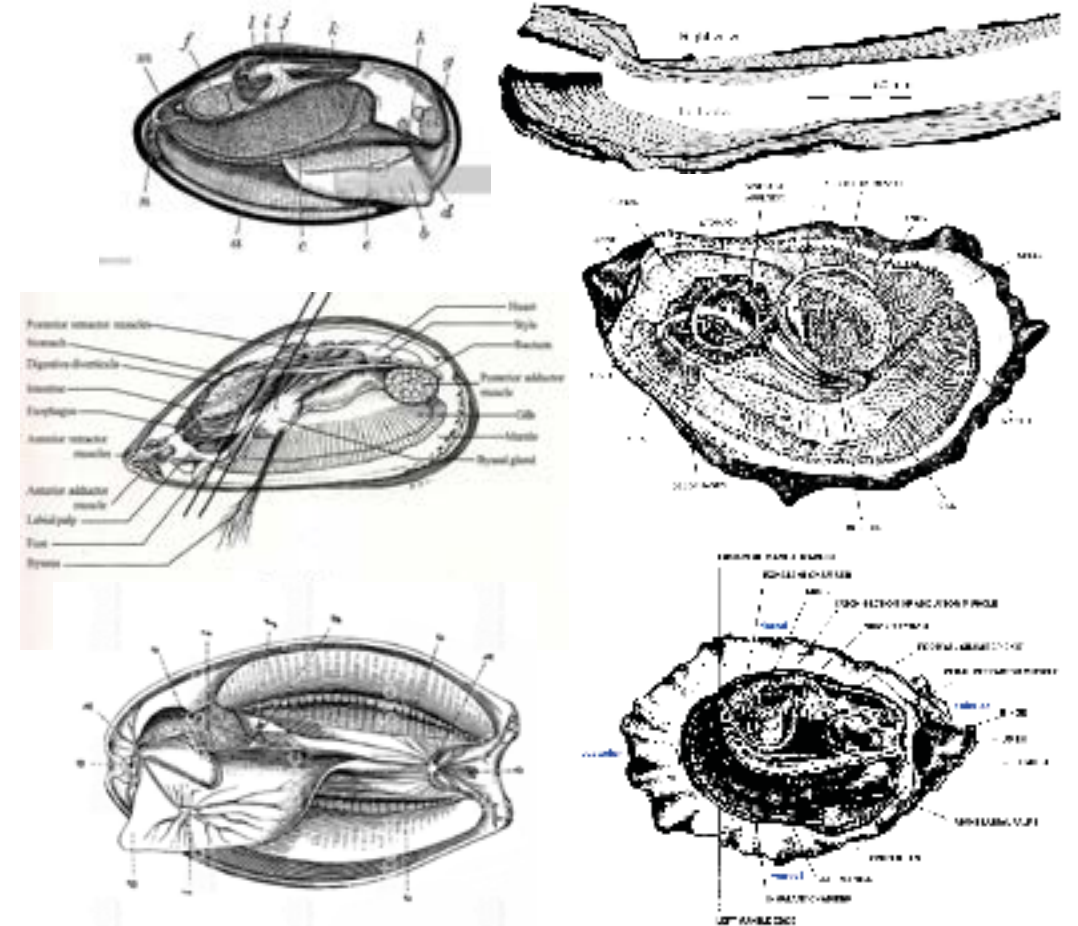
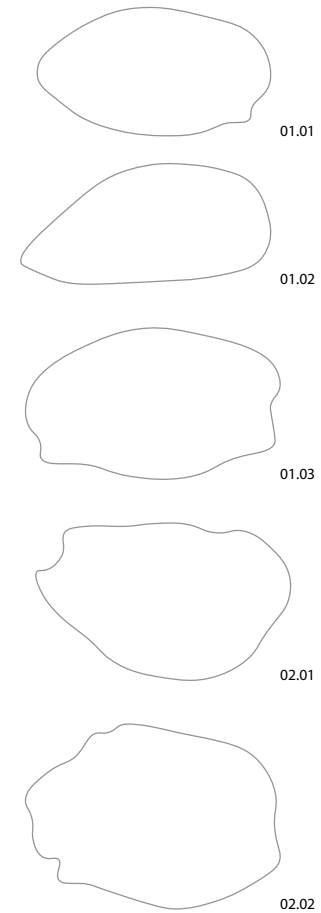
In order to develop the interiors, we looked at the multiple layers of the oyster. Each layer has its own function, which structurally holds the muscle in place and protects it from outer threats.

hybridized the study on the performance of the oyster with a physical model exploration of the interior space, which resulted in oval capsules that shelter different living things, including humans, algae, and marine species.

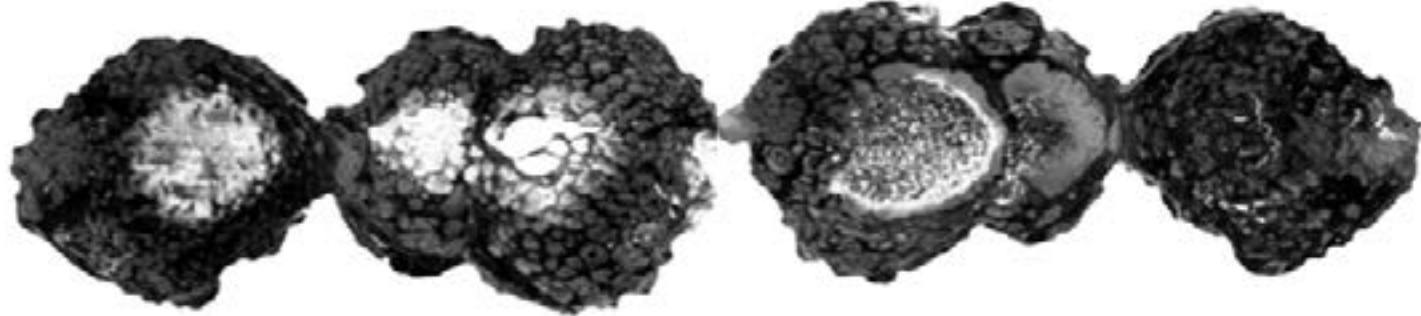
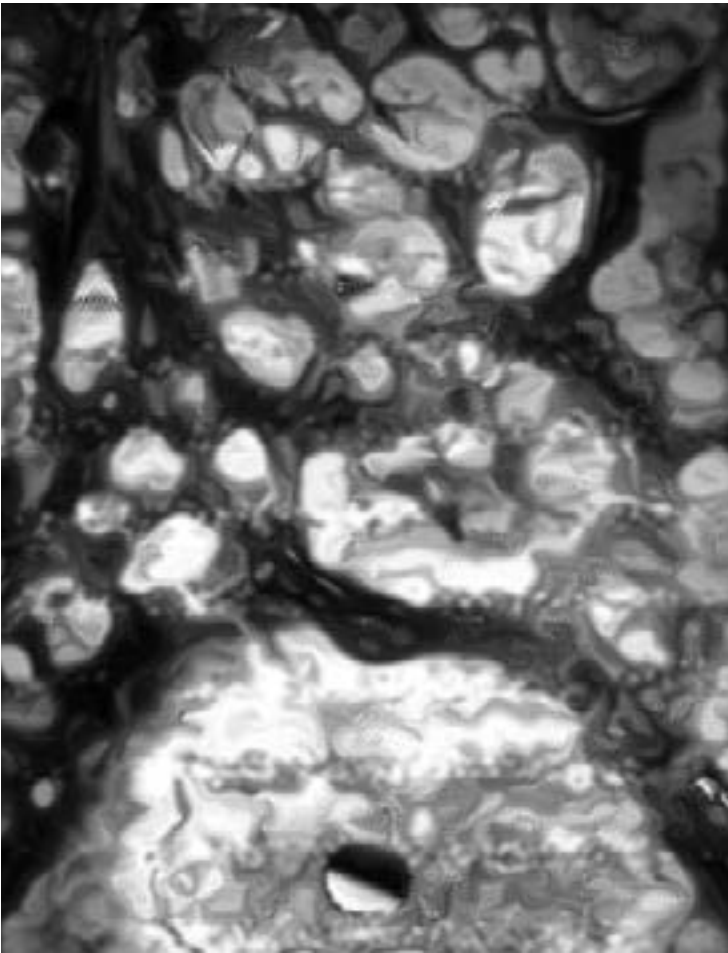


Section studies of an oyster and a mussle  
Computational Drawing 11" x 17" [p.63]

Physical Prototypes  
Foam Study Models [p.62] [p. 64-65]



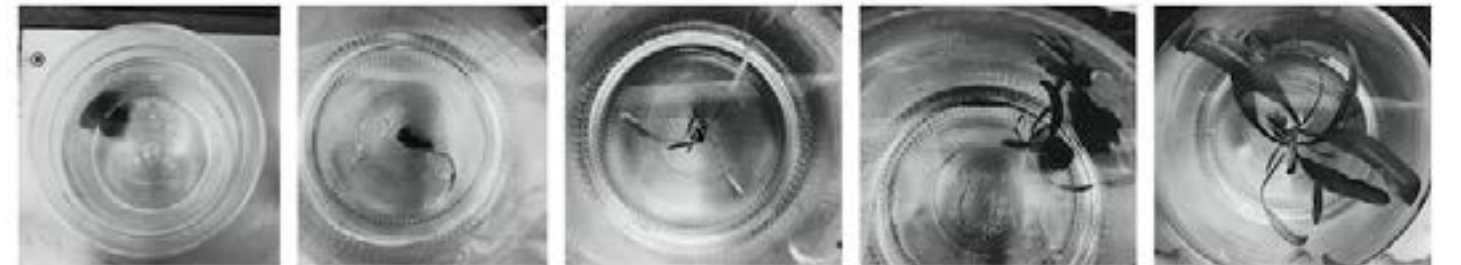
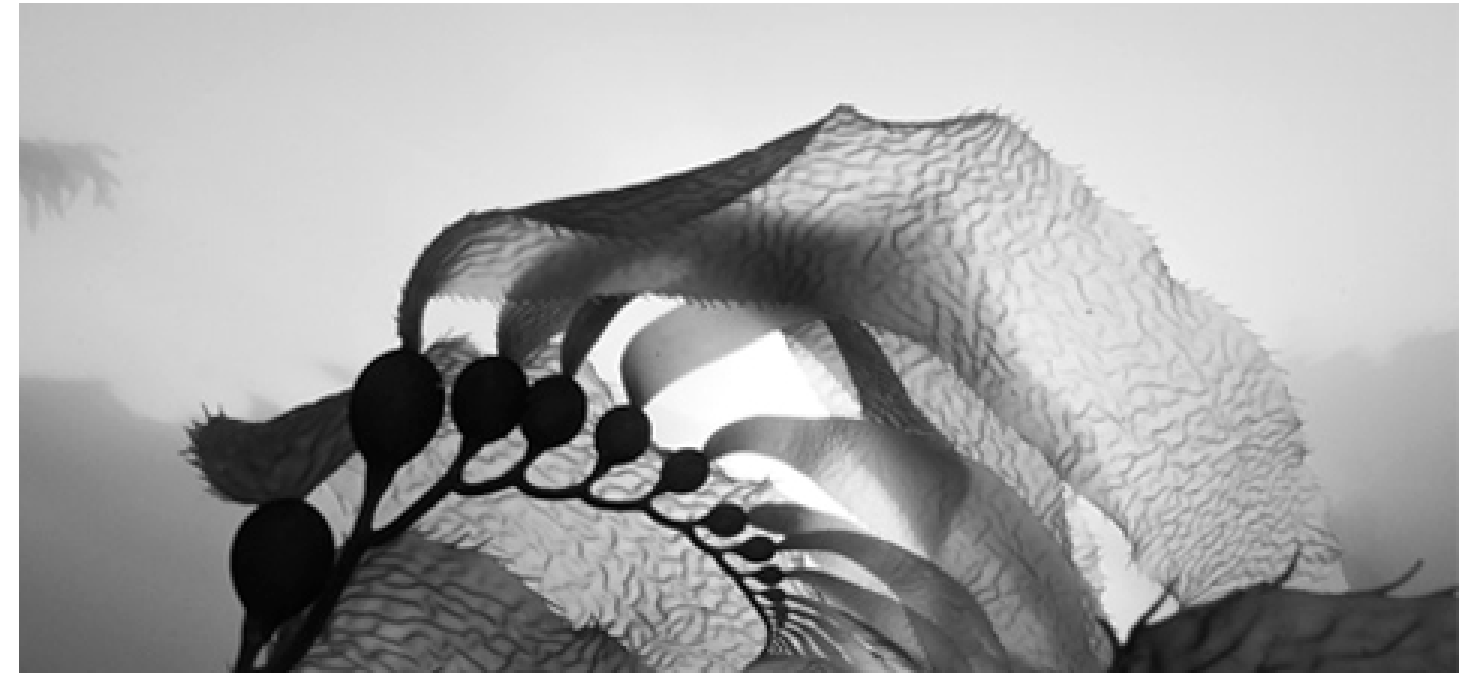




## ALGAE: KELP FOREST

For the research related to non-human environments, the Algae Kelp forests were selected as representatives of a vegetal species.

Aponageton Algae was grown in 1gallon tanks of water, and daily observed. Observations on how algae is able to float vertically in space instead of laying flat influenced further studies in regards buoyance techniques.



Kelp Forest  
Photograph by Parley Organization [p.67]

Stages of growth of Aponageton Algae  
in a 10-day period  
Photogpath Series [ p.67]

## algae [ al-jee ]

plural noun, singular al·ga [al-guh]

Any of numerous groups of chlorophyll-containing, mainly aquatic eukaryotic organisms ranging from microscopic single-celled forms to multicellular forms 100 feet (30 meters) or more long, distinguished from plants by the absence of true roots, stems, and leaves and by a lack of nonreproductive cells in the reproductive structures: classified into the six phyla Euglenophyta, Crysophyta, Pyrrophyta, Chlorophyta, Phaeophyta, and Rhodophyta.

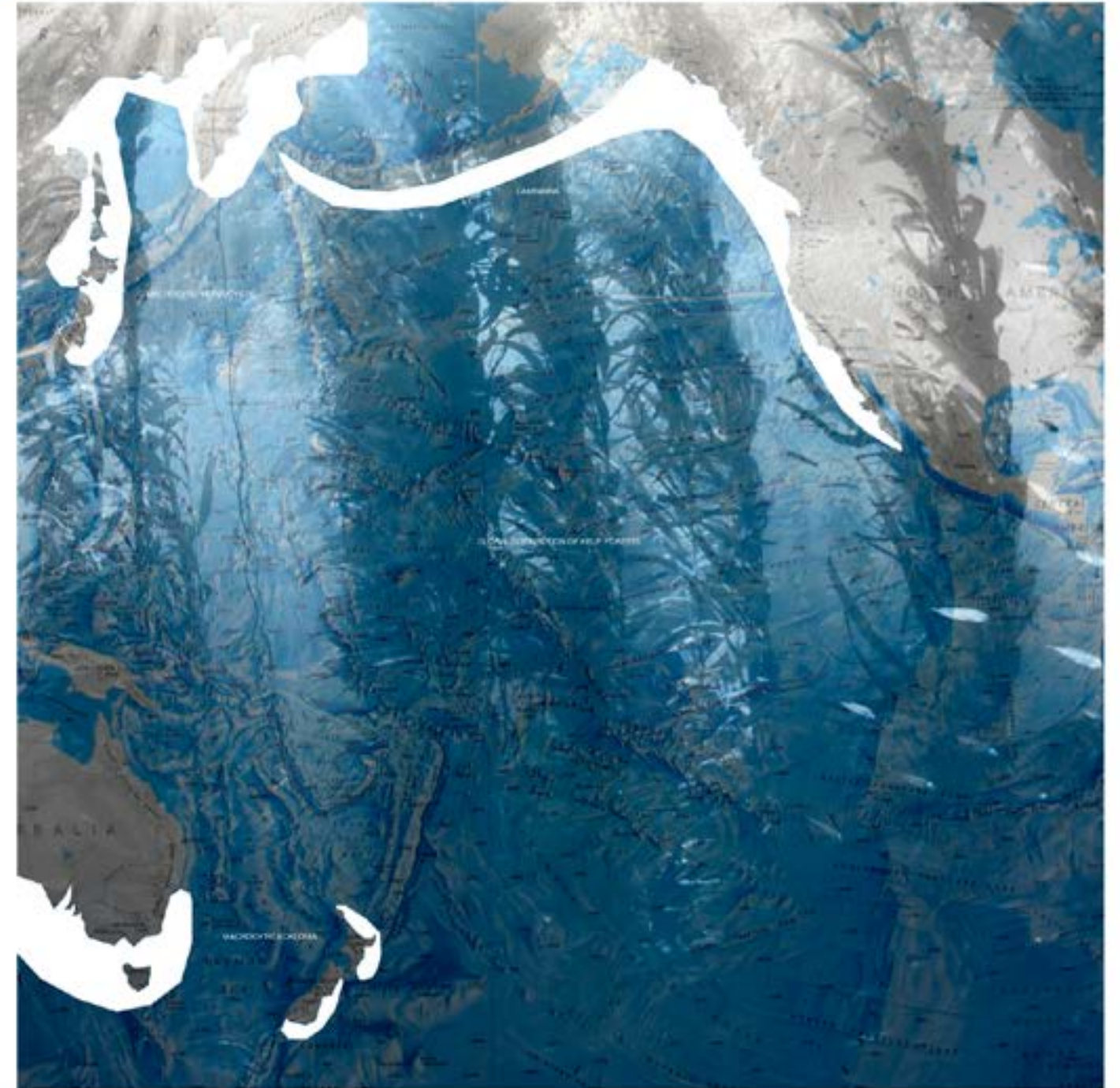
## seaweed [ see-weed ]

noun

any plant or plants growing in the ocean.  
a marine algae.

[source: English Dictionary]

Global Deistribution of Pasific Kelp Forests  
Computational Drawing 18in x 18in [p.69]



## UNDERWATER FARMING

**Project Name:** Nemo's Garden

**Location:** the coast of Italy

**Year Complete:** 2012

**Client / Owner:** Sergio Gamberin, Ocean Reef Group

**Size:** 20 biospheres

Nemo's Garden is a project that uses underwater transparent bubbles (biospheres) that house edible plants. The idea is to expand agricultural efforts in areas where surface-farming would be difficult due to economical, geographical or natural factors.

The system is almost fully self-sustainable. No pests can wander in, nor can disease spores be brought in by the wind. Fresh water is available 24/7 through desalination. All biospheres have a dome-like structure where only the bottom part is immersed in seawater. This design ensures much-needed fresh water for the topmost area with plants: When salt water evaporates within the biosphere, it condenses on top of the dome, then trickles back down, salt-free, and nurtures the herbs and vegetables.

As for sunlight, domes are transparent, and the sun's rays increase the internal temperature.

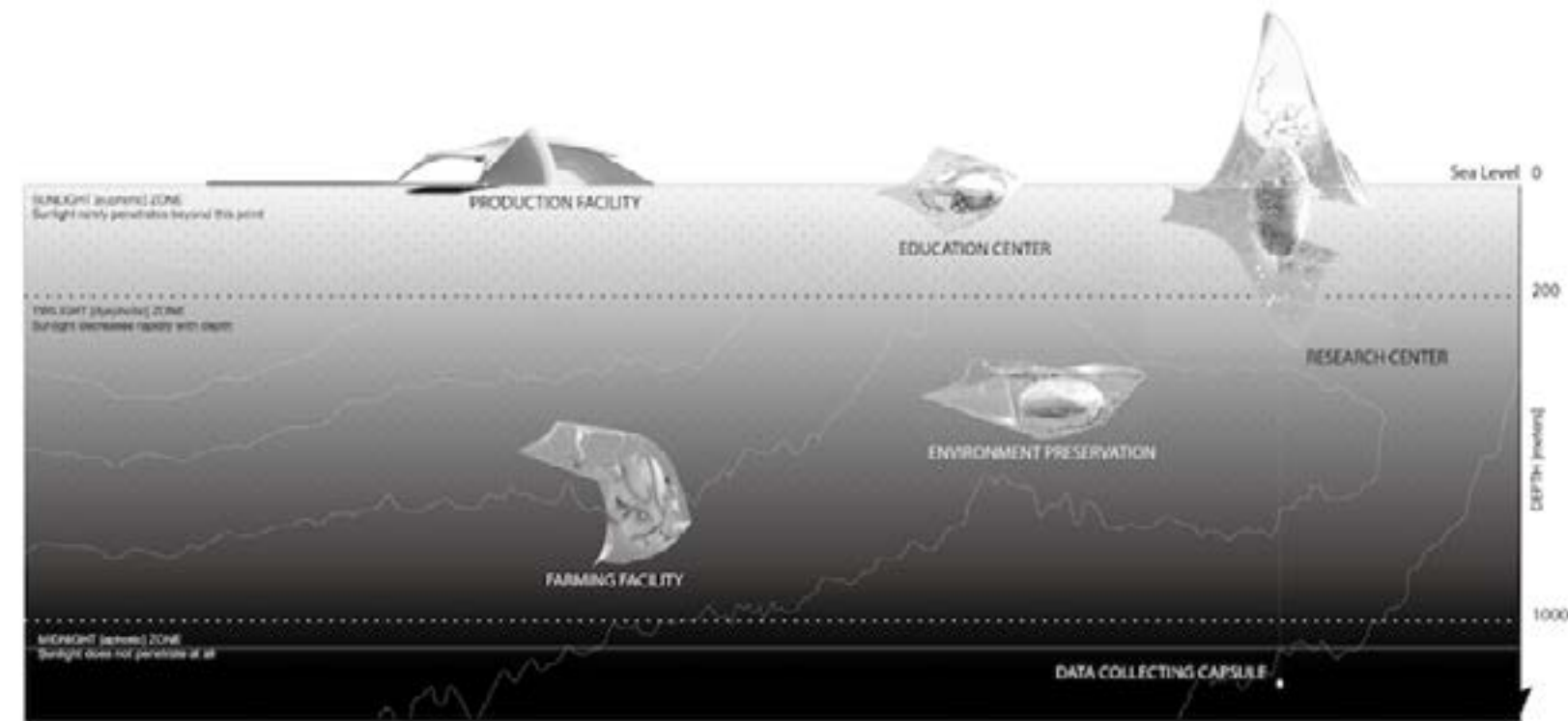
[source: Nemo's Garden]



## PROGRAM STATEMENT

When closely investigating and doing research on our oceans, we were absolutely amazed how the deep sea is largely unexplored and unknown to humanity. Yet billions of creatures live in this alien and extremely fascinating environment. Therefore, a major part of our proposal is being dedicated to research labs, and data collecting centers. The deep sea looks much the same at any given depth anywhere in the world, but with the change of temperature, pressure and salinity of the water it is known to be occupied by different living organisms. Those are potential zones for investigation for the part of the program dedicated towards oceanic research and education.

Other parts of the program would be dedicated towards preserving endangered marine species and their ecosystems. A variety of known living organisms face extinction due to the simple inability to adapt to the new climatic conditions in their living environment, therefore their lives are highly endangered. Environmental preservation centers would be independent and would focus on animals and vegetal species as a main priority, while allowing a program mixture with research investigation.



**WHERE EVERYTHING STARTS...**

**Program:** Production Facility

**Location:** Middle of the Northern Pacific Gyre - Ocean's Surface

Its duty is to detoxify the ocean by capturing the plastic floating on the ocean's surface, and then process it into building materials such as plastic bricks, 3D-printing filaments, and plastic panels. Collected plastic waste would be directed into a shredder, which would tear it up into small pellets, preparing them for recycling. The shredded plastic is then melted so it can be formed through robotic extruders.

The Heat Compression type of recycling allows us to recycle all types of plastic at once. The major advantage of this process is that it does not require matching forms of plastic to be recycled together. Microplastics can go through an elaborate and accurate monomer recycling process, overcoming the major challenges of plastic recycling. This process not only purifies, but also cleans the plastic waste to create a new polymer.

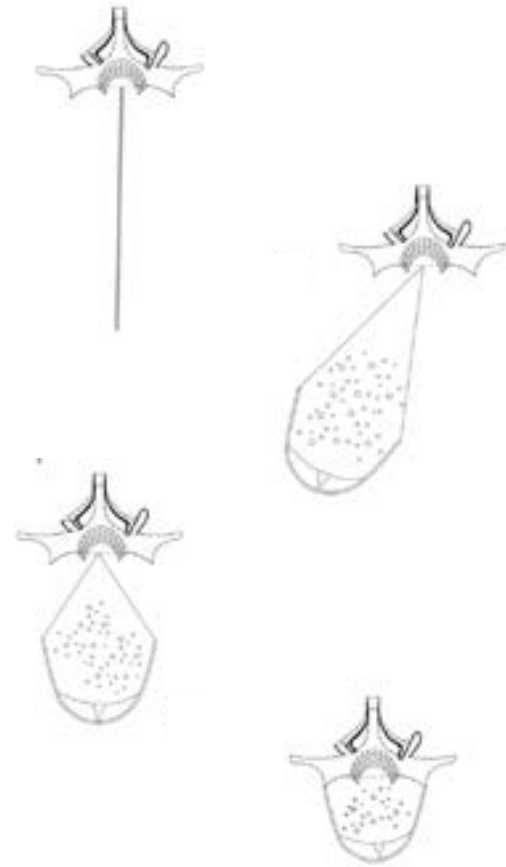
**Detailed instructions for plastic collection:**

Tow-Out: Carrying the net out to the concentration of plastic waste

Gather: Collecting plastic by dragging the net

Pulling the net back to the facility

The net re-engage to the facility



Parts of Program Analysis  
Computational Drawing 18" x 18" [p.74]

Aerial View  
Render 18" x 18" [p.75]  
Render 18" x 36" [p.76-77]





## RESEARCH CENTERS & DATA COLLECTING PODS

**Program:** Research Center + Data Collecting Pods  
**Location:** Middle of the Northern Pacific Gyre - Partially underwater.

The Research Center is the largest program in its size and scale. Like other programs, located partially or fully underwater, it will have a protective, translucent exterior skin that is made out of recycled plastic, and the vein-like structure that will control the luminosity and buoyancy of the vessel.

People are able to fully occupy the separate capsule inside the Research Center. The laboratory, living spaces, offices and working zones are all inside the capsule. The lobby sits right in the middle. The non-working zones such as living spaces are on the top, and the working zone is at the bottom. Those spaces are designed primarily for scientific purposes where scientists are able to collect marine data and samples for research in the lab. Eventually, we hope that humanity will be able to fill out the unknown 95% of data about the ocean.

Spheres - are small-size capsules, located at the very bottom of the Research Center. They are designed to be able to reach the depth of the Ocean, in order to collect data and information, once released from the facility. Each sphere will have its own mission and type of information one will gather. Some may focus on aquatic life and its behavior, while others may specifically focus on measuring water temperature, its salinity, simultaneously tracking the Ocean's Deep Sea currents.

West Elevation  
 Computational Drawing 17" x 11" [p.78]

Detailed South Section  
 Computational Drawing 40" x 60" [p.79]

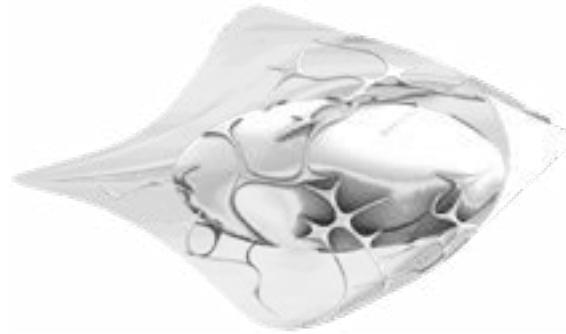




## EDUCATION FACILITY CENTER

**Program:** Education Center

**Location:** Middle of the Northern Pacific Gyre - Water's surface.  
Underwater once attached to a Research Center.



We will be promoting knowledge of the oceans and teaching the public their duty to protect natural heritage. The education facility can also join with the research center to enrich the possibility of studying and practicing.

After the garbage patch cleanup is finished, we still want this project to continue its purpose of maintaining a clean ocean. Therefore, we are including an educational facility to teach the next generation about the hard work that people have done to clean up the mess that humans had made in the past.

West Elevation  
Computational Drawing 17" x 11" [p.80]

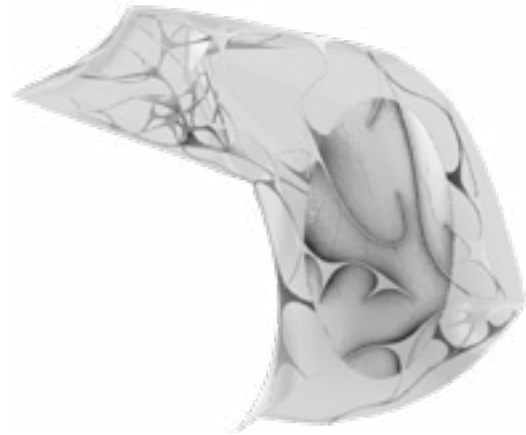
Interior Collage  
Computational Drawing 18" x 18" [p.81]

Aerial View  
Render 18" x 36" [p. 82-83]





## FARMING FACILITY CENTER



**Program:** Farming Facility Center

**Location:** Middle of the Northern Pacific Gyre - Underwater  
( <1 km of depth)

Humans can navigate the space between the exterior skin and the capsule for maintenance, observation, and collection of the kelp and algae. The tunnels between the capsule and exterior skin also structurally hold the capsule in place. The white hatches become the heart of the capsule, which contains mechanical equipment that keeps the farm running.

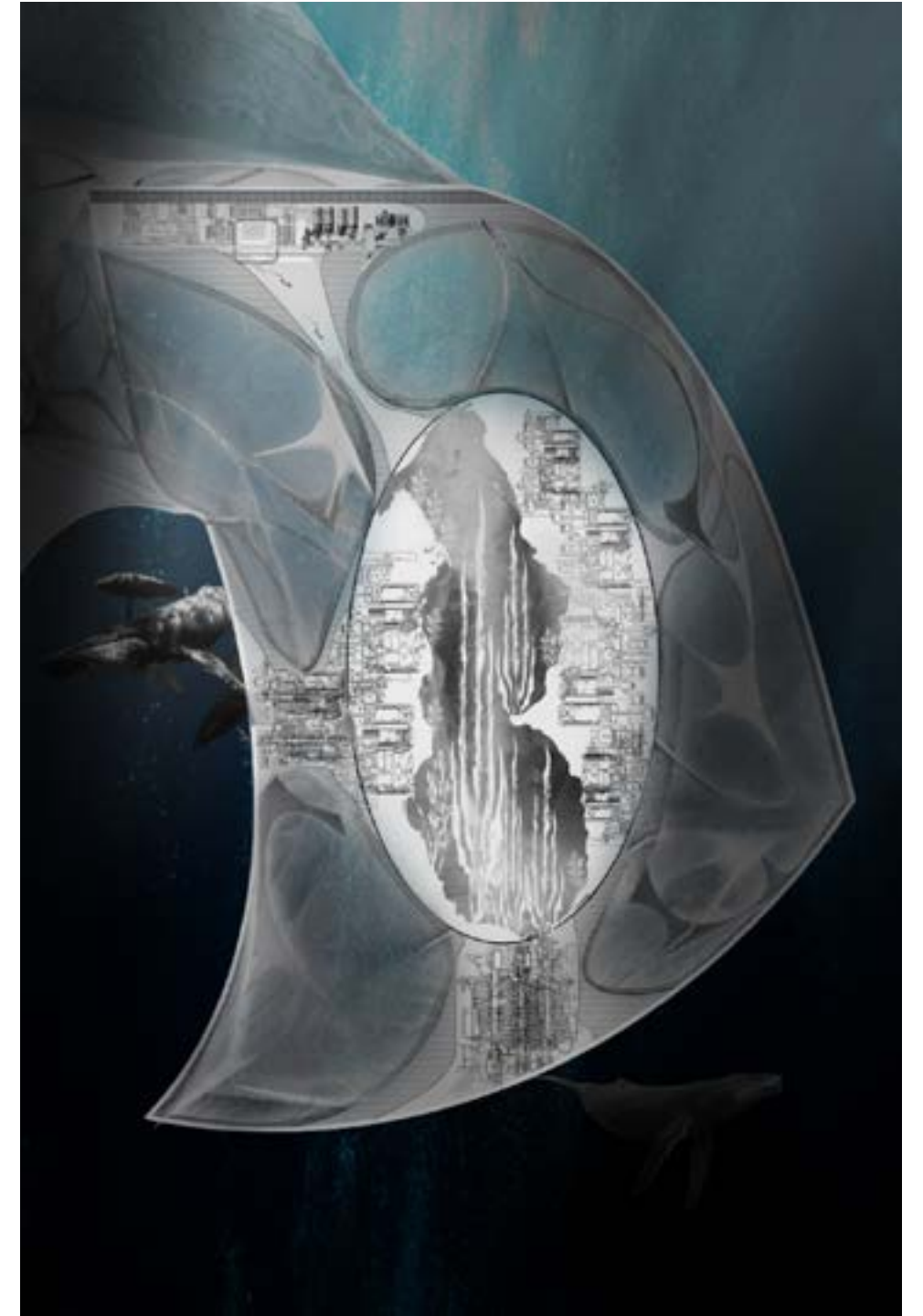
We will be growing algae and kelp in order to produce biofuel, food sources, and oxygen. Most importantly, algae will be the material that eventually replaces plastic.



West Elevation  
Computational Drawing 17" x 11" [p.84]

Interior Collage  
Computational Drawing 18" x 18" [p.84]

Detailed West Section  
Computational Drawing 36" x 18" [p. 85]



## BETWEEN LIVING AND NON-LIVING MATTER



West Elevation  
Computational Drawing 17" x 11" [p.86]

Interior Collage  
Computational Drawing 18" x 18" [p.87]

Detail of interior  
Computational Drawing 17" x 11" [p.88]

Detailed West Section  
Computational Drawing 18" x 36" [p. 88]

Detail Digram  
Computational Drawing 18" x 18" [p. 89]

Plan of Primary Iteration  
Computational Drawing 18" x 18" [p.90]

Section Primary Iteration  
Computational Drawing 18" x 18" [p.91]

West Elevations  
Computational Drawing 18" x 60" [p.92]

East Section Through a Hybrid System  
Computational Drawing 40" x 60" [p.93]

Underwater View  
Render 18" x 36" [p. 94-95]

**Program:** Environmental Preservation Capsule  
**Location:** Middle of the Northern Pacific Gyre - Underwater  
( $<1$ km of depth)

There are many marine species whose lives are threatened because of human activity and the plastic patches. The goal is to provide an artificial environment that mimics the original habitats that have been destroyed, and to closely monitor them and help them to grow back larger numbers. Sea turtles are the target marine species in this case.

The relationship between the exterior and the capsule is similar to the farming facility, where the white hatches are the mechanical space that supports the functionality of the capsule. The exterior skin protects sea turtles from their predators and pollution, and the vein-like structure controls the buoyancy.

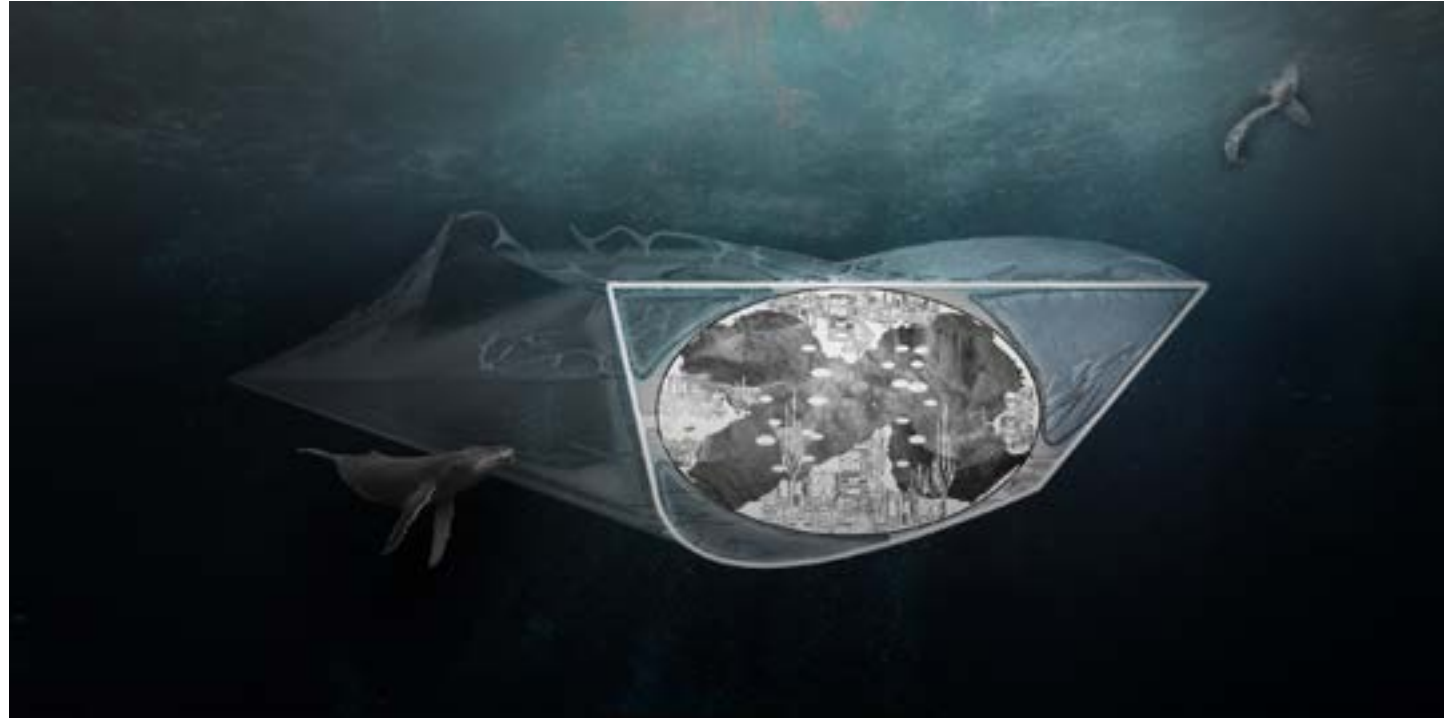
Sea turtles will be able to swim into one of these bubbles to safely lay their eggs without human intervention.



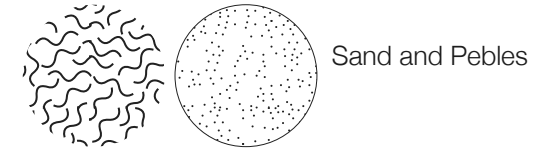
DESIGN PROPOSAL



Both species need light. Due to advanced technologies, people are able to create synthetic light. It may be generated from recycled plastic, that will be chemically treated in order to emit light.



Components of the Capsules:

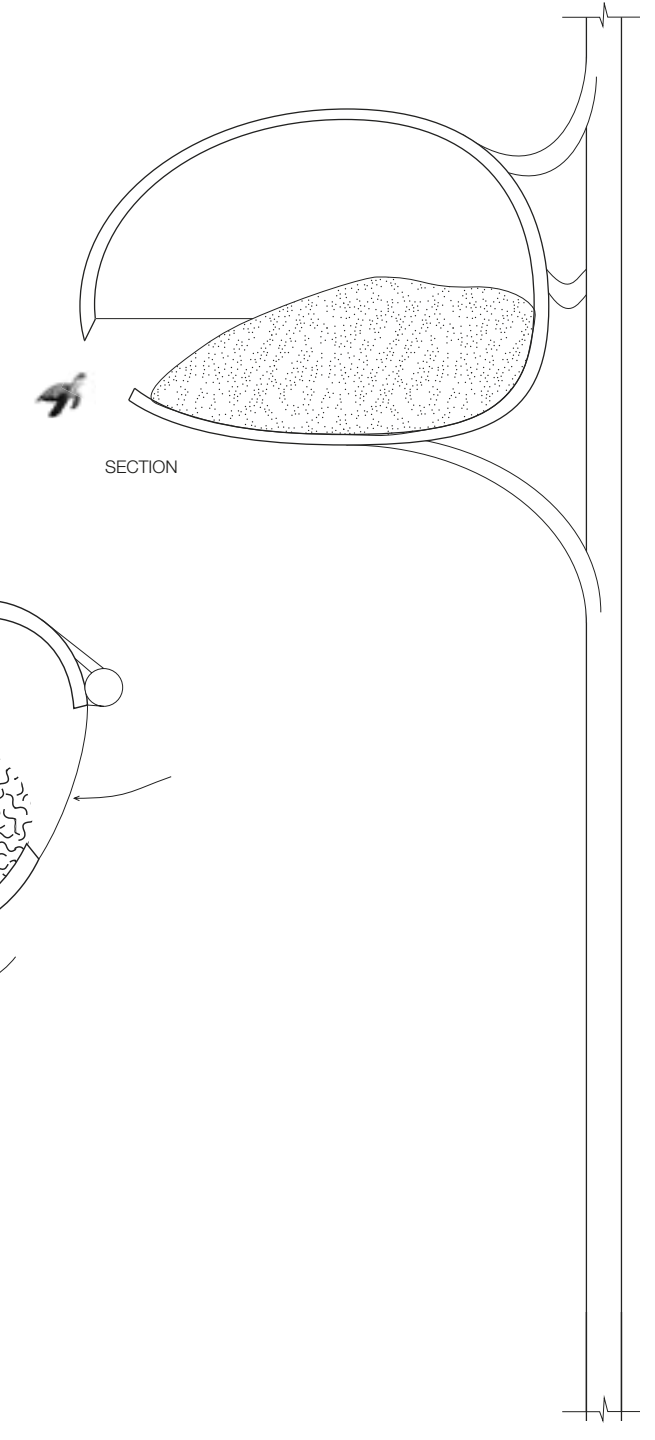


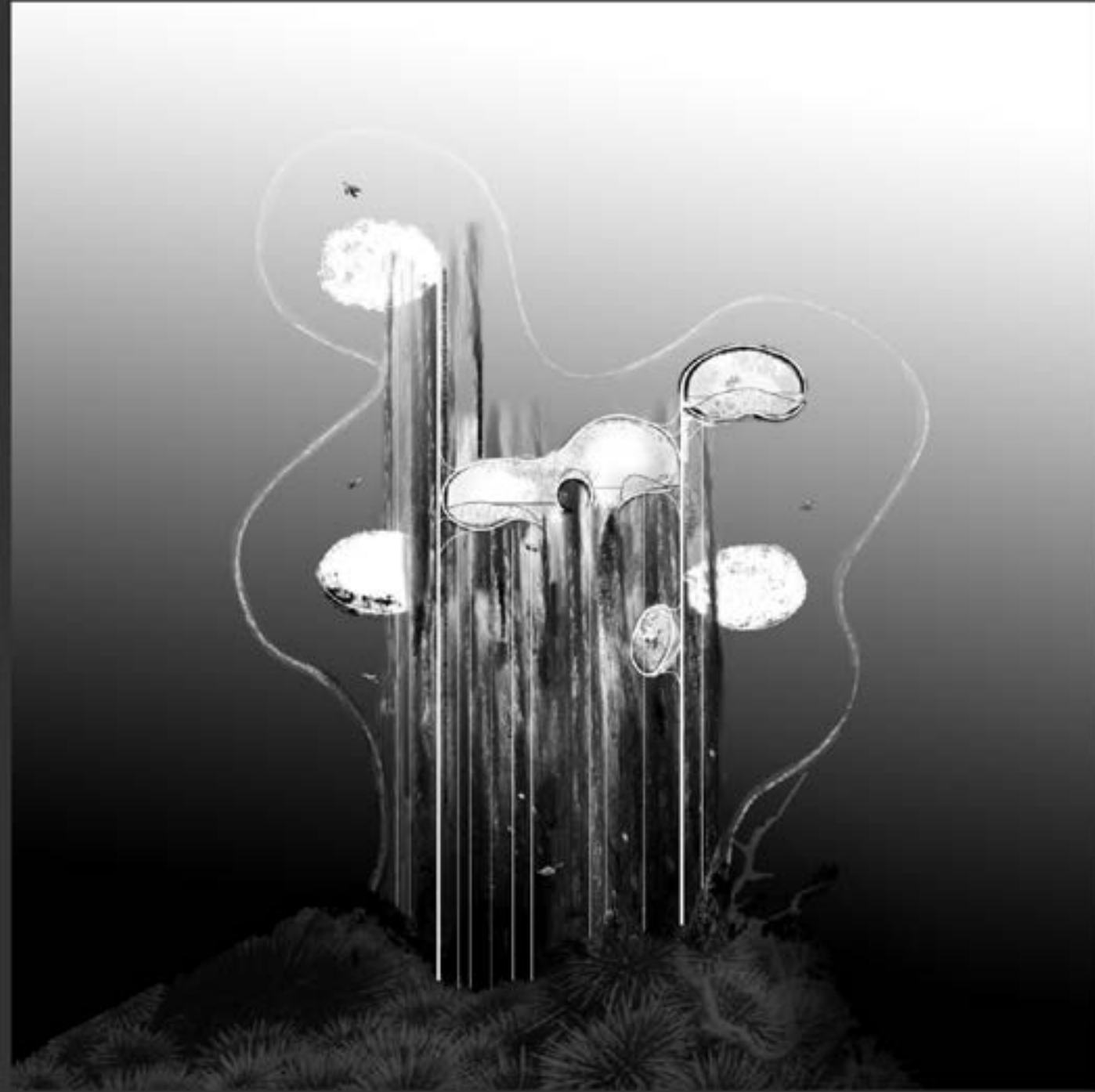
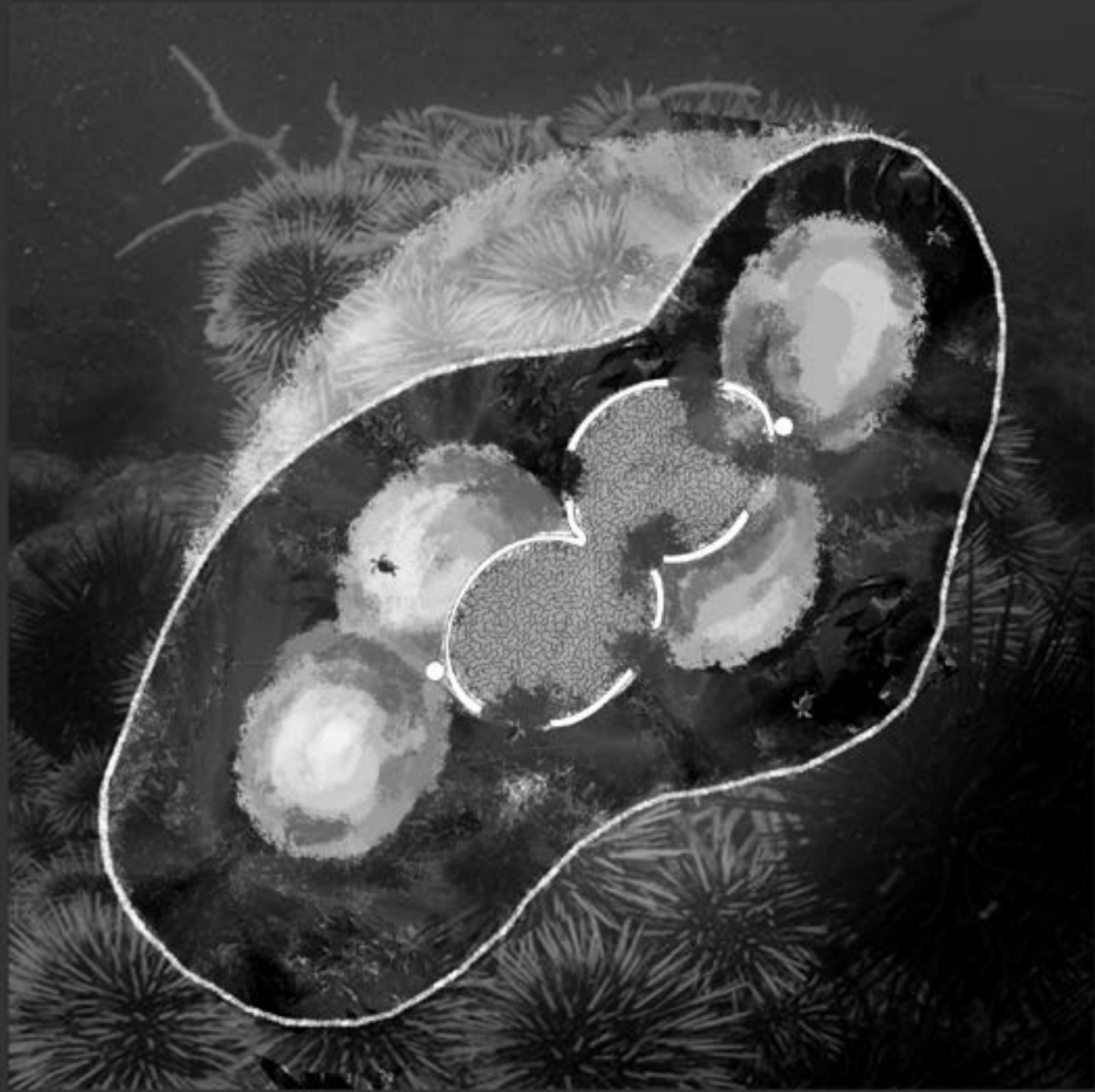
Air

Sand and Pebbles



Shell Made out of Plastic



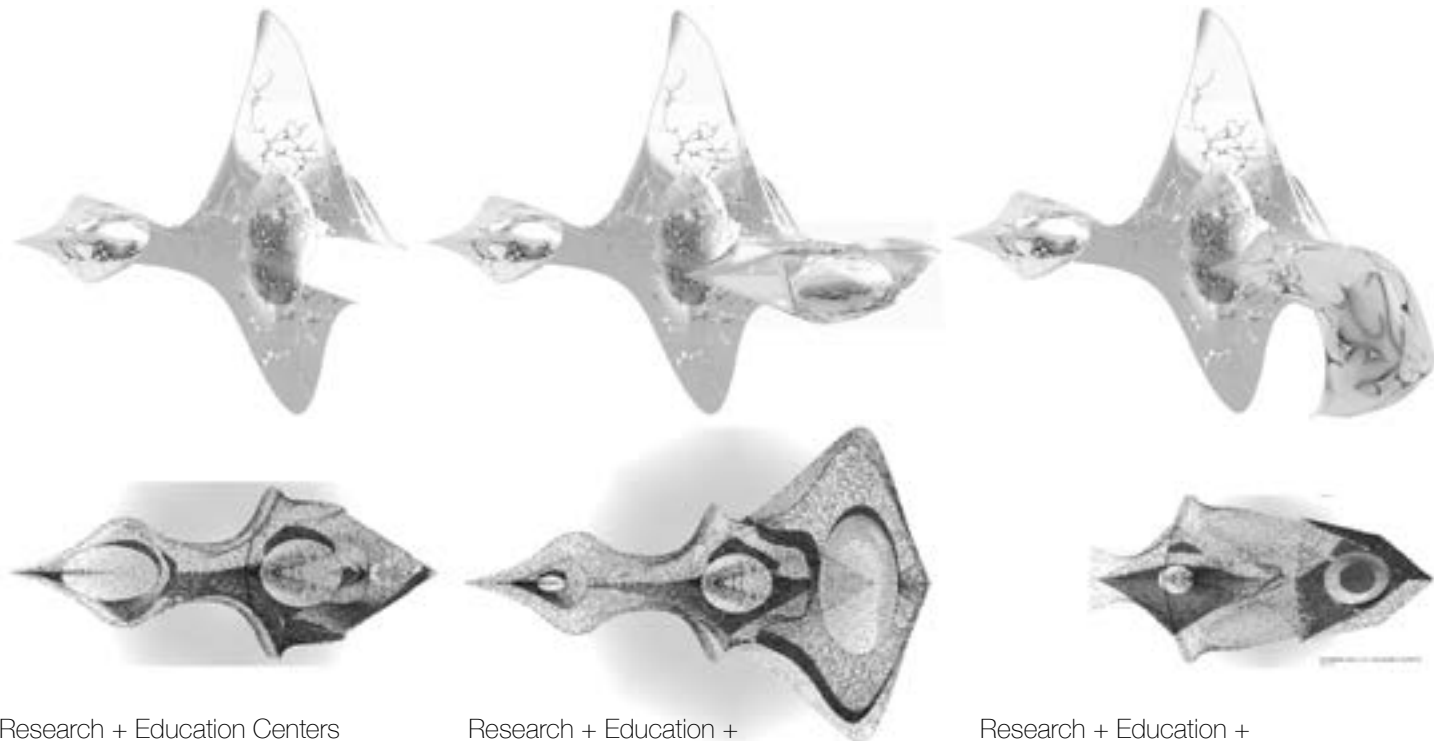


## BETWEEN LIVING AND NON-LIVING MATTER

### Hybridizing Programs

Location: Middle of the Northern Pacific Gyre

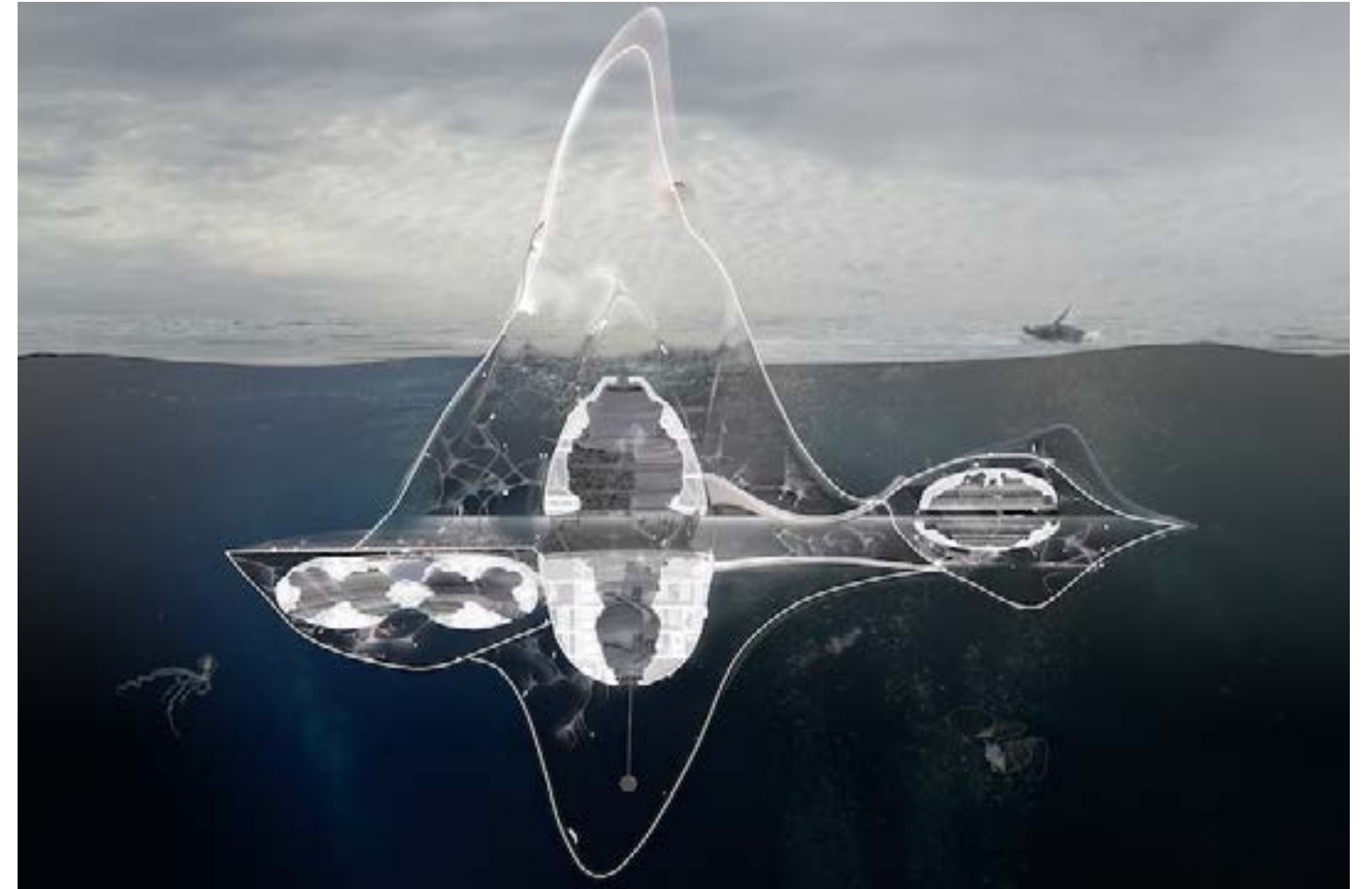
The research center also works as a receptor to the education center, the farming facility, and the endangered marine species center. This project is a cluster of vessels in international waters that work together to benefit not only humans but also other species that are important to this oceanic environment.



Research + Education Centers

Research + Education +  
Environmental Precervation Centers

Research + Education +  
Farming Facility Centers







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Throughout our history different forms of life have co-existed together in one living environment. This includes insects, birds, mammals and aquatic life, but simultaneously – humans. Consequently, human settlements have always included a variety of other species as neighbors, whether in the form of help, food supply, or even enemies. While advancing our settlements and technologies, and evolving through science and education, humans have taken a path of a complete isolation from other species, focusing only on themselves. Consciously or unconsciously, the uncountable use of all available for human resources, and the waste that has been created, have begun to harm the environment and all its living organisms, including people.

People are able to take a great care of species that were harmed due to our activities, while creating an infrastructure that accommodates coexistence and includes well-being. These solutions could lead to widespread preservations of a huge varieties of life in our world that are important to its ecosystem, especially the ones close to complete extinction. In the end, this benefits humans