LIVING MUSEUM OF THE BAY:
Chesapeake Bay Aquarium

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ABSTRACT

This thesis is the design of an aquarium in the industrial city of Newport News,
Virginia. The focus is a living museum that illustrates the diversity beauty and
grandeur of a precious yet fragile estuary, the Chesapeake Bay. The thesis
proposes by increasing public awareness of the fragile tenure with nature, modern
industrial society is the context, an industrial landscape is transformed into a
living/interpretive aquarium.

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THE CONTEXT

INTRODUCTION

The Chesapeake Bay is the largest estuary in the continental United States, and is one of its most valuable and productive natural resources. The Bay serves many functions: it provides millions of pounds of seafood; functions as a major hub for shipping and commerce; and provides a great variety of recreational opportunities for residents and visitors. But perhaps the most important role is that of wildlife habitat. The Chesapeake estuary supports an intensity of life due to the unique and diversified habitats it provides for the myriad of plants and animals which make it home. However, changes are now occurring to this habitat due to the activities of man which reduce its ability to support this abundance of life.
THE CHESAPEAKE BASIN

The Chesapeake Basin is a 200 mile long 2000 square mile body of water, which ranges in width from about four miles near Annapolis, Maryland to 30 miles at its widest point near the mouth of the Potomac. Although the Bay's length and width assume dramatic proportions, the average depth is less than 30 feet. In general, the Bay is shaped like a very shallow tray except for a few deep troughs which are believed to be remnants of the ancient Susquehanna River valley.

Because it is so shallow, the Chesapeake is far more sensitive to temperature fluctuations and wind than is the open ocean.

Each year the Bay's fifty major tributaries drain a volume of water close to the 18 trillion gallon volume of the Bay from an enormous 64,000 square-mile drainage basin that includes the Atlantic Coastal
Plain, the Piedmont Plateau, and the Allegheny Plateau. This large volume of water combined with the different rock and soil types contained in these three radically different geological structures in its drainage basin, provide a mixture of waters with a broad geochemical range. Each of these geological structures contributes a characteristic mixture of minerals, nutrients and sediments. A mixture which contributes to the diversity of life in the Chesapeake Bay.

Of all bodies of water, estuarine systems offer the greatest diversity of water composition. Within an estuary, freshwater mixes with salt water, each contributing its own variety of chemical and physical characteristics. The mixing creates unique chemical and physical environments, each capable of supporting different communities of organisms particularly suited to that type of water. The greater the number of different environments available within a body of water, the greater the variety of life that is likely to be sustained therein. The Chesapeake offers both a large volume, and diversity of waters to support its complex ecosystem.

**THE LIFE OF THE ESTUARY**

More than 2,700 species of plants and animals inhabit the Chesapeake and its shoreline. All depend on the Bay and their fellow inhabitants for food and shelter. Each, in turn, contributes to the continued life of the entire Chesapeake ecosystem.

Each of these organisms have specific and varied physical and chemical requirements for life which are satisfied by the physical environment of the Bay. Temperature, water salinity, nutrients, substrate, light, oxygen and shelter are variables which combine to determine particular habitats.
Within each habitat, communities of organisms are found which coexist in interdependent relationships. Bay communities can be as small as an oyster bar or as large as the entire Bay. These communities overlap and intertwine with each other to form the ecosystem of the entire Bay.

The five major Bay communities are the marsh dwellers, bay grass inhabitors, plankton, bottom residents and swimmers. Each community occupies a particular habitat within the Bay, and these habitats exhibit a wide range of characteristics. The marshes are relatively stable areas along the shoreline. The Bay grass community extends from about mean low tide to a depth of about ten feet or when light becomes limiting. The Plankton community is composed of minute creatures that float and drift with the movement of the water. The benthic environment includes the Bottom of the Bay and its residents. Finally, the
Neckton are the fish and other swimmers who move freely throughout the Bay.

Migratory birds and waterfowl use the Bay as a major stop along the Atlantic flyway. Here they find food and shelter in the numerous coves and marshes. The Chesapeake is also the winter home for approximately half a million Canadian geese and to more than 40,000 whistling swans. The shore areas are nesting grounds for the endangered bald eagle and the largest population of osprey in the U.S.A.

The Chesapeake’s tributaries provide spawning and nursery sites for several important species of salt-water fish including white perch, striped bass and shad. During the warmer months, blue fish, weakfish, croaker, menhaden and spot fish feed in the Bay on its rich food supply.

THE BAY AND MAN
Since its creation following the last ice age, the Chesapeake ecosystem has been subjected to an unending process of change. Nature like a dissatisfied artist, is constantly reworking the details. Some modifications enhance the Bay while others seem to detract from it; but all affect the ecosystem and its interdependent parts.

Human activity is becoming more involved in reshaping the life of the Bay. The value of the Bay’s fishing catch exceeds $100 million annually of fin and shell fish. The Bay’s fishery production is only exceeded nationally by the Atlantic and Pacific fisheries. The Has been described as a “great big outdoor protean factory. Juxtaposed to the fishery, the Chesapeake Bay is one of the top three commercial shipping centers on the east coast. The hospitable climate, lush vegetation, and natural beauty have made the Bay a popular recreation area. Boating, fishing, swimming, hunting and camping are major attractions. Urban and
industrial development along the shore, and within the watershed which drains parts of New York, Pennsylvania, West Virginia, Maryland, Delaware, and Virginia also directly compact the Bay.

Inadvertently our actions are initiating chains of events which reverberate through the Bay's ecosystem. Growing commercial, industrial, recreational and urban activities are putting substantial pressures on the Chesapeake's regenerative powers. Some problems are apparent. The Bay grasses, a crucial component of the ecosystem, are declining. The oyster catch is diminishing and pollutants are found in the biota of the Bay. Algae blooms are becoming more prevalent. This damage is increasing and needs to be addressed in a comprehensive manner to balance the conflicting demands on the Bay's resources.

THE ECOLOGICAL PERSPECTIVE

A new perspective is required to determine caused and find remedies to the problems now facing Chesapeake Bay. This perspective involves seeing man not as external to his environment but as an integral part of it. Understanding the relationships between humans and other living creatures requires understanding the environment from an ecological perspective. An aquarium based on the model of a living museum could be an important tool in achieving a broad based public awareness of this new environmental perspective.

"It lies to the south," the old seer of his village had said, "the river of rivers in which the fish of fish abound... To paddle down it would take even the God of rivers many days and its shores are cut..."
with a hundred places to hide. On this river of rivers a storm lasts for nine days, and fish are so big, one can feed a village......

“and there it was, the Chesapeake! in Pentaquod’s language the name meant: The great river in which fish with hard shell coverings abound.....”

“The Chesapeake! The name was familiar to all children, for on this great water strange things occurred. This was the magical place where the waters became even wilder than those of the Susquehanna, where storms of enormous magnitude churned up waves of frightening power. This was the river of rivers where fish wore precious shells....”

Chesapeake

James A Michener
THE CONCEPT

REFERENCES

To better understand the dynamics for the design of an aquarium, two facilities were compared: The National Aquarium in Baltimore, Maryland and the Monterey Bay Aquarium in California. Relative advantages and disadvantages were identified to inform the design of this project.
BALTIMORE AQUARIUM

ADVANTAGES:

The National Aquarium is a strong focal point; an important component to a carefully planned waterfront design. The building is a good landmark!

There is strong directional movement through exhibit spaces.

Exhibit layout relates to programmatic requirements, especially temporary exhibits.

Control of light celebrates exhibits and stimulates the visitors' journey through the facility.
DISADVANTAGES:

Thematically, there is no relationship to the Chesapeake Bay; approximately two-thirds of marine exhibits are non-indigenous.

The structure though carefully designed is too self contained and does not allow for administrative or programmatic growth.

Narrow ramps and corridors discourages lengthy observation of exhibits.

Tours are limited to one hour. Although the Facility is situated on a pier thus having water on three sides, visitors lose any reference to the surrounding water, once you enter the Aquarium.

Education is not encouraged; interaction is mostly limited to visual observation of marine life.
MONTEREY BAY AQUARIUM

ADVANTAGES:

The facility has a strong sense of place:
It is physically connected to Monterey Bay and contextually connected to Cannery Row, and to the town at large.

The large scale framework of the industrial typology allows for ease of new infill (formerly a sardine cannery transformed into an aquarium). Program and building technology are balanced; each informing the other.

The facility is part entertainment and part education. Visitors can touch, smell, hear as well as see ecology from the local area. This approach allows participants to learn more about an ecosystem.
Freedom of movement or lack of a designated path allows visitors choices for exploration. This informal movement complements the education program. The pattern is activity/slack/activity/slack; Visitors average stay is 2-3 hours.

Scheme allows for ease of expansion.

**DISADVANTAGES**

Temporary exhibit spaces are small and suffer from poor visibility.

Food concessions could have been linked to the programmatic theme.
THE SITE

Newport News is a heavily populated industrial city located in the peninsula region of southeastern Virginia, at the mouth of the James River on Chesapeake Bay. The City forms a metropolitan area with neighboring Hampton and Norfolk.

Heavy industry, especially the mammoth Newport News Shipbuilding and the Hampton Roads Marine Terminal have been the economic hub of this community for nearly a century. Mega-structure towers, pavilions and cranes create an intensive industrial landscape.

The works of Gunter Behnisch, Richard Rogers and Renzo Piano embrace the dynamic quality of industrial technology and transform these building systems into new applications.
The spirit of the industrial landscape of Newport News was celebrated and transformed for use in a public facility which attempts to challenge programmatic and structural limits.

"...buildings are given legibility through the expression of the process of building which in turn gives grain, scale, and ultimately harmony to the whole"

Richard Rogers
SCHEME 1: SITE LOCATION & URBAN SCALE

The aquarium in the context of its industrial neighbors requires a place of high visibility from land or water; a peninsula or pier. Access by land is clear, direct, and directional via a major corridor, Jefferson Avenue.

The industrial community which borders the site is a collage of moorings for vessels of the Virginia fishermen, locally known as the watermen, a small craft shipyard, oil terminals and the massive marine coal and container car terminal.

Traffic congestion is a major problem in this metropolitan area. Construction of a new bridge along side the site improves the aquarium's visibility, as well as providing a backdrop for its architecture.
The program called for a facility which is an analog of the Bay. Like the Bay and its tributaries, the facility is a cluster or
aggregate of exhibits that terminate in a larger exhibit and aggregate into a collective whole.

An organizational narration superimposed over a conceptual diagram.
SCHEME 2
EDGE REGISTRATION

To register the aquarium on the edge attempted to use the facility as an experiential transition from land to water. Unfortunately, edge registration forces the building to be long and linear. A scheme which did not reflect the conceptual narration.
The notion of going from land to water was not experiential enough. The gesture was a good start but needed to be pushed further! It was critical for this facility to achieve the highest/optimum visibility possible on this site.
Though the bridge and the adjacent industrial activities offered a perfect backdrop, the program required a stronger identity and autonomy. This was achieved by projecting the building into the forefront of this industrial community.
SCHEME 3:
ON THE WATER

By detaching the aquarium from the land and placing it on the water a number of new associations could be developed. Connections to the land could now be visual and formal rather than physical. An interstitial zone could be created between the building and the shore. The directional connection with Jefferson Avenue could be extended out into the water. However, the entrance though strong became problematic.

The image of the facility as an interpreting the Bay became much stronger. To know the water you must be out on and in the water; to understand the character of the bay you must go down into it, experiencing the Chesapeake’s world from the ocean floor to the surface.
The structure though conceptual takes on an autonomous form similar to an oil derrick, or a pier extending out into the water, and terminating in a place. The roof forms and the tank/exhibit closures also begin to take on autonomous forms that respond to the water and the sky.
SCHEME 4: THE TRAYS

The notion of the Bay as a huge tray filled by smaller or secondary trays is an appropriate anecdote for generating a progression or journey that leads you physically into the Bay, while the aquarium educates the visitor about it.

The trays begin above the surface and step down into the Bay. As one descends, the water is used as a datum level to reference the visitor to their relative position to it. As the progression into the Bay follows the trays stepping down, the tanks and exhibits intensify.
The detached, directional move from scheme 3 is reinforced by tall, pole-like bollards reinforce controlled views and movement out to the Bay. Like Halprins’s buffers at sea ranch that allow a sequence of panoramic views, the bollards, direct the visitors view in a forward direction, while allowing vignets looking out to the Bay. The Bollards also begin to establish a structural framework from the land to the water to the aquarium.

This scheme also introduced strong vertical elements allowing the movement to ascent above the trays. This allows movement which is not limited to simply descending into the water but also ascending above the surface of the bay.
Two edges illustrate two worlds of the Bay. Different edge forms define different program elements.

The western edge relates to the built edge of the land and is rectilinear. Program elements include interactive educational exhibits displaying how the bay works and public interaction with the Watermen to understand the folklore and tradition of men who spend their lives on the Bay.
Pietila’s Student Centre at Otaniemi is “not an image of city and urbanity - but of forest and nature and of ‘a sense of belonging,’ a connection and relationship between building and place.”

“All material in nature, the mountains and the streams and the air and we, are made which has been spent, and this crumpled mass called material casts a shadow, and shadow belongs to light.”

Louis Khan

Dipoli Centre, Otaniemi, Finland 1966
"The use and understanding of materials, is just as important as form and space."

Fumihiko Maki
The amorphous eastern edge relates to the Bay at large simulating an edge shaped by wind and water. Program elements include the tanks holding the inhabitants of the Bay and its tributaries.

From the perch and trout found in streams.

to the striped bass and bluefish of the rivers.

.........to the menacing sharks and stingrays of the Bay.........
SCHEME 5
TECTONICS

As the exploration increase in scale, the concept becomes more disciplined. Building dimensions, programmatic issues and structure become more defined.

Clarity of the trays, building closure and openings inside the structure that reference you to the water become crucial issues.
Detachment of the structure from the land magnifies the problem of having no reference as it relates to the water.

The question of the whales persist. Where/how do you adequately house a thirty foot mammal?

Amenities of parking and restaurant are resolved as they pertain to views and direction.
Image of the aquarium vs. Industrial structure (i.e. oil derrick) comes into question.
SCHEME 6: THE SAILS

The entry is rooted to the land, so there is a strong, clear transition from land to water.

Issues of closure and reference to the water and mammal exhibits are resolved.
The structure of crane like columns are directional, supporting space frames and vertical movement.

The strong structural grid combined with tilted space frames take on the nautical character of masts and sails of a ship or piers jutting above waves.
“through identification man possesses a world, and thus an identity. Today identity is often considered an “interior” quality of each individual and growing up is understood as a realization of the hidden self.”

Christian Norberg-Schultz
Tilted space frames protect tanks and shade visitors from the sun’s summer southern exposure, yet allow natural light to filter into the space from the east while allowing natural ventilation.

The mammal exhibit now inhabits previously the moorings for the watermen. With the ships now docked in the rear of the aquarium, this 16,000 square foot area becomes a fenced in pen for whales and dolphins. At this point in their journey the visitors descend to the bottom of the Bay.

Now the mammal’s world is the bay at large and, you, the visitor, are in the tank.
SCHEME 7: FINAL DESIGN

The administrative section relates to the land and modestly defines your entrance to the aquarium.

The entrance, administrative and main activity areas become more clearly defined.
The looming, tilted space frame informs you of something special beyond the administrative area.
Skywalks transport you through the exhibits of the river, Bay, sea vegetation tanks and educational labs.
The lower level of the aquarium reaches out to the Bay, to allow views of the mammals and exploration of the structural underside that supports these massive trays and tanks.
The marsh exhibit simulates the complete ecosystem of the Bay. The interaction of the water to the marsh vegetation, to the waterfowl. The partial submersion of this exhibit allows observation of the tidal differences one would experience in the Chesapeake.

“Civility implies living in harmony with the past, the present and the future”

Richard Rogers
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