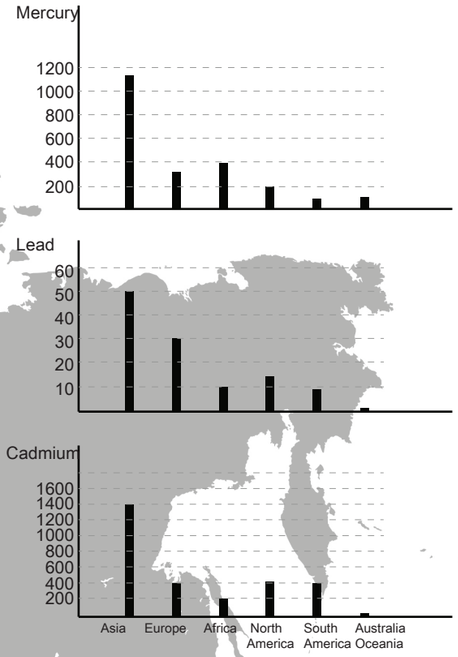
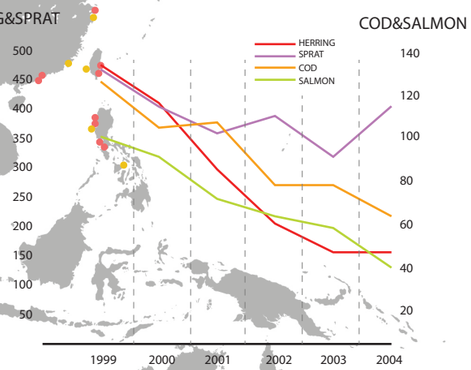
Ocean Hyacinth

Floating Tidal Marsh Islands



Regional contribution of anthropogenic heavy metal emissions into the costal and marine environment (source : AMAP, 2002)



Reduction in the catch quota(thousand tons) of principal fish in the Baltic Sea (source : marine pollution bulletin, volume 48, issues 7-8)

Legend

Eutrophic and Hypoxic Areas

- Eutrophic
- Hypoxic
- Systems in Recovery

source : Diaz, R, and M. Selman. 2010.
www.wri.org/eutrophication/map

COASTAL POLLUTION

Costal ecosystems throughout the world are in major crisis. Costal sea water is becoming increasingly contaminated with man-made toxic chemicals and the rate of costal sedimentation is also rising due to the increases human population and development in the coastal regions. Majority of all marine pollution is originated from land-based sources that are the result of industrial, agricultural and urban processes. Since majority of these land-based pollutants enter the sea via rivers, the highest concentration of contaminants are often found in estuaries where the rivers meet the sea (including bays and tidal rivers). The contamination of estuaries poses a major threat to the costal ecology since these waters need to server as a nursery zone for many fish species and shellfish populations (e.g. shrimp, oysters, scallops and crabs). In this milieu, this project focuses on the severely broken costal site caused by the ship breaking process.

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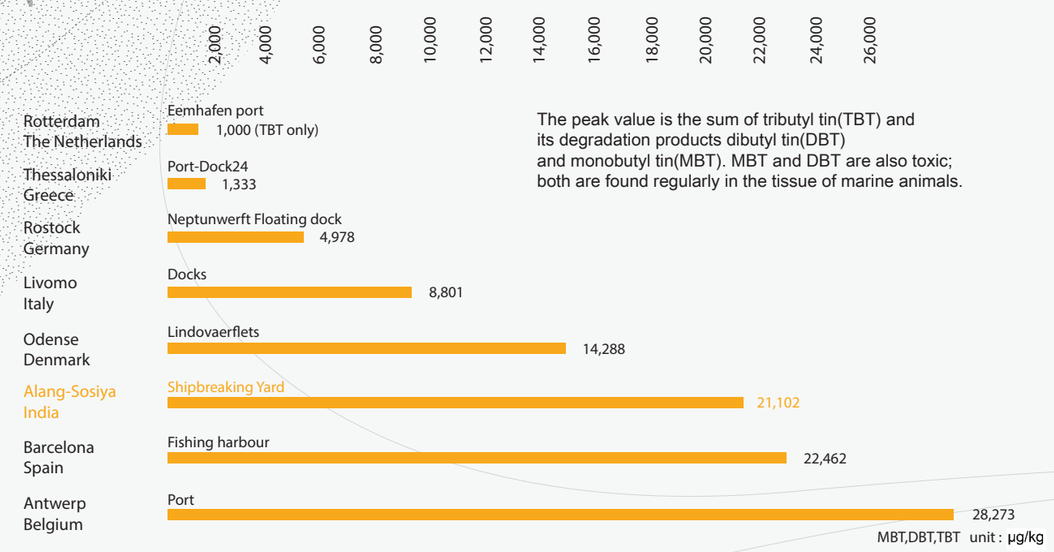
Floating Tidal Marsh Islands

SHIP BREAKING

Ship breaking is a process of dismantling, recycling, and disposing of retired ships. The amount of raw materials from this industry is astonishing, which includes the steel exterior and all of its interior elements such as machinery, furniture, and fitting. Although there are a significant amount of materials that are reusable, recyclable, or safely disposable; significant amount of hazardous substances and chemicals are also released to the ocean. Most of the current major ship breaking sites are located in Turkey, China, Pakistan, India, and Bangladesh where the labor cost is lower and the environmental restrictions are less stringent.

Lakchanka Formation
Mud Flats
Laterites
Ship
Urbanization

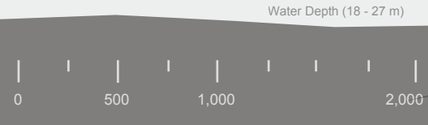
Gulf of Khambhat



The peak value is the sum of tributyl tin(TBT) and its degradation products dibutyl tin(DBT) and monobutyl tin(MBT). MBT and DBT are also toxic; both are found regularly in the tissue of marine animals.

Comparison of peak concentrations of TBT and its degradation products in the sediment of European ports with the peak level found in the Alang-Sosiya shipbreaking yard (source : Dutch Ministry for transport and waterways,1999/Greenpeace,2000/Danish Energy Ministry,2000)

Alang's advantageous environmental–intertidal and geomorphological conditions for the ship breaking activity (Source: Ship Recycling Industries Association, 2006)



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THE SITE - Alang, India

Alang is a small coastal town in Bhavnagar district in the Indian state of Gujarat, India. Approximately 10 km long sea front on the western coast of the Gulf of Cambay adjoining to Alang-Sosiya village (50km from Bhavnagar by road) is developed as the largest ship recycling yard in the world. The ship breaking activity was initiated in June 1983, and thousands of ships such as Cargo-boast, warships, and cruise ships have been dismantled here which is approximately half of all ships around the world.

The Alang site has a number of major advantages that allow larger ships to come straight into the shore, reduce the total working time on each ship, and make ship recycling a safe perennial activity. The advantages include high tidal gradient, mild rainfall, and being sheltered from high velocity winds or excessive humid conditions. The sandy beach does not let the heavy items sink in the mud, and a layer of hard rock just beneath the sand prevents rainwater and even seawater from seeping into the subsoil. The relatively moderate rainfall, shelter from strong tides and winds, and the absence of rocks around the area allow smaller ships to be recycled easily at the yard, thus increasing the number and types of the ships that can come in.

Types of waste generated from the vessels are categorized largely into two—hazardous waste and non-hazardous waste. Oil obtained from ships—one of the hazardous waste, is sold to MoEF registered traders, and many other wastes such as a part of rubber and plastics, glasswool, thermocol, and kitchen waste are sent to TSDF site at Alang. However, as the hazardous waste including toxic wastes, radioactive elements, poisonous gases, and unusable oil enter into the marine food chain, not only do they contaminate the oceans, but also they greatly affect the health of workers who already live in poor condition. Although the tonnage reported sold for breaking at the world level has been decreased in past decade, forty-five thousand workers break down about 200 ships in the yard each year, and the work produces 2.6 million tons of steel per year which makes about 15 percent of the country's total steel production. (Source: N. Cotzias Shipping Group, UNCTAD 2007, Ship Recycling Industries Association (India) 2006)

HIGH TIDE LINE

MEAN TIDE LINE

LOW TIDE LINE

Lat 21° 24'00.14" N Long 72° 11'06.72" E
Alt 15,000 metres

Alang Shipbreaking Yard Alang, a small coastal town in Bhavnagar, India, and the largest ship recycling yard in the world. (Source: TerraMetrics 2011)

0 500 1,000 2,000 m

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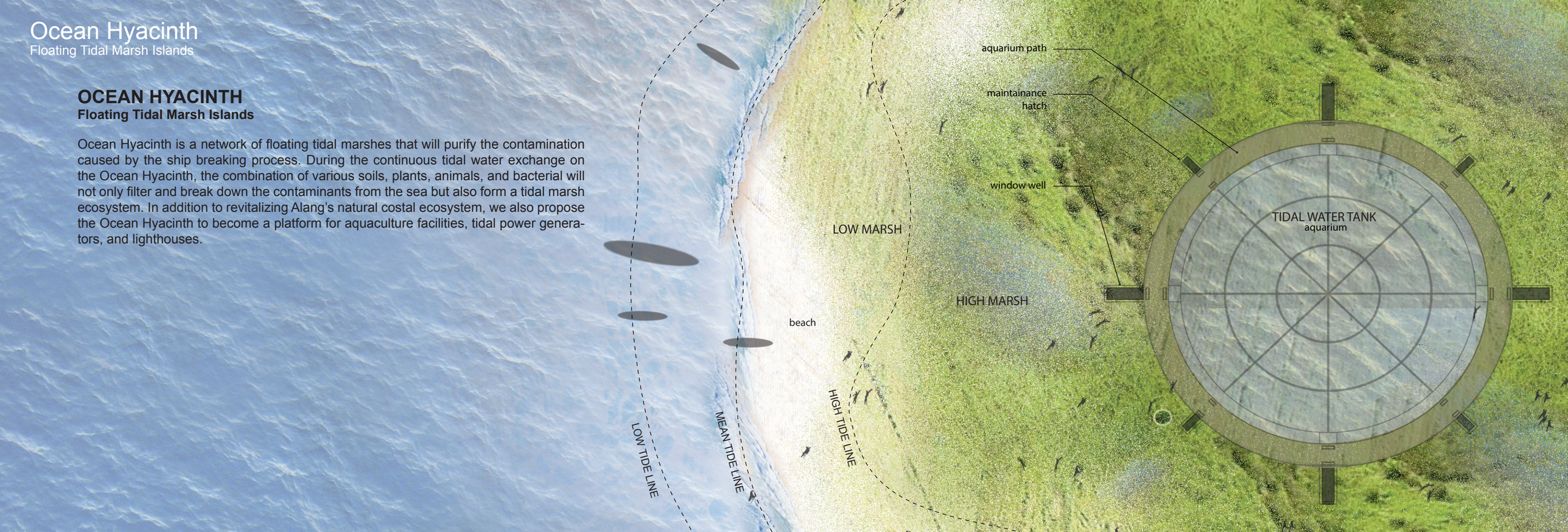
OCEAN HYACINTH
Floating Tidal Marsh Islands

Ocean Hyacinth is a network of floating tidal marshes that will purify the contamination caused by the ship breaking process. During the continuous tidal water exchange on the Ocean Hyacinth, the combination of various soils, plants, animals, and bacterial will not only filter and break down the contaminants from the sea but also form a tidal marsh ecosystem. In addition to revitalizing Alang's natural costal ecosystem, we also propose the Ocean Hyacinth to become a platform for aquaculture facilities, tidal power generators, and lighthouses.



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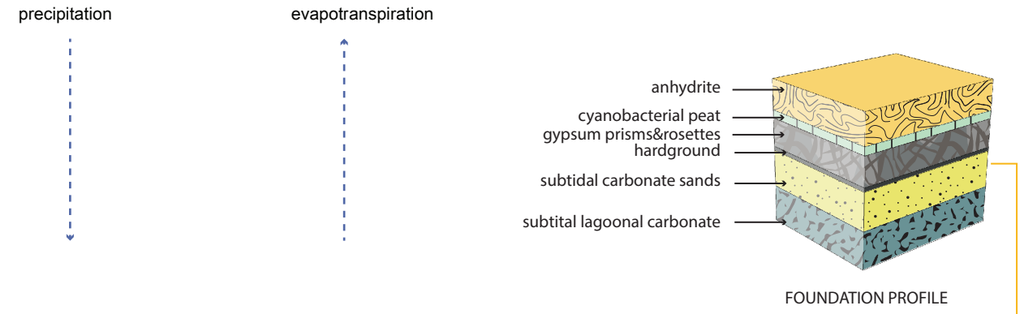
Tidal Flat/Marsh Ecolories

Producive Coastal Ecosystems

. Increasing N, P > S, ratio leading to shift in phytoplankton community
. Deposition of phytoplankton leading to hypoxia
. N limitation predominant in coastal waters
. Salt arsh accretion through peat formation and sea level rise
. Persistent upwelling
. Seasonal stratification



SUBTIDAL

low tide line

Algea Urchins

Common Species:
Red Green and Brown Algea, Cunjevoi, Sponges, Urchins, Holothurians, Warms, Tritons& Turbans

INTERTIDAL

Common Species:
Zostera marina
Thalassia testudinum

Chitons Seastar

Common Species:
Galeolaria, Chitons, Seastars, Shore Crabs, Balanus&Surf Barnacles

Limpet Nerite

Common Species:
Limpets, Top Shells, Conniwinks, Nerite, Siphon Shells

mean tide line

SUPRATIDAL

LOW MARSH

FLOODED TWICE A DAY BY HIGH TIDES
Common Species:
Spartina alternififlora

Razor clam Mud snail

Common Species:
Razor clam, Blue green algea, Beach flea, Eastern mud snail

high tide line

HIGH MARSH

FLOODED OCCASIONALLY DURING MONTHLY HIGH TIDES AND STORMS

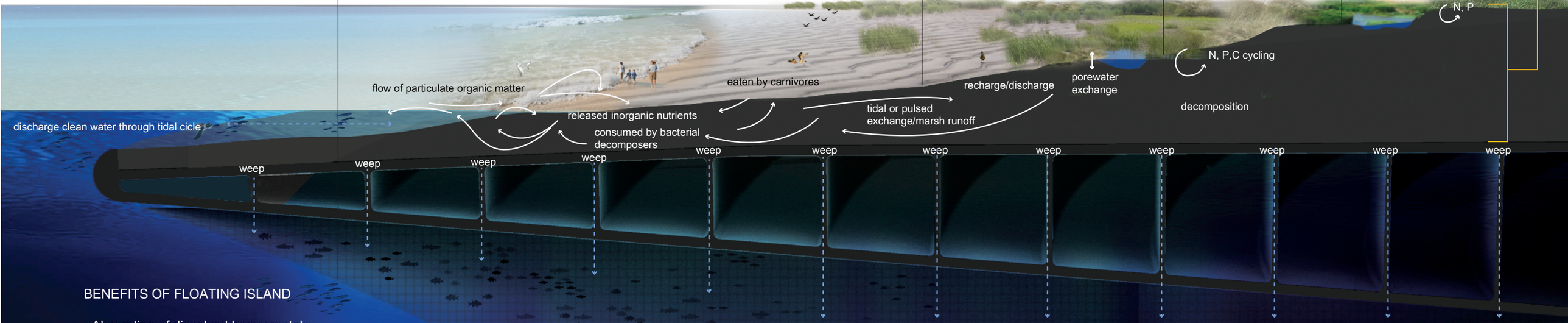
Common Species:
Ruppia maritima
Plantago maritima
Salicornia sp.
Spartina alterniflora

Common Species:
Common tern, Dunlin, Herring gull, Glossy ibis

MARSH BORDER

Common Species:
Panicum virgatum
Spartina pectinata
Phargmites australis
Iva frutescens

Dunlin Common tern



BENEFITS OF FLOATING ISLAND

- Absorption of dissolved heavy metals
- Clarification of water through the tidal eco system
- Removal of dissolved organic matter
- Reduction of odours
- Suppression of habitat for aquatic fauna and birds
- Aesthetically pleasing effect of floating gardens
- Reduced evaporation through the shading effect on water

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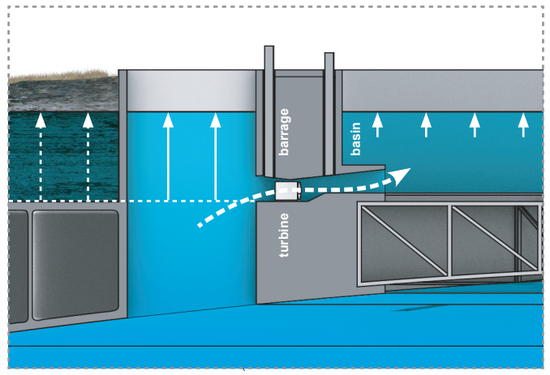
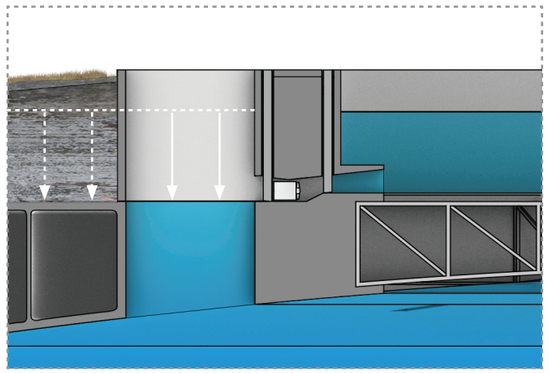
TIDAL POWER

- Total energy potential per day: 13,350,000,000 J
- Mean power generation potential per day: 154,000 W
- Daily-average power generated (efficiency 30%)
  : 46,300 W = 46 KW

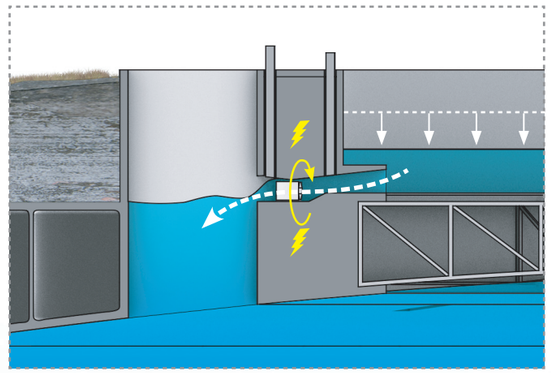
= POSSIBLE POWER CAPACITY
  : around 40 Average US homes



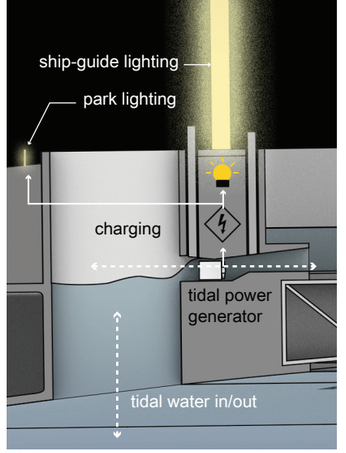
High Tide



Low Tide



Tide Power



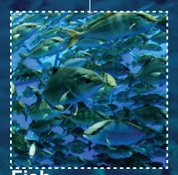
Tide Power Uses

TIDAL MARSH PARK

FLOATING STRUCTURE

OCEAN FARM

ship-guide lighting
machine room
water tank
window well
marsh
public beach
tidal water in/out
clean water
fish farm
fish feed
aliments pour poissons
ocean argiculture
fish feed
aliments pour poissons
oganic deposit feeders

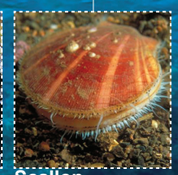


Fish

Kelp

Oyster

Mussel



Scallop

Sea Cucumber

Sea Urchin

Sea Worm

Lobster

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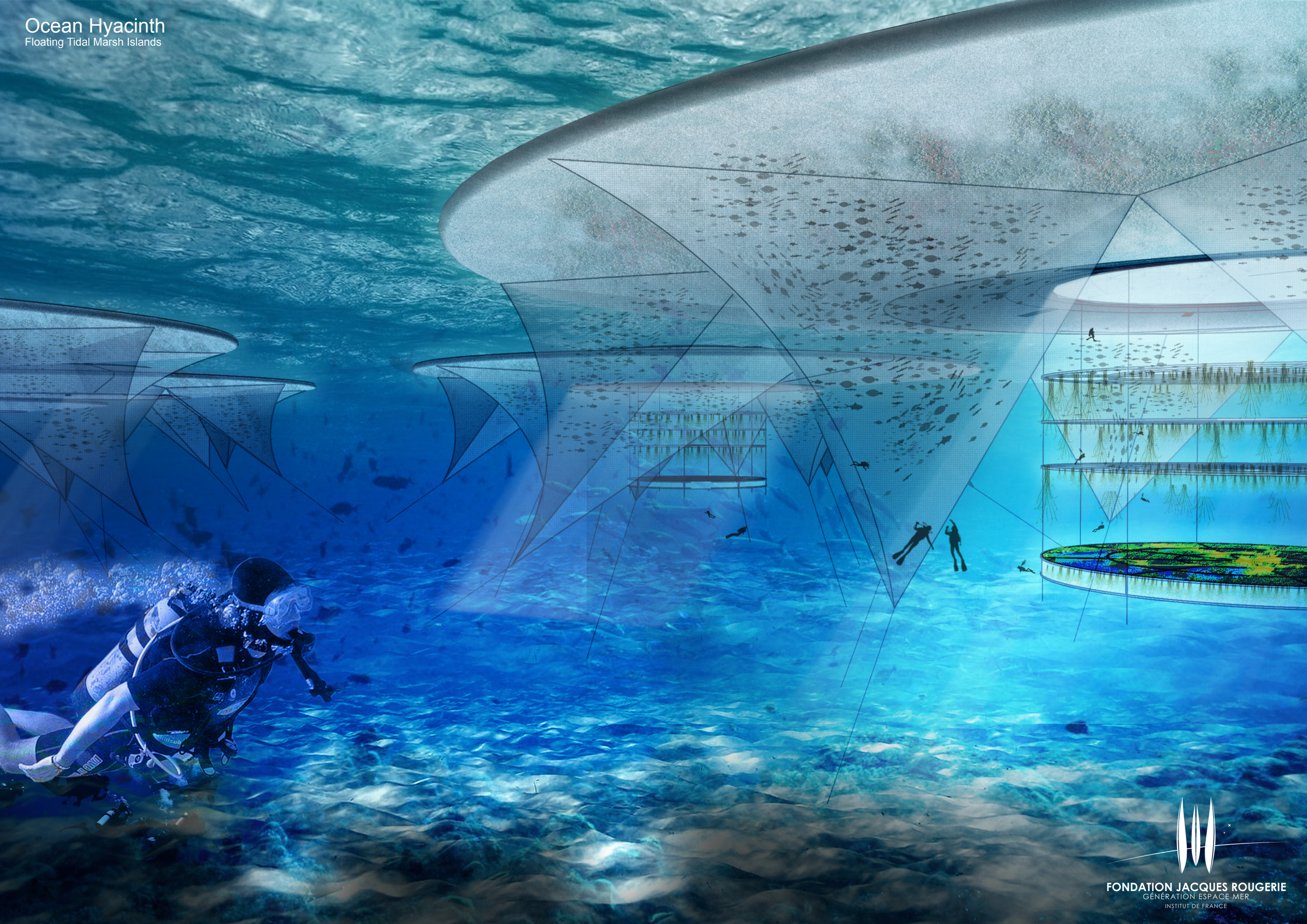

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At night, lights that are powered by tidal power generator provide navigational aid to the approaching ships.

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