

Fish Swarms

Industrial Design / Group Work

Responsible for research, brainstorming, sketching, rendering and layout making.

A marine oil spill cleanup system based on AFSA (artificial fish swarm algorithm)

Won the honorable mention in China Universities Industrial Design Competition 2020

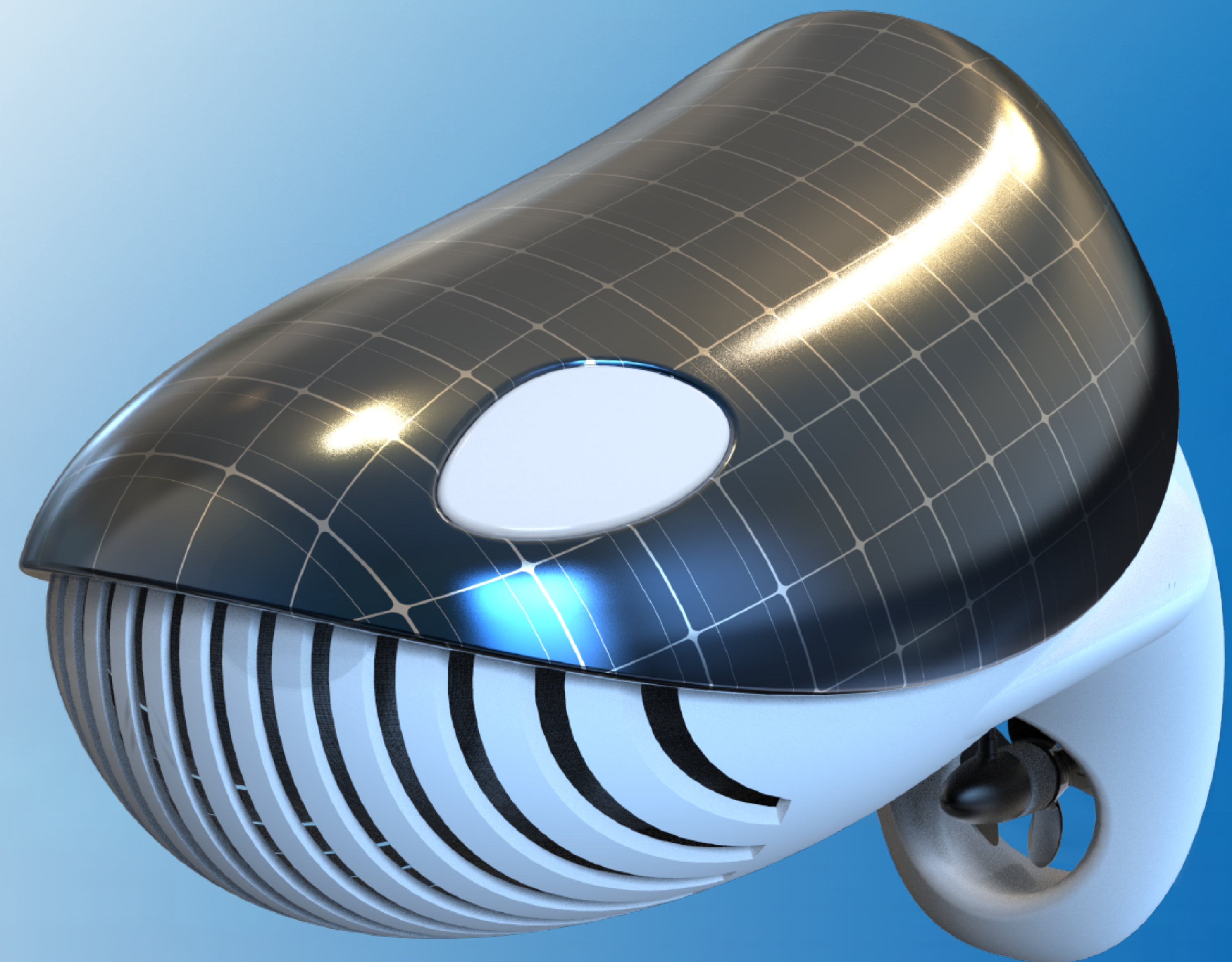
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Zixi / Lin

Shuhan / Lian

Tianyi / Ye

2020.7



Background



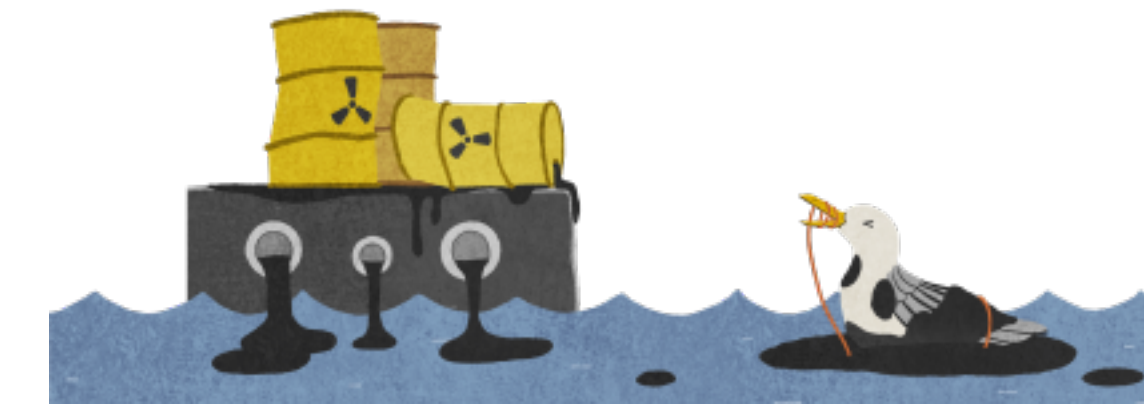
Marine oil spill is the release of a liquid petroleum hydrocarbon into the marine ecosystem, due to human activity, and is a form of pollution. It may due to releases of crude oil from tankers, offshore platforms, drilling rigs and wells, as well as spills of refined petroleum products and their by-products.

human impact



In 2013, two different oil spills contaminated water supplies for **300,000** in Miri, Malaysia; **80,000** people in Coca, Ecuador.

environmental effects



Oil spills penetrate into the structure of the plumage of birds, **reducing its insulating ability**, and making them more vulnerable to temperature fluctuations and much less buoyant in the water.

other massive effects we can't imagine...

Primary Research

Is there any solution to solve this problem? Is there any existing problem during the cleanup process?

Physical method

methods

Oil Boom

Skimmers

Washing

Manual Labor



bad effects

Effective only when the oil is in one spot

skimmers can get clogged easily

labour intensive & time-consuming

Chemical method

Sorbents

Burning

Dispersant



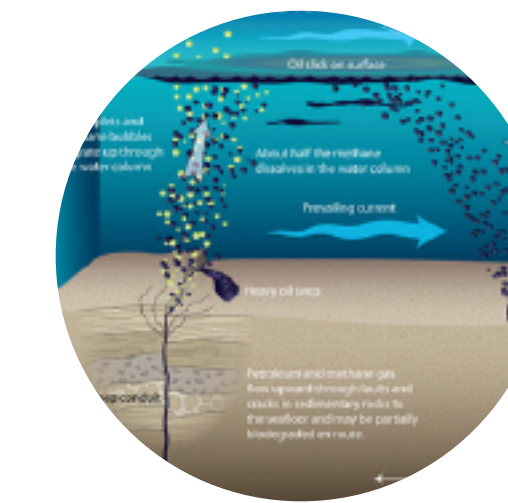
hard to retrieve

cause damage

The toxicity of dispersants can affect marine organisms

Biological method

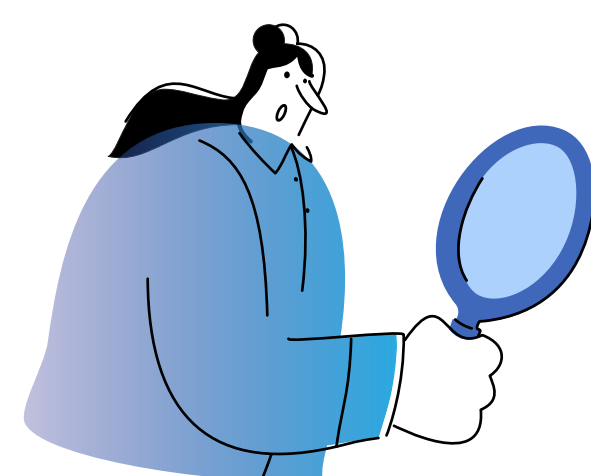
Bioremediation



may take years

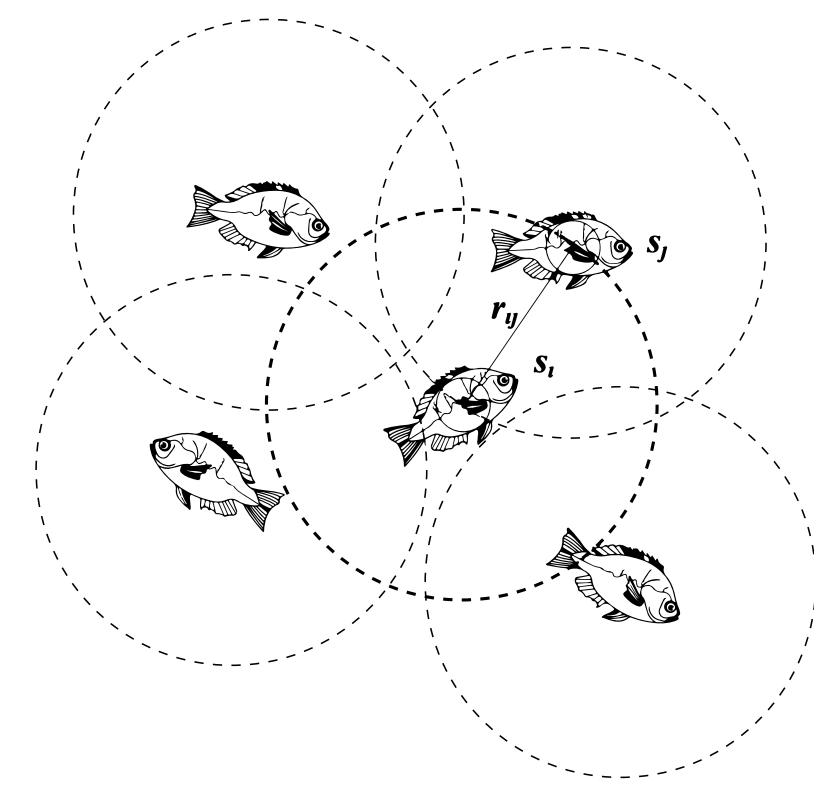
No thoroughly satisfactory method has been developed for cleaning up major oil spills.

There are *always some oil spills* that have not been cleaned up or found.



Is it possible to design an *unmanned marine oil spill cleanup system, which can find and clean the oil spill by itself*? This system is better not to consume any manpower, and can *maintain environmental friendliness* to the greatest extent.

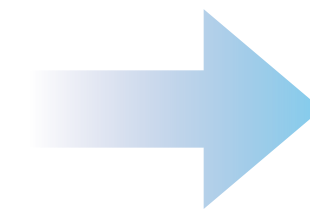
Inspiration



AFSA Artificial Fish Swarm Algorithm

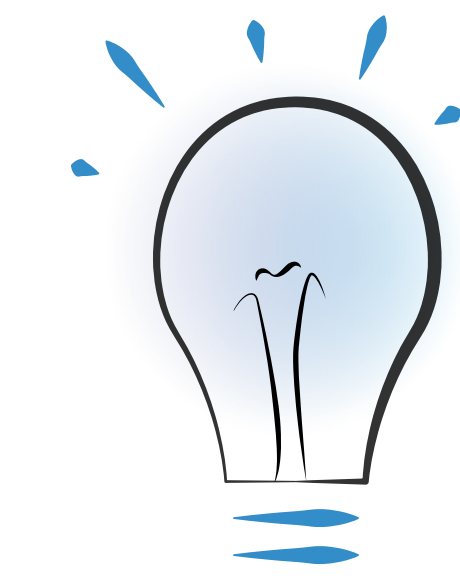
In a piece of water, fish can often find places with a lot of nutrients by themselves, which means that the place where the most fish live is generally the place with the most nutrients in the water area. Based on this feature, AFSA imitate the *foraging, clustering and rear-end behavior* of the real fish swarms to achieve the optimization.

BEHAVIORS



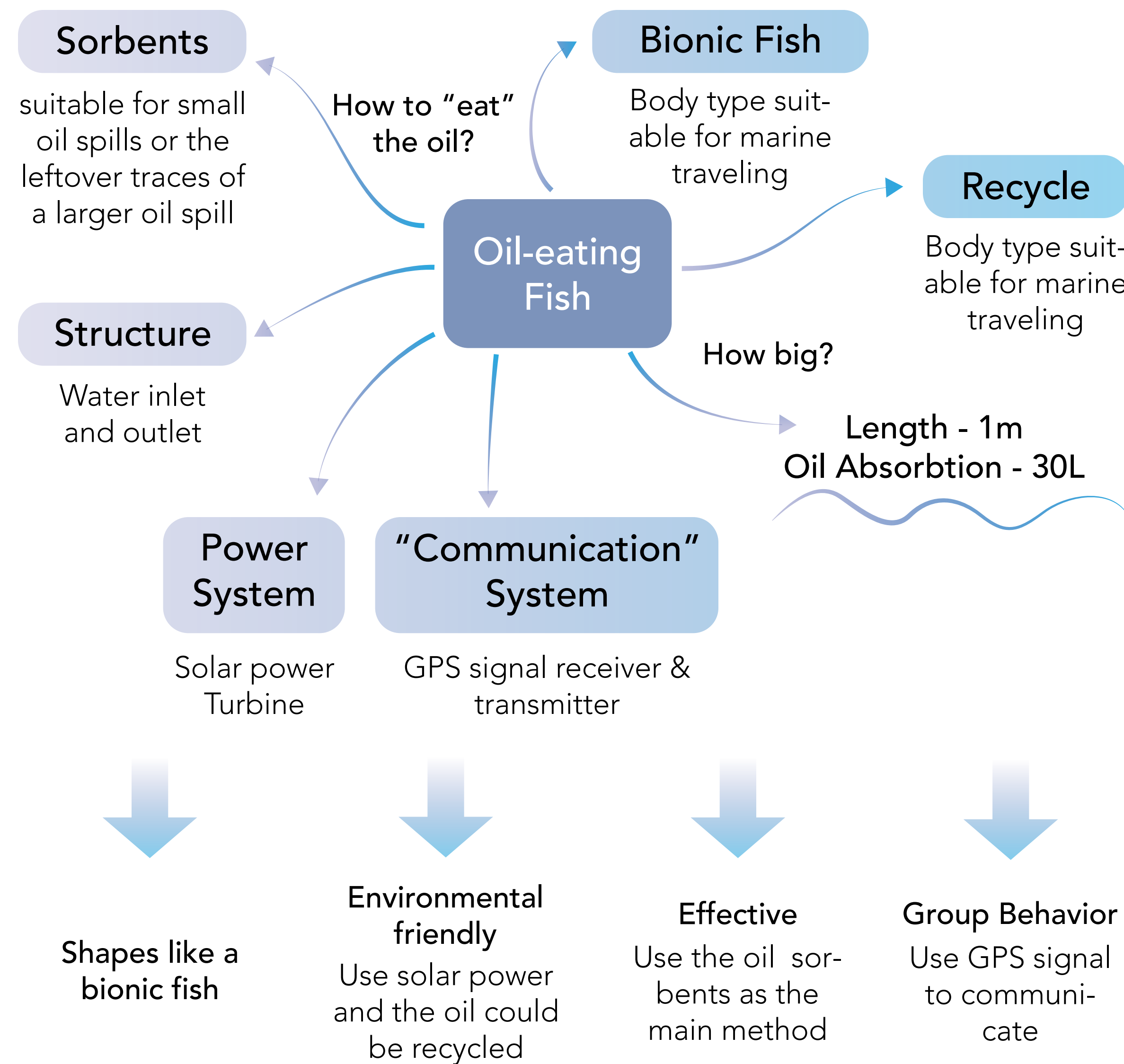
- Foraging
- Clustering
- Rear-end
- Random

Opportunity



An unmanned marine oil spill cleanup system based on AFSA!
Imagine that many artificial fish in the ocean seeking for their food - oil.

Ideation



Further Research

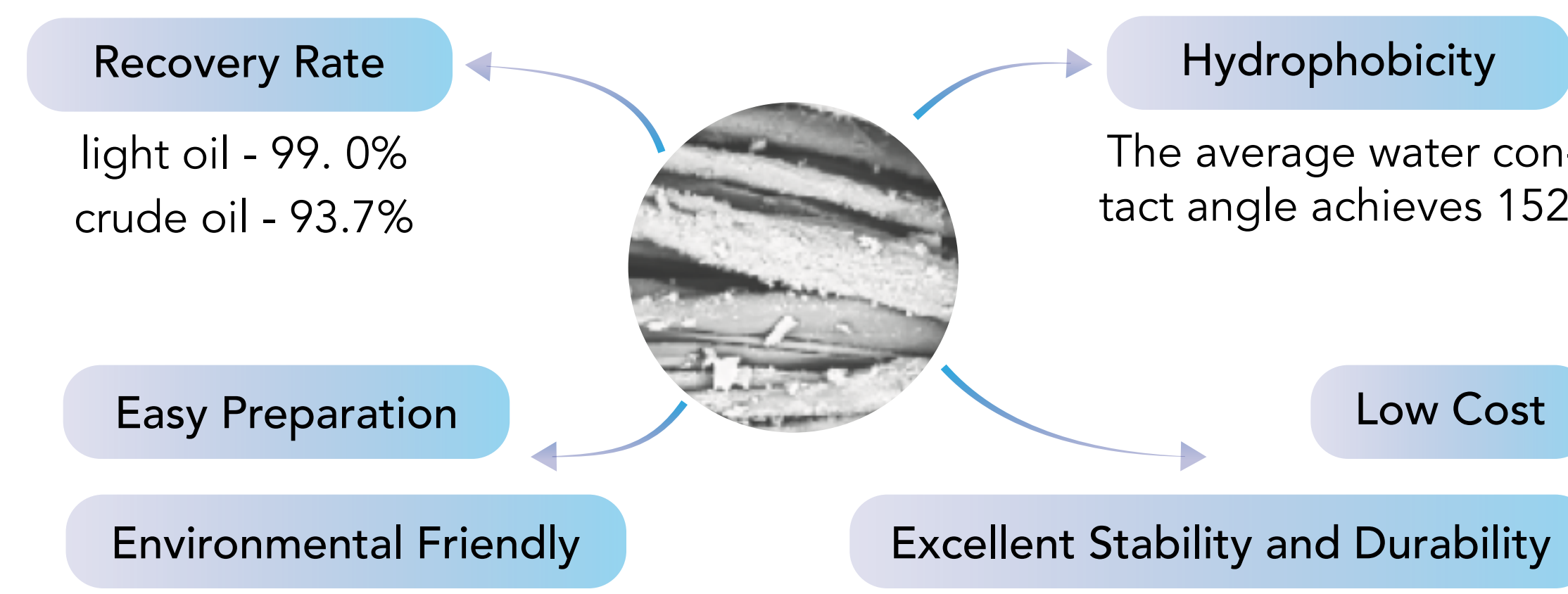
Bionic Fish

BIKI is the world's first bionic underwater drone that is also the only underwater robot featuring *automated balance, obstacle avoidance, and return to base.*

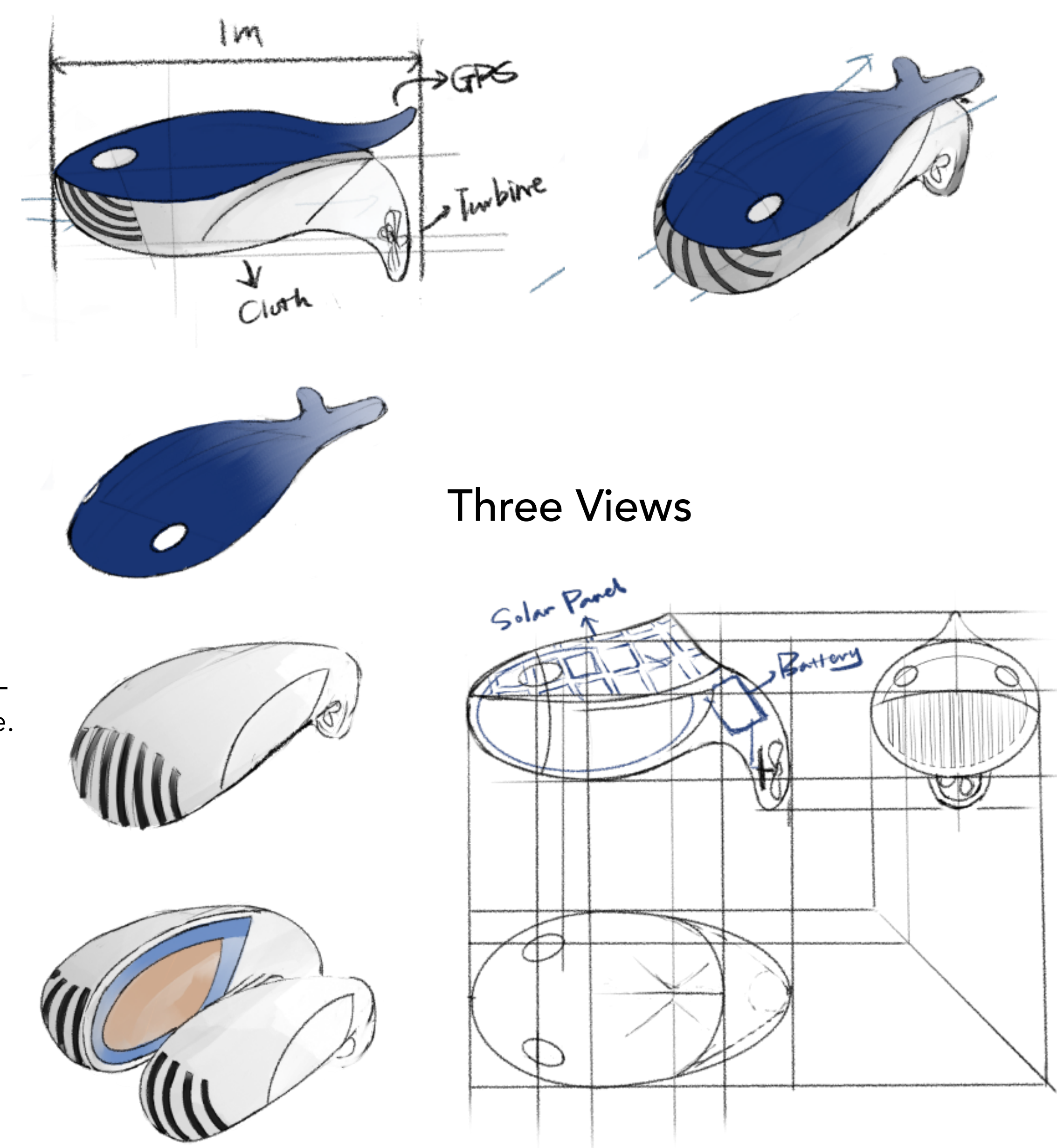


Magnetic Super-hydrophobic Cotton Cloth

The magnetic super-hydrophobic cocloth combines magnetism and superhydrophobicity, with good magnetic properties, making the product easy to recycle and reuse.

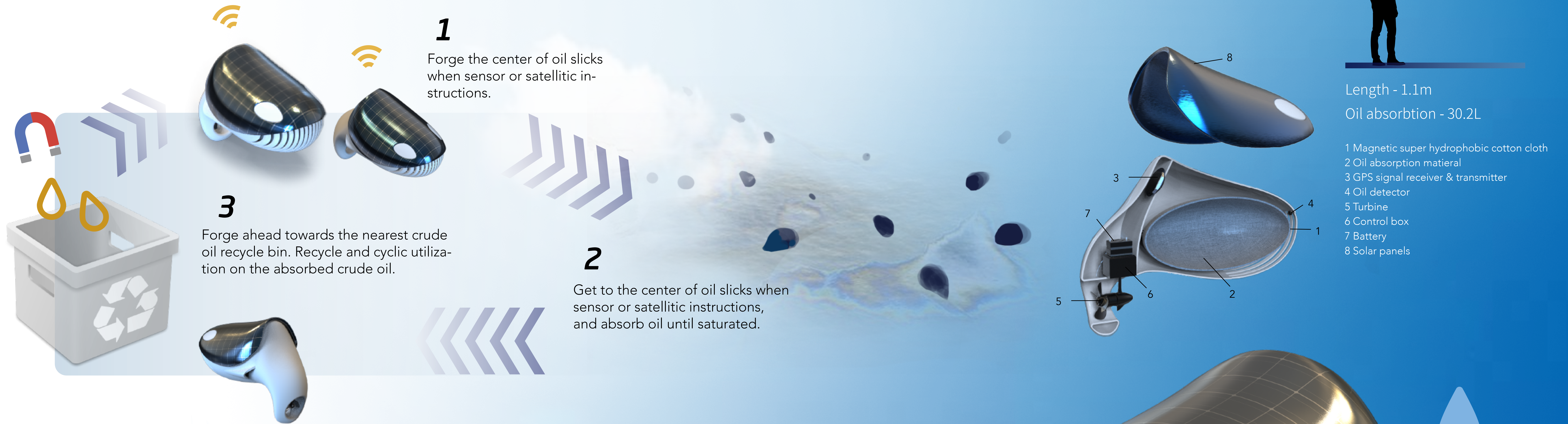


Sketch



Three Views

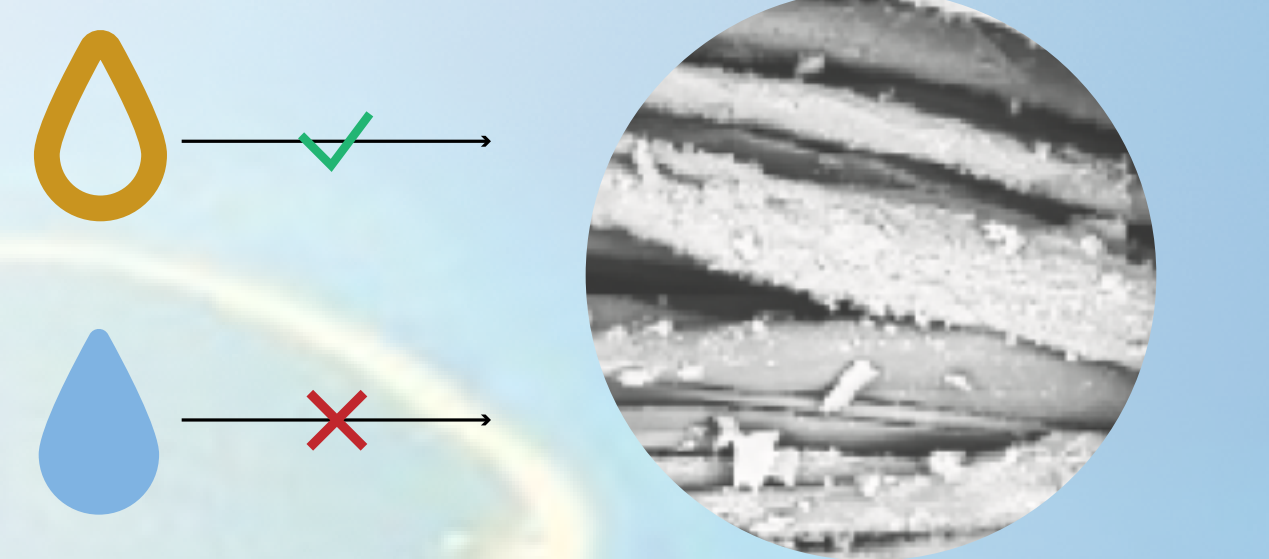
Final Concept



Behaviors

- Random**
Patrol in sea areas, locate oil spills.
- Foraging**
Find the oil slicks, head for its location.
- Rear-End**
Give off signals, summon all the partners.
- Bunching**
Partition, aligning up, cohesion, efficiently forging ahead.

Principle



Magnetic Super-hydrophobic Cotton Cloth
the main oil absorbing material of this product

