

# *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

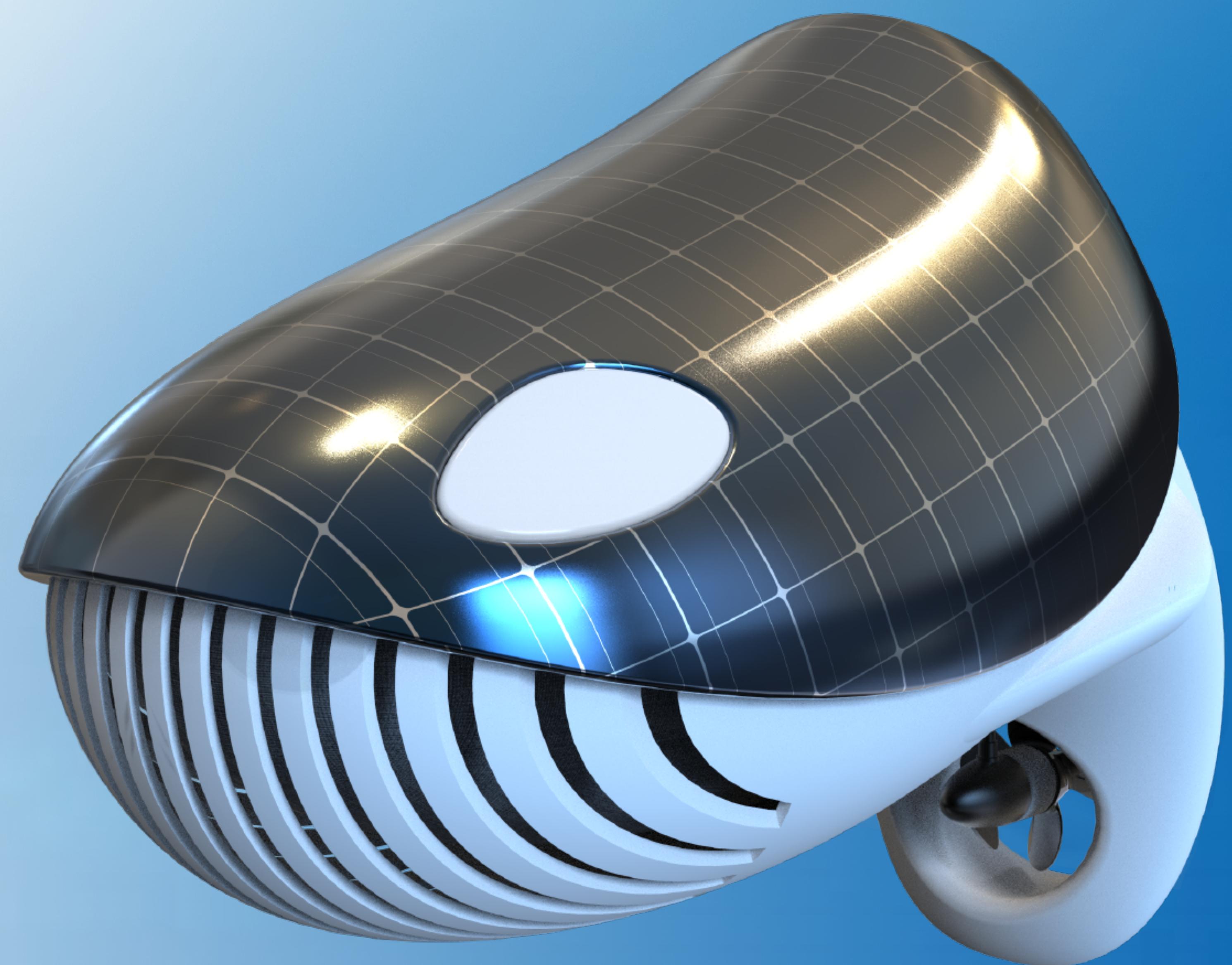
Yunqi / Li

Zixi / Lin

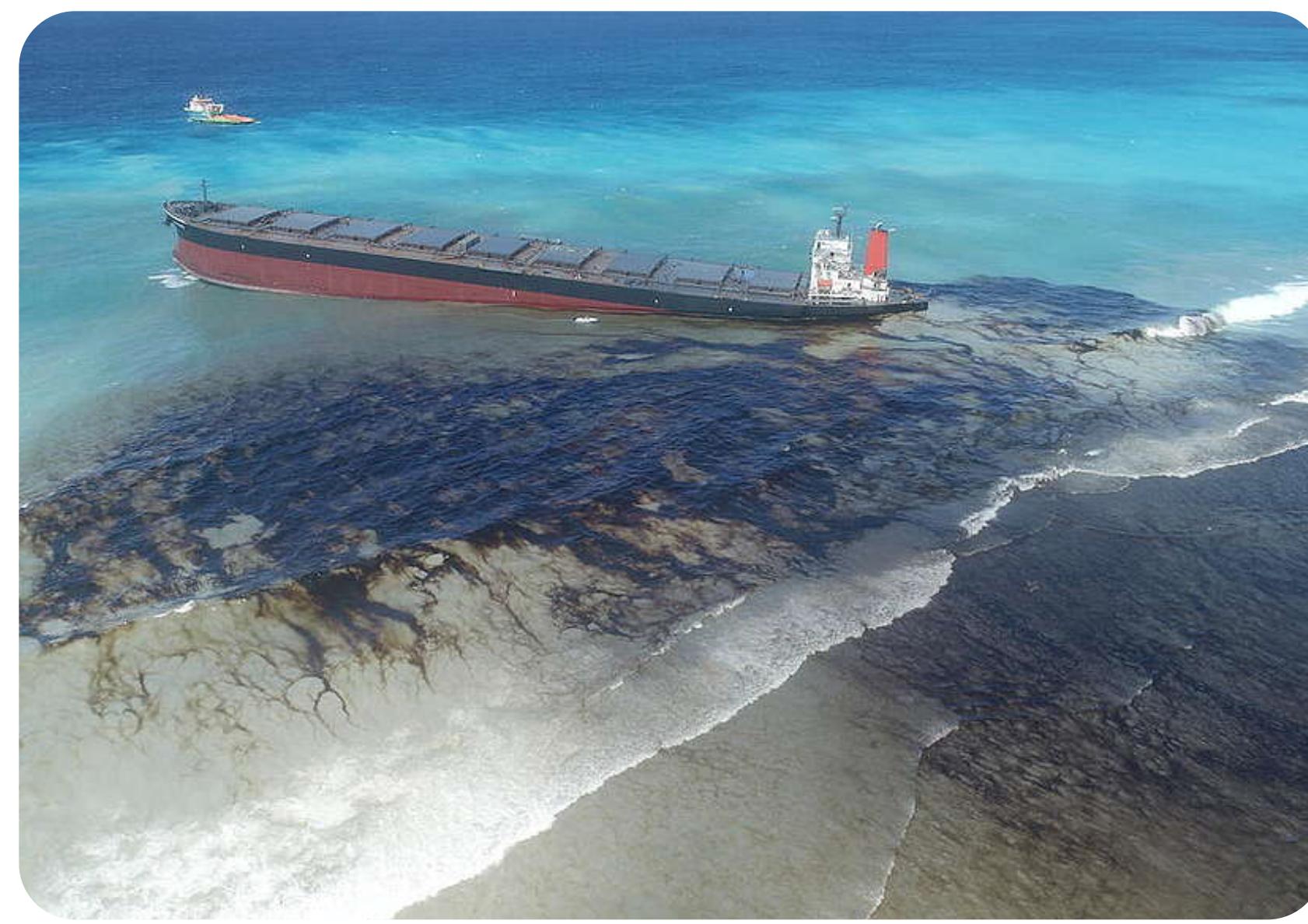
Shuhan / Lian

Tianyi / Ye

2020.7

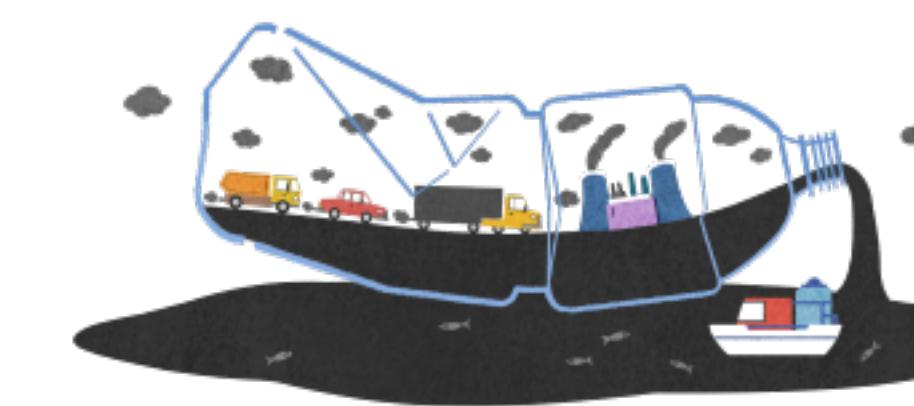


# Background



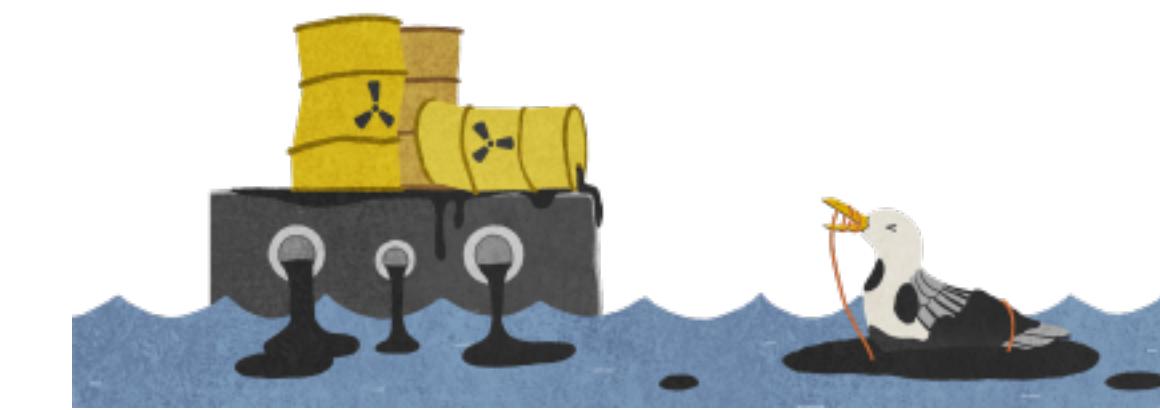
Marine oil spill is the release of a liquid petroleum hydrocarbon into the marine ecosystem, due to human activity, and is a form of pollution. It may due to releases of crude oil from tankers, offshore platforms, drilling rigs and wells, as well as spills of refined petroleum products and their by-products.

## 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.

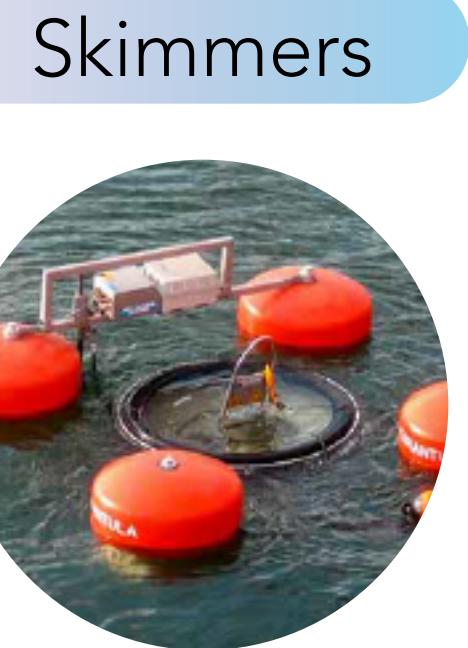
other massive effects we can't imagine...

# Primary Research

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

## Physical method

### methods



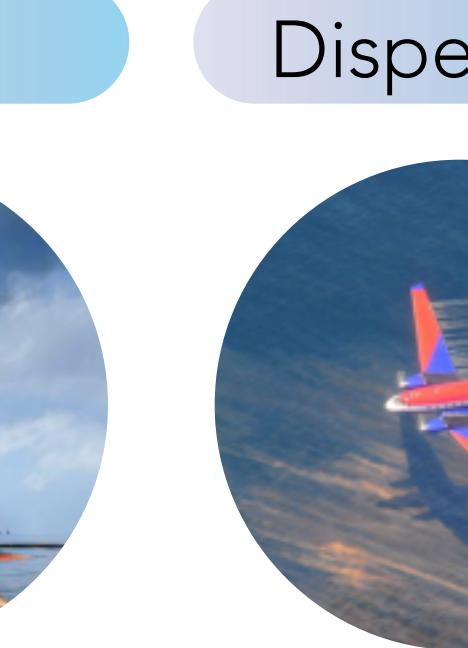
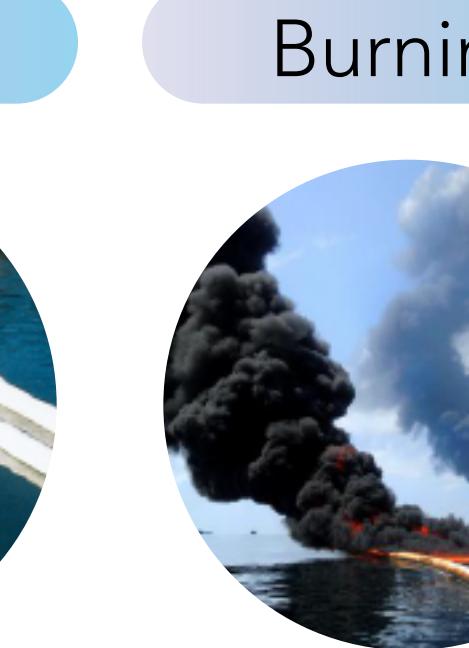
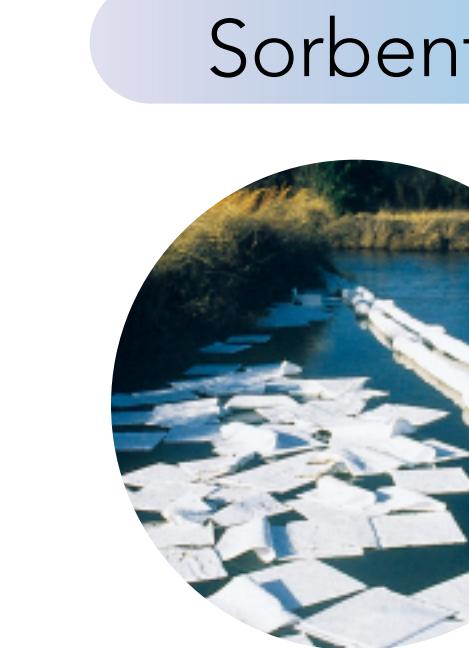
### bad effects

Effective only when the oil is in one spot

skimmers can get clogged easily

labour intensive & time-consuming

## Chemical method

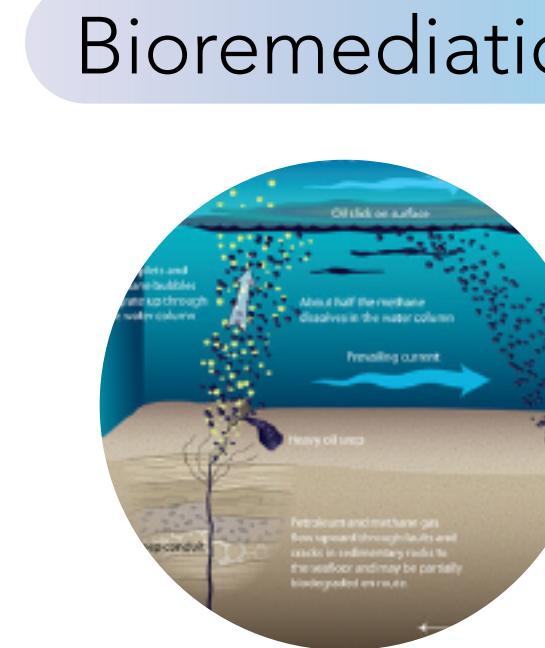


hard to retrieve

cause damage

The toxicity of dispersants can affect marine organisms

## Biological method



may take years

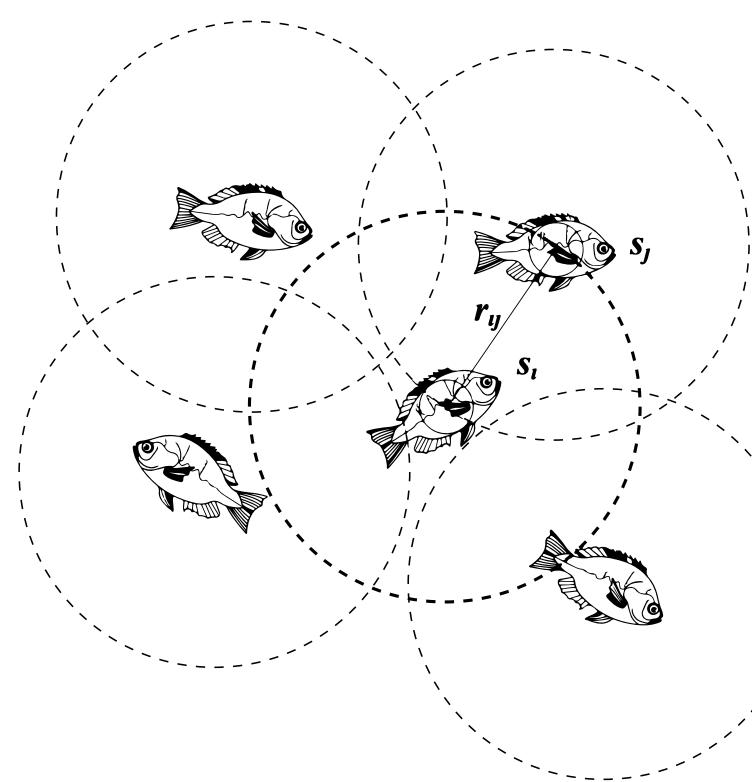
No thoroughly satisfactory method has been developed for cleaning up major oil spills.

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

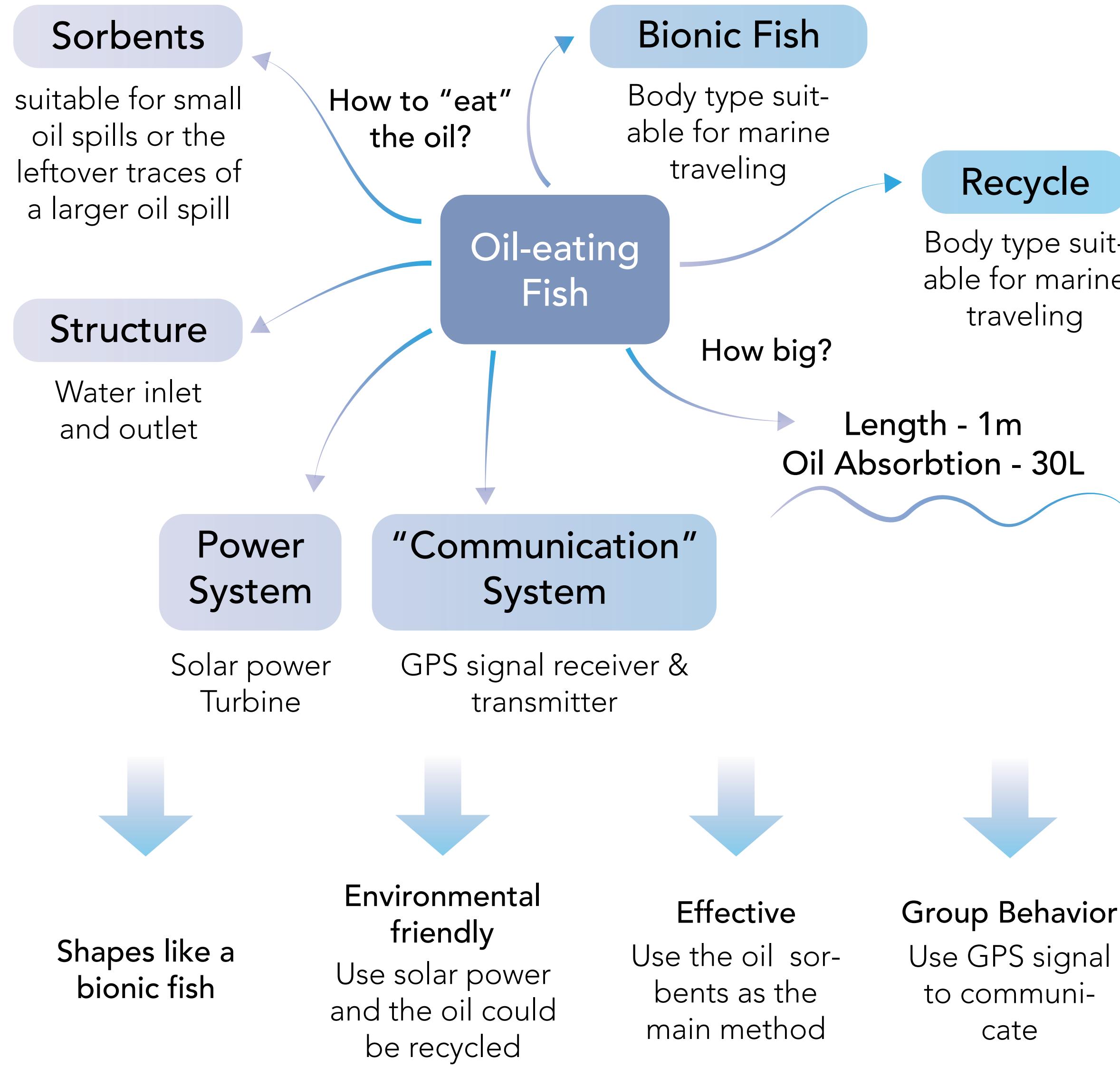
# Opportunity



An unmanned marine oil spill cleanup system based on AFSA!

Imagine that many artificial fishes in the ocean seeking for their food - oil.

# Ideation



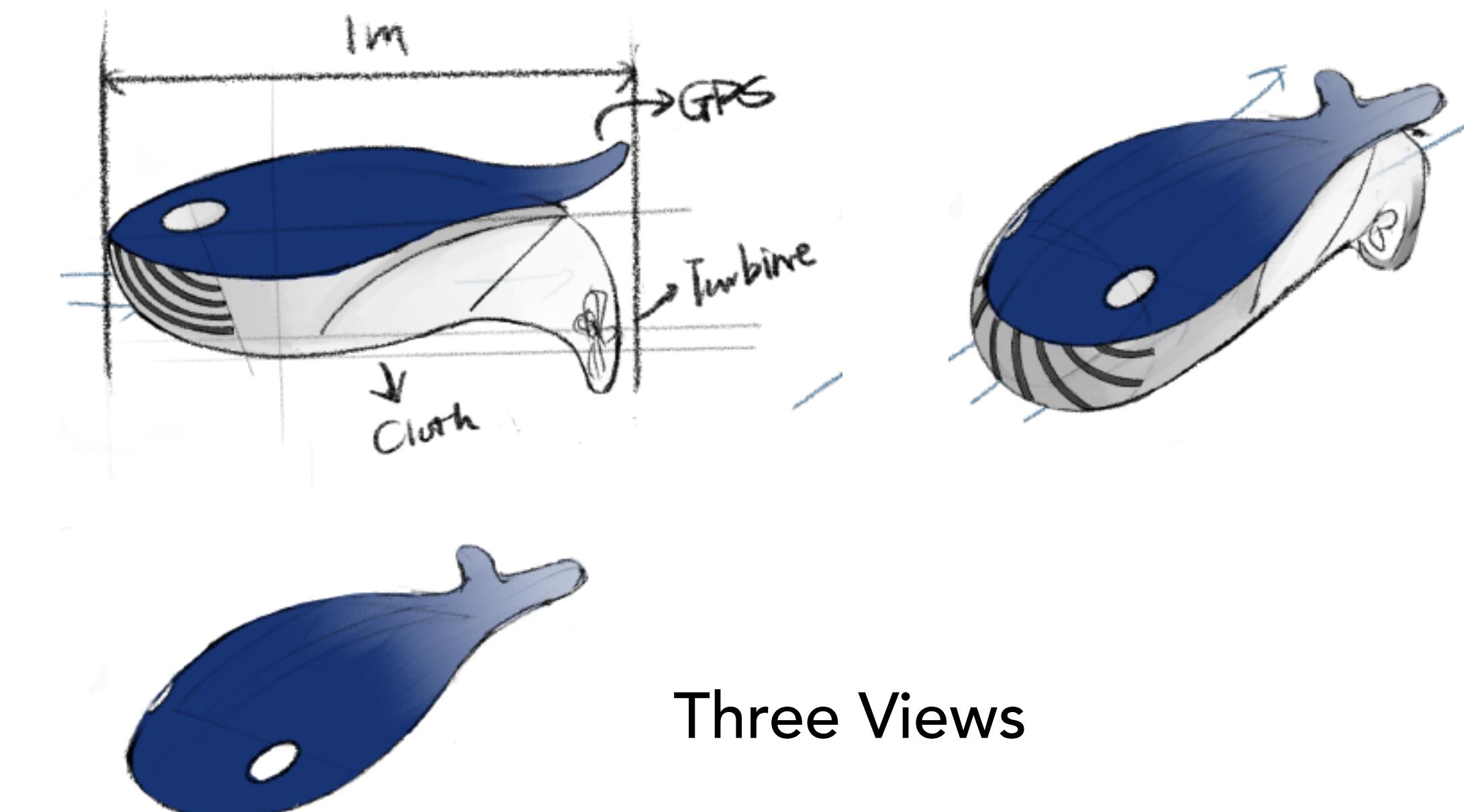
# Further Research

## Bionic Fish

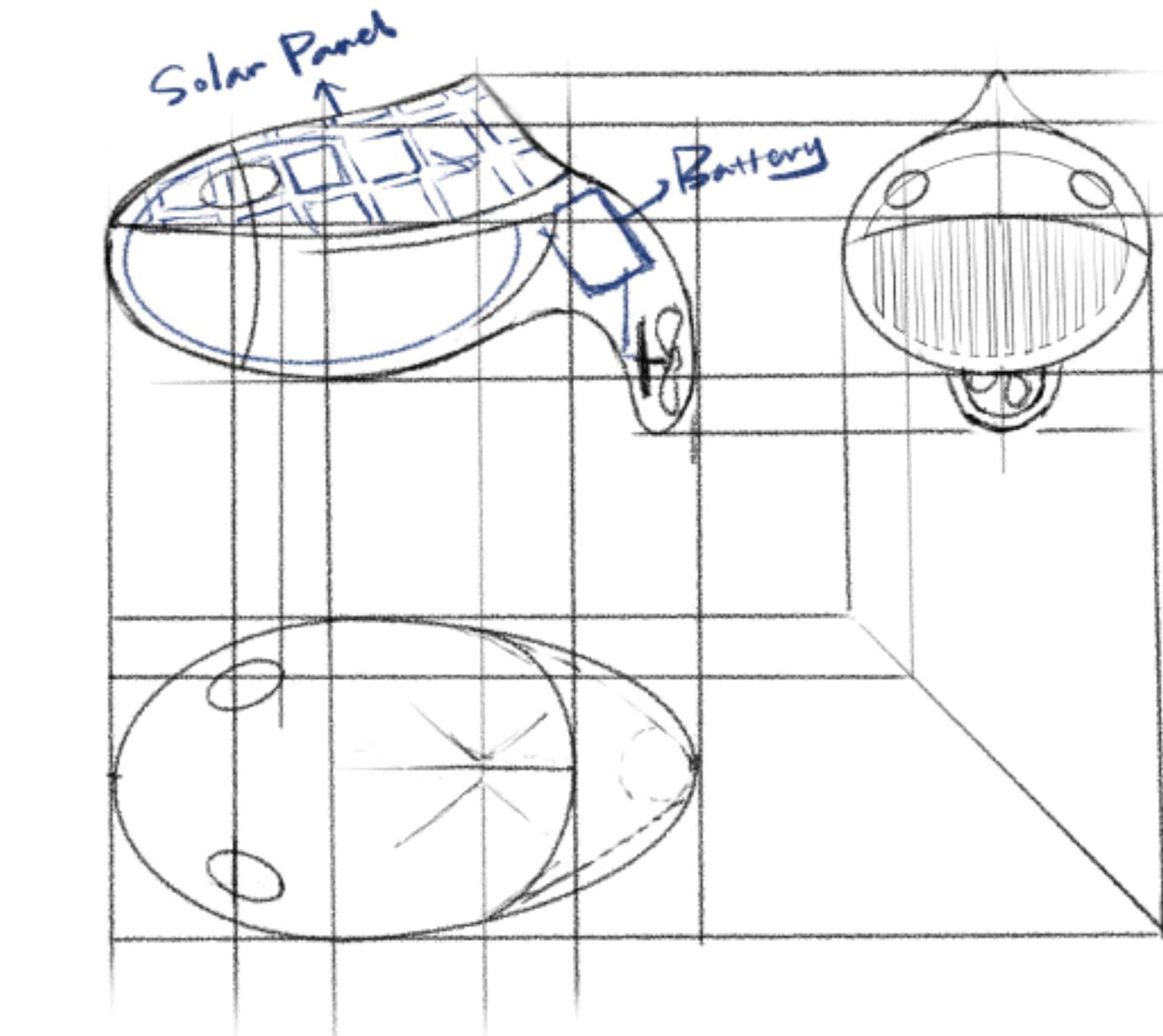
BIKI is the world's first bionic underwater drone that is also the only underwater robot featuring **automated balance**, **obstacle avoidance**, and **return to base**.



# Sketch

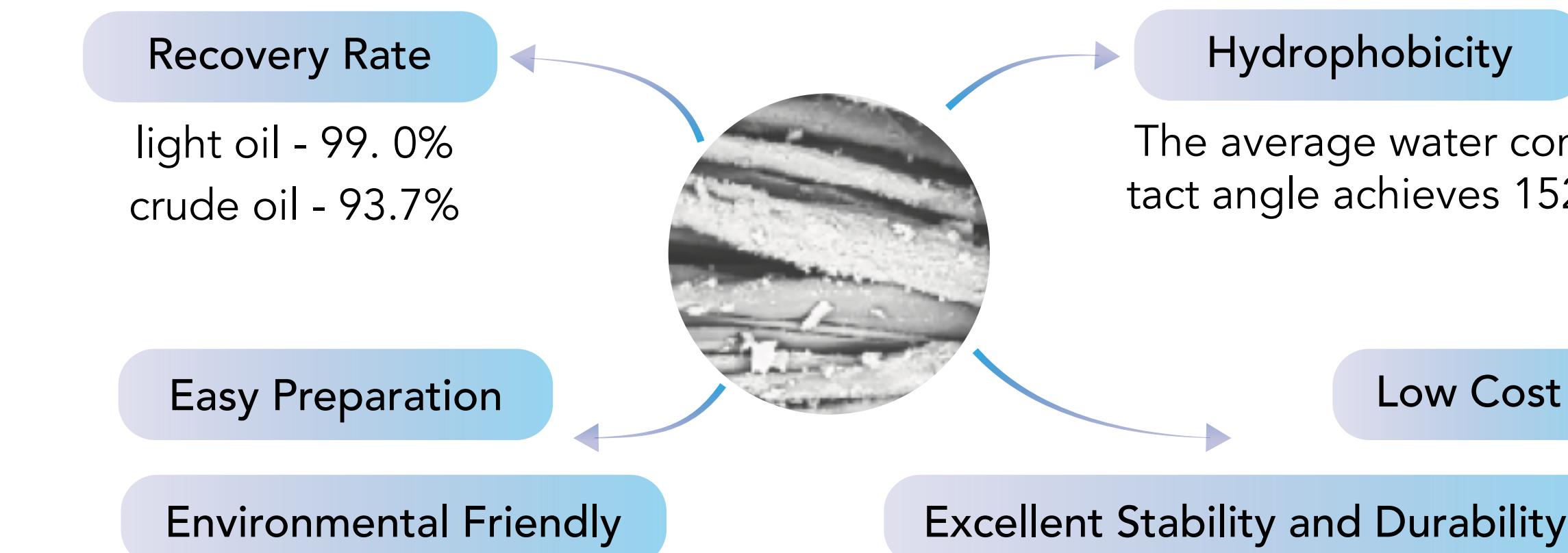


## Three Views

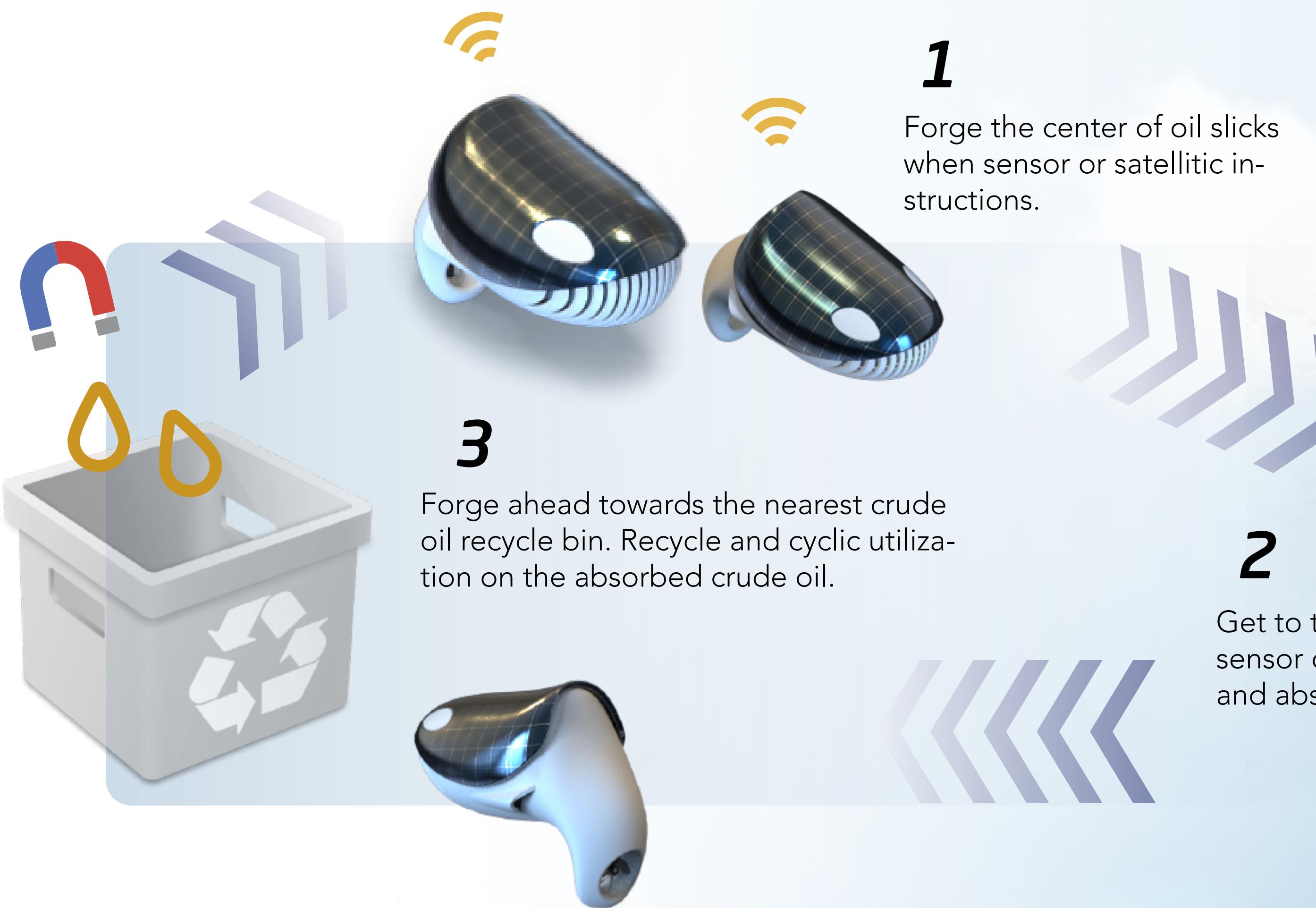


## Magnetic Super-hydrophobic Cotton Cloth

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



# Final Concept



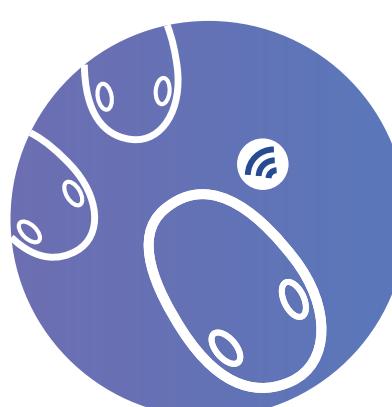
## Behaviors



**Random**  
Patrol in sea areas, locate oil spills.

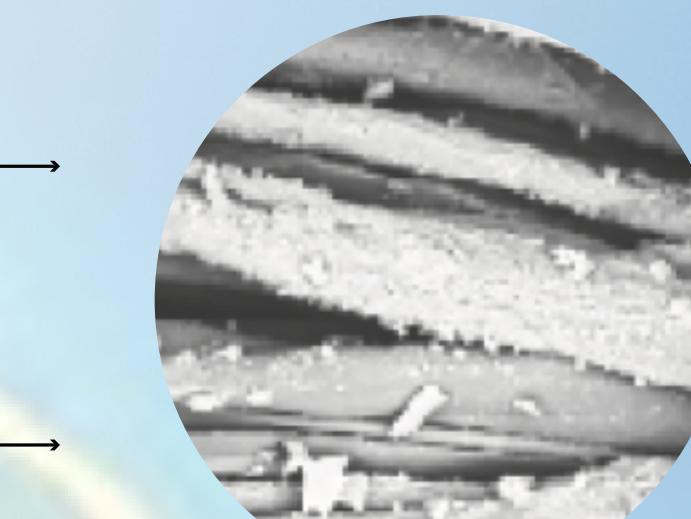
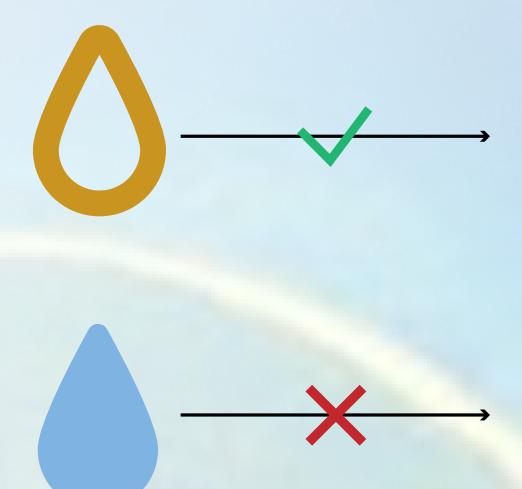


**Foraging**  
Find the oil slicks, head for its location.

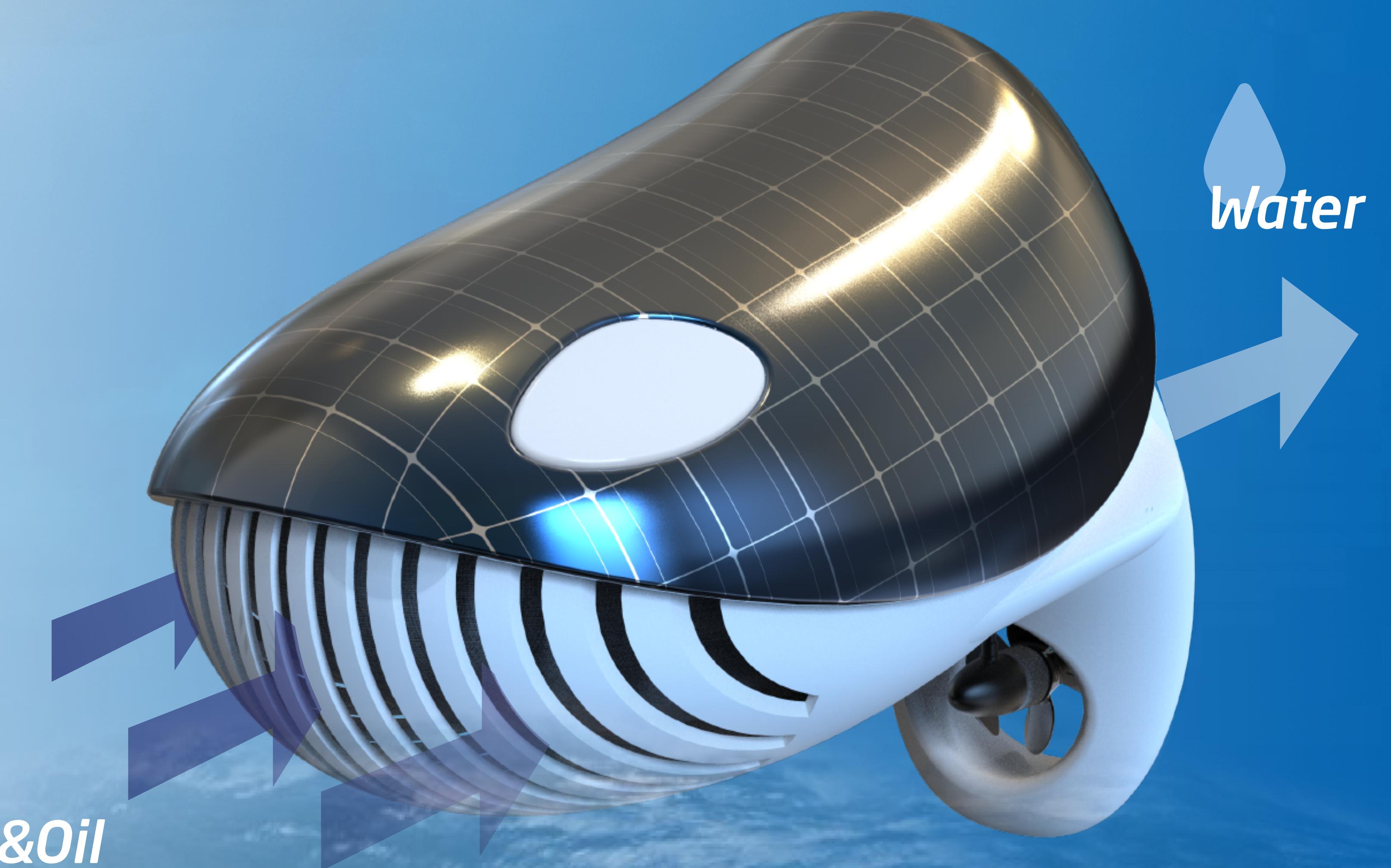


**Rear-End**  
Give off signals, summon all the partners.

## Principle



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



- 1 Magnetic super hydrophobic cotton cloth
- 2 Oil absorption material
- 3 GPS signal receiver & transmitter
- 4 Oil detector
- 5 Turbine
- 6 Control box
- 7 Battery
- 8 Solar panels