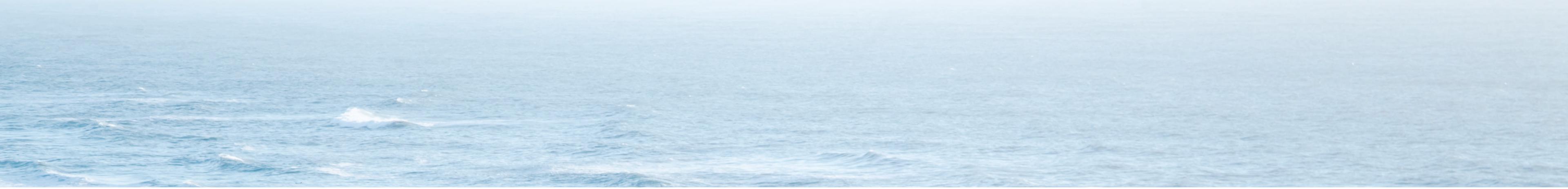




ECO-ENZ



WHAT IS ECO-ENZ?



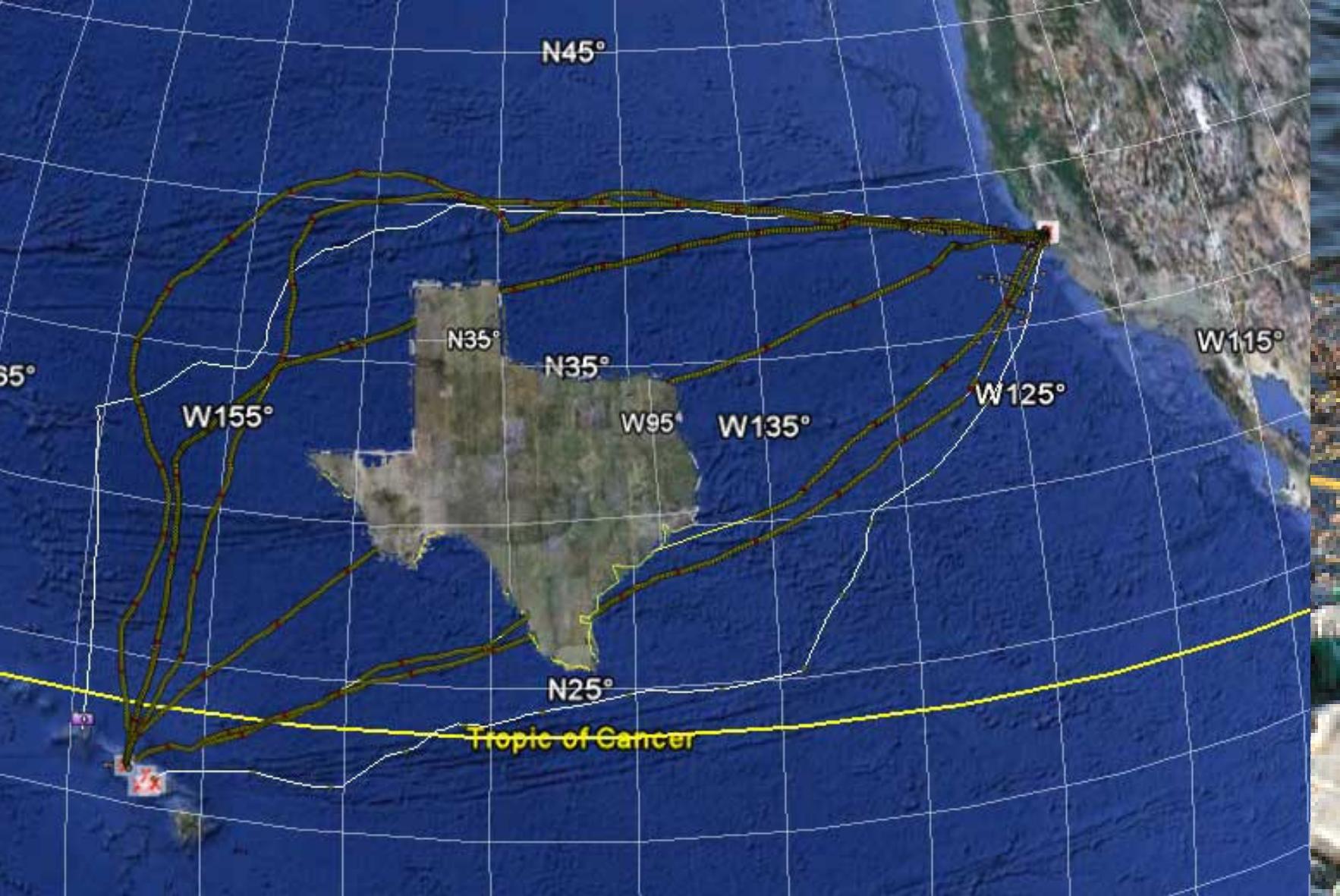
Eco-Enz is a non-profit company focused on creating a cleaner planet, beginning with the ocean, for this generation, as well as generations to come. Eco-Enz, utilizing biotechnology, genetic engineering, environmental engineering, physics, and much more, aims to understand what each organism on Earth has to offer to make this planet thrive. By understanding these efficient mechanisms, scientists within this company can create improved plants that can utilize these mechanisms, as well as their own stellar capabilities, and introduce them into various environments without affecting the wildlife.





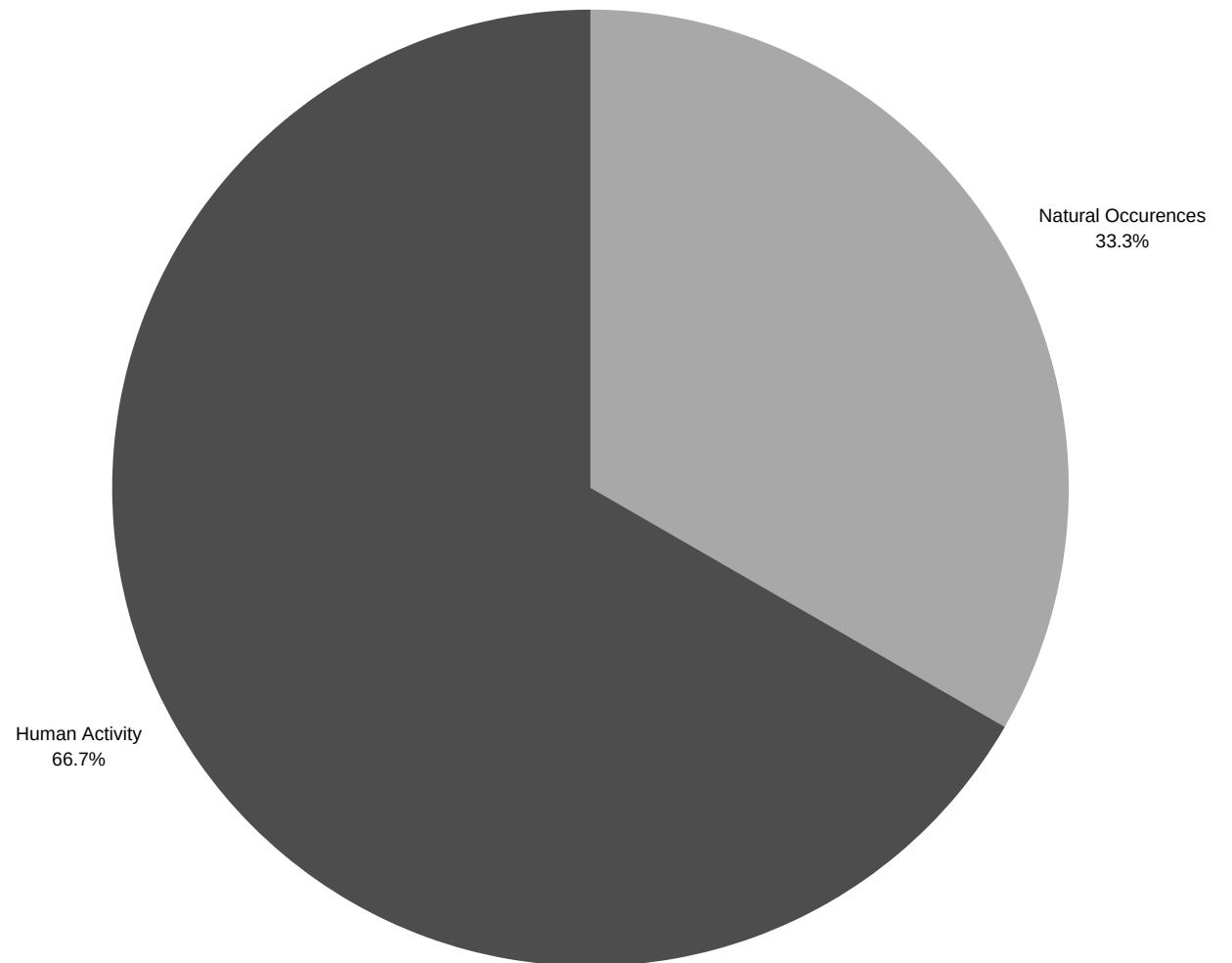
MISSION

Eco-Enz's mission is to rid the ocean of chemical pollution.



PROBLEM

Ocean pollution has been an issue for many years, but more recently, the ocean is in more danger than ever. Entire ecosystems have become "dead zones" in which no life can thrive due to the excessive amounts of waste in the area like oil, septic sludge, dirt, and trash. Toxic chemicals from these kinds of pollution can cause more long-term issues like mutation and disease in marine life and life on land. One such toxic chemical is mercury. Although, elemental mercury is not the main problem: *Methylmercury* is. "Dirty Coal" from human activities such as fossil fuel burning are the primary culprits.



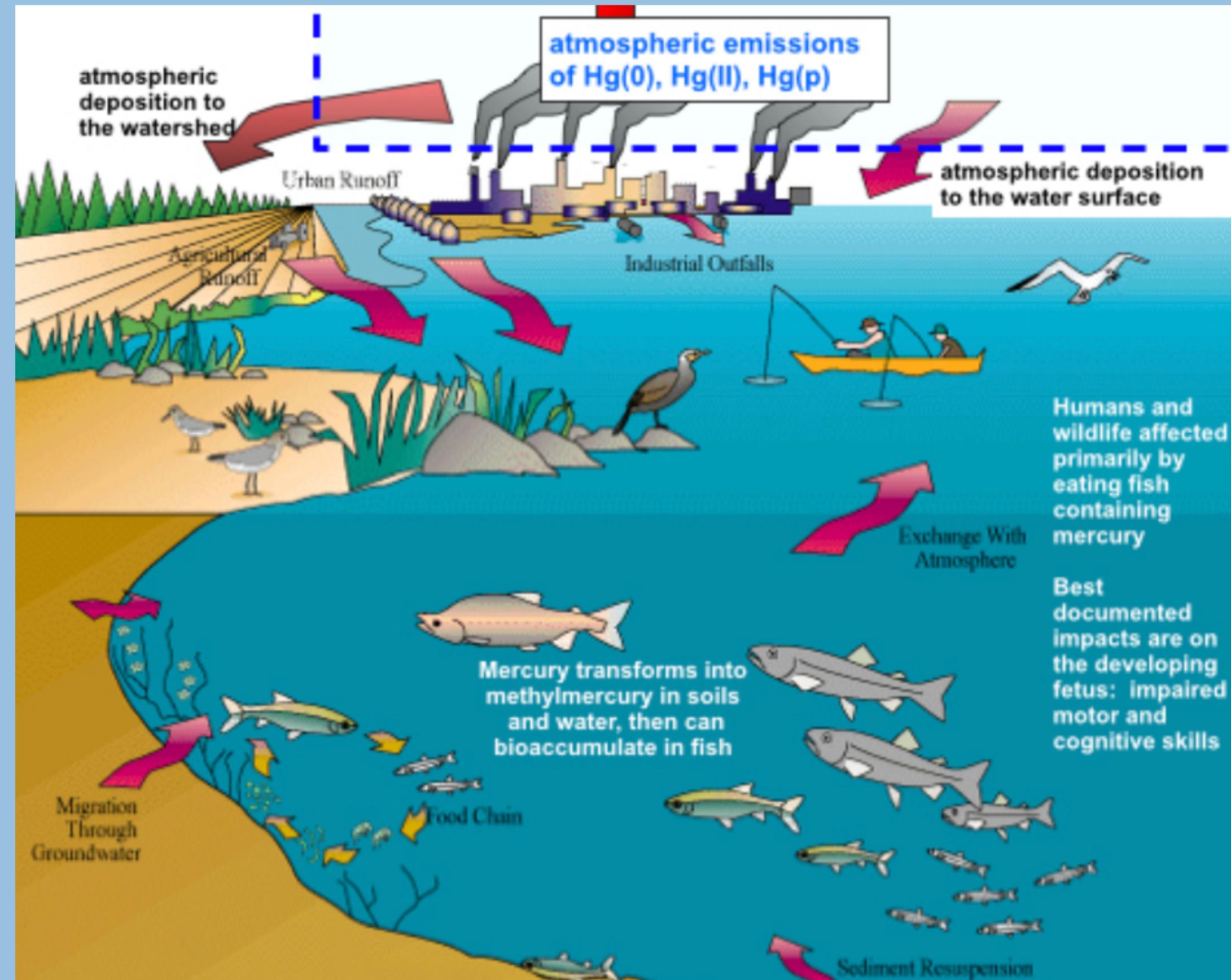
METHYLMERCURY THEORY

Chemical reactions on the sea floor/sea: Sulfide and mercury ions combine and enter cell membranes of microbial cells to be methylated.



Low oxygen zones in the ocean (100 to 1,000 feet below the surface): Feces and dead plankton sink to the bottom of the ocean and absorb oxygen. Any bacteria relying on sulfate for respiration could create methylmercury.

BIOACCUMULATION: Methylmercury is passed up the food chain through a bioaccumulation process until it reaches the highest in the food chain in which the most methylmercury has accumulated.



MERCURY'S EFFECTS

On humans:

- Affects the brain, kidneys, lungs, and skin.
- Red cheeks, fingers, and toes
- Bleeding from the mouth and ears
- Rapid heartbeat and high blood pressure
- Intense sweating
- Loss of hair, teeth, and nails; blindness and loss of hearing
- Impaired memory; lack of coordination; disturbed speech patterns
- Birth defects.

On animals:

- Affects vertebrae, neurological, and hormonal development
(Ex: Captive mallards laid less eggs with mercury in their system, lower stimulation to threat)
 - Lethargic behavior
 - Reproductive deficiencies
 - Endocrine disruptors
- * Mercury can travel much farther than the Pacific, effecting species of wildlife elsewhere.

SOLUTION

Coprinus comatus + MerB or MerA Enzyme

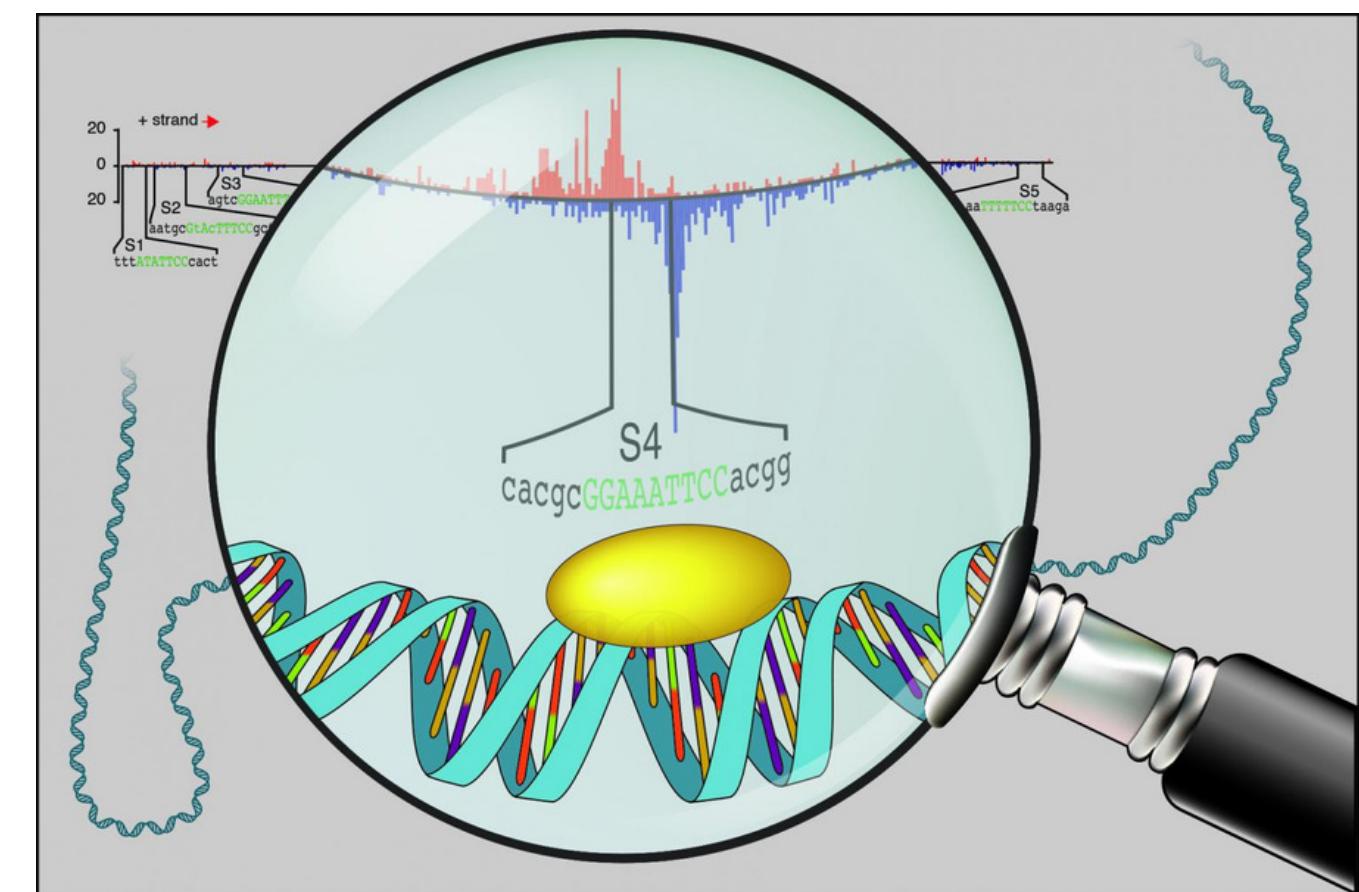
In a certain experiment published by Jerzy Falandysz, a researcher at the Laboratory of Environmental Chemistry and Ecotoxicology in Gdańsk University, the contents of mercury in the caps and stipes of the *C. comatus* from soils correlated positively with the levels of contamination of mercury in the ground. Falandysz found *C. comatus* to be an efficient bioextractor of mercury, similar to the unique capability of other macrofungi of absorbing metalloids. The fungi can also sequester the Hg levels.



SOLUTION

Coprinus comatus + MerB or MerA Enzyme

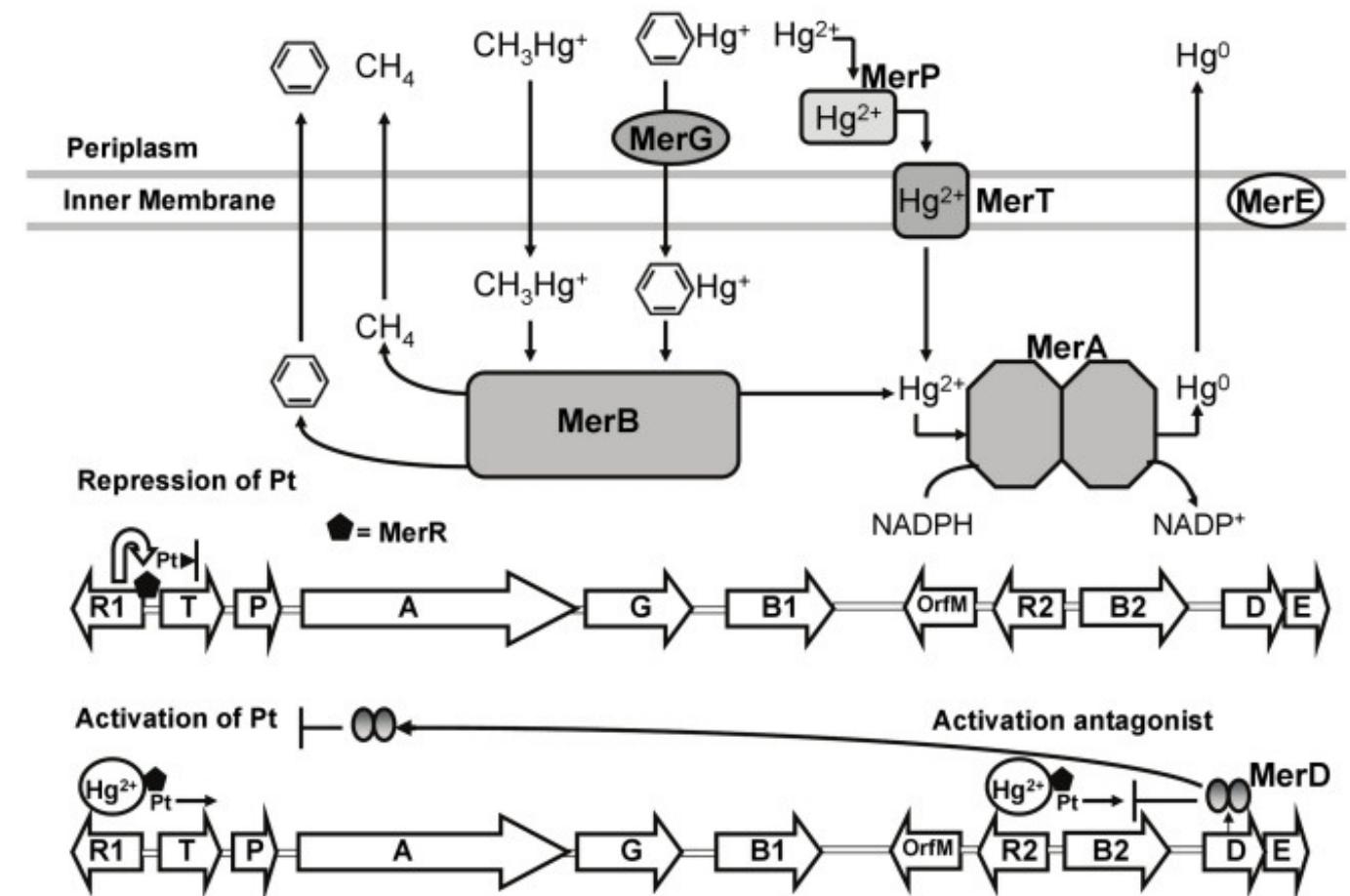
MerB is an enzyme found in bacteria resistant to HgCH_3^+ toxicity, which has three cysteine residues in its active site that are known to be imperative for dividing the Hg-C bond. Another enzyme, MerA, reduces the resulting Hg^{2+} to less toxic elemental mercury. Although, the exact way this process is done, according to researchers, is somewhat a mystery. If this mystery were to be solved, the bioremediation of methylmercury may be possible.



SOLUTION

Coprinus comatus + MerB or MerA Enzyme

By inserting either MerB or MerA (Appendix, Figure 4) into the gene sequence of the *C. comatus* through bacterial plasmids, the fungi would have the ability to both sequester mercury in the soil around it and safely remove of the toxicity of the element. This can be done through viral transduction, transformation and transfection, Agrobacterium, or injection.



UNIQUE VALUE

- Solves the root issue of mercury entering the ocean at all, rather than focusing on the aftermath of mercury entering the ocean.
- Approach also provides a way to rid of the mercury naturally once absorbed, creating a solution to the decades-long struggle of safely disposing of mercury.
- The toxicity of the mushroom would be essentially zero, preventing the organism from harming the environment around it.
- Working with bacteria is much more cost effective than working with mammalian cell structures.

TARGET MARKET

The target market of this solution to manage the ocean's pollution is the United States Government, more specifically the Environmental Protection Agency (EPA). The reason why the EPA is the primary customer segment is that Eco-Enz is not focused on making a profit. Its main goal is to gain funding in order to implement its many agricultural innovations in various environments. The government also outsources most of its ocean pollution clean-up functions to third parties like Eco-Enz.



START-UP COSTS

Dedicated Infrastructure/Utility: \$166,664

***University of Chicago Marine Biological Lab Rental**

MerA Sample: \$930.75

C. comatus sample (100 kg): \$6,992.99

Salaries for 25 Employees: \$2,114,000

TOTAL: \$2,288,587.74

The EPA grants \$4 billion every year to various organization.

TIMELINE

Minimum: 3 years

