

# The Tech for Global Good

## Save the Species Design Challenge



SHARKS



**The Tech**  
for Global Good

# Introduction

## The Tech for Global Good

The Tech for Global Good is an initiative that will create the next generation of innovators ready to tackle the toughest challenges facing our planet.

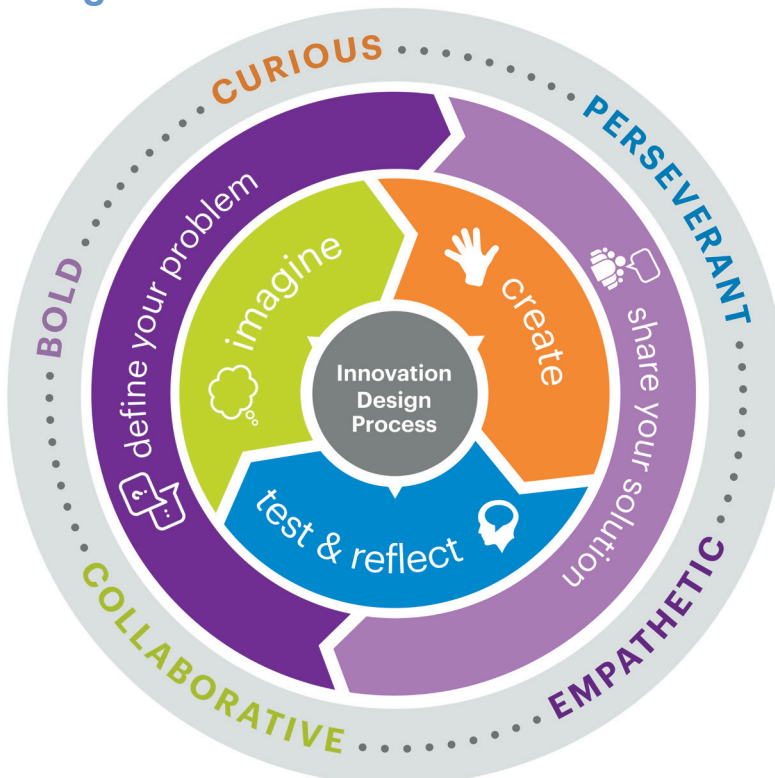
## Smart Parks

Smart Parks combines conservation with innovation and technology to protect some of the world's most threatened animal populations.

## Wild Me

Wild Me uses machine learning and artificial intelligence to track animal populations in the fight against species extinction.

# Innovation Design Process








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## Design Challenge Scenario

You and your team run an animal conservation foundation that develops innovative technology and policy plans to help save endangered and threatened animals. Four communities around the world have reached out to you for help. Your team will use your skills as communicators, researchers, collaborators and creative problem-solvers to assist one of these communities in developing plans to help create more sustainable environments for animals and humans.

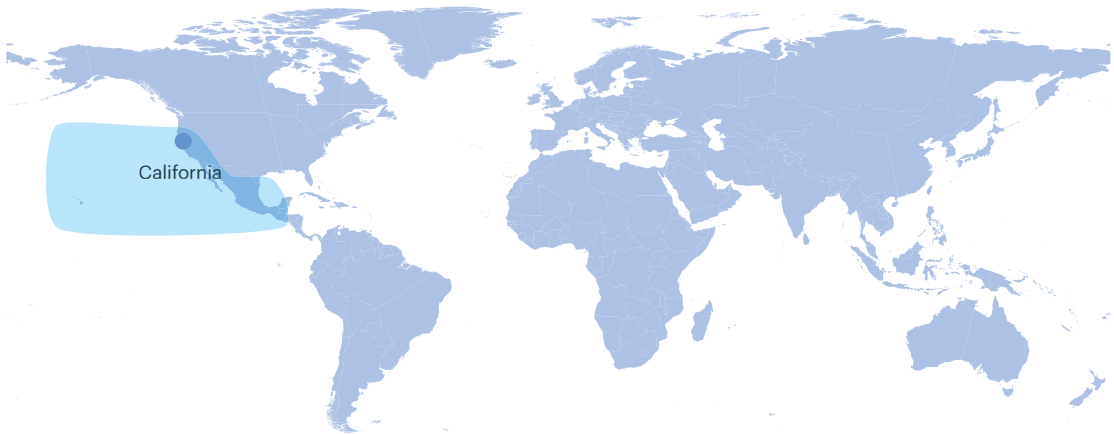
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-  **1. Research the problem:**
  - Understand the design challenge.
  - Read the background material.
-  **2. Brainstorm:**
  - Write each idea (in text, an image, or both) on a sticky note and put it on the board.
  - Be creative! Think of as many wild ideas as possible.
  - Develop questions and search out answers.
-  **3. Create a solution:**
  - Each member shares their sticky notes and posts them on the board.
  - Pick someone to group similar ideas.
  - Label the categories.
  - Work together to add more ideas.
  - Each team member ranks their favorite ideas (1-5).
  - As a team, choose a solution to focus on.
-  **4. Refine your solution:**
  - Get feedback from peers on your solution.
  - Edit your solution and improve how it addresses the problems your team is focusing on.
-  **5. Design a project and presentation:**
  - Get feedback on your solution from others.
  - Please show:
    - The specific problem your team is going to address.
    - Your team's solution for this problem.
    - A story of how someone is impacted by your work.

# Designing a Solution for the Great White Shark in the Pacific Ocean (California, U.S.)

## Problem

You and your team run an animal conservation foundation. Community members who work with great white sharks have asked your team to develop plans for helping to conserve this animal population.



**Share with your team a couple things you already know about sharks.**

Your team is working directly with the State of California to innovate in marine life conservation. As a company, your team has the ability to create policy and new technologies to help maintain and protect great white shark populations in the Farallon Islands and Monterey Bay National Marine Sanctuaries.

On the following pages, you will receive more information about the challenges of protecting sharks around the globe. Think about these different issues to help inspire your solution. It is fine to design solutions that require collaboration with other organizations and governments, or that create new technologies or innovate with existing ones.

**What will you do to create a change in California that will ripple out into the world?**

## Background Information

Oceans cover 72% of the Earth's surface, contain 97% of the planet's water, and create 50% of the oxygen in the atmosphere.

Understanding and protecting oceans is key to human survival. Part of learning about the ocean is understanding its food chains and ecosystems. Sharks are at the top of many food chains in the ocean. They help balance marine animal populations and maintain healthy ecosystems.

Currently, scientists have identified over 400 different species of sharks. Determining exact populations is nearly impossible due to the size of the ocean and our current technological capabilities. What scientists do know is that changes are occurring in the ocean ecosystems that are having an impact on sharks and on shark/human interactions, including:

- Some shark species are being affected by loss of coral reef and other habitats.
- Sharks follow where the food is, that means going to protected areas near the coast where seals or sea lions live. This increases the chance of human and shark interactions.
- Sharks live a long time and reproduce slower than other fish, which makes quick adjustments to changes in ocean climates more difficult.
- Changes in water temperature and increased acidification of the water can make finding prey and breathing harder for sharks.

- Increased fishing for both sharks and their food sources decreases the number of sharks overall.

All of these changes affect shark numbers and behaviors, however, the largest threat to sharks at the moment is overfishing. Although they may be caught unintentionally, sharks are often retained and used for food, animal feed, or other trade. Scientists believe the biggest impact on shark numbers comes from shark finning (harvesting shark fins for soup) and the curio trade (taking part or all of a shark, like the teeth, as a memento). It is hard to get a full picture of how many sharks are caught for these reasons due to the many different laws, the size of the ocean, and the extent of the illegal trade. The current estimate is that 100 million sharks are caught a year, 73 million of them for soup and the curio trade. It is impossible to know which species make up the 73 million sharks caught annually.



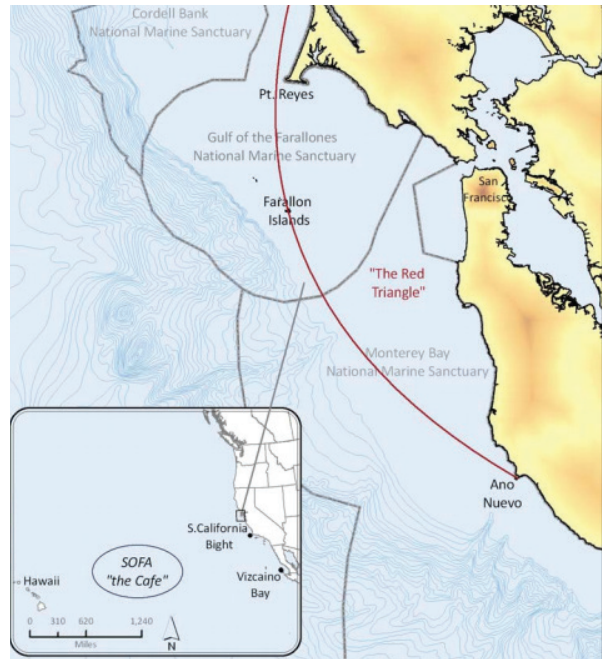
# Great White Sharks

Along the coast of California there are many species of sharks. Perhaps the most famous species is the great white shark. Some great white sharks have their pups along the coast of Southern California. In the fall (August to November), young adult and adult great white sharks stop by the Farallon Islands (30 miles away from the Golden Gate Bridge in San Francisco) to hunt elephant seals and other animals. Throughout the year, these great white sharks often migrate to the Baja Peninsula of Mexico and out to Hawaii through a region scientists have named "The Shark Cafe."

Currently, great white sharks are considered a species vulnerable to extinction. Estimates from shark tagging efforts suggest that their numbers are between 1,000 and 3,000. The science community is concerned that given the length of time it takes for sharks to grow and reproduce that great white sharks are at a higher risk of becoming extinct. Since 1994, the State of California has been working to provide more protections for these sharks. Some of the current policies include:

- No person is allowed to attract great white sharks anywhere in the Farallon Island and Monterey Bay National Marine Sanctuaries. This includes the use of food, bait, chum, dyes, decoys, etc. This does not include the presence of humans.
- No one is allowed to approach any great white shark within 50 meters or within two nautical miles of the Farallon Islands.
- No one in California is allowed to possess, sell, trade, or distribute shark fins of any kind within the state.

- Instances of accidental fishing or the collection of specimens for research will be decided case by case through the California Department of Fish and Wildlife (CDFW) as of 2013.



These are the main protections offered to sharks near the Farallon Island and Monterey Bay National Marine Sanctuaries. Not far beyond are international waters, which are not regulated or patrolled by one governing body. This means that the rules change and there is not a lot of oversight. Furthermore, there are a number of unconnected agencies that enforce these laws, including the CDFW, U.S. Customs and Border Patrol, and the Coast Guard. To see how other coastal places create policies regarding sharks and human-shark interactions, research Western Australia, the State of Florida, Hong Kong, and Taiwan.

# Perspectives on the Issue



## Restaurateur

*I own a popular restaurant in Hong Kong where people come from all over the world to have*

*lavish dinners and parties. One of the dishes we traditionally serve is shark fin soup, which takes two days to make because shark fin takes a lot of work to prepare. However, it is becoming clear that some sharks are overfished and I have no way of knowing if my fins come from a threatened species. Also, shark fin doesn't have nutritional value and is high in mercury content, making it unhealthy. What do I do? If I stop serving it many of my long standing customers will go to other restaurants. If I continue to serve it I will lose the younger customers that see shark fin soup as a danger to the environment.*

## Technology

- Substitution of glass noodles to make “fake” shark fin soup.
- DNA testing of shark tissue to identify species.

## Organizations

- **HKSharkFoundation.org:** Hong Kong-based advocacy group that provides resources and organizes action to protect sharks.

## Opinions

- Read TripAdvisor reviews of the best restaurants to get shark fin soup.
- See Change.org petition to ask Food Network to stop any cooking shows from using shark.

Twitter: [#sharkfintrade](#) [#sharkfinsoup](#)

## International Approaches

- The “Real Cost of Shark Fin Soup” initiative in China encourages people to change the practice of serving shark fin soup at weddings.
- CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) countries require permits for fishing of great white sharks.



## Shark Biologist

*I conduct research to help find out more about sharks. It is hard to fully understand*

*many kinds of sharks because of the depths and distances they travel throughout the year. Using radio and GPS trackers, we have recently started learning much more about how great white and other sharks travel the oceans. It is an exciting time, with many discoveries on the horizon like the breeding and social behaviors of large sharks. However, it seems like sharks are disappearing and we are having a hard time finding new sharks to study. Some of my colleagues have even snuck into seafood auction houses to get counts of shark products being sold. We are on the verge of knowing more about these essential predators at the same time they are disappearing from the ocean. How can we protect sharks before there aren't enough to study?*

## Technology

- Drones with AI technology to spot sharks.
- Submarines and submersibles that can collect data where humans cannot travel.
- GPS and radio trackers to collect data on shark travel patterns through the ocean.

## Organizations

- **MarineBio Conservation Society:** Source for data on marine species, conservation, and research.
- **Hawai'i Institute of Marine Biology:** Source for research in marine biology, including sharks.
- **Atlantic White Shark Conservancy Research:** Education and public safety around white sharks in the Atlantic Ocean.

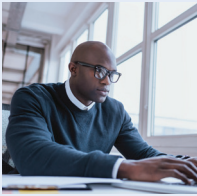
## Opinions

- **Global Shark Tracker App:** Application that connects with sharks tagged and tracked by a nonprofit.
- **Expedition Great White App:** Marine Conservation Science Institute shares adult great white shark tracking data in real time.

Twitter: [#sharkbiologist](#) [#marinebiology](#) [#sharklab](#)

## International Approaches

- **Wildbook for Whale Sharks:** Scientists use an artificial intelligence program developed by Wild Me to analyze photographs of whale sharks' spot patterns. This project has led to many new discoveries.
- **Shark Research Institute** Conducts research and conservation and has offices all over the world.



## Shark Research Committee Member

*In order to protect shark species, I joined the Shark*

*Research Committee. We strive to study human and shark interactions to get better data on what causes these interactions and how to prevent “attacks” that make people afraid of sharks. If we can get a better understanding of shark behaviors, maybe we can create products and methods to keep all humans and sharks safe in the water together. That would reduce people’s fear, and reduce their desire to kill sharks in order to protect these amazing fish. What can we do today to make all interactions safe for humans and sharks?*

## Technology

- **Sharkbanz**, electromagnetic ankle bracelet to deter a shark. It only works on certain sharks at very close range.
- Studying shark eyesight, changing surfboards to dark blue or black colors to look like water to sharks.
- **SharkStopper**, acoustic repellent that makes the sounds of an orca, a shark predator.
- Wetsuits in black and white stripes to look like sea snakes.
- Drones used by lifeguards and coast guards to help patrol areas where there are surfers or swimmers.
- **Clever Buoy**, a device that monitors the water using radar to detect shark-like movement patterns and send alerts.

## Organizations

- **Tracking Sharks**: Produces a map about shark attack bites that can be reviewed by year.
- **Surfrider Foundation**: Mission to protect the world’s oceans, waves, and beaches.

## Opinions

- **Dorsal app**: Crowdsourced information on shark sightings.
- There are many surfer opinion pieces written about sharks with a wide range of perspectives and proposed solutions. Search online for “surfer opinions about sharks” to read a few.

Twitter: [#sharks](#) [#surfers](#) [#surfers4sharks](#) [#savesharks](#)

## International Approaches

- **Cull Sharks**: Sometimes after a surfer is attacked by a shark, people go out and kill sharks in the area.
- **Drumlines**: Nets around swimming and surfing areas to keep sharks out. The netting can kill sharks, turtles, and dolphins.
- **Global Wave Conference**: Surfers, conservationists, and innovators work together to come up with new ideas to protect marine life.



## U.S. Fish and Wildlife Officer

*I am one of about 500 officers in the United States*

*that works on investigating and stopping illegal animal smuggling. The illegal exotic animal trade is a multi-billion dollar industry and the second largest illegal trade after illegal drugs and weapons. Our research suggests that about 30% of these sales take place in the U.S. We have less than 500 officers, work with airports and border crossings, and conduct undercover operations. About 25% of our department can be pulled at anytime to work as federal agents to protect dams and waterways from potential threats. When we do catch smugglers, the punishments are minimal compared to drug or gun offenses. How can we rein in this trade that damages to ecosystems and wildlife populations?*

## Technology

- **Internet Sales Sites**: People sell products online and then ship the animal or animal product with the contents labelled as something else. When sites find this type of trade they typically block the merchants from their site.
- Machine learning to use automated programs to look for animal trade online.
- **“Electric nose”** device created by the University of Technology Sydney Center for Forensic Science in Sydney can pick up the scent of different animals.
- New England Aquarium is creating **Smart Invoice** technology that routes invoices and shipping info through a computer to spot improper materials going through the mail.

## Organizations

- **United Parcel Service of the United States** will not ship any shark fins as of 2015.
- **American Airlines** will not transport shark fins as of 2015.

## Opinions

- Opinions on legal and illegal exotic pet trades are diverse. On one hand, individual owners might provide great care and really value the animal. On the other hand, taking animals from their habitat damages our ecosystems and creates incentive to commit crimes.

Twitter: [#exoticanimaltrade](#)

## International Approaches

- **TRAFFIC**: The wildlife trade monitoring network, is the leading non-governmental organization working globally on trade in wild animals and plants.
- **World Wildlife Fund**: In over 100 countries and with over 5 million members, this organization works to provide information and support in wildlife conservation.
- **Environmental Investigation Agency**: Conducts undercover investigations into transnational wildlife crime.





## From Your Reading

**Below are some questions to help you process what you read.**

- What are some problems that affect shark populations?

- What questions do you have based on your reading?



## Brainstorm Notes

### **Problem**

- Why is this a problem?
- What region(s) are we going to focus on?
- What other problems does it remind you of?
- Often larger problems need to be broken down into smaller pieces. What part(s) of this problem does your team want to address?



## Solution

- How could you combine these ideas to create a new solution?
- What ideas do you have that are nothing like what you have researched? (Wild ideas are welcome!)
- Who will help your team solve this problem? Which organizations, governments, etc.?
- How do these ideas help solve the problem?
- What is needed to implement or enforce your solution?

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## Impact

Pick one of the following identities:

- Tour boat operator
- Scuba diver
- High school student

Adopting one of the above identities, think about how they will be impacted by your team's solution to this problem.

- How will this person's life change because of your solution?
- What would they think or say about your solution?
- How would this change impact someone with a similar identity that lives 2,000 miles away?



## Listen and Help

	Team Presenting	Audience
3 min	<b>Present their design solution.</b>	Silently listen. Take notes.
3 min	<b>Respond to clarifying questions.</b>	<b>Ask clarifying questions.</b>
2 min	Silently listen. Take notes.	<b>Provide feedback.</b>

## Listen and Help Notes

Feedback <i>from</i> the other team	Notes <i>for</i> the other team

## Design a Project and Presentation!

Your conservation team will need to create a presentation to share your plan with the community, including:

- The problem your team has identified and addressed.
- Your team's solution for this problem.
- A story of how your solution will impact one person in the community (ex., tour boat operator, scuba diver or high school student).

Remember your project can include any tools that are useful. Like a ...



**Business plan**



**Advertising campaign**



**Demo of potential device**



**Slideshow**



**Infographic**

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## Notes

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