

# Into the Deep: Exploration of Whale Fall

Alexa Simos | Draft Project Summary | 23 April 2017

As top predators of another realm, whales have been fascinating and inducing awe in hunters, scientists, and cultural producers for centuries. These huge, majestic mammals that roam the waters of the world invoke both fear and fascination in humans. They have inspired cultural production of all kinds including novels, most notably Herman Melville's *Moby Dick*, films, artwork, and even prose. Our interaction with the species of giants hasn't always been smooth sailing; they have been hunted incessantly for the raw materials they offer, some families of whale nearly being pushed to extinction as a result of the lucrative whaling societies that arose on the east coast and around the world [01]. This comes at a great cost to the stability of our climate. Whales play an enormous role in the ecosystems they inhabit both during life and after death. Unfortunately a great number of whale species are still highly threatened by human interference and are very limited in numbers. The product package I have designed will raise awareness about the beauty of whales and the importance of preserving them if only for the purpose of recognizing their vitality to the health of our oceans and, ostensibly, our planet.

People have studied whales for thousands of years. These huge mammals have specific feeding areas that they return to in several consecutive years, and many travel to different feeding areas in the same season, sometimes covering over 300 miles per season. Various species feed on fish, shrimp, larvae, plankton, crab, krill, sea lions, seals, sea birds and large squid. Their diet is enormous and keeps the population size of their prey in check. Whales belong to two major groups: Odontoceti, or toothed whales, and Mysticeti, or baleen whales [02]. Toothed whales have a single blowhole and teeth, which they use to catch prey. Baleen whales, on the other hand, have keratin plates instead of teeth that allow water to pass through a feeding whale's partially closed mouth while fish and plankton get trapped inside the baleen. There are ten species total of baleen whales and seventy-two of the toothed whales.

Whales, like all large predators, play a crucial role in the fragile ecological balance of their environment. The ecological wheel is complex and interlinked, so if one part is removed or altered, other cogs could slow down or even stop functioning [01]. Whales can live as long as 30 to 110 years, depending on the species. Upon their death, their carcass floats to the bottom of the ocean and begins supporting an entirely different ecosystem. The value of whale carcasses to life in the ocean was for the most part unexplored until 1987, when a thriving whale carcass happened to be discovered off the coast of Southern California [03]. The first hint that a dead whale could host specialized animal communities, however, came as early as 1854 when a zoologist found a new species of mussel floating in whale blubber off the coast of South Africa. Crispin Little, author of *The Prolific Afterlife of Whales*, describes studies in which scientists set up studies to understand the workings and duration of whale-fall communities, which go through a few different stages upon arriving at the sea floor. The initial feast can last up to two years. The second stage lasts up to two years as well, where animals feed

directly on large amounts of blubber. Commonly referred to as the “Sulfoliphic” stage, the third and longest stage is where bacteria anaerobically break down lipids contained in the bones [03]. This is highly significant because the skeletons act as ‘stepping stones’ for deep-sea animals to spread from one chemosynthetic community to another. Deep-sea chemosynthetic sediments provide habitats that offer evolutionary opportunities and energy-rich environments to deep-sea fauna. Without this energy source for the organisms, methane and hydrogen sulfide would not be turned into usable energy, which would essentially kill off most deep-sea organisms as in these regions of the ocean, at such great depths, there is no energy provided by the sun.

A study conducted in Japan over the course of three years from 2003-2005 by scientists Yoshihiro Fujiwara, Masara Kawato, and other team members is indicative of how important whale-fall communities are [06]. The study was made possible by a mass stranding of sperm whales in January 2002. The group of scientists took five of these whales and implanted them at depths of 219-254 meters with weights into the ocean off the south of Japan and monitored the chemosynthesis-based communities that grew from them. It was discovered that they have unique features at greater depths, where less sunlight was available. Not only did they discover new species appearing around the whales, but also the rate of epifaunal succession was more rapid at greater depths and the sulpholiphic stage much shorter.

Humans have reduced the abundance of large marine vertebrates, including whales, to only a small percentage of their pre-exploitation levels [04]. Carbon is stored in whales, and then exported to the sea floor when their carcasses sink after their lives are over. Scientists estimate that rebuilding whale populations would remove  $1.6 \times 10^5$  tons of carbon each year through sinking whale carcasses. Fishing and whaling have negatively altered the ocean’s ability to sequester carbon. Although these changes are small relative to total ocean carbon, rebuilding these populations would be a highly effective carbon management initiative. This would improve the health of our oceans, ecosystems, and our quickly changing planet in general, underlining the importance of raising awareness and becoming even more proactive about protecting whales of all species.

Many nations recognize the need to safeguard the world’s delicate ecological structures, but awareness needs to be raised in the general population of countries so that they can stand together and become proactive. For this reason I created a product that is meant to entice the consumer, educate the new generation, and then start a conversation in the home and workplace. Here’s how it would work: A mom or dad would see the whale-shaped flowerpot being sold in a store like Home Goods or Target. They wouldn’t really know the concept behind it but would be convinced to buy it because of its sophistication and beauty. The surface is ceramic-like, with a high-gloss finish over a marbled texture that references the specific rock under the ocean floor. The marble drips in many layers, referencing the different stages of decomposition when a whale falls to the ocean floor. The hole for the plant is where the blow-hole would be, so the flower or grass will emerge from that point to symbolize the whale during life. The whole vase rests on only 3 points – the two fins and the belly, giving the impression of a dive position. The plants that will grow from the vase out of the whale



allude to the life the carcass of the whale creates at the bottom of the ocean floor. The tag is made out of recycled wood and the logo is drawn into it with fire (carbon), which is relevant because the creatures that feed on the whale turn carbon into oxygen.

On the tag is a direction to go to a webpage. On the website is an educational video that serves as a tool to educate the consumer and his or her children at the same time. The style of the animation is child-like and fun, but even though it is colorful it is modern and cohesive with the general aesthetic of the sophisticated vase and branding at the same time. It educates the consumers about how whales lower the carbon in the oceans, and how we have indirectly raised the carbon levels of the waters with our negative impact on the fish and whale populations. It starts out giving some background on whales and an introduction to whale fall with everything highly simplified for a young child to understand. The music goes from being fun to being dramatic when the topic of whaling and the death of hundreds of whales is introduced. The transitions are mostly all the same, the slide-up of the web page, but when the whaling slide is on the red background seeps onto the page like blood, giving an ominous feeling to the viewer. The purpose is to convince people to get involved in the issue and to at least know enough to raise awareness about it. There is also an additional page for them to donate, and to purchase other products that are about animals that have been endangered by the results of human action. In getting the younger generation involved, the message of how much humans impact the environment (oftentimes negatively) is enforced, and the young person can be thinking about it and hopefully encouraged to become involved at an older age. Parents can be convinced to continue purchasing products from the Wild Wonders<sup>®</sup> company, the majority of whose profits benefit the featured animal.

Whales are integral in supporting the life of their ecosystems, both during their lives and after death. This product creates a metaphor to give people a way to directly interact with this process by physically planting a flower or plant in the elegant body of a whale and then sharing the concept with their kids. My hope is that it would induce thought about the animal and the importance of its survival and longevity on our planet. Finally, to have a constant reminder in the home or workplace would make it that much more likely that someone who sees it would inquire about it, be educated by the homeowner or coworker, and then be inspired to take action to support the cause.

# Source List

## 01

Cohat, Yves; Collet, Anne. 2001. *Whales: Giants of the Seas and Oceans*, English Translation. New York, NY. Harry N. Abrams, Inc.

Humans have always been fascinated by whales. They have inspired cultural production of all sorts including films, myths, novels, songs, and artwork. They have been hunted for centuries though, the hunt becoming an enormous massacre in the 1900's. Many whale species face extinction because of the horrible human interaction. At the time of publication, scientific expeditions also sail the oceans to study and protect the whale species. They are observed by marine biologists and conservationists and learn about the ecology of their ocean habitats and their impact on them is also described. They play a crucial role in the ecological balance of their environment. It is fragile and complex and all its elements are interdependent. According to IWC the populations of certain species have been reduced to 5-10% of their original numbers. Since 1967, when a ban on hunting blue whales was imposed, the number of these creatures have actually fallen due to pollution, maritime traffic, reduction in food sources and poor rate of reproduction.

## 02

Dietz, Tim. 1987. Page 15-39 in *Whales & Man: Adventures with the Giants of the Deep*, First Edition. Dublin, NH. Yankee Books.

All whales belong to two major groups: Odontoceti, or toothed whales, and Mysticeti, or baleen whales. Toothed whales have a single nostril, or blow hole, and teeth which they use to catch prey. There are 10 species of baleen whales, known as filter feeders, because they use their mouths to filter small fish, krill and plankton from the water. They have keratin plates instead of teeth which allows water to pass through the feeding whale's partially closed mouth while fish and plankton get trapped inside the baleen. People have studied whales for thousands of years. Whales have specific feeding areas that they return to in several consecutive years, and many travel to different feeding areas in the same season sometimes swimming 300+ miles to do so. There are also parts of the ocean where whales will come right up to boats.

Dietz, Tim. 1987. The Tulip Project, Page 42-51 in *Whales & Man: Adventures with the Giants of the Deep*, First Edition. Dublin, NH. Yankee Books.

The Tulip Project, done in 1981, was launched to set the sperm whale's reputation straight. It had been destroyed by Herman Melville's *Moby Dick*, which gave the whale a reputation of ferocity and violence. It was organized by cytologist Hal Whitehead, and it was one of the first studies conducted in the Indian Ocean after its establishment as an international whale sanctuary in 1979, which was created to protect the many species of whales that inhabited those waters. When attacked, sperm whales are capable of total destruction, often times sinking entire ships. Is the whale's violent behavior a result of whale man's attacks? Eventually the Tulip Project not only dispelled myths about the demeanor of sperm whales but also shed light on their social structure. Sperm whales consume about 800 pounds of fish and squid each day, captured at depths of well over 1500 feet. Also describes Ambergris, which is a raw material found in whales that humans have used. Now it is still a highly prized substance but there has been a ban on sperm whale hunting so the real thing is actually even more rare.

## 03

Little, Crispin. February 2010. Page 40-44. Life at the Bottom: The Prolific Afterlife of Whales. *Scientific American*.

Whale carcasses on the deep sea floor support whole ecosystems, providing life and light to a region of the deep sea that does not receive any energy from the sun. The value of whale carcasses to life in the ocean was for the most part unexplored until 1987 when a thriving whale carcass was discovered off the coast of Southern California, but the first hint that dead whales could host specialized animal communities came as early as 1854, when a zoologist found a new species of mussel in floating whale blubber off the coast of South Africa. Whale skeletons act as 'stepping stones' for deep-sea animals to spread from one chemosynthetic (organisms that turn inorganic compounds like methane or hydrogen sulfide into energy as opposed to sunlight) community to another. Describes studies Smith and his colleagues set up to understand the workings and duration of whale-fall communities, which go through partially overlapping ecological stages that begin when the whale carcass arrives on the seafloor. The initial feast can last up to two years. The second stage lasts up to two years as well, where animals feed directly on large amounts of blubber. The third phase, the longest phase, is the sulfophilic stage where bacteria anaerobically break down lipids contained in the bones. We still know very little about these communities and more finds will need to be done to truly understand them.

## 04

Pershing, Andrew; Christensen, Line; Record, Nicholas; Sherwood, Graham, Stetson, Peter. August 26, 2010. The Impact of Whaling on the Ocean Carbon Cycle: Why Bigger was Better. *PLOS One*. 5:e12444.

Humans have reduced the abundance of large marine vertebrates including whales to only a small percentage of their pre-exploitation levels. The scientists consider the consequences of removing these animals on the ocean's ability to store carbon. The analysis focuses on populations of baleen whales. They consider the impact of whaling on the amount of carbon stored in living whales and on the amount of carbon exported to the deep sea by sinking whale carcasses. They estimate that rebuilding whale populations would remove  $1.6 \times 10^5$  tons of carbon each year through sinking whale carcasses. Fishing and whaling have altered the ocean's ability to store and sequester carbon. Although these changes are small relative to the total ocean carbon, rebuilding these populations would be a highly effective carbon management initiative.

## 05

Bernardino, Angelo; Levin, Lisa; Levin, Lisa; Thurber, Andrew; Smith, Craig. April 2012. Comparative Composition, Diversity and Trophic Ecology of Sediment Macro fauna at Vents, Seeps and Organic Falls. *PLOS One*. 4:33515.

Biochemical differences across ecosystems and within habitats result in wide differences in food sources and the prevalence of chemosynthetic nutrition. This has huge implications for the conservation of reducing ecosystems, which face enormous threats from human activities. Deep-sea chemosynthetic

sediments provide habitats that offer evolutionary opportunities and energy rich environments that have excluded the background deep sea fauna. Broad scale analysis shows that macro faunal assemblages in the sediments show a low degree of similarity at the species level across systems, so they are more susceptible to human extractive and disposal activities.

## 06

Fujiwara, Yoshihiro; Kawato, Masara; Yamamoto, Tomoko. 2007. Three-Year Investigations into Sperm Whale-Fall Ecosystems in Japan. Blackwell Publishing Ltd. 219-232.

In this study, Sperm whale-fall communities were investigated for three years using a remotely operated underwater vehicle. They implanted sperm-whale carcasses into the ocean off of the south of Japan from July 2003-August 2005. This was made possible by a mass stranding of sperm whales in January 2002. Five sperm whale carcasses sustained chemosynthesis based communities at depths of 219-254 m, and had features unique of communities at a greater depth. The rate of epifaunal succession was more rapid and the sulphophilic stage is much shorter. No vent/seep specialists were present and many new species appeared.

## 07

EVNautilus. 2016. Observing a Natural Whale Fall | Nautilus Live (Video). August 2. <https://www.youtube.com/watch?v=x32PLnBsZsw>

EV Nautilus explores the ocean and studies biology, geology, and more. This is a video showing a natural whale fall, which is very uncommon because most of the whale falls that have been studied have been planted intentionally. They are areas of great biodiversity and change over time, depending on how much content there is left of the whale. There are whales growing out of the bones, and they know this is a natural one because there are no large anchor changes. The worms burrow into the bones and digest the lipids. On the surface are females and the males are parasitic, living off of the female. There could be hundreds of males within a single female. However because the female benefits from the male interaction, it would be a mutualistic relationship. It is a baleen whale. The carcass is relatively small, and is seen by a underwater vehicular camera. There is very high visibility. There tend to be more fat storage at the base of the skull and jawbone, so there is the most growth there.

# Wild Wonders

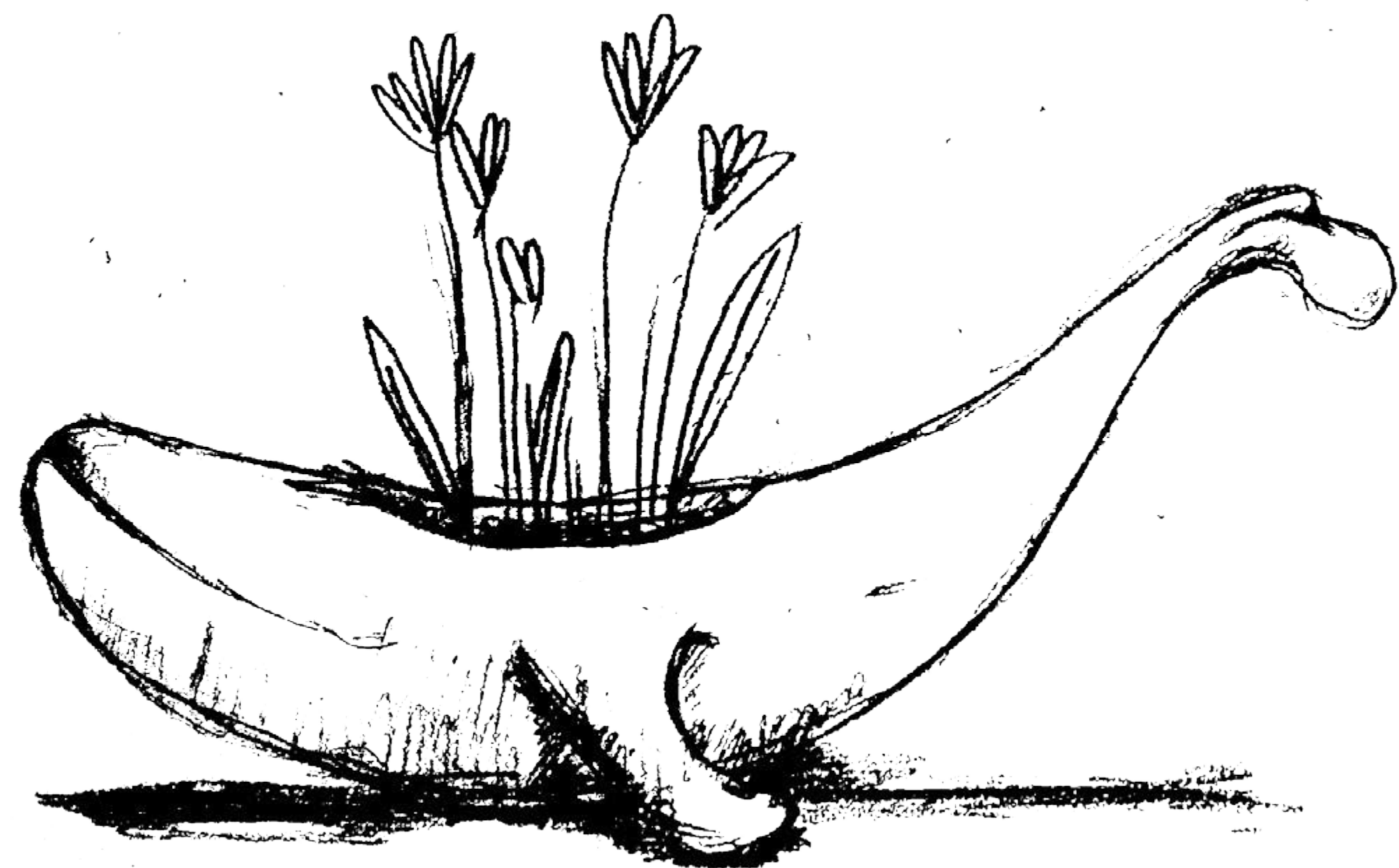
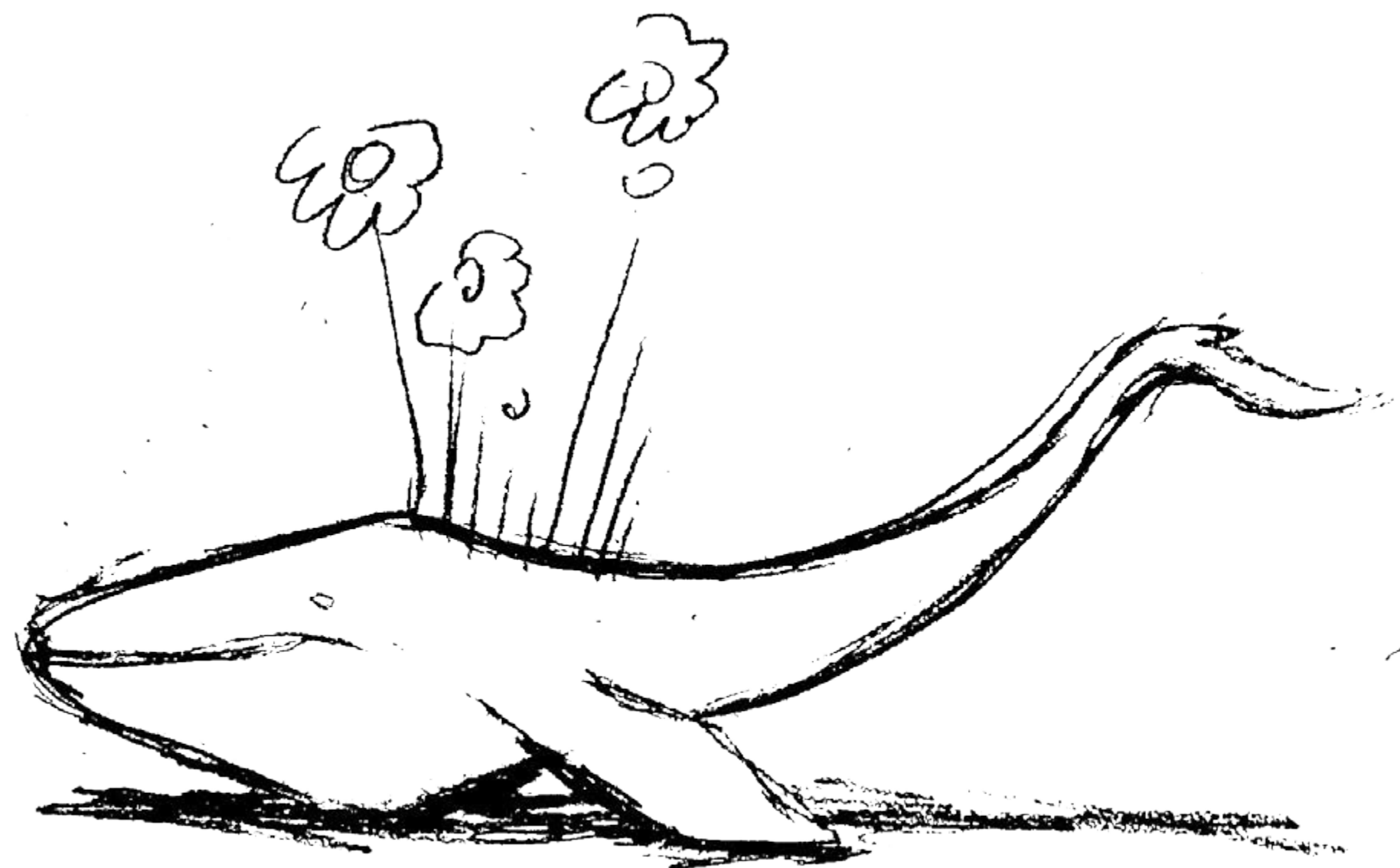
Vase, Tag, Hat, and Website

# Purpose

Entice the consumer with beautiful items

Educate the consumer and involve younger generation

Create a conversation in the home/workplace













INTRO

ABOUT

GET INVOLVED

PRODUCTS



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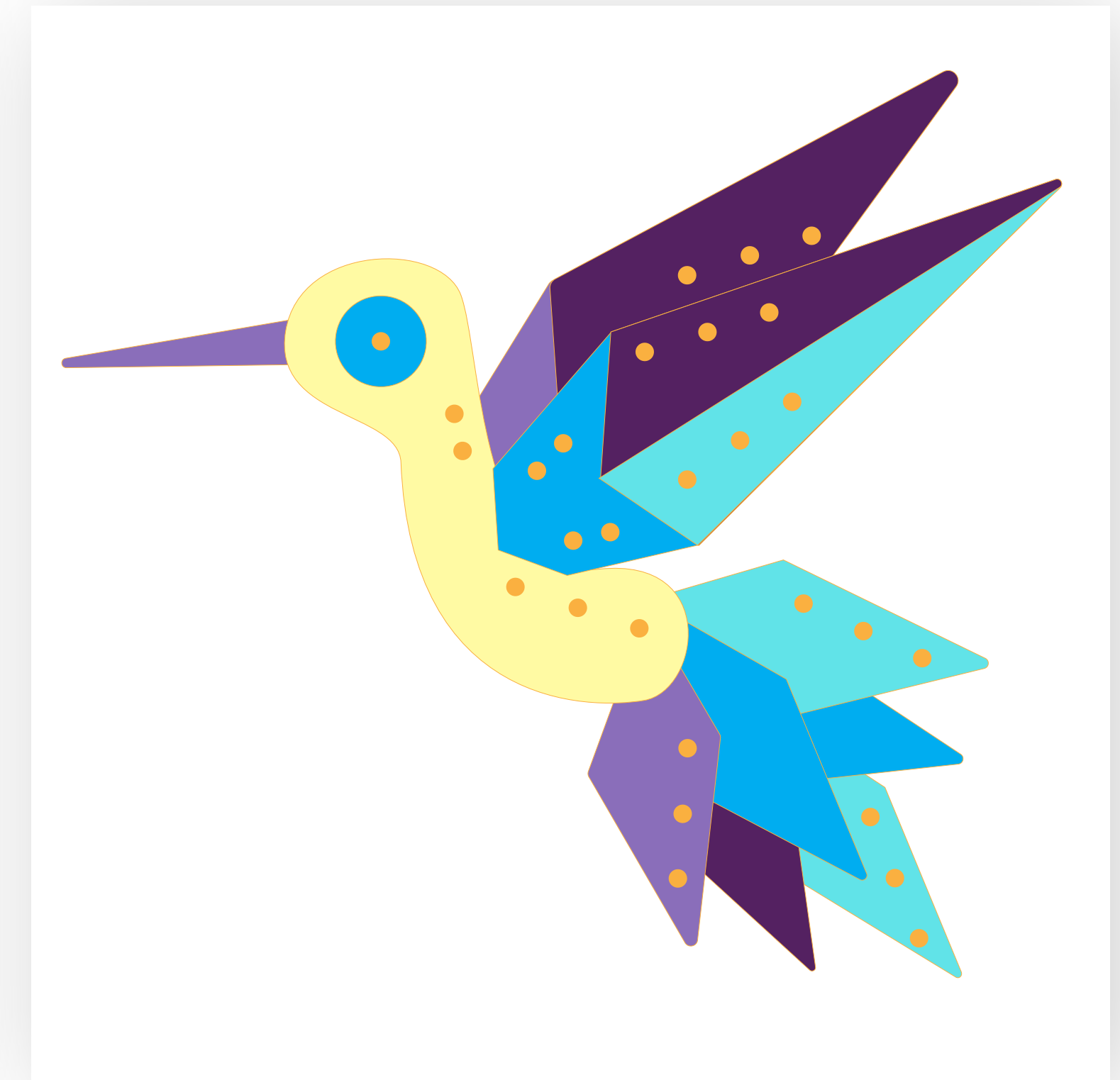
# Other Products



Wild Wonders Whale Hat



Priceless Plant Plates



Beautiful Bird Pins