

UP FROM BELOW: EXPLORATION OF THE DEEP

By

Mary LaRoche

A Thesis

Submitted to the

Graduate Faculty

of

Corcoran College of Art and Design

in Partial Fulfillment of

The Requirements for the Degree

of

Master of Arts

Exhibition Design

Committee:



Thesis Advisor

Selma Thomas



Department Chair

Clare Brown

Provost

Catherine Armour

Date: May 2013

Corcoran College of Art and Design,
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A thesis submitted in partial fulfillment of the requirements for the degree of Master of Arts at Corcoran College of Art and Design

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ABSTRACT

UP FROM BELOW: EXPLORATION OF THE DEEP

Mary C. LaRoche, Master of Arts Exhibition Design

Corcoran College of Art +Design, 2013

Thesis Advisor: Selma Thomas

In order to understand future space exploration, we must first understand the planet we live on and strive to learn from the depths as yet undiscovered. Providing the public an exhibit that combines both science and beauty, both of which are found in an inaccessible natural environment they might never experience, is the main priority.

We have put more men on the moon than have touched the ocean floor. We have not fully explored our own planet, yet NASA trains astronauts in the deep ocean waters to prepare them to venture into the unknown of space. My thesis provides a history of deep diving by way of interweaving personal and public stories of Ocean discoveries, disasters, and future exploration, and compares it to that of space exploration.

Immersive environments “transport” visitors to the bottom of the Marianas

Trench where they learn about the difficulties of deep diving, three specifically disastrous wrecks at sea, and the people who have braved the depths to document what is located below.

To my Family and Friends, you are my world.

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LIST OF ABBREVIATIONS/SYMBOLS

CIA: Central Intelligence Agency

COMISMER: Commandement des Interventions Sous la Mer (Undersea Interventions Command)

ESA: European Space Agency

FOC: French Oceanographic Campaigns

GRS: Groupement de Recherches Sous-marines (Underwater Research Group)

JAMSTEC: Japan Agency for Marine-Earth Science and Technology

NASA: National Aeronautics and Space Administration

NEEMO: NASA Extreme Environment Mission Operations

NOAA: National Oceanic and Atmospheric Administration

RMS: Royal Mail Ship

SCUBA: Self-Contained Underwater Breathing Apparatus

SOSUS: an acronym for Sound Surveillance System

USS: United States Ship

USNS: United States Naval Ship

WHOI: Woods Hole Oceanographic Institution

CHAPTER 1

Mission Statement

My exhibit will showcase the extremely beautiful, as well as the harshest, environments that exist on Earth, and the lengths human kind have gone to explore the depths: the Deep Ocean. Providing the public an exhibit that combines both science and beauty, both of which are found in an inaccessible natural environment they might never experience, is the main priority. In order to understand future space exploration, we must first understand the planet we live on and strive to learn from the depths as yet undiscovered.

Target Audience

The exhibit is for the general populace, as it will provide the 3 “E’s”: Entertaining, Educational, and Enlightening. School groups (Middle school and High school aged students) and oceanic enthusiasts are the primary audience group, as they’ll be attending the aquarium on their own volition. Interest explorers, tourists, as well as nautical and aeronautic aficionados are definitely to be included in the target audience, but as the Chicago area (proposed site of exhibit) has such a large and educated population, as well as a large tourist draw, the exhibit will be informational and accessible (knowledge base and understanding/appealing) by all.

CHAPTER 2

Teaching Points

I would like to help increase a public appreciation for the natural beauty found in the deep ocean, specifically: the Mariana Trench (not limited to, but including: bioluminescent fish, strange creatures, and alien like life forms found on terra firma).

I would like the visitors to learn about the rigorous training and equipment required for deep-sea exploration, and compare both to training and equipment required of space exploration.

To have the visitors understand the historical timeline of deep-sea exploration, and/or space exploration in comparison.

A public appreciation for the natural beauty found in the deep ocean (bioluminescent fish, strange creatures, and alien like life forms found on terra firma).

To have the visitors leave the exhibit considering the human toll on the nearly unknown ecosystem thinking “big picture” thoughts about what might be in their backyard.

Site Selection

The site chosen for my exhibit is the Shedd Aquarium in Chicago, Illinois. Of the annual 14.4 million visitors (in 2011), the Shedd Aquarium cornered 2.1 million (increasing numbers by 3 percent over the last year). Of all museums and educational institutions in Chicago's Museums in the Park, the Shedd garnered the most attendees. Because the Shedd Aquarium is located in Chicago, and is well within a daily drive of three other large cities (Madison and Milwaukee, Wisconsin, and Grand Rapids, Michigan) it is the perfect location for a large-scale, blockbuster exhibit. The site has also been specifically chosen to be one located in the Midwest, because in the winter season (which seemingly lasts longer in the North) people need to get out of the house. This means museum attendance is markedly higher in the Midwest in comparison to other locales.

Visitor Experience Narrative

Upon arriving, the visitors are greeted by a large and open informational lobby with visitor amenities (lockers, ATM, membership booth, bathrooms, etc.). They will enter the museum/main exhibit hall via the large hallway to the right located directly behind the ticket and information desk, or they are able to go straight into the gift shop. The local rivers, islands and lakes, local waters, oceans, and Amazon bodies of water exhibits currently surround the Pritzker Caribbean Reef exhibit. Visitors are then herded into the North stairway (also housing the elevators) to get to the MacArthur Special Exhibit Gallery (currently showing “Jellies”), the Abbott Oceanarium, and the Cafe. If the visitors take the South stairway (also housing elevators) they will first reach the Phelps Auditorium and then the Abbott Oceanarium.

For my thesis, I intend to surround the Pritzker Caribbean Reef, by taking over the rivers, islands and lakes, local waters, oceans, and Amazon exhibit halls. In my grand scheme, visitors will enter through the North doorway into the “Rivers” hall, into the introduction/timeline/back history of deep-sea exploration. To be specific: the history of deep-sea exploration in the Mariana Trench. They will then be guided into the second section presenting shipwrecks and human discovery of shipwrecks. The third room will contain scientific exploration, training, and equipment used in the Mariana Trench. The fourth section will contain

information and examples (live or representations) of the sea life found specific to the trench. And the fifth will showcase current exploration and experimentation in tandem with NASA, and will emphasize how much is left unexplored. The fifth section will also include pop cultures curiosity with deep-sea. The Pop Culture section may also be applicable to the second section, regarding Atlantis, the adventures of Captain Nemo, etc.

The fifth section will end near the South stairway, thus allowing for ease of access to the Phelps Auditorium, and Abbott Oceanarium. Ideally the visitors will be walking through in a clockwise manner, but will have the ability to exit early to the café and Oceanarium, should they need a break. The exhibit will be intentionally dark and gloomy, so “escape” routes will be necessary for those with claustrophobia, children, or if they’re just plain hungry.

As previously mentioned, the exhibit will have a particularly gloomy and claustrophobic feel, as visitors will be introduced to the topic of deep sea exploration by being “transported” to the very bottom of the Mariana Trench at the beginning of the exhibit, and will work their way to the “surface” by exploring the rest of the exhibit. The first room will be a bit cooler than the average temperature; the entire area will have a surface treatment creating the illusion of the craggy rock/sandy/reef edges of the trench, to be carried throughout the exhibit halls and transformed per desired “depth” effect; the visitors will be able to hear the occasional

submarine “ping” and bubbles released as ambient noise, the lighting will be dim with pin points of spotlights upon section panels and select objects, and background lighting of blues and greens; when the visitors look up they will see an illusion of shimmering water far, far, above them, thus reinforcing the illusion that they are extremely deep under water.

Upon entering the second section discussion shipwrecks, and their subsequent discoveries, the entire section of the exhibit hall will have been transformed into the interior hull or cargo/common area of a sunken wooden ship. While not technically accurate per Mariana Trench shipwrecks, this will help reinforce the history and fictional allure to underwater discovery. The lighting in this section will create a warm and welcoming glow, yet still letting the creeping dark gloom from the exterior of the “sunken” ship leak through so that they don’t forget they’re deep under water. Sea shanties, whale song, and other select recordings of authentic sea faring songs will be played as either ambient noise for effect, or as a separate music interactive.

The third section will be brighter yet, moving into the deep but brighter blue and green jewel tone color palettes (think Mediterranean vs. Caribbean). The section will be divided into two sections, one half will be the interior of the Aquarius (or other Sea lab model chosen), and the second will be a vast array of exploration equipment used for sea

exploration: diving suits, diving pods, helmets, weighted boots, air pumps, etc.

Section four will be a busy section, as this is where the living organisms will be displayed. Floor to ceiling tanks will surround the room; the tanks (separation needed for natural predatory actions require samples to be segregated) will be divided by glass partitions, giving the illusion of a giant all encompassing tank. Above the patrons will be to dioramas: a whale, and a giant squid, both life-size. The room will be lighter and brighter than the previous rooms, allowing for a glimmer of sunlight in the ceiling water illusion. Possibly adding a school of fish or jellyfish to the illusion as the visitors are now at the ocean depth for aquatic life.

The fifth and final section will be light and airy, the sunlight shining bright through the ceiling water illusion. The room will be slightly warmer than the initial exhibit hall, as the visitors are much closer to the “surface.”

Surrounding the Caribbean Reef display in the center of the existing Shedd Aquarium and between the existing exhibit halls is a sizable hallway. In this hallway, between exhibit sections, the visitors are welcome to visit the Caribbean hall for a respite, but to keep them engaged and interested in the next section of the exhibit, diving and space equipment will be displayed in conjunction, side by side, creating a

statement about the profound similarities between deep sea and space travel. The suits, helmets, pods, equipment, etc. will be located in cylindrical floor to ceiling acrylic tubes with contained lighting making them glow or appear to levitate within, adding another “other worldly” dimension to the objects.

CHAPTER 3

Exhibit Content Outline: Introduction

Exploration has been part of the Human story since the dawn of time, with ocean exploration as a close second. Human and animal migration patterns have occurred not only on land, but also by sea and air. The discovery of the New World is a prime example of exploration of the unknown (by sea): was it Christopher Columbus from Genoa, or the Viking Leif Erikson to first set foot on North America, aside from the indigenous population, who traveled over the ice bridge in the Bering Strait long before. Today, there is little left to explore on our globe, and we are looking towards the sky. Before we do so, we should take a look at our deep oceans, as there is still much to learn and territory to discover. Because the history of ocean exploration is so vast, this exhibit will be limited primarily to the Marianas Trench area of the Pacific Ocean, which is located off the coast of Guam, for the scientific research and significant exploration sections of the exhibit. Major shipwrecks, including the USS Indianapolis, the Russian submarine K-129, and the Titanic, and their subsequent discoveries will be discussed. And popular culture interests such as pirates, mermaids, and song will be elaborated upon.

There are several distinct levels zones when traveling down into the trench.¹ The *Epipelagic* Zone (approximately 1-1000 feet below sea level) where sunlight and photosynthesis are both abundant, the *Mesopelagic* zone (1000-3300 feet below sea level) known as the “Twilight Zone” where life subsists on scraps of dead plants and animals, the *Bathypelagic* Zone (3300-13,100 feet below sea level) or when “Deep Sea” begins, the *Abyssopelagic* Zone (13,100-19,700 feet below sea level) referred to aptly as “The Abyss,” and the *Hadopelagic* Zone (19,700-36,100 feet below sea level, and counting) known as “The Trenches” or “Hades Zone.” Below is listed an easy guide to understanding unique characteristics of each zone:

- Epipelagic:** Coral Reef, Recreational diving, and Scuba diving possible.
- Mesopelagic:** Atmospheric suits needed, mesopelagic fish (Stoplight Loosejaws, Barreleye, etc.)
- Bathypelagic:** No Sunlight, bathypelagic fish (low metabolisms, phosphorescent, etc.) Giant Squid
- Abyssopelagic:** Midnight dark, Deepwater Horizon oilrig depth, hydrothermal vents
- Hadopelagic:** Ocean Floor, sea life (sea cucumber and xenophyophores, 4 inch single cell amoebas)

¹ Neo-Pangea. “Deepsea Challenge.” Deepseachallenge.com. <http://deepseachallenge.com/> (accessed September 23, 2012).

There have been four trips into the depths of the Marianas Trench. The first, on January 23, 1960, US Navy lieutenant Don Walsh and Swiss engineer Jacques Piccard² set a record for the deepest descent below the ocean's surface, roughly 35,800 feet, in the 150 ton steel submarine, the Trieste, designed by Piccard's father Auguste. For context, 35,800 feet above sea level is the average cruising altitude for commercial airlines. Their descent to the sea floor took approximately 5 hours, traveling at 4 feet per second, where the pressure is eight tons per square inch. Their record-breaking dive not only proved that deep-sea life is possible (sea cucumber witnessed) at those depths, but that it is possible for humans to survive the trip. The second dive occurred in 1996, by the unmanned ROV (remote operated vehicle) *Kaiko*³, and the third was the *Nereus* in 2009.⁴ *Kaiko* was built and operated by the Japan Agency for Marine-Earth Science and Technology (JAMSTEC), and *Nereus* was designed and operated by the non-profit Woods Hole Oceanographic Institution (WHOI). Movie director James Cameron recently accomplished the fourth dive, on March 26, 2012.⁵ The National Geographic Foundation and Rolex Company both sponsored his vehicle the *Deepsea Challenger*. James

² Piccard, Jacques and Robert S. Dietz. *Seven Miles Down*. (New York: Putnam, 1961). pg. 200-249.

³ Japan Agency for Marine-Earth Science and Technology. "7,000 m Class Remotely Operated Vehicle – KAIKO 7000II." Jamstec.go.jp. <http://www.jamstec.go.jp/e/about/equipment/ships/kaiko7000.html> (accessed November 10, 2012).

⁴ Woods Hole Oceanographic Institution. "Ships & Technology: Overview." Whoi.edu. <http://www.who.edu/main/nereus>. (accessed November 10, 2012).

⁵ Neo-Pangea. "Breaking News: Cameron Begins Descent." Deepseachallenge.com. <http://deepseachallenge.com/latest-news/breaking-news-cameron-begins-descent/>. (accessed November 10, 2012).

Cameron became the first person to reach the “Challenger Deep” section of the Marianas Trench in a one-man craft. He also happened to be the only person to have made it to the ocean floor of the Marianas Trench since the first initial manned dive in the 1960s. To put this information into context, we have had more men walk on the moon, in fewer years, than have been to the bottom of the ocean.

CHAPTER 4

Shipwrecks and Subsequent Discoveries

The history of nautical trade and adventure is so vast and widespread, we will focus on three ships that met their untimely end at sea have been chosen to represent all that may lay undiscovered below the waves: the USS Indianapolis, the Soviet submarine K-129, and the RMS Titanic. All three can be found at varying degrees of difficult retrieval depths, and represent military history, espionage at sea, and civilian casualties mixed with human error, respectively.

At 12:14AM, the USS Indianapolis was sailing from Guam to join the battleship USS Idaho at Leyte Gulf in the Philippines. While underway, she was hit by two manned-torpedoes (six were fired in total, all were piloted by Japanese Kamikazes) by the I-58 Japanese submarine. Striking the bow and midship, near a fuel tank and a powder magazine, the resulting explosion split the ship wide open, sinking within 12 minutes. Of the 1,196 souls aboard, approximately 900 made it into the water. Very few life rafts were able to be released the kapok life jackets were before the ship submerged, but luckily most who made it into the water wore the

standard kapok life jacket.⁶ At sunrise, the shark attacks began, and continued day and night until the men were rescued almost five days later. They were luckily accidentally discovered by LT. Wilbur C. Gwinn, flying his PV-1 Ventura Bomber on an (ironically) antisubmarine patrol. Alerting his base, Lt. R. Adrian Marks and his PBY (seaplane) were dispatched to help rescue, and the USS Cecil Doyle (DD-368) diverted under its captain's orders to assist. Adrian Marks waited for help to arrive, all the while pulling dying men, and those at greatest risk of shark attack, from the water. When his seaplane was full, he and his crew tied even more survivors to the wings with parachute cord, saving in total 56 men that day. Completely disregarding the safety of his own ship and crew (more feared submarine attacks), the captain of the Cecil Doyle aimed his largest searchlight towards the sky to alert other rescue vessels. After all were rescued, and of the total 900 sailors who made it into the water, only 317 remained alive. Shark attacks, starvation, thirst, hyponatremia caused by ingestion of salt water, and extreme suffering from exposure and wounds incurred had taken quite the toll on human life. The loss of the Indianapolis occurred merely two weeks before Japan's surrender. Captain McVay, of the USS Indianapolis, was subsequently court-martialed, even though the Navy itself was responsible for sending the

⁶ Made from the fibers of the *Ceiba pentandra* tree, also used as impromptu baseball diamond bases during WWII. (<http://www.botgard.ucla.edu/html/botanytextbooks/economicbotany/Ceiba/index.html>).

Indianapolis into harm's way.⁷ McVay's court martial stood until October 2000, when President Clinton and Congress passed legislation that Captain McVay's record be exonerated for the loss of the Indianapolis. It became official in July 2001⁸, when the Navy Department announced that his record had been amended, acknowledging the exoneration, but unable to officially repeal the court-martial, as there has never been a court-martial overturned, in United States military history.

The story of the Soviet Golf Class 2 Nuclear Missile submarine, the K-129, is something entirely different than that of the USS Indianapolis. The K-129's commander was Captain First Rank V.I. Kobzar on the final tour of duty when the submarine went missing.⁹ After missing scheduled radio check-ins, and leaving urgent messages breaking radio silence unanswered, the submarine was declared "missing" by the Soviet naval headquarters, and proved to have sunk on 8 March 1968. The Soviet government was unable to find the missing submarine and/or its wreckage. Here is where the espionage plot thickens. After losing contact with the K-129, the Soviet Navy launched a large-scale search and rescue operative for the Pacific Theater, all the while keeping just what they were searching for hush-hush. This did not go unnoticed by the US Intelligence,

⁷ Newcomb, Richard. *Abandon Ship!: The Saga of the U.S.S. Indianapolis, the Navy's Greatest Sea Disaster*. (New York: Henry Holt and Company, Inc., 1958). 1-368.

⁸ USSIndianapolis. "Seeking Justice." Ussindianapolis.org. <http://www.ussindianapolis.org/resolution.htm>. (accessed November 11, 2012).

⁹ Craven, John. *The Silent War: The Cold War Battle Beneath the Sea*. (New York: Simon & Schuster, 2001). 1-300.

who happened to notice the unusual behavior, realizing it to be similar to search and rescue for a lost submarine. Following up on the data, the US Intelligence contacted US SOSUS Naval Facilities¹⁰ who were able to consult with SOSUS arrays of the suspect wreck site, and using the acoustic arrays pinpoint a large isolated sound of explosion, thus providing the precise coordinates where the K-129 had sank near 40 N, 180th longitude. The US government was able to locate and photograph the resting place of the K-129. Lacking the SOSUS technology, the Soviets eventually gave up on the search, and declared the ship lost with all hands.

This, however, is not the end of K-129's story. Because the submarine was carrying top-secret Soviet nuclear missiles, the US was given the perfect chance to confiscate the weapons without Soviet knowledge, in a perfect world. President Nixon authorized the covert, clandestine, and secret salvage retrieval operation, titled Project Azorian. Howard Hughes' company, of *Spruce Goose* notoriety, was contracted in 1969 to design and build the retrieval ship, USNS *Hughes Glomar Explorer*. The Hughes Glomar Explorer was designed to lower a giant grab 5 kilometers to the seabed and pick up the submarine, whole, and raise it to the surface placing (also known as: hiding) it into the Glomar's huge water filled hold, known as the "Moon Pool." In 1974, the mission

¹⁰ SOSUS: an acronym for Sound Surveillance System

was ready to begin. Unfortunately, the mission was compromised when thieves broke into a warehouse owned by Howard Hughes, stealing money and top secret documents, which then ended up under the door of the Soviet Embassy in Washington, DC. Because the technology was so far advanced from their technological capabilities, the Soviet government did not *really* believe the information. Despite the information leak, the operation was given the go-ahead to proceed, and the Glomar set sails. Even with all the careful planning, and narrowly avoiding detection, another set back which could potentially compromise the mission occurred: while lifting the K-129 from its resting place, the grab failed and snapped part of the submarine off (releasing a nuclear missile to float harmlessly to the ocean floor). A second grab brought the submarine into the Glomar's hold, and was delivered at a Long Beach, California port. Nothing is currently known as to what happened to what was recovered. New York Times writer Seymour Hersh had discovered information about Project Azorian in 1974, but was kept from publishing the information by the Director of the CIA until 1975, after the salvage had been completed. The Soviet government assumed that nuclear warheads and torpedoes, operations manuals, and finally top-secret codebooks and coding machines were recovered. The only things recovered that were ever acknowledged by the United States government when pressed about the salvage mission were the bodies of six Soviet sailors. Because fear of

radioactive contamination was feared, the recovered bodies were buried at sea in a steel chamber with full military honors. The burial ceremony was recorded and presented in October 1992 to Russian President, Boris Yeltsin, as a gesture of good will and as a way to finally end the Cold War while looking forward to a promising future by Robert Gates (Director of Central Intelligence). Consequently, the retrieval ship, the *Hughes Glomar Explorer*, was moored for years as part of the Suisun Bay Ghost Fleet. It's importance to Cold War maritime history, lurking unbeknownst to the public. Eventually it was leased and sold to a private company, Transocean Inc., in 2010 and is currently being used for deep sea drilling (currently located off the shores of Indonesia, as of March 2012).¹¹

Finally, for the third example of a nightmare scenario at sea, we present you the story of the Titanic. At the time of construction and preparation for its inaugural voyage, the Titanic weighed in at 52,000 tons (fully loaded), and measured approximately 882.5 feet long by approximately 92.5 feet wide. The design and construction of the Titanic were undertaken by naval architect Thomas Andrews (schematics and ship making) and Alexander Carlisle (interior design and general equipment implementation, including the life raft design)¹². From the very start, the Titanic's voyage was followed by bad omens: the ship's architect

¹¹ Sharp, David. *The CIA's Greatest Covert Operation: Inside the Daring Mission to Recover a Nuclear-Armed Soviet Sub.* (Lawrence, Kansas: University Press of Kansas, 2012). 1-344.

¹² Chirnside, Mark. *The Olympic-class ships: Olympic, Titanic, Britannic.* (Stroud, UK: Tempus, 2004). 135-216.

knew it to be sinkable contrary to popular rumor, upon setting off from the docks it narrowly avoided being struck by the New York due to suction created by the Titanic's launch. The ill-fated voyage of "The Unsinkable Ship" steamed off on April 10, 1912, from Southampton, England, to New York City, with approximately 2,200 people aboard, 1,300 of which were passengers. While steaming towards New York City, the ship's radio operators received several warnings about icebergs up ahead and sent the information to the Titanic's bridge. The information was acknowledged, and the ship's course was altered to head further south than intended, into warmer and ideally iceberg-less waters.

At 10:55PM, the *Californian*, a Leyland liner, radioed advising that it had been halted by ice, but the notice was ignored. Unusually calm waters and missing binoculars from the crow's nest proved difficult conditions for noticing and alerting the bridge of an oncoming iceberg in time to veer the ship to safety. At approximately 11:40PM on April 15th, at about 400 nautical miles south of Newfoundland, Canada, the Titanic's starboard side scraped the iceberg. Five of the ship's "water tight" compartments were ruptured, and began to take water. The ship's architect Andrews realized that the ship would continue taking on water, and that sinking was imminent. The radiomen immediately sent distress signals and were able to contact the *Carpathia* at 12:20AM, which immediately changed course to help rescue. Unfortunately, the *Carpathia*

was over three hours away. As mentioned previously, the ship carried 2,200 souls, yet the lifeboats were only able to physically carry 1,178 of them in ideal conditions. The lifeboats were sent out with women and children at first, and some of which weren't even at full capacity. Because of fears of being swamped, the life boats that made it into the waters waited so long to return, most left in the water had died from the extreme conditions and exposure. At approximately 2:18AM the Titanic broke in two, fully sinking into the Atlantic within minutes. More than 1,500 perished, 700 members of the crew, and approximately 700+ members of the third class (primarily because the complex routes to get to the ship's deck took so long).¹³

Because of the sheer numbers lost, the many glamorous and rich passengers, and the heroic stories related to the rescue, the Titanic's sinking deeply affected the public. It continues to intrigue and interest (often used as a blockbuster exhibit at museums around the world) many explorations have been made of the wreck, and its story has been used as inspiration for a major motion picture.¹⁴

¹³ Butler, David Allen. *Unsinkable: The Full Story of RMS Titanic*. (Mechanicsburg, PA: Stackpole Books, 1998). 1-300.

¹⁴ Cameron, James. *Titanic*. DVD. James Cameron. Los Angeles: Paramount Pictures, 1997.

CHAPTER 5

Deep-sea Scientific Exploration and Equipment

As previously mentioned, there have been four exploratory trips into the depths of the Marianas Trench. However, there have been many other forays into the deep, which were limited by tools and technological capabilities. The trench was first sounded (explored/mapped using large underwater explosions and reading/charting the return echoes) to depths of 26,850 feet during the *Challenger* expedition from December 1872-May 1876 producing a map in 1877 called the “Tiefenkarte des Grossen Ozeans.” The area sounded was titled the *Challenger Tief*, hence today’s *Challenger Deep*.¹⁵ The *USS Nero* recorded depths of 31,614 feet, in 1899¹⁶, and the *Challenger II* used new echo sounding equipment for more precise recordings measuring depths at 35,760 feet (in the area known as the *Challenger Deep*) in 1951.¹⁷ And finally (before our aforementioned manned trench explorations took place), the Soviet vessel

¹⁵ Encyclopedia Britannica. “Challenger Expedition.” Britannica.com. <http://www.britannica.com/EBchecked/topic/104756/Challenger-Expedition>. (accessed December 2, 2012).

¹⁶ Theberge, Albert. “Thirty Years of Discovering the Mariana Trench.” Hydro-international.com. http://www.hydro-international.com/issues/articles/id1049-Thirty_Years_of_Discovering_the_Mariana_Trench.html. (accessed December 2, 2012).

¹⁷ Mariana Trench. “The Mariana Trench.” Marianatrench.com. http://www.marianatrench.com/mariana_trench-exploration_001.htm. (accessed December 2, 2012).

Vityaz reported depths of 36,201 feet in 1957, and dubbed it the *Mariana Hallow*.¹⁸

For man to explore such depths, and at such great pressure, special equipment is needed to ensure their survival. Atmospheric suits, helmets, armor, boots, etc. are all needed, and are strikingly similar to space suits used today. For cold water deep dives, swimmers are required to use dry suits (similar to wet suits, but more suitable to temperatures of 0-10 degrees Celsius). Boiler suits (armor) is used as abrasion protection, coral reefs are extremely jagged and sharp, and several varieties of fish have strong jaws/pincers. Diving hoods and boots are usually incorporated into the dry suits, but are also worth mention. Safety helmets are good to have, especially those with built-in forehead lights. Depending on the site and wildlife conditions, a chain mail suit may also be necessary for protection (sharks, strong jaws, pincers). A backplate adds extra stability, and provides a tether to the ship above. Buoyancy compensators, diving weighting systems, and fins all regulate how to get to where you're going in the water. Equipment necessary for monitoring where you're going, and/or where you need to be, includes: depth gauge (on diver) and corresponding pneumofathometer (on board) which show the divers position, a dive computer to monitor decompression

¹⁸ Encyclopedia Britannica. "Mariana Trench." Britannica.com. <http://www.britannica.com/EBchecked/topic/364967/Mariana-Trench#ref186981>. (accessed December 2, 2012).

sickness and oxygen toxicity, a diving watch, compass, and pressure gauge. Necessary safety equipment includes: a lifeline, surface marker buoys, and cutting tools (so they can cut, pry, and dig at objects of interest). Cameras are always necessary.

A great adventurer who has furthered ocean exploration and inspired generations is self-taught oceanographer Jacques – Yves Cousteau, also known in English as Jacques Cousteau (Born June 11, 1910 – Died June 25, 1997).¹⁹ Cousteau entered the École Navale, and graduated as a gunnery officer, but had his naval career cut short after an automobile accident. He remained vital to the French Navy as a member of the information service until 1939. In 1943, Cousteau and his neighbor Marcel Ichac won the Congress of Documentary Film for the first French underwater film: *Par dix-huit mètres de fond (18 meters deep)*. In 1943, he also made the film *Épaves (Shipwrecks)* that showcased usage of the very first two Aqua-Lung prototypes (of which he and Emile Gagnan designed). Aqua-lungs were the first prototypes of self-contained underwater breathing apparatus (SCUBA).

While in the French Navy, Admiral Lemonnier recognized Cousteau's talents and tasked him with creating the Groupement de Recherches Sous-marines (GRS) (Underwater Research Group) of the

¹⁹ Olmstead, Kathleen. *Jacques Cousteau: A Life Under the Sea*. (New York: Sterling, 2008). 1-128.

French Navy in Toulon. The GRS then became the COMISMER ("Commandement des Interventions Sous la mer", in English translates to the "Undersea Interventions Command"), and finally more recently the CEPHISMER. The GRS was responsible for clearing mines, exploration, technological and physiological testing, and uncovering sunken archeological treasures such as the Roman wreck of Mahdia.

In 1950, he left the French Navy, founded the French Oceanographic Campaigns (FOC), and leased the ship *Calypso*, for a nominal yearly lease of one dollar, which he refitted as a laboratory for field research and as the principle vessel for his diving and filming. After winning many awards for his films (including the Palme d'Or at the Cannes Film Festival) in 1956, he made a "diving saucer" SP-350, an experimental underwater vehicle named *Denise* which could reach a depth of 350 meters. In 1960, after learning of a scheduled radioactive waste dump into the Mediterranean, Cousteau was able to organize a successful anti-dump campaign that in two weeks halted the train bearing the waste, and send it back to it's manufacturers.

He created his incredibly popular television series *The Underwater Odyssey of Commander Cousteau* that provided the public underwater adventures and oceanic lessons that were accessible to all. It also

introduced the public with his signature red hat, a remnant of the “required diving dress.”²⁰

Jacques Cousteau was never originally an environmentalist, but an adventure seeker and explorer. After spending so much time at sea, and among it’s creatures, he recognized that we desperately need to take care of the ocean and it’s creatures, especially paying attention to protecting the more remote environs and ecosystems as yet undiscovered.

²⁰ Cousteau Society. “The Captain.” Cousteau.org. <http://www.cousteau.org/about-us/jaques>. (accessed November 20, 2012).

CHAPTER 6

The Aquarium

In this section, the living objects, as listed below, will be displayed in simulations of their natural environments:

Giant tubeworms (Riftia)	Archaea
Sperm Whale	Comb Jellyfish
Giant Ostracod	Vampire Squid
Glass Squid	Deep-sea shrimp
Predatory Tunicate	Giant Squid
Crown Jellyfish	Deep-sea Siphonophore
Black Seadevil	Vent Crab
Squat Lobster	Vent Eelpout
Deep-sea Anemone	Vent Scaleworm
Nereid Worm	Stalked Vent Barnacle
Pompeii Worm	Atlantic Footballfish
Dumbo Octopus	Hairy Anglerfish
Loosejaw	Highfin Lizardfish
Giant Sea Spider	Goblin Shark

Because the Sperm Whale and Giant Squid are equally enormous, and are unable to be displayed safely (in reference to the animals necessary

living environment requirements) can be found “swimming” above the exhibit, life size, and locked in battle.

It is understood, and acknowledged, that there are issues related to displaying many of the species listed above. First, it is understood that this is a theoretical exhibit installation, and that displaying the living objects listed above would not be entirely realistic. Many cannot be displayed above a specific pressure unit, as they would expand and perish. The second issue with displaying the wide variety of living objects is the potential for the predators to eat those unable to defend themselves. Glass barriers located within the aquarium will separate those who might potentially attack one another. The visitors would not see the barriers, and the living objects would be protected from each other. Every effort would be made to ensure each object’s safety and longevity.

CHAPTER 7

Current Experimentation and Exploration: NASA and NOAA

To prepare for space, the National Aeronautics and Space Administration (NASA) trains its astronauts in water simulation situations. There has also been crossover where former naval divers, who become astronauts, then become Sea lab scientists. Such is the case for Scott Carpenter, former Naval deep diver and Mercury 7 astronaut, who spent a record 30 days aboard the Sea lab II performing experiments, testing new tools, and taking physiological testing.²¹ Famously, Mr. Carpenter received a call from President Lyndon B. Johnson, but was at the time confined to a decompression chamber (which had helium gas replacing the nitrogen in his system) thus rendering his call to the president unintelligible.²²

In order to more successfully compare deep sea and space situations, we will be focusing more on two of the recent underwater training missions. As the Aquarius is the last underwater research facility

²¹ Carpenter, Scott. "Sealab." Scottcarpenter.com. <http://www.scottcarpenter.com/sealab.htm>. (accessed September 23, 2012).

²² The Kitchen Sisters. "LBJ & the Helium Filled Astronaut." Npr.org. <http://www.npr.org/programs/lnfsound/stories/991015.stories.html>. (accessed September 23, 2012).

left in the world, NASA has partnered with NOAA to provide the astronauts the most realistic training conditions on Earth possible. The near-weightless conditions, the harsh terrain, and the otherworldly like visitors (fish and creatures of all sizes) create the perfect scenario for the astronauts to gain their bearings.

In June 2012, four astronauts took to the ocean, to the *Aquarius*, to take part in a simulated near-Earth asteroid practice situation. The astronauts are all members of NASA's NEEMO 16 (NASA Extreme Environment Mission Operations, 16th expedition) program. Their mission was to have what is basically a dress rehearsal for a trip to an asteroid in deep space. The inspiration for this came in 2010, when President Barak Obama encouraged NASA to aim for asteroid visitation by 2025, and to then train for landing on Mars by 2039.²³ The chosen astronauts are Dottie Metcalf-Lindenburger and Tim Peake of the European Space Agency (ESA), Steve Squyres of Cornell University, and Kimiya Yui of Japan. The three areas of concentration on their trip have been dealing with communication delays, figuring what the optimum crew size would be, and finding ways to attach to and travel across an asteroid.

²³ Wall, Mike. "Mock Asteroid Mission on Ocean Floor 'Incredibly Realistic,' Astronauts Say." Space.com. <http://www.space.com/16232-mock-asteroid-mission-ocean-neemo16.html> (accessed January 12, 2013).

As a precursor to the NEEMO 16 asteroid specific trip to the Aquarius, there was the NEEMO 14 trip in 2010²⁴. With 6 crewmembers the primary objective was to focus on the 250-pound space suits and how to make them more comfortable for spacewalks. Increased mobility and flexibility in the arms, shoulders, and gloves of the space suits are a main focus, but they are also focusing on issues such as what to do should a crewmember in space suit become incapacitated. They have advised that while similar to walking in space, working in water is still noticeably different. When in space, in order to get around you must take preparatory actions so that you don't float away, and you must quite literally crawl everywhere. While underwater, there is still a marginal gravity factor that allows you to bounce along. Making sure the astronauts' packs are centered correctly on their backs, allowing them to collect samples and move without tipping over is imperative in both underwater and space conditions.

²⁴ Gage, Deborah. "NASA astronaut speaks from the ocean floor: 'We're completely isolated.'" Smartplanet.com. <http://www.smartplanet.com/blog/thinking-tech/nasa-astronaut-speaks-from-the-ocean-floor-8216were-completely-isolated/4078> (accessed October 18, 2012).

CHAPTER 8

Pop Culture and the Deep Sea

The Pop Culture and the Deep Sea section will be spread through each of the other five exhibit sections, to help maintain a level of interest as well as encouraging personal connection to the exhibit via enthusiasm and excitement. Because the influence of deep sea exploration, travel, and innovation have pervaded our cultural consciousness so completely, I would like to touch on specific aspects of how we've been, or continue to be, influenced by it today. Film, Mythology, Music, and Literature will be the main categories.

James Cameron, of the Deepsea Challenger notoriety, is a world famous film director. It is only natural to include his works in the exhibit. Many of his works relate to underwater exploration, and even reference finding alien life forms at the bottom of the ocean.²⁵ Not only has his personal interest in the Deep Sea affected his movies, his cinematic successes have allowed him to actually access it.

²⁵ Cameron, James. *The Abyss*. DVD. Directed by James Cameron. (Los Angeles: 20th Century Fox, 1989).

The mythology behind Mermaids will be addressed. Everyone has heard the stories of mythical beautiful creatures, half women and half fish. Tales sailors have been telling their friends and families upon return home have been transformed so that these creatures could be anything from beautiful half women/half fish to hideous manatee like creatures. The real story behind the mythology is that of Asian and West African Pearl Divers. Women, being more adapted to the cold ocean waters with their slightly higher percentage of subcutaneous fat, were more successful as Pearl Divers (with stories going all the back to the ancient Greeks). It wasn't until the Dutch seaman Hamel's ship, *Sperwer*, wrecked near Cheju, a Korean island, in 1653, stranding the sailors for ten months, spurred his writing a book, which detailed their interactions with mermaids.²⁶ If you go to Cheju today, you can still find women divers hunting for shellfish and edible seaweed.²⁷ The interesting question is whether Hendrick meant to refer to the women divers intentionally. In the more "macho" Chinese, Japanese, and Korean cultures, the women divers are often referred to as "dragon-wives." The husbands stay at home taking care of the children and the home, while the wives are out diving and supporting the family with their wages. Because the women were/are seen as tough, while the husbands appear/ed weak, it was more or less forbidden to have their

²⁶ Hendrick Hamel. *Hamel's Journal and a Description of the Kingdom of Korea, 1653-1666* (Neatherlands, 1666)

²⁷ Suk Ki Hong and Hermann Rahn, "The Diving Women of Korea and Japan," *Scientific American May* (1967): pg. 43.

profession historically documented. The lack of written documentation encouraged the famous Mermaid mythology. The reason for such variety is that when arriving home, the sailors could tell their single sailor and landlocked buddies stories about the attractive naked women met while travelling, but as people tend to do while trying to impress their friends, the women were made half fish to make the stories even better. When telling the same story to their wives and girlfriends, of whom had been left behind at home for possibly years at a time for their sailor's return, the sailors would never dream of telling their significant other about the beautiful naked women. But, a hideous, ugly, lumpy creature would be more suitable a story, and just as exciting, in her eyes.

To bring music into the exhibit, soundtracks from Jacques Cousteau's aforementioned documentaries and television shows (*Le Monde sans soleil [The World Without Sun]*²⁸, *The Underwater Odyssey of Commander Cousteau*²⁹, etc.) will be included. To engage the Millennial Generation, the soundtrack³⁰ (as well as the movie³¹) to Wes Anderson's exhibit. The inclusion of *The Life Aquatic* is pertinent as it demonstrates how those that have come before have influenced the newer generations. *Life Aquatic with Steve Zissou* was a direct caricature of the life of

²⁸ Cousteau, Jacques. *Le Monde sans soleil*. Jacques Cousteau. Paris: C.E.I.A.P., 1964.

²⁹ Cousteau, Jacques. *The Underwater Odyssey of Commander Cousteau*. Jacques Cousteau. Paris: C.E.I.A.P., 1976-1982.

³⁰ Mothersbaugh, Mark and Robert Casale. *The Life Aquatic with Steve Zissou*. (Los Angeles: Hollywood Records, 2004).

³¹ Anderson, Wes. *The Life Aquatic with Steve Zissou*. (Los Angeles: Touchstone Pictures, 2004).

Jacques Cousteau. The exaggerated and ridiculous social situations, the costume-like uniforms of the crew, and the love for the oceanic unknown, all of it can be linked to the life events of Jacques Cousteau.

Literature to be included would be a sampling from the ages. Greek and Roman mythologies referencing Neptune and Poseidon (respectively), *The Voyage of the Beagle*, by Charles Darwin in 1839,³² discussing his scientific observations with exploring the ocean and it's inhabitants over an 18 month period at sea; *Moby Dick*, by Herman Melville in 1851, highlighting the interaction of the mad Captain Ahab and his quest for the great white whale (of which was written around the approximate time of Wilhelm Bauer's *Deep Dive Submersible*, built in 1852 and located in the first section of the exhibit)³³; *Twenty Thousand Leagues Under the Sea*, by Jules Verne in 1870, bringing to life the great adventures of Captain Nemo and his submarine "Nautilus,"³⁴ the Aquaman character from DC Comics, introduced to the public in 1941; and for the youngest of visitors, the *Percy Jackson and the Olympians* series (2005-2009) by Rick Riordan.

³² Darwin, Charles. *The Voyage of the Beagle*. (New York: Penguin Classics, 1989).

³³ Melville, Herman. *Moby Dick*. (New York: W.W. Norton & Company, 1979).

³⁴ Verne, Jules. *20,000 Leagues Under the Sea*. (New York: Sterling, 2006).

CHAPTER 9

Conclusion

What I would like my visitors to leave with would be the knowledge that while space exploration might seem to be our only viable option of exploration, that in actuality the deep waters of our oceans have so much more to provide us. We should not forget that there is immeasurable opportunity and discoveries lurking, just waiting to be found. If a more even disbursement of funds that are going to our space program (NASA) could also be directed to our ocean exploration program (NOAA), both programs would benefit exponentially. As of 2012, the Aquarius's stay at the bottom of the ocean is listed as endangered. Dwindling funding, and lack of public interest due to poor advertisement and awareness has made the Aquarius's operations tenuous, at best.

Those with personal interest in ocean exploration will be the ones to help expand our knowledge base. Jacques Cousteau and James Cameron both invested their own time, money, and ideas to get under the surface, and have created images and films for the world to enjoy. Personal interest of the United States Government in Soviet tactical missions allowed the United States (allegedly) to locate and raise the

K-129. Innovations in gear and equipment have allowed our divers (and astronauts) to excel the diving field exponentially based on personal need and function ability. Imagine what we could develop and invent and discover if we invest more time and energy in fully exploring what remains untouched below our oceans' surface.

CHAPTER 10

Exhibit Resources

Live bioluminescent fish exhibited in all their finest colors and flair via impossible fish tanks (already discussed with Thesis professors, will do the math to show how impossible this would be). These are integral as they emphasize the delicacy and strangeness of the unknown, or what we might be destroying due to ignorance.

Popular literature inspired by the deep ocean (examples: Captain Nemo, Atlantis, clips from Titanic (located in the Mariana Trench) and The Abyss, Little Mermaid, etc.)

Equipment from both deep ocean and space travel: space suits, diving bells, submarines, diving gear, etc. They provide legitimacy to the exhibit for those who learn via interaction with physical objects.

Personal accounts and histories of those who have been to either Space or Deep Ocean, or both. For example, astronaut Scott Carpenter of the Project Mercury was also a deep-sea diver.

REFERENCES

Neo-Pangea. "Deepsea Challenge." Deepseachallenge.com.
<http://deepseachallenge.com/> (accessed September 23, 2012).

Piccard, Jacques and Robert S. Dietz. *Seven Miles Down*. (New York: Putnam, 1961).
pg. 200-249.

Japan Agency for Marine-Earth Science and Technology. "7,000 m Class Remotely
Operated Vehicle – KAICO 7000II." Jamstec.go.jp.
<http://www.jamstec.go.jp/e/about/equipment/ships/kaiko7000.html> (accessed November
10, 2012).

Woods Hole Oceanographic Institution. "Ships & Technology: Overview." Whoi.edu.
<http://www.whoi.edu/main/nereus>. (accessed November 10, 2012).

Neo-Pangea. "Breaking News: Cameron Begins Descent." Deepseachallenge.com.
<http://deepseachallenge.com/latest-news/breaking-news-cameron-begins-descent/>.
(accessed November 10, 2012).

Newcomb, Richard. *Abandon Ship!: The Saga of the U.S.S. Indianapolis, the Navy's
Greatest Sea Disaster*. (New York: Henry Holt and Company, Inc., 1958). 1-368.

USSIndianapolis. "Seeking Justice." Ussindianapolis.org.
<http://www.ussindianapolis.org/resolution.htm>. (accessed November 11, 2012).

Craven, John. *The Silent War: The Cold War Battle Beneath the Sea*. (New York: Simon
& Schuster, 2001). 1-300.

Sharp, David. *The CIA's Greatest Covert Operation: Inside the Daring Mission to
Recover a Nuclear-Armed Soviet Sub*. (Lawrence, Kansas: University Press of Kansas,
2012). 1-344.

Chirside, Mark. *The Olympic-class ships: Olympic, Titanic, Britannic*. (Stroud, UK:
Tempus, 2004). 135-216.

Butler, David Allen. *Unsinkable: The Full Story of RMS Titanic*. (Mechanicsburg, PA:
Stackpole Books, 1998). 1-300.

Cameron, James. *Titanic*. DVD. James Cameron. Los Angeles: Paramount Pictures,
1997.

Encyclopedia Britannica. "Challenger Expedition." Britannica.com.
<http://www.britannica.com/EBchecked/topic/104756/Challenger-Expedition>. (accessed
December 2, 2012).

Theberge, Albert. "Thirty Years of Discovering the Mariana Trench." Hydro-
international.com. [http://www.hydro-international.com/issues/articles/id1049-
Thirty_Years_of_Discovering_the_Mariana_Trench.html](http://www.hydro-international.com/issues/articles/id1049-Thirty_Years_of_Discovering_the_Mariana_Trench.html). (accessed December 2, 2012).

- Mariana Trench. "The Mariana Trench." Marianatrench.com. http://www.marianatrench.com/mariana_trench-exploration_001.htm. (accessed December 2, 2012).
- Encyclopedia Britannica. "Mariana Trench." Britannica.com. <http://www.britannica.com/EBchecked/topic/364967/Mariana-Trench#ref186981>. (accessed December 2, 2012).
- Olmstead, Kathleen. *Jacques Cousteau: A Life Under the Sea*. (New York: Sterling, 2008). 1-128.
- Cousteau Society. "The Captain." Cousteau.org. <http://www.cousteau.org/about-us/jaques>. (accessed November 20, 2012).
- Carpenter, Scott. "Sealab." Scottcarpenter.com. <http://www.scottcarpenter.com/sealab.htm>. (accessed September 23, 2012).
- The Kitchen Sisters. "LBJ & the Helium Filled Astronaut." Npr.org. <http://www.npr.org/programs/Infsound/stories/991015.stories.html>. (accessed September 23, 2012).
- Wall, Mike. "Mock Asteroid Mission on Ocean Floor 'Incredibly Realistic,' Astronauts Say." Space.com. <http://www.space.com/16232-mock-asteroid-mission-ocean-neemo16.html> (accessed January 12, 2013).
- Gage, Deborah. "NASA astronaut speaks from the ocean floor: 'We're completely isolated.'" Smartplanet.com. <http://www.smartplanet.com/blog/thinking-tech/nasa-astronaut-speaks-from-the-ocean-floor-8216were-completely-isolated/4078> (accessed October 18, 2012).
- Cameron, James. *The Abyss*. DVD. Directed by James Cameron. (Los Angeles: 20th Century Fox, 1989).
- Hendrick Hamel. *Hamel's Journal and a Description of the Kingdom of Korea, 1653-1666* (Neatherlands, 1666)
- Suk Ki Hong and Hermann Rahn, "The Diving Women of Korea and Japan," *Scientific American* May (1967): pg. 43.
- Cousteau, Jacques. *Le Monde sans soleil*. Jacques Cousteau. Paris: C.E.I.A.P., 1964.
- Cousteau, Jacques. *The Underwater Odyssey of Commander Cousteau*. Jacques Cousteau. Paris: C.E.I.A.P., 1976-1982.
- Mothersbaugh, Mark and Robert Casale. *The Life Aquatic with Steve Zissou*. (Los Angeles: Hollywood Records, 2004).
- Anderson, Wes. *The Life Aquatic with Steve Zissou*. (Los Angeles: Touchstone Pictures, 2004).

- Darwin, Charles. *The Voyage of the Beagle*. (New York: Penguin Classics, 1989).
- Melville, Herman. *Moby Dick*. (New York: W.W. Norton & Company, 1979).
- Verne, Jules. *20,000 Leagues Under the Sea*. (New York: Sterling, 2006).
- Carpenter, Scott M. *For Spacious Skies: The Uncommon Journey of a Mercury Astronaut*. (Orlando: Harcourt, 2002).
- Carpenter, Scott M., Gordon L. Cooper, John H. Glenn, Virgil I. Grissom, Walter M. Schirra, Alan B. Shepard, Donald K. Slayton. *We Seven: By the Astronauts Themselves*. (New York: Simon & Schuster, 1962).
- Goetz, Philip W., Robert McHenry, and Dale Hoiberg. *Encyclopedia Britannica, 15th Edition*. (Encyclopaedia Britannica, June 2009).
- Hoyt, Eric. *Creatures of the Deep: In search of the sea's 'monsters' and the world they live in*. (Ontario: Firefly Books, October 6, 2001).
- Koslow, Tony. *The Silent Deep: The Discovery, Ecology, and Conservation of the Deep Sea*. (Chicago: University of Chicago Press, April 15, 2007).
- Lynette, Rachel. *Deep-Sea Anglerfish and Other Fearsome Fish (Creatures of the Deep)*. (Chicago: Heinemann-Raintree, August 1, 2011).
- Nouvian, Claire. *The Deep: The Extraordinary Creatures of the Abyss*. (Chicago: University Of Chicago Press; First Edition, March 15, 2007).
- Rex, Michael A. *Deep-Sea Biodiversity: Pattern and Scale*. (Cambridge, Massachusetts: Harvard University Press, February 15, 2010).
- Batson, Peter, Karsten Schneider, and Don Walsh. *Into The Deep*. (London: Quercus Publishing Ltd. London, 2008).
- Cameron, James, and Steven Quale. "Aliens of the Deep." DVD. Walt Disney Studio, Buena Vista Home Entertainment, November 1, 2005.
- Fothergill, Alastair. "The Blue Planet: Seas of Life." DVD. Produced by Andrew Byatt. BBC Warner, February 5, 2002.