“CONNECTIVITY”
A Documentary/Series of Transmedia Research Projects

Exploring Intertwined Ecosystems
Throughout the Pacific
filmed in Ultra High Definition (4K)

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Executive Summary

“Connectivity” is the title for my video capstone project for graduation from the Master of Advanced Studies program at Scripps Institution of Oceanography. The concept for this project was well received, and the piece which was originally designed to have a run time of under 10 minutes, has blossomed into a full documentary film project. This project is a transmedia research series that is captured in the stunning format of Ultra-High Definition, or 4k. We explore how life on Planet Ocean, and specifically around the Pacific basin, is inseparably intertwined. Ecosystems tug at one another, some give way before our unblinking eyes. Recovery of some species of whales like the humpbacks are conservation success stories, while other species like the Main Hawaiian Islands insular population of false killer whales are threatened due to habitat degradation, decrease of prey species and longline fishing techniques. Scripps scientists are interviewed about their respective fields of research, and weigh in on their interests, concerns, and the broader scale implications of their work in oceanography.

These stories from around the Pacific need to be told, and it is my goal to go out into the field, assist in the research, capture the images, and improve outreach so the messages effectively reach the public in an innovative and unforgettable way. Our legacy as humans depends on it.

Common anthropogenic stressors take many forms but for this documentary will include:

- Near coastal land development can increase siltation and nutrient loading, which can smother sensitive coral reefs
- Unsustainable fishing practices are depleting fish stocks in many areas around the Pacific
- Plastic micro-particles are accumulating in the subtropical oceanic gyres, and overall ocean health is declining
- Changing ocean chemistry (Ocean Acidification) is having a direct effect on aqua farms on the Pacific Northwest Coast
- Whales and fisheries interact, from humpbacks to false killer whales
- Acoustic soundscapes - from deep ocean ecosystems to shallow reef environments and how sound may be affecting biodiversity
- Human use of oil-based products is causing increasingly less subtle planetary shifts, adding toxicity to the ecosystem and fueling climate change
A good deal of the footage needed for this feature-length documentary has already been captured, all in the clarity of 4K. From doors-off helicopter filming of waterfalls, agriculture, and trash incinerator plants, to rare in-water filming of humpback whales swimming majestically through crystalline Maui waters, this project has already gained momentum as well as fiscal backing.

The project is unique because it allows for a combination of scientific research, communication, and artistic filmmaking – as well as incorporating progressive 4K technology. To know a place or a topic, it is best to spend some time up close and actively involved in it’s observation. As a research assistant with one foot grounded in science, the other in journalism, I hope to continue to find my way to places I can participate in and then report on the science being conducted. Yet it is truly the generous support received by a myriad of sponsors, agencies and individuals that propel this documentary forward. There are many Pacific stories worth telling, and it is my hope that these research/film sessions will synergistically tie elements together, bringing them clockwise around the Pacific on an inward spiral.

“Transmedia storytelling” is an approach used by filmmakers, roughly defined as separate story pieces that can live across multiple formats. My vision is to utilize the captivating UHD underwater and aerial footage that once collected, will be repurposed into different uses, telling slightly different stories to different audiences. The footage will be shared with major collaborators, donors and stakeholders such as Scripps, the Birch Aquarium, COORC, Algalita, etc, who can recut it into web assets or standalone vignettes tell their stories to help draw future funding and support.

This UHD documentary project we create will be submitted to various independent film festivals as well as HBO and PBS. Such is the versatility of a transmedia project that can use footage in a variety of ways and bridge multiple platforms.

PLEASE SEE LINK TO VIEW PRIVATE ROUGH-CUT ASSEMBLY OF FOOTAGE ALREADY CAPTURED:

Link to Vimeo clip: vimeo.com/96675429

Password: Capstone

Defining Ultra-High Definition: What does it mean to be 4K?

The idea for this technologically advanced (2160p) format was originally developed by the Japanese broadcasting network (NHK Science & Technology Laboratories), and has gone through a number of name changes including: “4K,” “Ultra HD,” “Super Hi-Vision,” “UHDTV.” It has a minimum resolution of $3840 \times 2160$ (8.3 megapixels), which is roughly
equivalent to 4 times the number of pixels in Full HD format (1080p). Aspect ratio is 16:9, and it should also be noted that the “p” in 2160 p stands for “progressive scan” rather than pixels, which one might imagine. There is also 8K resolution being developed, which is closer to actual IMAX quality, and may one day be a new standard, but for now beyond the scope of this capstone.

While resolution is part of the story, so is frame rate. To be considered truly “progressive” a frame rate of over 24 frames a second is needed, so although some less expensive cameras like the new GoPros Hero 3+ are available in 4k, their frame rate is considerably less (15 frames per second) and would therefore not qualify. What they call true “Rec. 2020” which is a color gamut and another jump upwards in color space. “Rec. 2020” color format allows frame rates of up to 120 fps (frames per second) and reproduces colors that cannot be seen on a lower 1080 p High Definition screen.

The camera that my capstone project collaborators Susan Kucera and Greg Furstenwerth have been shooting is the Red, or Epic camera, which features lenses capable of capturing exceptional images at a sufficiently high and therefore detail-packed frame rate. For the gyre expedition and other deep filming, I will use the new Sony AX-100 4K (shoots at 24 fps) and a yet-to-be released on the market underwater housing by the manufacturer Gates Underwater Products as part of in-kind donation. They generously support this project and have guaranteed me a unit to take into the field, even if it’s their prototype.

The market for consumer quality UHD screens in home theaters is growing, yet due to production costs there is somewhat limited ocean science outreach content for consumers - right now. Timing is key as the future of broadcast television is ushered in via Ultra HD, this project is perched to receive high viewership.

The manufacturer Sony is now selling UHD players for under $700, and they come preloaded with 10 films and other content. Programming is also being made available on their Video Unlimited service that allows customers downloadable 4k content. The BBC is the first to announce a nature series that will be shot in UHD, as well as Amazon studios will film originals in this resolution starting this year. YouTube is also now putting out 4k content, but there are only five videos on the site to date. In a race to be the first, South Korea has started to test transmissions of five channels with 4k content, beating Japan’s SkyPerfect. It is a budding industry thirsty for content, by all accounts.
Broader Impact of the Work

This illuminates an excellent opportunity to create scientific outreach material that can have a broad reach and viewership if produced in a timely manner. Future productions will need the proven talents of technologically advanced filmmakers.

In addition to being educational, with intense shots of whales and reefs visually gripping in 4k, this project is important for its collaborative bridge-building opportunities. The partnership has already been forged between various groups, agencies, NGO’s and companies. By working together all parties supporting the project are perched to benefit from the creation of future projects with standalone funding that will likely ensue. Each partner as well as participant in this project has been selected because we all share similar core values.

As we look at issues facing the ocean realm and Pacific Basin, there is reason for hope as well as behavioral change on our parts, and knowledge will empower. A series of interviews and the juxtaposition of images will engage audiences. Creating custom Ultra HD content will serve not only to create a stunning showcase of nature imagery to display in theaters and increasingly in homes nationwide, it will share the important stories of oceanographic research and conservation that affect all life on Planet Ocean.

Major Collaborators and Sponsors:
Cinepartners
Clean Our Oceans Refuge Coalition (coorc.org)
NOAA
Hawaiian Islands Humpback Whale National Marine Sanctuary
Windward Aviation
Algalita Marine Research Institute
Human Dolphin Foundation
Gates Underwater Products

Proposed Total Project Budget: $300,000

Requested from Calitz CSRO grant for Graphics: $48,500
**Match Funds/Cost Sharing from Collaborators to date:** $149,400

- $78,000 from Clean Our Oceans Refuge Coalition for GPGP/gyre Algalita expedition, Midway, San Juan Islands & Arctic filming
- $25,000 from NOAA for in-kind access to humpback whale research vessel and crew
- $25,000 from independent filmmakers Kucera and Furstenwerth for Epic/Red filming
- $9,000 from Maui Electrical Solar Energy Company to support filming, research and travel expenses (boats and helicopter)
- $5,000 from Gates Underwater Products
- $4,800 Trilogy Excursions
- $1,400 Windward Aviation
- $1,200 Maui Dive Shop

**Total Amount Left to Raise:** $150,500

**Relevance to MAS program/CMBC Strategic Plan:**

This UHD capstone project implements multidisciplinary collaboration and adheres to the vision of the CMBC MAS program by:

- allowing work on various scientific research projects with different groups
- producing meaningful communication of ocean science research and exploration for a full-length documentary as well as other freestanding projects
- educating viewers and offering insight into human stressors to the ocean and what is being done to study and protect biodiversity as marine environments are changing rapidly
- recognizing a niche market and innovative distribution possibilities of a UHD project
- presenting vivid underwater imagery that will captivate audiences and fully demonstrate the vibrancy of emergent 4k technology
- maximizing benefits for all parties while fostering a spirit of collaboration for education
- providing a mechanism for future growth into projects with deliverables that provide concrete measurements of success, such as continued research or a cable television series
Work Plan and Milestones

Footage collected so far includes aerials from doors off helicopter on Maui and Molokai, as well as reef in distress footage from West Maui. Have worked with filmmaker Susan Kucera on her film “Breath of Life” as a subject discussing marine debris, and assisted footage collection in the process.

For the last 3 years I have been on NOAA permit as both in-water and topside researcher, gathering images for a study on scar analysis to show possible gear entanglements and fisheries interactions. In addition to aesthetic value of footage I can use for other educational purposes, I analyze, pull stills and submit images to NOAA for this research on scarring.

My time at SIO in the MAS program has afforded the opportunity to meet as well as interview several professors whose work has had an impact on me. Interviews with these prominent researchers have already been conducted, and it is my hope to follow them into the field, assist them in their field research, and capture images (called “B-roll”) that can be shown with their interviews. Participants and interviewees from SIO include: Greg Rouse, Aaron Thode, Michael Buckingham, Stuart Sandin, Jennifer Smith, Jenni Branson and Levi Lewis.

Interviews with NOAA/Hawaiian Islands Humpback Whale National Marine Sanctuary collected while on Maui this winter include: Malia Chow, Sanctuary Superintendent; Ed Lyman, Entanglement Response Coordinator/Researcher; Joseph Carrier, Captian and Naval Officer; and Ka’au Abraham, Sanctuary Coordinator.

Phase One: June 28 - August 16, 2014: Expedition to the Great Pacific Garbage Patch with Algalita Marine Research Institute. Will spend 6 - 8 weeks on 50’ catamaran with other researchers to study the accumulation zone in the Northeastern Pacific Gyre. Will test for radioactivity in extracted ghost nets and debris, as well as document any possible species rafting and potentially forming habitat within the described Tohoku tsunami debris field. The trip will spend a total of 30 days in the accumulation zone, doing midwater as well as surface trawls. My responsibilities as documentarian and media outreach director include daily blogs, running the Ship-to-Shore program into classrooms across the globe, and a mid-gyre live interview via satellite. This will be my second gyre expedition with Algalita - the first was in 2011 sailing approximately 3,000 miles across the Western Pacific Gyre from the Marshall Islands to Japan sampling for plastics via manta trawl. Spending over a month in the accumulation zone with dive equipment and an on-board compressor will allow me to really capture the images we seek for the documentary in a way rarely done before.

Phase Two: September, 2014. Filming marine debris in Midway Atoll, both above and below the surface. Will work with resident researchers to conduct several beach and reef transects, to see approximately how long it takes for 2 workers to clean one cubic meter of beach or reef.
**Phase Three:** December 2014. Hope to be able to join research cruise with Michael Buckingham’s lab to deploy “Deep Sound” and send sphere to bottom of Mariana Trench (“Challenger Deep”) to record various data including acoustics. Also want to film remote island beaches in that vicinity (around Guam and the Philippines) to gather footage of state of reefs and debris accumulation offshore as well as nearshore watersheds in areas of dense coastal population.

**Phase Four:** Winter/Spring 2015. Hope to film and assist Aaron Thode doing field research on humpback whale vocalizations in Baja California, Mexico. Want to gather footage of his team in action to support with visuals his interview sharing findings of interesting time-of-day trends of humpback being recorded.

**Phase Five:** May, 2015. Tokyo, Japan and Majuro, Marshall Islands. Will return to areas already visited and researched in 2011 to gather b-roll footage of cities on coasts, crowded fish markets, as well as radioactive remnants from nuclear testing conducted approximately 50 years ago.

**Phase Six:** July - August 2015. Arctic Circle and Southeast Alaska. Collect footage as well as ice-core samples for Alglaita and COORC.org in the High Arctic. Join research team of Fred Sharpe and the Alaska Whale Foundation to conduct humpback research on bubble net feeding. Rest of schedule and post-production TBD.

**Project Type:** 4k Ocean Science Content Creation

**Project Participants:** SIO capstone committee members - Greg Rouse, Stuart Sandin, Aaron Thode, and Michael Buckingham

**UCSD Internal:** Zeinabu Davis, Communications Department

**External** participants include filmmaker Susan Kucera, funder Tom Hirschberg of COORC, Charles Moore of Algalita Marine Research Institute, Keone Laepaa and Barbara Lilly of Human Dolphin Foundation, Mary Harper of NBC, Fred Sharpe of Alaska Whale Foundation, u/w rebreather cameraman Greg Furstenwerth, and mentor Ed Lyman of NOAA.

**Proposed Project Duration:** 6/15/14 - 8/1/16
Documentary Treatment for

“SPIRAL PACIFIC”

_Exploring Ocean Ecosystem Connectivity_

The significance of the spiral is well documented throughout history. The "golden ratio" is found in nature from galaxies to shell and leaf patterns, used by artists and architects, and said to symbolize connectivity and union. This documentary explores various ecosystems throughout the Pacific basin, and brings us ultimately on a journey inward, to look at how humankind is rapidly changing the health of many ocean ecosystems that sustain us. Viewers experience a spiral tour of the North Pacific in Ultra High Definition, following that sometimes invisible thread of connectivity that will lead to an inward reflection.
The story begins as a ship of scientists arrives at the Mariana Trench off Guam and prepares to launch a sphere to slowly descend and probe downward, eventually touching down at Challenger Deep, the deepest spot in the ocean. From scientist Michael Buckingham we learn about ocean acoustics, and how soundscapes in the sea provide much needed information about the physical environment of the deep sea.

From there the journey heads northeast to Japan to follow up on the aftermath from the Tohoku earthquake and subsequent tsunami that triggered the tragic Fukushima nuclear power plant meltdown. Familiar scenes from fish markets will be filmed, paired with Geiger counter readings. Other topics such as by-catch and overfishing are introduced.

Proceeding clockwise to Russia then Alaska, we look at the situation in the Arctic Circle, where the loss of summer sea ice and subsequent opening of NW Passage will have profound effects on the area. Plastic micro particle concentrations recently discovered in sea ice introduces the topic of consumerism.

Southeast Alaska researcher Fred Sharpe introduces us to the summertime habitat of the humpback whale and we look at fisheries interactions as well as the importance of this region in food production.

Continuing southward along America's Northwest Coast, sea changes continue as the burning of fossil fuels is having an effect that can be felt by aqua farms in Washington and California. Ocean Acidification is changing seawater chemistry and posing challenges for calcareous shell-building animals such as clams, mussels and scallops, threatening those industries. We also look at the southern resident orca population, and heavy metals and pollutants found in their blubber.

At Scripps Institution of Oceanography's Birch Aquarium in San Diego, Professor Greg Rouse works with students, aquarists, and others worldwide in attempts to help propagate delicate and unusual species, such as the Common and Leafy Sea Dragons. A new breeding facility will hopefully shed light on their life cycles in hopes of eliminating the need to catch animals from the wild for the aquarium trade.

Due south in Baja California, Mexico, acoustician Aaron Thode studies humpback whale vocalizations. His team of researchers drop hydrophones to gather the data for up to a couple months at a time to analyze back in the lab at Scripps. Spectrograms, which provide colorful graphic representations of the sound, are read to help seek and understand patterns.

Researchers onboard the 50' catamaran Alguita set sail from California due east into the Eastern Pacific subtropical gyre, to spend over a month living in the Great Pacific Garbage Patch. The accumulation of micro-plastics in this area, as well as derelict or "ghost" fishing
gear and possible remnants from the Tohoku tsunami may potentially be creating a new synthetic ecosystem in remote offshore areas. Rafting organisms are of concern to areas vulnerable to invasive species, such as Hawaii. Captain Charles Moore of Algalita Marine Research Institute speaks to how the ocean is downhill from everywhere. We must face the massive trash mess we’re creating because although we can toss things out, in actuality "there is no away."

The spiral journey arcs to the Hawaiian archipelago, where the rebound of the North Pacific humpback whale population symbolizes hope and shows the effects sound policy change can have on conservation. Stunning in-water 4K images of humpbacks in their breeding grounds help researchers record scarring and study possible fisheries interactions as well as evidence of collision with ships in hopes of mitigating these threats.

Off of the Big Island, we look at the topic of fishing again from the perspective of false killer whale depredation from the tuna and swordfish long line fisheries. New genetics studies show that much like other killer whales (*orcinus orca*) the false killer whales of Hawaii have genetically distinct populations with unique learned feeding habits, and the Main Hawaiian Islands Insular population is dwindling, leading to their new “endangered” designation. Hopefully through research we can find ways to solve this pressing issue.

Coral reef ecology in the Hawaiian Islands is discussed by researchers Jennifer Smith and Stuart Sandin who study indicators of balanced reef ecology and discuss the link between population density and health to surrounding reef ecosystems.

The arc continues into the center of the geographic spiral, Midway Atoll. With such a low human population and isolated location, one would expect pristine beaches and a thriving ecosystem. Instead the beaches are littered with plastic debris, Laysan Albatross chicks choke on beverage bottle lids, and turtles nest amid toxic bits which can affect laying as well as the success of their clutches. It’s time to stop the spinning and ground.

Modern conveniences allow us to easily move about this earth farther and faster, consume more, toss items away and repeat the process tomorrow with rarely a second thought. The consequences of our actions on other species is not widely beneficial, as we make the Pacific Ocean less hospitable at a rate too fast for many species to adapt to. Through our behavior, we are engaging in an almost parasitic relationship with the host planet that sustains us, and biodiversity declines under our anthropocentric lifestyle.

Hopefully the final destination for viewers will be going within, to see how we might change our behavior and slow the damage so other species have the room to live. Suggestions will be offered that will help mitigate the damage we are creating, but the takeaway message is
to try to live more simply, support our local communities in commerce as well as volunteerism, and slow the frenzy of consumerism.

The film *Spiral Pacific* represents the consciousness of nature, juxtaposes the beauty and tragedy found in this great sea, and nudges humanity to slow down and reflect inward. By seeing the connectivity, we can shift to support a more sustainable future.