

UC San Diego

Capstone Projects

Title

Ecologies of Sound and Sea: An Auditory Journey through Acoustic Ecology

Permalink

<https://escholarship.org/uc/item/9pd4n7sf>

Author

Amor, Michelle G.

Publication Date

2021-06-01

A Capstone Project

Ecologies of Sound and Sea

An Auditory Journey Through
Acoustic Ecology

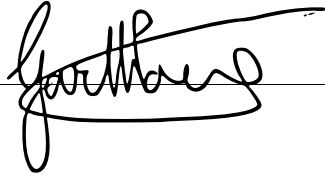


Michelle G. Amor

Masters of Advance Studies:
Marine Biodiversity & Conservation
Scripps Institution of Oceanography

Capstone Advisory Committee:

Garth Paine, PhD (Arizona State University)



Date June 8, 2021

*Richard Norris, PhD
(Scripps Institution of Oceanography)*



Date 8 June, 2021

*Kerri Seger, PhD
(Applied Ocean Sciences, University of New Hampshire)*



Date June 9, 2021

Abstract/Executive Summary:

Sound can be defined as an auditory impression and sensation, perceived by the sense of hearing. Sound is a mechanical radiant energy, transmitted by longitudinal waves of pressure through a material medium. A material medium is determined by the environment, which can be gas, liquid, or solid. The characteristics of this medium, such as temperature and density affect the characteristics of propagation of sound. Every sound heard is a signal within an environment. These sound signals then become a part of a network of sound signals interacting amongst one other. Collections of sonic networks then create complete soundscapes. Each soundscape, which is defined by its environment, has a unique signature that describes the state of being of that place. Studying the relationships within these soundscapes is called acoustic ecology. Acoustic ecology is a way to quickly assess the overall ecosystem properties of a place and its health. One of the most effective ways to transmit sound to the public is through radio, which has the ability to communicate information to large audiences and in different cultures around the world. Podcasts, online radio systems, are becoming increasingly popular, allowing listeners to tune into a specific genre or show. The Podcast created for this presentation, *Ecologies of Sound and Sea* is a subversive science communication project about Sound, Listening, Stewardship and Ecology. From interviews of leading researchers to composers, all focused on the significance of sound within acoustic ecology. This project works towards creating social and communal change

as well as using acoustic ecology as a tool for looking at human impact, climate change and the overall health and balance of our ecology. It is also meant to support acoustic researchers to find funding, encourage education through podcasts, as well to support teachers to use auditory programs in their classrooms. This sonic journey takes the listeners from the chaotic city to rivers, farms, swamps, marshlands, down into the ocean and finally back to the surface. The program surrounds the listener with each unique soundscape, in order to gain a deeper appreciation and understanding of acoustic ecology and our impact within the world we live in.

Context

Since the beginning of the Industrial Revolution, human generated signals (anthrophony) have become louder over the years. These louder signals started to overpower other sounds, weakening networks within other species and masking some critical communication bands. Since various species use sound to communicate, find food and hide from predators (biophony), many must adapt or relocate as a result of increasing anthrophony. As the environment started to change, so where the sounds being produced. As sounds started to change, so did the environment. Both sound and the environment are interrelated. Today, this shift in soundscapes and changes in the environment are still evident.

Broadband anthropocentric signals can also potentially harm the auditory systems of certain species. Examples of this are seen in the various beached cetacean cases along the coastlines of many countries. Factors such as contamination and temperature can also alter the density of the medium in which sound propagates. This is seen in environmental changes in forests and in coral reefs, where silence begins to dictate the once bustling biodiverse soundscape. The project, *Ecologies of Sound and Sea: an Auditory Journey Through Acoustic Ecology*, introduces various topics related to current acoustic studies and conservation issues. There are many forms of listening and by being aware of these different forms one can begin to practice mindfulness while listening. The following are four basic modes of Listening:

- Directed listening, directing your attention to a specific sound. e.g. bird
- Active listening, directing your attention to the relationships of sounds. e.g. bird calling other birds, reverberation in a canyon.
- Passive Listening, listening to the entire environment all at once, the overall soundscape.
- Somaphony, whole body listening. e.g. feeling the vibrations of your clothes, feeling the wind on your face, the density of air.

Topics In the Audio Soundscape work - *Ecologies of Sound and Sea: an Auditory Journey Through Acoustic Ecology*

The program begins in the city, allowing the listener to feel overwhelmed and over-saturated with sound. This introduction scene was chosen because it is a familiar place and it allows us to feel connected and yet disconnected. There are footsteps, someone gets in their car, turns on the radio and drives off. The radio broadcasts familiar music, voices and news stations covering stories such as the wildfires in California, global warming, and mass stranding of cetaceans due to sonic exposure. We then hear the voice of Greta Thunberg, in her speech, “How Dare you”, capturing the frustration in some youth, along with David Attenborough’s

empathetic perspective on the natural world. Lastly, Richard Nixon's speech on the environment. Nixon was chosen in this section because of his controversial reputation, along with the fact that the National Environmental Policy Act of 1969 was signed into law by President Nixon and was considered the starting point for the Clean Water Act.

Following this, we hear a storm which evokes a rain song of the Salish Sea tribe Tla'amin Nation sung by Ta'Kaiya Blaney. I chose the Tla'amin Nation tribe because of their strong relationship with the teeming biodiversity found within this area. The Salish Sea holds great importance in acoustic ecology because many policies are trying to help the local resident orca population in Puget sound, along with Chinook salmon, which are the main food source for the resident orcas. Ta'Kaiya Blaney's voice subsides and the definition of acoustic ecology is briefly then introduced by the author, allowing the listener to begin to understand that all of the sounds we hear, including our own sounds, make up the acoustic ecology.

The composition then tapers off into farmlands, hearing the sound of bees buzzing and cows, goats and a distant dog. We hear the voice of Lei Liang, a composer and professor at UCSD, who describes his curious two year old son, listening to the sound of wind rustling the tree leaves for the first time. He explains how sound is full of mystery and wonder and how we need to submit ourselves in order to hear the sounds being made all around us. We begin to perceive the overwhelming, symphonic sounds of birds. Jenny Brooks, an ornithologist at Texas A&M, then introduced how she moves slowly, while she is out doing fieldwork, in order to study the sounds of birds. She also discusses the benefits of listening to these natural sounds and how taking the time to listen to birds has demonstrated health benefits.

The piece then shifts to a night scene in a swamp where we hear the sound of distant owls, loons, various birds, bears, otters, mice and more. Acoustic ecologist, composer and professor at Arizona State, Garth Paine, gently reintroduces acoustic ecology. He illustrates how all of the sounds we hear are interconnected and how soundscapes have a unique signature which helps us understand their state of being. His voice fades and we hear the trickle of a river again, and the sounds of a beach and seagulls. We hear the barking of seals in the distance along with a ferry horn, children laughing and then footsteps walking. Suddenly, there is a large splash! A diver is in the water. We begin to feel whimsical as the diver descends down. We hear a siren-like voice singing, the sound of the ocean's ambience and the sound of breathing through a scuba regulator rhythmically. Breathing continues and we hear a heartbeat.

As the diver goes deeper, PhD student and researcher at Scripps Institution of Oceanography, Camille Pagniello discusses how sound propagates differently on land than in water. There is then the voice of the Director of the Marine Mammal Protection Project and marine acoustic policy expert, Michael Jasny. He speaks on the various ways animals use sound in the ocean. The voice of Senior Researcher at Applied Ocean Sciences LLC, Kerri Seger, appears, explaining aural camouflage; a way that grey whales camouflage themselves, by using the sounds of snapping shrimp and murky waters. Researcher, Camille Pagniello, speaks again, this time about fish choruses. She describes the sound of fish spawning, which sound like immense choruses, so loud that it looks like a wave of energy on a spectrogram. The voice of Composer and Professor at UCSD Lei Liang appears. He mentions that whatever he does as a Composer, there is little he can do to try to compose as beautifully as nature does, it is the highest form of achievement.

Suddenly an abrupt explosion occurs. There is total silence, then ringing in our ears and then comes along the distant sound of a submarine. The voice of Researcher Associate at Institute for Terrestrial and Aquatic Wildlife Research, Maria Morell Ybarz, discusses how she

has found lesions in ears of cetaceans and how she is able to determine the frequency at which the damage was created and potentially where the sound came from. We hear Senior Researcher Kerri Seger's voice again, discussing the efficiency of motors and how if you truly want an efficient ship, you actually want a quieter ship. The author then introduces a poem about anthropogenic sounds in the ocean; sounds of speedboats, shipping vessels, explosions and scientific exploration. At last, we hear the voice of Postdoctoral Researcher at Florida International University's Institute of Environment, John Butler and PhD student at University of Exeter, Tim A.C Gordon , both researchers in marine habitat restoration. They discuss an acoustic enrichment method, which is a method of broadcasting sounds of healthy reefs, to restore areas which have been depleted. The journey ends with Lei Liang saying that there are stories being made all the time with sound. A diver is then heard breathing again and surfacing on the water. The diver is surprised at all the sounds and information they learned about but wants others to understand how all sounds are a part of a unique network and how we need to understand these relationships within the soundscapes we all share in order to manage balance in our ecology.

Equipment used to create work

Zoom Recorder, Soundtrap, Macbook 2015 Laptop, Akai Mini MPK, Hang Drum, Dulcimer

Methodology

- Guide listeners through a process of active listening by using Radio Art.
- Use recording equipment, such as a Zoom and Sound trap to document marine acoustics
- Use collected material from SIO Acoustic Lab, NOAA sound library in a creative narrative.
- Compose, process and edit sounds using Ableton Live.
- Collaborate with podcast and radio stations and begin to expand potential audiences.
- Render final product with appropriate specifications.
- Make website with additional resources for public action

Background/Problem Statement:

The future of acoustic studies is at the forefront of conservation science. We are just beginning to understand how to use sound to increase stewardship along with management and protection methods. Because there are many sounds around us, the source of which is not intuitive, for example the sound of a fish, it is important for us to be able to study these sounds, understand the relationships and come up with effective methods of conservation in order to balance these systems. Rather than viewing our sounds as separate from the environment, we are a part of the environment. By seeing some of our unbalanced broadband sounds within the sonic network we are able to see how to use effective methods of balancing and managing these soundscapes and systems.

Challenges

Many of the challenges faced within this project had to do with the way we perceive sound in the ocean rather than on land. Because some sounds produced in the ocean are less

intuitive, I had to tell the audience exactly what they are listening to, rather than letting sound alone inform them. Of course, there are many sounds on land that we are still not aware of or do not come as intuitively, such as the sound of a river otter, or bear, or perhaps an animal that we were not even aware produces sound, which is why acoustic studies need to be considered when understanding and managing our environment as each sound and relationship is teeming with information. There are many relationships within this network that we are unaware of and by understanding how individuals react, or don't react via sound, we can begin to paint a clearer picture of environmental health.

Conclusion

To allow a space for people to question the sounds around them and the sounds they produce as well as to be able to find ways to listen to the soundscapes we all share.