Deep Bells

In this piece, I explore the data captured from three tagged Salmon Sharks in Prince Edward Sound, Alaska via a pop-off satellite archival tag. The dataset tells us how deep the sharks dive throughout the month of August, 2016 as well as the water temperature for a given dive. Scientifically, this data implies conclusions about the maturity and food sources of the three sharks, but I wanted to humanize this data so that we can get a step closer to understanding what it is like to live entirely underwater, and what it feels like to be subjected to the data collection practices used for sharks. All the sounds in this piece are synthesized. Its tempo is random, reading through each datapoint at between 1 and 1094 milliseconds per datapoint, giving a total runtime of 31.06 days, about the same number of days that we have data for.

My goal was to create a sonic landscape that could be universally recognized as oceanic while still maintaining an abstract interpretation of the data. I try to connect the ocean’s waves to breath. Sharks don’t need to surface breathe, but the piece invokes the feeling of losing your breath underwater through repetition. Each bell tone is a reminder that we must return to the surface to regain our breath and preserve our life.

The piece is largely an exercise, to place yourself in the position of the shark. A cow set free to roam on the mountain is given a bell so that its owner can find it. Likewise, the sharks in question were surgically implanted with satellites that act much in the same way a cowbell does. I chose to sonify the data as bell tones to call up the image of these sharks exploring the depths with an inescapable reminder of their own motion, much like a domesticated cow wears a cowbell, we can imagine these sharks with large bells swinging below their graceful bodies, bodies temporarily claimed by mankind. For this reason, the installation is designed to run for 31.06 days. If, theoretically, one was to sit and listen to it in its entirety they might emerge with a better understanding of what it was like to be a subject of this study.

The main work that I referenced when imagining this installation was Celeste

Boursier-Mougenot’s *clinamen*. This installation works heavily with the idea of motion and water, as well as the interaction between science and art, in this case physics. I also love the discrete nature of the sounds produced in *clinamen*. The bowls resonating after impact was an aesthetic that I kept in the back of my mind as I experimented with my own synthesis.

Data is synchronized between the three sharks via the use of a master timesheet. This text file contains a date and timestamp for every minute between 7/31/2016 and 8/31/2016. The timestamp is compared to the current line in the shark data file to see if they match. If they do, a bang is sent to a click~ object and the temperature and depth parameters are output to be used in the patch. The rate at which this master timesheet is read is determined by a unique random number (urn object) a new one is generated every 112 lines.

My main synthesis strategy involves sending clicks to three resonant lowpass biquad filters. The frequency of the filters is related to the depth parameter of each data point, scaled between a specific frequency range. The gain is set to 157 for the filters to ensure that they resonate enough. The Q of the filters is related to the speed at which the data is read through.

Additionally, I have built a wave engine that amplitude-modulates pink noise by the function 0.6(2+sin(2πFt) where F is a random frequency between .001Hz and .15Hz, whose amplitude is in turn modulated by sin(2π\*.0124t). Thus the generating function for the wave sounds is sin(2π\*.0124t)((0.6(2+sin(2πFt))P) where P is the pink noise generator.

All four of these sources (3 sharks + waves) are panned to six channels in the specialization subpatch that makes use of the Ambisonics package. The six speakers are set up hexagonally so that each shark inhibits the space between two speakers, and there is a gap between every shark. (see block diagram below) The position of each source is determined by the azimuth on the circle which encloses the hexagon and passes through each vertex. The azimuth of each source is given by a sine curve at the frequency of the average temperature of a given shark’s data. The waves trace out a full clockwise circle before pausing and tracing out a full counterclockwise circle.

During the process of putting together this installation, I learned about working with data in a musical context, as well as what forms of data are efficient to implement in code. I spent a lot of time optimizing my patch to be transportable to any computer, and simplifying the user interface. Going forward, I hope to add a visual element. My dream is to be able to [visualize vector fields](https://anvaka.github.io/fieldplay/?dt=0.01&fo=0.998&dp=0.009&cm=3&cx=-337.6714&cy=-23.351550000000003&w=601.9858&h=601.9858&vf=%2F%2F%20p.x%20and%20p.y%20are%20current%20coordinates%0A%2F%2F%20v.x%20and%20v.y%20is%20a%20velocity%20at%20point%20p%0Avec2%20get_velocity%28vec2%20p%29%20%7B%0A%20%20vec2%20v%20%3D%20vec2%280.%2C%200.%29%3B%0A%0A%20%20%2F%2F%20change%20this%20to%20get%20a%20new%20vector%20field%0A%20%20v.x%20%3D%20sin%28p.y%0A%0A%20%20return%20v%3B%0A%7D) that correspond to the position of sounds relative to the speakers via a projector or electronics.

For now, I hope that this work gives you a greater appreciation for the wonderful creatures in the ocean, and teaches you something about yourself. The data I am using is from an unpublished study that was more for teaching purposes than scientific breakthrough. Although these researchers wound sharks to attach recording devices to them, they also form an emotional bond with the sharks they study. This study originally followed four sharks, one of which was lost. Although it is possible that the data from that shark is sitting at the bottom of the ocean, it is more likely that the shark was killed by fishermen.



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