

Meryl van Noie: Programme Notes

(7'10)

Umnenga (2022)

Visual Music

Sightings of whales in Southern Africa are not unusual from June to January as Southern Humpback (*Megaptera*) whales migrate to warmer waters from the polar regions up the East Coast of Africa to mate and calve in the warmer waters off the coasts of Mozambique and Madagascar. Although simply passing by the continent on their epic journey, they are often spotted from South African beaches. Humpback whales can be seen just offshore in small groups of up to ten animals, as single females with a calf. These whales can launch their entire bodies out of the water and are the most vocal of the whale species. If you dive during the winter months of South Africa, you may be able to hear the haunting songs of the humpback whales underwater from several kilometres away.

The Monterey Accelerated Research System (MARS) Cabled Observatory is located off the coast of California. It consists of a 52Km long undersea cable that carries real-time data from the deep sea to a lab on land. This infrastructure has allowed various scientists to deploy instruments at the MARS ocean observatory testbed. Audio data recorded using this infrastructure fall into three categories: *biophony* (sounds of marine life), *geophony* (sounds of the earth), and *anthrophony* (sounds of human activities). The intensity of all received sounds can be measured, and all are filtered and amplified so that people can accurately hear the character of these exciting sounds. However, some sounds have such a low pitch that they can only be heard with very capable speakers.

Researchers in global research teams use hydrophones and biological tagging to expand their understanding of the use of sound by whales. Pacific blue whale calls have been monitored together with other observations of their behaviour and ecosystem to indicate that whales alert other whales of foraging opportunities, thus sharing food resources with other animals. The calls signalling concentrated food sources are unusually frequent during aggregation periods. This indicates social behaviour as it reduces the time for individual whales to discover high-quality sources, allowing more efficient foraging for a large group without costing the individual caller their feast. This is helping them increase their population growth after human exploitation, which is slow at first but may increase faster as the population numbers increase. (*Animal Behaviour* 182, 2021:251-266)

The Directional Hydrophone Project

Currently on MARS is the Directional Hydrophone, a powerful underwater microphone. The project is led by Dr Kevin B. Smith, Professor of Physics at the Naval Postgraduate School in Monterey, California. The Directional Hydrophone is deployed with a shroud to dampen ocean current motions. It samples sound at a low rate (8kHz) in contrast to another project - the Ocean Soundscape project (sampling at 256 kHz) - which has a live stream of ocean sounds in the Soundscape Listening Room recorded off the coast of central California.

The Directional Hydrophone project studies include tracking spatial patterns in marine mammal populations and anthropogenic noise sources. Whale songs are analysed as they communicate with each other. Anthropony is increasingly harmful to marine life, including sea and noise pollution. Marine animals may adapt their behaviour to avoid this alien noise, consequently missing out on prime foraging or mating opportunities. Noise generated by humans can cause hearing damage or loss in marine mammals and fish, affecting their navigational abilities. In some cases, anthropogenic noise will increase the mortality rate in marine animals.

I came across the sound files posted by one of the co-authors of the paper cited above. John Ryan, a Senior Biological Oceanographer, studying whale behaviour using powerful hydrophones, posted some of their findings on freesound.org under the Creative Commons 4.0 (CC BY 4.0) licence. I asked his permission to use some of these files in this composition, and I was curious to learn more about his research. He kindly agreed to speak to me.

Quote from Johan Ryan: "All sounds are amplified and filtered because the raw recordings are largely tiny electrical signals, as needed to record everything from very quiet to very loud. The filter removes a DC offset so that the audio equipment is not damaged and the sound is clear. The degree of amplification depends on both the intensity of the sound as received and the purpose of the recording, but usually, we normalise for comfortable listening on the sound systems that can represent the sound (depending on its frequency content)."

Since I discovered the audio sources simply by searching for whale sounds, I asked him what he thought about their data being used in electroacoustic composition in such a serendipitous manner. This is what he said about the intersection between science and other fields of study:

"Flukes are a great subject for art... and science. We just finished a paper in which we applied machine learning to identify individual whales by the contours and colours of their flukes, tapping into a huge photo database from ecotourism."

The journal article referenced below articulates the findings of a study confirming how whales signal each other when aggregation of food sources are in strong supply, thus supporting other animals and not withholding the location of the source as one would expect. Formation and dispersion of whale aggregations were observed opportunistically from research vessels in each ecosystem. To examine foraging behaviour within and outside of supergroups, scientists in Ryan's study attached 17 integrated 3D accelerometers and video tags to individual blue whales for time periods of ~ 2-20 h, six of which were whales foraging within supergroups in 2017. They tagged an additional 22 blue whales in the same region in 2018 (no supergroups were observed in 2018).

One of the source videos in *Umnenga* is from the video tag collected during this study and shared by the scientists. It captures the whale feeding apparently noncompetitively within an extensive prey patch whose depletion is likely independent of foraging effort.

This composition is dedicated to the southeast Atlantic humpback and northeast Pacific blue whales that roam the Pacific and Atlantic Oceans and interprets whale songs recorded by the MBARI institute Directional Hydrophone, with their kind permission. All the sounds in the composition are affected in various ways but may not appear in the order that they were

recorded. They may also be layered, digitally altered and re-organised. Visual material is either from the study mentioned above or freely available from [pexels.com](https://www.pexels.com) under Creative Commons licences, with those who captured the image material referenced below.

I sincerely thank John Ryan from the MBARI Institute for his dedication to his work, patience and generosity in answering my questions.

Umnenga is the Xhosa word for Whale.
Ryan remarked: *Umnenga*. Love it.

References: *Underlined links are active.

Audio Material:

Pacific Ocean Sound Recordings recorded by John Ryan from the MBARI Institute were accessed on 11 August 2022 from www.freesound.org under the Attribution 4.0 International (CC by 4.0) licence.

Video and Image Stills material:

Video and still image material extracts were accessed between 13 and 25 August 2022 from www.pexels.com under the Attribution 4.0 International (CC by 4.0) licence, uploaded by the following contributors:

Videos

[pexels-greg-grzegorz-sobieraj-6825302](https://www.pexels.com/video/greg-grzegorz-sobieraj-6825302/)
[pexels-bhumik-photography-6625561](https://www.pexels.com/video/bhumik-photography-6625561/)
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[pexels-production-ID_4279313](https://www.pexels.com/video/production-ID_4279313/)
[pexels-production-ID_4332085](https://www.pexels.com/video/production-ID_4332085/)
[pexels-production-ID_3184446204](https://www.pexels.com/video/production-ID_3184446204/)
[pexels-sean-johnston-video](https://www.pexels.com/video/sean-johnston-video/)

Video S3: A humpback whale in South Africa (tag ID mn161105-37)

Images

[pexels-andre-estevez-3309870](https://www.pexels.com/photo/andre-estevez-3309870/)
[pexels-andrea-holien-892548](https://www.pexels.com/photo/andrea-holien-892548/)
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Journal Article:

David E. Cade, James A. Fahlbusch, William K. Oestreich, John Ryan, John Calambokidis, Ken P. Findlay, Ari S. Friedlaender, Elliott L. Hazen, S. Mduduzi Seakamela, Jeremy A. Goldbogen, Social exploitation of extensive, ephemeral, environmentally controlled prey patches by supergroups of rorqual whales, *Animal Behaviour*, Volume 182, 2021, Pages 251-266, ISSN 0003-3472, <https://doi.org/10.1016/j.anbehav.2021.09.013>.
(<https://www.sciencedirect.com/science/article/pii/S000334722100316X>)