
SONUS
MARIS

SONUS MARIS

UNSW Library
6 February - 5 May 2023

UNSW Library is located on the unceded traditional lands of the Bedegal peoples, who are the Traditional Custodians.

InletTracker processing of Sentinel-2 image of Durras Lake in an open state (14.01.2021) Credit: Public Domain image courtesy of the European Space Agency (ESA) / National Aeronautics and Space Administration (NASA)

We acknowledge that this project encompasses the unceded territories of the Biripi, Jerrawangala, Jerrinja, Murramarang, Tharawal, Wandi Wandian, and Worimi peoples, who are the Traditional Owners of the lands and waters. The estuarine systems featured in *Sonus Maris* are ecologically, economically, and culturally important. While the exhibition examined coastal changes over the past three decades, this is Aboriginal Land inscribed with more than 65,000-years of rich history and heritage. We recognise the longstanding and ongoing interdependent relationship the Traditional Owners have with these lands and waters.

SONUS MARIS

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Sonus Maris is an exhibition navigating the intersections between art and science emerging from an ongoing collaboration between artist Dr. Nigel Helyer and water engineers and scientists at the UNSW Water Research Laboratory (WRL). Working in close partnership with WRL postdoctoral researcher Dr. Tino Heimhuber, Helyer employs audio-visual media to reinterpret data charting the unique dynamics of intermittently closed and open lakes and lagoons (ICOLLs). ICOLLs are the most prominent type of estuaries found on the NSW coastline and are unique in that they alternate between open and closed oceanic entrance conditions, driven by the dynamic interplay between oceanic and land-based forces.

Through data archaeology and a novel algorithm, Heimhuber extracts valuable information from a three-decade archive of public satellite imagery, drawing attention to long-term morphological and eco-hydrological variations in these crucial sites. Helyer interprets this detail-rich source material to compose a musical score translating the changeability of ICOLLs as a multisensory experience. Helyer's experimental music invites audiences to re-think knowledge systems by seeing, feeling, and hearing the flows and patterns of coastal environments.

LIQUID MEDIUMS

By Dr. Emily Morandini

Dr. Nigel Helyer has long worked at the forefront of interdisciplinary art practice. His large-scale sculptures, sound works, and expansive creative research practices have straddled fields such as acoustics, engineering, and biology to engage the viewer with poetic, social, and cultural histories of place.

Within Helyer's practice, there is a distinct sub-narrative of water, maritime, and marine ecology. It's fair to say that throughout the decades, Helyer's artworks have spent less time in a gallery than on ships, boats, life-rafts, buoys, floating platforms, as well as submerged in seas, rivers, lakes, and wetlands. The boat-mounted soundwork *VoxAura: The River Sings* (2011) tells the story of the river through its changing chemical composition, and in *Meta-Diva* (2001), a solar-powered sculpture is placed within a pond, mimicking the sounds of the surrounding wetland ecosystem. *Under the Icecap* (2012) arranges the complex bio-logging data of elephant seals in the Sub-Antarctic Islands into live music performances. In some works, Helyer expresses narratives through data and analytics, in others, he pieces stories together with the many voices and sounds that reverberate on, and in, bodies of water.

Born in a small Sussex fishing village, Helyer recalls that at the age of ten, his mother packed him off to Portsmouth Naval shipyard to learn to sail, then later, she purchased him a small sailing boat to keep him occupied. "So it seems my fate is co-mingled with salt water, as it is professionally with sound. Both are liquid mediums, both immerse and surround us – and naturally, we can drown in both."[1] Like water, sound overflows into the surrounding environment, rippling against walls, floors, objects, and humans alike. When we encounter sonic works like Helyer's, we attune to acoustic patterns, intuitively gathering

Nigel Helyer, aged 17, sailing in Chichester Harbour, Sussex (Magnus Portus to the Roman invaders)
Credit: Image courtesy of the Artist

Farquhar Inlet, located on the traditional lands and waters of the Worimi and Biripi peoples, in an open state (05.09.2022)
Credit: Google © 2022, Image: Maxar Technologies, CNES / Airbus

information through vibrations marked by duration, frequency, and space. A space saturated in sound forms an environment itself – we don't just hear it; we are in it. Notably, this submersive quality of sound serves to connect the viewer to environments more broadly – to audible atmospheres thick, resonant, spacious, or sparse – be that in a gallery space, a ship haul, or a pond.

At a time of accelerating environmental change, challenge and uncertainty, *Sonus Maris* uses sound to immerse the viewer within the long-term fluctuations of coastal waters in a way that is highly specific to place. Durras Lake, Shoalhaven River, Smiths Lake, and Farquhar Inlet are sites rich with Aboriginal culture and history, as well as locations that many who visit the exhibition may be fondly familiar with. Their natural beauty has long attracted holidaying families who go to swim, sail, fish, or camp by these serene, picturesque estuaries. Helyer describes the deep connection he holds with such places, writing, "The saying Salt is in the Blood speaks not only of my family history but to our collective origins – our blood has the same salinity as sea water, a reminder of our evolutionary prehistory and a caution that we share our fate with our aqueous mother, who controls our climate and our atmosphere."[2] These are sites where land meets the sea, and environmental, cultural, and personal histories intertwine.

Sonus Maris draws both our attention and senses to the morphological duration of these sites; decades of waves, currents, tides, surges, and flows that cannot be entirely fathomed by numbers, nor by human observation alone. Becoming increasingly conscious of the long-term human impacts upon complex environmental ecosystems also means contemplating the uniqueness of places such as these; our collective and individual relationships to, and within, them.

1 Nigel Helyer, "Biography," *Sonic Objects*, 9 August 2009, accessed 30 March 2023, www.sonicobjects.com/index.php/2005/08/09/biography/.
2 Nigel Helyer, "CrayVox," *Sonic Objects*, 27 May 2011, accessed 30 March 2023, www.sonicobjects.com/index.php/2011/05/27/crayvox/.

Installation view, *Sonus Maris*, UNSW Library, 6 February – 5 May 2023
Credit: UNSW Library

Installation view, *Sonus Maris*, UNSW Library, 6 February – 5 May 2023
Credit: UNSW Library

A still from an animation of InletTracker data showing an accumulation (over time) of inlet channel behaviour
Credit: InletTracker

SONUS MARIS; THE STRANGE ATTRACTOR

by Dr. Nigel Helyer

The Brain – is wider than the Sky –
For – put them side by side –
The one the other will contain
With ease – and you – beside –

The Brain is deeper than the sea—
For – hold them – Blue to Blue –
The one the other will absorb –
As sponges – Buckets – do –

The Brain is just the weight of God –
For – Heft them – Pound for Pound –
And they will differ – if they do –
As Syllable from Sound –

- Emily Dickinson, c. 1862[1]

We are neurologically predisposed to seek patterns in our surroundings; in fact, pattern recognition is our core cognitive ability, vital to our evolution and survival as a species—as it affords the capacity of prediction.

In life, as in art, we delight in the symmetries, growth patterns, and morphologies of the natural world as we recognise our own formation through them. However, there is a constant flux between the regularity or predictability of a pattern and a counter-current of instability or turbulence that might threaten to render it indecipherable. This is embraced

in creative practice as we always require a twist to a narrative, a dissonant metaphor in a joke, or an unpredictable note to conclude a melodic series. This is the sweet spot where our expectations of regularity in a pattern are disrupted, but not too much, just enough to throw the brain into mild confusion. It is the fissure, the reveal, and the punchline that reflects on the narrative arc and plays with our assumptions. To walk this tightrope between order and chaos is one of the central techniques of art. By contrast, the task of science is to distil clarity from chaos, to disambiguate the signal from the noise.

This subtle distinction has frequently placed art and science in a polarised position, seemingly at opposite ends of the spectrum of human endeavour, where in reality, neither has a monopoly on imagination, creativity or inspiration. Now more than ever, the disciplines need to communicate, collaborate, and hybridise.

The *Sonus Maris* project at the UNSW Water Research Laboratory established a collaboration with Dr. Valentin Heimhuber, an environmental researcher & engineer working on the integrated management of river systems, wetlands, and estuaries in the context of climate change and the pressures of population growth. His work focuses on using large satellite datasets and machine learning to develop new tools for the improved management of water resources and water-dependent ecosystems.

Valentin developed the algorithm InletTracker that draws upon more than three decades of public-domain satellite imagery (Landsat 5, 7 and 8 and Sentinel-2). His new analytical tool can reconstruct the dynamics of ICOLLs by retro-analysing the relatively low-resolution satellite images to identify the flow patterns and frequencies of these water bodies, thus providing a historical perspective demonstrating the cyclical nature of interactions between fresh-water and salt-water bodies. InletTracker reveals when and how they open and close to the ocean. This data can then be correlated with the associated climatic and oceanic data to illustrate a complex web of environmental interactions, which may indicate future behaviours under the influence of a changing climate.

The ingenuity of InletTracker is that it functions to recreate observational data of environmental events that are geographically and temporally distant. This potential caught my imagination as it presented a form of data-archaeology capable of exploring a single location and comparing hundreds of similar systems around the globe. In effect, the system facilitates a look back at environmental water events that, at the time, were mostly unremarked and certainly not intentionally observed or recorded.

The InletTracker system can trace inlet channels along and across the coastal barrier/berm and analyses the resulting data to infer the location and shape of entrance channels, their width at the throat and their status as either open or closed to the ocean.

The principal drivers of such interactions are terrestrial rainfall, fluvial action, wave and tidal action, atmospheric pressure, and associated storm events. These combine to set in motion a constant but irregular cycle of opening and closing water bodies that have implications for coastal integrity, human habitation, coastal land use, and changes to the micro and macro ecologies.

As in many of my environmental works, the dominant concern is how to manifest such complex data to make it palpable, visceral, and emotionally engaging. How can these complex webs of information become something that illuminates the fundamental connection between our human activities and planetary dynamics as it spins out of control? My initial and immediate response was to imagine the complex web of mental conditions fluctuate; an organic composition, the melody line constructed directly from an analysis of the pixels present in legacy Landsat images.

Installation view, *Sonus Maris*, UNSW Library, 6 February – 5 May 2023
Credit: UNSW Library

Environmental concern has become a central political and artistic issue in the contemporary world. Environmental and climate change science now perform crucial roles in analysing and forecasting the increasingly precarious state of the global environment as it teeters towards a cascade of irreversible tipping points.

Siân Ede, in his book *Art and Science* (2005), has proposed that "the fragile environment" might well become "the most crucial matter for the future concerns of both artists and scientists."[2] However, in the broader public and political realm, the realisation that art and science can form powerful and symbiotic relationships with benefits that extend into all aspects of social, economic, and cultural life has been a long time coming.

L'art c'est la science faite chair.[3]

"Art is science embodied," these words by the French poet Jean Cocteau written in 1918, neatly encapsulate a perspective that imagines art and science as two expressions, as two voices of the same spirit of enquiry, but perhaps delivered in a different register. Cocteau's short phrase employs the French word 'chair,' in English quite literally 'flesh,' emphasising that art brings science into the visceral world as a palpable experience, and by so doing, it can become something that we can relate to directly—a narrative behind the data! It is this embodiment of curiosity, knowledge, and sheer wonder that the melding of art and science is all about.

The oceans are front and centre of the climate emergency. *Sonus Maris* hopes to elucidate this in a way to draw people into dialogue with the issues rather than polarise the debate.

1 Emily Dickinson, "632: The brain is wider than the sky," in *The Complete Poems of Emily Dickinson*, ed. Thomas H. Johnson (Boston: Little, Brown and Company, 1960), 312-313.
2 Siân Ede, *Art and Science* (London: I.B. Tauris, 2005), 12.
3 Jean Cocteau, *Le Coq et L'Arlequin: Notes Autour de la Musique*, (Paris: Editions de la Sirène, 1918), 11.

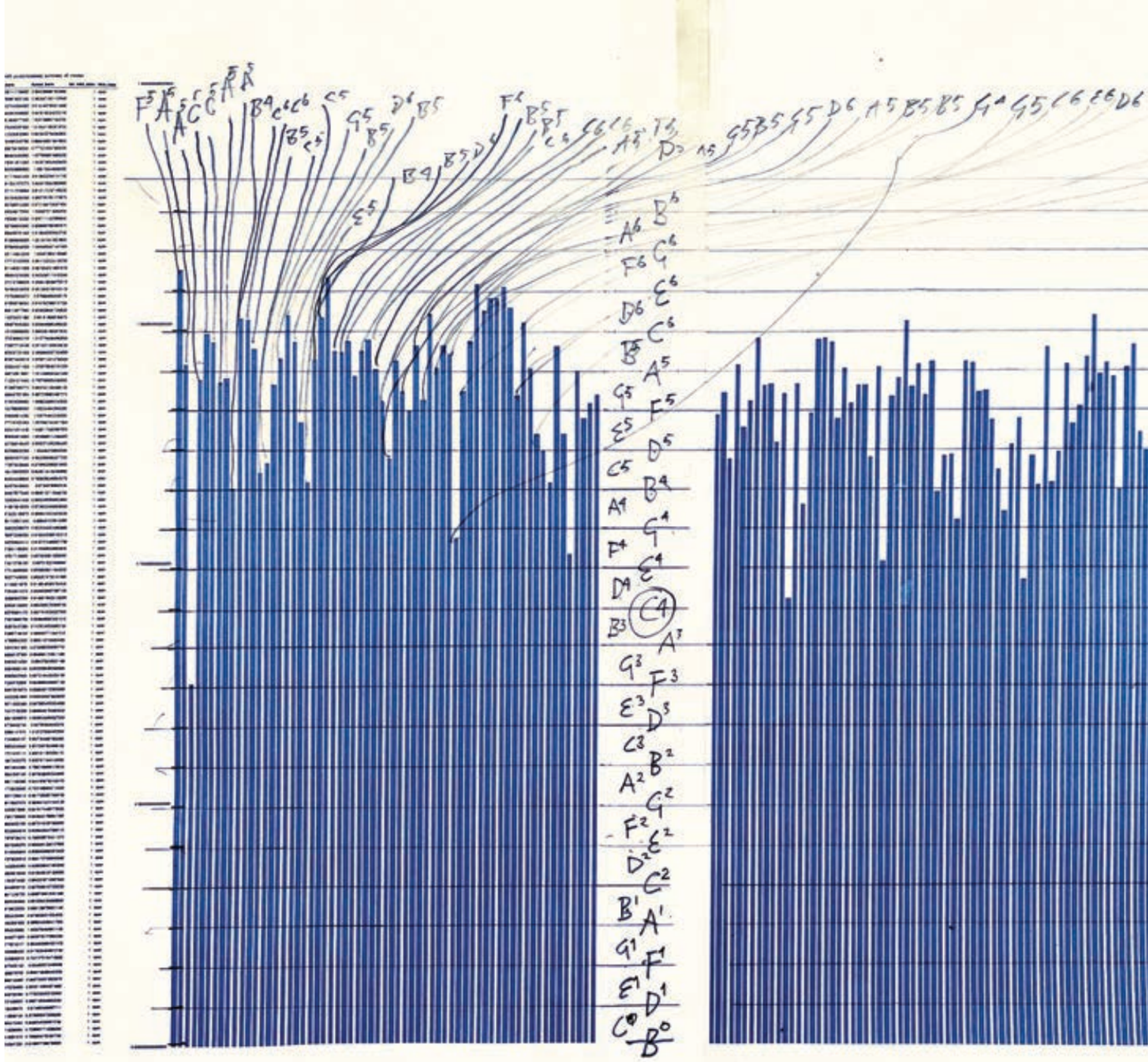
Shoalhaven Heads, located on the traditional lands and waters of the Jerrinja, Tharawal and Wandi Wandian peoples, in an open state (24.02.2016)
Credit: Google © 2022, Image: TerraMetrics, Data: SIO, NOAA, U.S. Navy, NGA, GEBCO

SENSING DATA

by Dr. Megan R. Fizell

Mapping data often relies on the visual sense to perceive and synthesise information. Scientists and researchers use various techniques to represent and collate data; for example, bar charts map categorical data, line graphs depict trends over time, and scatter plots compare two variables. These methods privilege monosensory contemplation. Audiences see and interpret the data without depending on other sensory inputs. In contrast, artist Nigel Helyer's soundscore *Sonus Maris* (2022) recasts music notation as a form of data mapping, one that translates sound into a communicable line graph charting coastline change over time. By employing sound, Helyer challenges the primacy of optical perception in information mapping, thus orientating the reception of data towards an active, multisensory body.

As the source material for the score, Helyer's *Sonus Maris* (2022) draws on a data bank generated through the novel algorithm InletTracker developed by Valentin Heimhuber, a postdoctoral researcher at UNSW Water Research Laboratory.[1] InletTracker charts the coastal dynamics of intermittently closed and open lakes and lagoons (ICOLLS) along the New South Wales coast. Helyer assigned correlating notes to the data depending on the water flow; low notes for little to no water movement and higher-pitched notes for active water flow. Sound artist Emily Morandini describes the resulting music as "melodic, without the repeating or predictable phrases one is used to hearing in a typical musical composition."[2] The score jumps between these high and low notes depending on coastal flows, and through sound, Helyer communicates the data's temporal dimension, where audiences can listen to shifts and changes in the coastal data over a 30-year timeline.



Nigel Helyer, early sketch attempting to map data values against musical pitch
Credit: Image courtesy of the Artist

Helyer's *Sonus Maris* has been described by some as *pointillistic*, in that it is comprised of individual, distinct data points translated into notes without following a linear pattern or melody. This term, pointillistic, has links to both musical composition and the visual arts. In music, pointillism is also known as *punctualism* or *point music*, which, simply defined, is a mid-20th-century compositional style that involves separate notes and tones. In the visual arts, pointillism refers to a painting technique developed in the late 19th century by Post-Impressionist French artists Georges Seurat and Paul Signac. The style involves arranging individual dots of pure colour so that, viewing the painting from a distance, the colours blend to form an image. Through pointillism, we can begin to understand the important role the senses play in perception and data interpretation; the senses amalgamate or mix individual notes or colours to communicate larger ideas.

Thinking further about this pointillistic manoeuvre, Helyer's sonic translation of data in *Sonus Maris* results in a series of disparate sounds that require aural perception to interpret more broadly. Helyer argues that "our aural sensibility is in fact more finely tuned to detect minor variations in pattern and recognise subliminal differences, than our visual sense."[3] We structure our surroundings by organising what we see and hear into patterns. Scholar Doris Lora describes how in order to hear patterns, audiences perceive music as a sum of a whole rather than a series of separate notes.[4] Notably, she writes, "When individuals respond to and measure sounds in the environment, the results are often quite different from machines measuring acoustically the same sound. Machines simply record, while humans discriminate and evaluate."[5] While *Sonus Maris* involves pointillistic notes, as a musical score, audiences bring a discerning ear to their perception of the work as a composite whole, inherently listening for and tracing the larger environmental patterns in the sonic flow.

Through *Sonus Maris*, audiences hear the long-term patterns of coastal ebbs and flows and can feel their changeability through sound waves. Sound is not only aural but also haptic; research reveals that subjects can differentiate sounds through vibrations on the skin.[6] Scientist Jeffrey M. Yau explains, "We hear with our ears and feel with our skin, but our brains may combine this information in specific ways," suggesting that "frequency information from the two senses appears to be always combined."[7] The sonic vibrations present in *Sonus Maris* generate an immersive environment that allows those with hearing loss to experience the physical sensations and engage with the sonified data. The cross-modal correspondence between sound and touch results in a multisensory experience that reconceptualises research, making it available to a broader audience.

While Helyer's *Sonus Maris* soundscore does not feature a readily apparent melody with a clear repeating rhythm, it deftly reveals the intrinsic oscillation of seasonal weather patterns and oceanic systems over time. From the wet to dry seasons, the data tracking the cyclical environmental systems produce similar but non-identical aural patterns. As historian Michael J. Kramer suggests, "The ear aids the eye in perceptual reorientation. New perceptions provide opportunities for more perceptive interpretations."[8] As a durational work lasting around 12 minutes, audiences sit with the sonified data seeing, hearing, and feeling the subtle environmental shifts, reorienting their perception and understanding of these important coastal sites. Helyer's *Sonus Maris* invites audiences to rethink knowledge systems by engaging with data through the senses.

1 See Valentin Heimhuber, "InletTracker," *GitHub*, February 2021, accessed 3 April 2023, https://github.com/VHeimhuber/InletTracker.

2 Wall text, "Sound Description," in *Sonus Maris*, UNSW Library, Sydney, NSW, Australia, 6 February to 5 May 2023.

3 Nigel Helyer, "Sonus Maris," in *Possibilities: Proceedings of ISEA2022 Barcelona*, ed. Pau Alsina, Irma Vila, Susanna Tesconi, Joan Soler-Adillon, Enrie Mor (Barcelona: International Symposium on Electronic Art, 2022), 342.

4 Doris Lora, "Musical Patter Perception," in *College Music Symposium* 19, no. 1 (Spring, 1979): 170.

5 Lora, "Musical Patter Perception," 169.

6 Studies show that the inverse is also true; when touching a material, we can hear the texture: "When we explore a texture with our fingers, the interaction between the skin and the surface produces vibrations that propagate both through the air, up to our ears, and through our skin, down to our mechanoreceptors. Both sensory channels contribute to the perception of the texture properties." See Corentin Bernard, Jocelyn Monnoyer, Michaël Wiertlewski, and Sølvi Ystad, "Rhythm perception is shared between audio and haptics," in *Scientific Reports* 12, no.4188 (2022): 1. https://doi.org/10.1038/s41598-022-08152-w.

7 Jeffrey M. Yau, quoted in Phillip F. Schewe, "'Feeling' sound: the sense of hearing and touch may have evolved together," *Medical Xpress*, 2 June 2011, accessed 3 April 2023, https://medicalxpress.com/news/2011-06-evolved.html.

8 Michael J. Kramer, "What Does A Photograph Sound Like? Digital Image Sonification As Synesthetic AudioVisual Digital Humanities," *Digital Humanities Quarterly* 15, no. 1 (2021).

Jonathan Wheeldon recording the piano notes used in the *Sonus Maris* score at the Boyd Education Centre at the Bundanon Trust, located on the traditional lands of the Dharawal and Dhurga peoples, 2002.
Credit: Image courtesy of the Artist

Installation view, *Sonus Maris*, UNSW Library, 6 February – 5 May 2023
Credit: UNSW Library

LIST OF WORKS

Artworks

Nigel Helyer
***Sonus Maris,* 2022**
video with soundscore,
11:22 mins
Credit: Reference visuals include Public Domain satellite footage courtesy of National Aeronautics and Space Administration (NASA). Google Earth imagery: © Google 2022

Nigel Helyer
***Sonus Maris: data sonification sketch,* 2022**
graphite and ink on paper,
30 x 130 cm

Nigel Helyer
***Sonus Maris: four monophonic scores,* 2022**
graphite and ink on paper,
21 x 30 cm

Nigel Helyer
***Sonus Maris: Strange Attractor,* 2022-2023**
video with soundscore,
11:28 mins

Exhibition contents

3D model of Landsat 9
thermoplastic, 25 x 9.5 x 5.1 cm
Credit: National Aeronautics and Space Administration (NASA). Author/Origin: NASA/JPL-Caltech

***24 Preludia (Preludes),* 1951**
by Frédéric Chopin
Printed in Kraków by Polskie Wydawnictwo Muzyczne
UNSW Library Special Collections
VF 780/CHO/S-3

***Atlas of the Settled Counties of New South Wales…,* 1872**
by Basch and Company
Printed in Sydney by Basch & Co.
UNSW Library Special Collections
VF 912.944/2

Australian Coastline with 4 ICOLLs: Durras Lake, Shoalhaven Heads, Smiths Lake, and Farquhar Inlet
digital illustration

***Conceptual diagram illustrating the architecture and key processing steps of InletTracker,* 2021**
by Dr. Valentin Heimhuber

***The Dharawal and Dhurga Languages of the New South Wales South Coast,* 1976**
by Diana Kelloway Eades
Printed in Canberra by Australian Institute of Aboriginal Studies
499.15/90

Google Earth satellite imagery of Durras Lake, NSW (14.09.2019)
Credit: Google © 2022, Image: CNES / Airbus, Maxar Technologies, TerraMetrics. Data: SIO, NOAA, U.S. Navy, NGA, GEBCO

Google Earth imagery of Farquhar Inlet, Oxley Island NSW (05.09.2022)
Credit: Google © 2022, Image: Maxar Technologies, CNES / Airbus

Google Earth satellite imagery of Shoalhaven Heads, NSW (24.02.2016)
Credit: Google © 2022, Image: TerraMetrics, Data: SIO, NOAA, U.S. Navy, NGA, GEBCO

Google Earth imagery of Smiths Lake, NSW (27.07.2021)
Credit: Google © 2022, Image: CNES / Airbus

Illustration of Landsat 7 satellite
Credit: NASA Goddard Space Flight Center

***InletTracker algorithm,* 2021**
by Dr. Valentin Heimhuber

InletTracker processing of Sentinel-2 image of Durras Lake in a closed state (10.4.2019)
Credit: Public Domain image courtesy of the European Space Agency (ESA) / National Aeronautics and Space Administration (NASA)

InletTracker processing of Sentinel-2 image of Durras Lake in an open state (14.01.2021)
Credit: Public Domain image courtesy of the European Space Agency (ESA) / National Aeronautics and Space Administration (NASA)

InletTracker processing of Sentinel-2 image of Farquhar Inlet in a closed state (21.11.2020)
Credit: Public Domain image courtesy of the European Space Agency (ESA) / National Aeronautics and Space Administration (NASA)

InletTracker processing of Sentinel-2 image of Farquhar Inlet in an open state (01.04.2021)
Credit: Public Domain image courtesy of the European Space Agency (ESA) / National Aeronautics and Space Administration (NASA)

InletTracker processing of Sentinel-2 image of Shoalhaven Heads in a closed state (25.12.2021)
Credit: Public Domain image courtesy of the European Space Agency (ESA) / National Aeronautics and Space Administration (NASA)

InletTracker processing of Sentinel-2 image of Shoalhaven Heads in an open state (12.08.2021)
Credit: Public Domain image courtesy of the European Space Agency (ESA) / National Aeronautics and Space Administration (NASA)

InletTracker processing of Sentinel-2 image of Smiths Lake in a closed state (13.08.2021)
Credit: Public Domain image courtesy of the European Space Agency (ESA) / National Aeronautics and Space Administration (NASA)

InletTracker processing of Sentinel-2 image of Smiths Lake in an open state (22.10.2021)
Credit: Public Domain image courtesy of the European Space Agency (ESA) / National Aeronautics and Space Administration (NASA)

***Landsat 7 [pre-launch],* 1999**
Credit: Landsat imagery courtesy of NASA Goddard Space Flight Center and U.S. Geological Survey

***Map of ICOLLs of Southeast Australia* by Dr. Valentin Heimhuber**
Credit: Google © 2022, Data: SIO, NOAA, U.S. Navy, NGA, GEBCO Landsat / Copernicus

***Map of Indigenous Australia* by Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS)**
Credit: David R Horton (creator), © AIATSIS, 1996

***A new and accurate map of New South Wales with Norfolk and Lord Howes Islands, Port Jackson from actual surveys,* 1794**
Etched by Thomas Foot
Printed in London by Robert Wilkinson
UNSW Library Special Collections
VQ 912.94/43

Sonus Maris
Main Library Level 5
6 February – 5 May 2023

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