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News Release

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The JASA paper is available in full on request.

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Do Fish Bay at the Moon? Can Their Odd Songs Identify Hawaiian Mystery Fish? Eavesdropping Scientists Progress in Recording, Understanding Ocean Soundscapes

Using hydrophones to eavesdrop on a reef off the coast of Goa, India, researchers have helped advance a new low-cost way to monitor changes in the world's murky marine environments.

Reporting their results in the **Journal of the Acoustical Society of America** (JASA), the scientists recorded the duration and timing of mating and feeding sounds – songs, croaks, trumpets and drums – of 21 of the world's noise-making ocean species.

With artificial intelligence and other pioneering techniques to discern the calls of marine life, they recorded and identified the throbbing / drumming sounds of fish from the Sciaenidae family (hear it here: <https://bit.ly/3KWtawy>); a medium sized “grunter,” Terapon theraps (<https://bit.ly/41LQmnR>), loudest at dusk; choruses of plankton-eating fish species (<https://bit.ly/3oAsGo5>); and snapping shrimp (<https://bit.ly/3mTQ0gd>), including commercially-valuable tiger prawns.

Some species within the underwater community work the early shift and ruckus from 3 am to 1.45 pm, others work the late shift and ruckus from 2 pm to 2.45 am, while the plankton

predators were “strongly influenced by the moon.” Also registered: the degree of difference in the abundance of marine life before and after a monsoon.

The paper concludes that hydrophones are a powerful tool and “overall classification performance (89%) is helpful in the real-time monitoring of the fish stocks in the ecosystem.”

The team, including Bishwajit Chakraborty, a leader of the International Quiet Ocean Experiment (IQOE), benefitted from archived recordings of marine species against which they could match what they heard, including:

- A cacophony of spawning tiger perch: <https://bit.ly/3LkZYkj>, and
- Snapping shrimp, <https://bit.ly/41NZWH2>, whose sounds baby oysters reportedly like to follow

Also captured was a “buzz” call of unknown origin (<https://bit.ly/3GZdRSI>), one of the oceans’ countless marine life mysteries.

Making a contribution to the International Quiet Ocean Experiment, the research will be discussed at an IQOE meeting in Woods Hole, MA, 26-27 April.

Advancing the Global Library of Underwater Biological Sounds (GLUBS)

That event will be followed April 28-29 by a meeting of partners in the new Global Library of Underwater Biological Sounds (GLUBS), a major legacy of the decade-long IQOE, ending in 2025.

GLUBS, conceived in late 2021 and currently under development, is designed as an open-access online platform to help collate global information and to broaden and standardize scientific and community knowledge of underwater soundscapes and their contributing sources.

It will help build short snippets and snapshots (minutes, hours, days long recordings) of biological, anthropogenic, and geophysical marine sounds into full-scale, tell-tale underwater baseline soundscapes.

Especially notable among many applications of insights from GLUBS information: the ability to detect in hard-to-see underwater environments and habitats how the distribution and behavior of marine life responds to increasing pressure from climate change, fishing, resource development, plastic, anthropogenic noise and other pollutants.

“Passive acoustic monitoring (PAM) is an effective technique for sampling aquatic systems that is particularly useful in deep, dark, turbid, and rapidly changing or remote locations,” says Miles Parsons of the Australian Institute of Marine Science and a leader of GLUBS.

He and colleagues outline two primary targets:

- Produce and maintain a list of all aquatic species confirmed or anticipated to produce sound underwater;
- Promote the reporting of sounds from unknown sources

Odd songs of Hawaii’s mystery fish

In this latter pursuit, GLUBS will also help reveal species unknown to science as yet and contribute to their eventual identification.

For example, newly added to the growing global collection of marine sounds are recent recordings from Hawaii, featuring the baffling [Mystery fish 1](https://bit.ly/3LjHDUJ) (<https://bit.ly/3LjHDUJ>), [2](https://bit.ly/3UW24u0) (<https://bit.ly/3UW24u0>), and [3](https://bit.ly/3KWtVpo) (<https://bit.ly/3KWtVpo>), now part of an entire [YouTube channel](https://bit.ly/3H5Ly54) ([here: https://bit.ly/3H5Ly54](https://bit.ly/3H5Ly54)) dedicated to marine life sounds in Hawaii and elsewhere (e.g. this “complete and total mystery from the Florida Keys”: <https://bit.ly/41w1Xbc> (*Annie Innes-Gold, Hawai’i Institute of Marine Biology; processed by Jill Munger, Conservation Metrics, Inc.*))

Says Dr. Parsons: “Unidentified sounds can provide valuable information on the richness of the soundscape, the acoustic communities that contribute to it and behavioral interactions among acoustic groups. However, unknown, cryptic and rare sounds are rarely target signals for research and monitoring projects and are, therefore, largely unreported.”

The many uses of underwater sound

Of the roughly 250,000 known marine species, scientists think all fully-aquatic marine mammals (~146, including sub-species) emit sounds, along with at least 100 invertebrates, 1,000 of the world’s ~35,000 known fish species, and likely many thousands more.

GLUBS aims to help delineate essential fish habitat and estimate biomass of a spawning aggregation of a commercially or recreationally important soniferous species.

In one scenario of its many uses, a one-year, calibrated recording can provide a proxy for the timing, location and, under certain circumstances, numbers of ‘calling’ fishes, and how these change throughout a spawning season.

It will also help evaluate the degradation and recovery of a coral reef.

GLUBS researchers envision, for example, collecting recordings from a coral reef that experienced a cyclone or other extreme weather event, followed by widespread bleaching. Throughout its restoration, GLUBS audio data would be matched with and augment a visual census of the fish assemblage at multiple timepoints.

Oil and gas, wind power and other offshore industries will also benefit from GLUBS' timely information on the possible harms or benefits of their activities.

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Among other IQOE legacies:

- [Manta \(bitbucket.org/CLO-BRP/manta-wiki/wiki/Home\)](https://bitbucket.org/CLO-BRP/manta-wiki/wiki/Home), a mechanism created by world experts from academia, industry, and government to help standardize ocean sound recording data, facilitating its comparability, pooling and visualization.
- OPUS, an Open Portal to Underwater Sound being tested at Alfred Wegener Institute in Bremerhaven, Germany to promote the use of acoustic data collected worldwide, providing easy access to MANTA-processed data, and
- The first comprehensive database and map of the world's 200+ known hydrophones recording for ecological purposes

Marine sounds and COVID-19

The IQOE's early ambition of humanity's maritime noise being minimized for a day or week was unexpectedly met in spades when the COVID-19 pandemic began.

New IQOE research to be considered at the April meeting includes a paper, [Impact of the COVID-19 pandemic on levels of deep-ocean acoustic noise \(https://bit.ly/3KZTaIt\)](https://bit.ly/3KZTaIt) documenting a pandemic-related drop of 1 to 3 dB even in the depths of the abyss. With a 3 dB decrease, sound energy is halved.

Virus control measures led to "sudden and sometimes dramatic reductions in human activity in sectors such as transport, industry, energy, tourism, and construction," with some of the greatest reductions from March to June 2020 – a drop of up to 13% in container ship traffic and up to 42% in passenger ships.

Other IQOE accomplishments include achieving recognition of ocean sound as an Essential Ocean Variable (EOV) within the Global Ocean Observing System, underlining its helpfulness in monitoring

- climate change (the extent and breakup of sea ice; the frequency and intensity of wind, waves and rain)
- ocean health (biodiversity assessments: monitoring the distribution and abundance of sound-producing species)
- impacts of human activities on wildlife, and
- nuclear explosions, foreign/illegal/threatening vessels, human activities in protected areas, and underwater earthquakes that can generate tsunamis

The Partnership for Observation of the Global Ocean (POGO) funded an IQOE Working Group in 2016, which quickly identified the lack of ocean sound as a variable measured by ocean observing systems. This group developed specifications for an Ocean Sound Essential Ocean Variable (EOV) by 2018, which was approved by the Global Ocean Observing System in 2021. IQOE has since developed the [Ocean Sound EOV Implementation Plan](#), reviewed in 2022 and ready for public debut at IQOE's meeting April 26.

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One of IQOE's originators, Jesse Ausubel of The Rockefeller University's Programme for the Human Environment, says the programme has drawn attention to the absence of publicly available time series of sound on ecologically important frequencies throughout the global ocean.

"We need to listen more in the blue symphony halls. Animal sounds are behavior, and we need to record and understand the sounds, if we want to know the status of ocean life," he says.

The program "has provided a platform for the international passive acoustics community to grow stronger and advocate for inclusion of acoustic measurements in national, regional, and global ocean observing systems," says Prof. Peter Tyack of the University of St. Andrew's, who, with Steven Simpson, guide the IQOE International Scientific Steering Committee.

"The ocean acoustics and bioacoustics communities had no experience in working together globally, and coverage is certainly not global; there are many gaps. IQOE has begun to help these communities work together globally, and there is still progress to be made in networking and in expanding the deployment of hydrophones, adds Prof. Ausubel.

A full description of the project's history and evaluation to date is available at <https://bit.ly/3H7FCbN>.

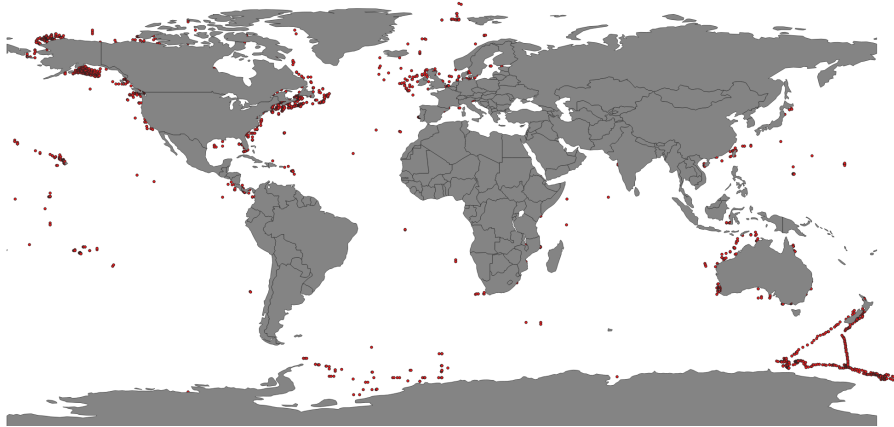
Encouraging greater worldwide use of hydrophones

According to Dr. Parsons, "hydrophones are now being deployed in more locations, more often, by more people, than ever before,"

To celebrate that, and to mark World Oceans Day, June 8, GLUBS recently put out a call to hydrophone operators to share marine life recordings made from 7 to 9 June, so far receiving interest from 124 hydrophone operators in 62 organizations from 29 countries and counting. The hydrophones will be retrieved over the following months with the full dataset expected sometime in 2024.

They also plan to make World Oceans Passive Acoustic Monitoring (WOPAM) Day an annual event – a global collaborative study of aquatic soundscapes, salt, brackish or freshwater – the marine world’s answer to the U.S. Audubon Society’s 123-year-old [Christmas Bird Count](#).

Interested researchers with hydrophones already planned to be in the water on June 8 are invited to contact Miles Parsons (m.parsons@aims.gov.au) or Steve Simpson (s.simpson@bristol.ac.uk).



Global hydrophone deployment as of 13 March 2023. Map by Eduardo Klein

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IQOE: Recent Peer-Reviewed Publications

S Robinson, P Harris S-H Cheong, L Wang, V Livina, G Haralabus M Zampolli & P Nielsen, *The extraordinary circumstances of the COVID-19 pandemic led to, Impact of the COVID-19 pandemic on levels of deep-ocean acoustic noise*, 2023, **Nature Scientific Reports**
doi:10.1038/s41598-023-31376-3

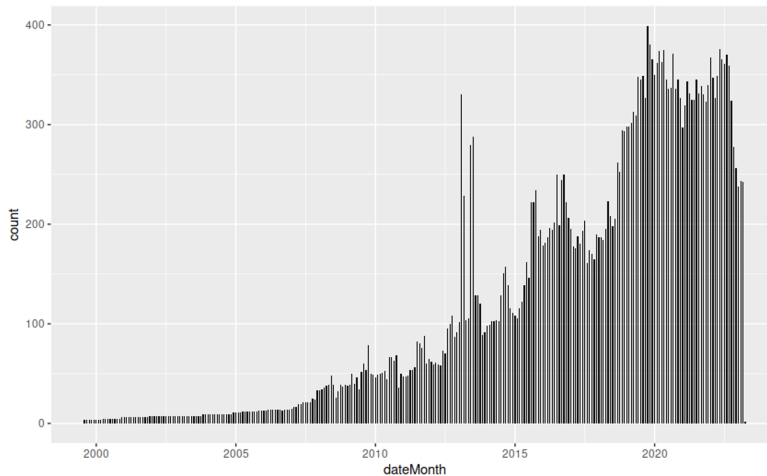
VP Mahale, K Chanda, B Chakraborty, T Salkar, GB Sreekanth, *Biodiversity assessment using passive acoustic recordings from off-reef location—Unsupervised learning to classify fish vocalization*. 2023, **Journal of the Acoustical Society of America** 153 (3), 1534-1553,
<https://doi.org/10.1121/10.0017248>

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The International Quiet Ocean Experiment

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Hydrophone records by month (n=3,433, as of 13 March 2023)
Created by Eduardo Klein
