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DATA DESCRIPTOR

A dataset of soundscapes from Polynesian altiphotic, mesophotic and rariphotic zones

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Tropical coral reefs encompass diverse acoustic environments, yet knowledge of their soundscapes beyond shallow altiphotic reefs remains limited. This dataset provides comprehensive underwater recordings from altiphotic reefs, mesophotic coral ecosystems (MCEs), and the rariphotic zone in French Polynesia, collected across multiple islands, depths, and temporal scales. Recordings capture a broad range of biophony, including fish, benthic invertebrates, dolphins, and baleen whales, alongside geophony and anthropophony. Data were collected using standardized fixed and drifting acoustic systems, digitized in uncompressed WAV format, and supplemented with metadata detailing deployment conditions, hydrophone specifications, and recording schedules. These datasets support diverse applications, including studies of fish and invertebrate acoustic behavior, soundscape ecology, and the effects of environmental change and marine protection measures. All recordings and associated resources are publicly available via Zenodo repositories, facilitating reuse for ecological and conservation research.

Background & Summary

Tropical coral reefs can be categorized into two main ecosystems: the shallow-water coral reefs, often referred to as altiphotic reefs, and the deeper mesophotic coral ecosystems (MCEs), which are followed by a zone without hermatypic corals but still harboring reef fish, known as the rariphotic zone. Altiphotic reefs are renowned for their rich acoustic environment, hosting a diverse array of benthic invertebrate sounds as well as many fish sounds.

Until 2020, knowledge on the French Polynesian biophony primarily focused on fish sounds from photic reefs. Gaps remained regarding (1) the high-frequency (>2 kHz) components of the biophony, and more broadly, the ‘mass-phenomena’ biophony, and (2) the biophony in MCEs and the rariphotic zone, including depth-related and diel cycle variations, as well as species-specific sound identification. A comprehensive understanding of the long-term consequences of protection measures on coral reef resilience, particularly in the face of threats such as coral bleaching, was also still lacking. In response, several fieldwork missions were conducted to collect acoustic data across altiphotic, mesophotic, and rariphotic zones.

Since soundscapes include many different sources (geophony, biophony, and anthropophony); the potential for dataset reuse is substantial. All studies that have utilized the datasets presented here have focused primarily on the biophony¹. For altiphotic reefs, one study investigated sound propagation from the reef², while two others examined the potential resilience of marine protected areas (MPAs) by analyzing high-frequency³ and low-frequency sounds⁴. For mesophotic reefs, studies focused on depth and diel patterns of benthic invertebrate sounds⁵, depth-related pattern of fish sounds⁶, diel cycles of fish sounds⁷, acoustic niches⁸, and potential sound sources⁹. For the rariphotic zone, studies addressed depth variation of fish sounds¹⁰, baleen whale sounds¹¹, and the overall soundscape¹². Additional reuse of several datasets include a studies on odontocete whistles¹³, acoustic indices for benthic invertebrate sounds¹⁴ and for fish diversity¹⁵.

Methods

Sampling places. Data were sampled in French Polynesia, a 5 million km² region in the South Pacific Ocean^{16,17}. Most data were collected in the Society Archipelago, a 700 km long NW–SE oriented volcanic archipelago divided into the Windward Islands and the Leeward islands. Part of the data were also collected in the Tuamotu Archipelago (Fig. 1), which follows the same orientation but extends over a much longer

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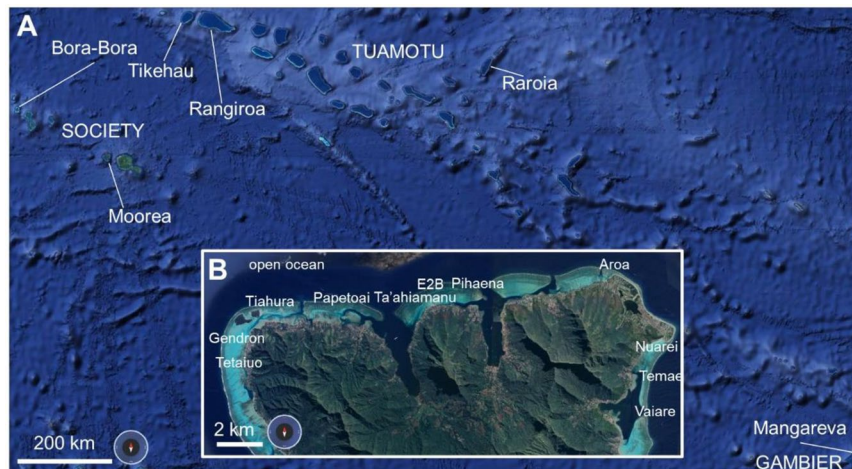


Fig. 1 Map of the sampling sites related to this dataset. **(A)** Central part of French Polynesia. **(B)** Zoomed-in view of the North coast of Moorea Island indicating all the sampled locations.

distance of 1,600 km¹⁶, as well as in the Gambier Archipelago, located on the eastern side of French Polynesia. Two types of islands were sampled: coral atolls (also known as low islands; Rangiroa, Raroia, and Tikehau) and high islands (volcanic islands surrounded by barrier reefs; Bora-Bora, Moorea, and Mangareva, Figs. 1 and 2). All islands were sampled on their oceanic side, referred to as “external slope”, a zone known for its richness and diversity¹⁸.

Recording systems. All data were collected using acoustic recording systems. These systems consist of three main components: a hydrophone, an integrated amplifier, and a recorder (Fig. 3). The hydrophone converts acoustic energy into an electric signal using a piezoceramic material that produces a voltage when mechanically stressed. The amplifier then increases the voltage of this signal to ensure it falls within the range that can be processed by the recorder. Finally, the recorder digitizes the signal. All the data were recorded in an uncompressed format called Waveform Audio File Format (WAV = WAVE). Data were obtained using both fixed acoustic recorders and recorders attached to drifting antennas. Fixed recorders were SNAP or Cyclops recorders (Loggerhead Instruments, Sarasota, FL, USA; Fig. 3) connected to HTI-96 hydrophones (High Tech Inc., Long Beach, MS, USA, sampling frequency = 44.1 kHz, gain between 2 and 2.05 dB, dynamics = 1.58 V) with variable sensitivities (between -170.5 and -169.6 dB re 1 V for a sound pressure of 1 μ Pa, Tables 1 and 2).

Two different recording schedules were employed, continuous and 1-minute intervals every 10 minutes, depending on the recorder’s battery life and the duration of the deployment period.

Recorders can be either deployed fixed to the seafloor or mounted vertically on a tripod above it. The latter method is privileged due to the three-dimensional complexity of reefs and the presence of local acoustic hotspots¹⁹. Therefore, during most fieldworks, recorders were fixed to a vertical pole. During one of the field campaigns, the recorders were placed horizontally on the seafloor to ensure comparability with previous studies^{20–22}. For drifting deployments, the recording system was mounted on a floating antenna. Drifting antennas were composed of a floater and an autonomous recorder (EA-SDA14, RTSys®, Caudan, France) connected to a wideband low-noise hydrophone (HTI-92, High Tech Inc., Long Beach, MS, USA; sensitivity: -155 ± 3 dB re 1 V μ Pa⁻¹; flat frequency response from 2 Hz to 50 kHz).

Acoustic analyses. In addition to the raw recordings, this dataset provides examples of low-frequency sounds (mainly produced by fish) and a dichotomous key for their classification. To generate these clips, various acoustic analyses were performed, following several steps outlined in Fig. 4. One key step consistently applied throughout the analyses is downsampling. While the procedures differ between studies of ‘mass-phenomena’ biophony and those focusing on discrete, identifiable sources of biophony, several core concepts are shared across both approaches. Downsampling, and spectrogram generation were conducted using Matlab® R2014b (MathWorks, Natick, MA, USA). Manual scrolling and data cleaning were carried out with RavenPro Sound Analysis Software 1.5 (K. Lisa Yang Center for Conservation Bioacoustics, Ithaca, NY, USA). Manual measurements of isolated fish sounds were performed using Avisoft SAS Lab Pro (Avisoft Bioacoustics; Glienicke/Nordbahn, Germany).

Recordings were obtained in the time domain by measuring voltage variations. To obtain a power spectrum, the data were transformed from the temporal to the frequency domain using the Fourier transform, which decomposes complex waveforms into an infinite sum of simple waveforms, each with a distinct frequency²³. Because the traditional Fourier transform is computationally intensive, the fast Fourier transform (FFT) algorithm was employed to efficiently compute multiple transforms²⁴. However, power spectra do not preserve temporal information. By applying Fourier transforms to short consecutive segments of the original signals, spectrograms were generated, allowing simultaneous visualization of frequency and time.

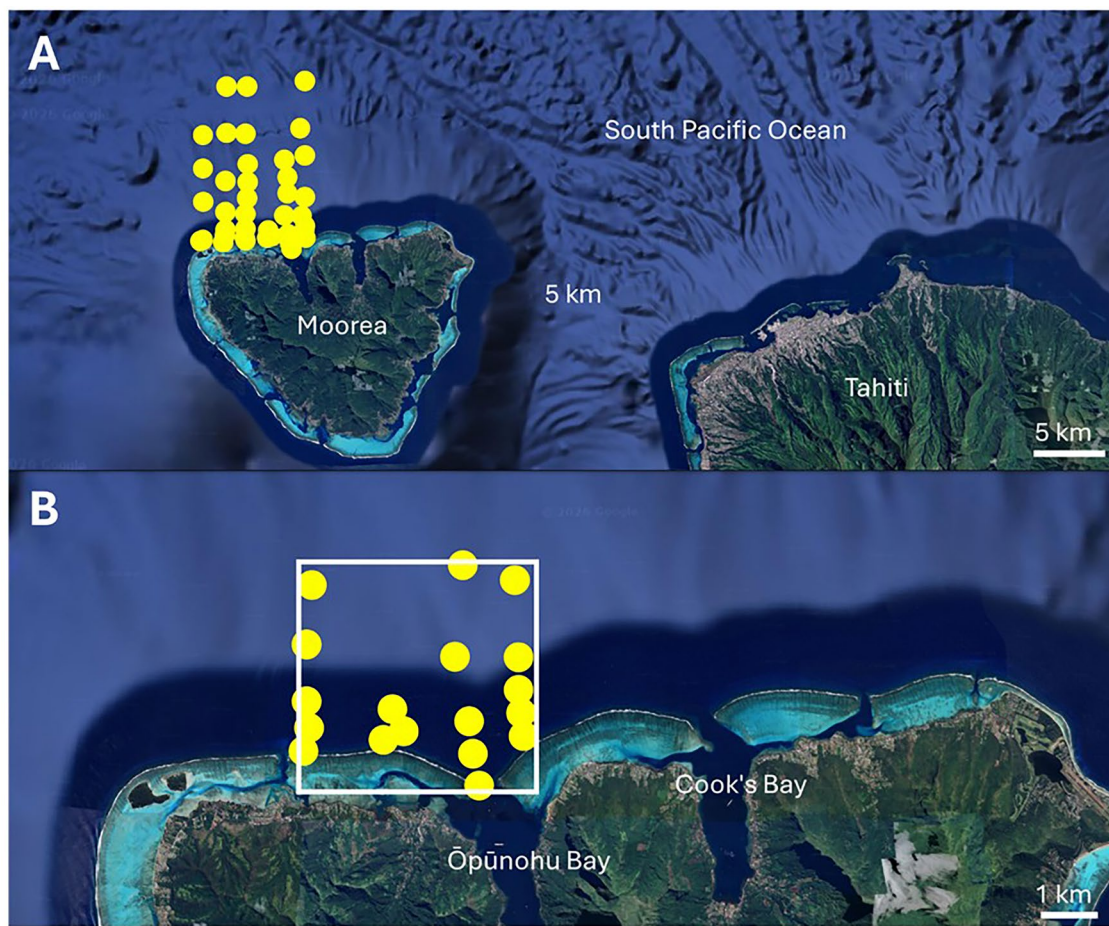


Fig. 2 Map of the drifting locations (A) The drifting locations encompass 78 stations between Tiahura and E2B from 50 m off the reef crest to 10 km in the open ocean. (B) Zoom-in on selected stations. Only the stations within the white box are shown in panel B for illustrative purposes.

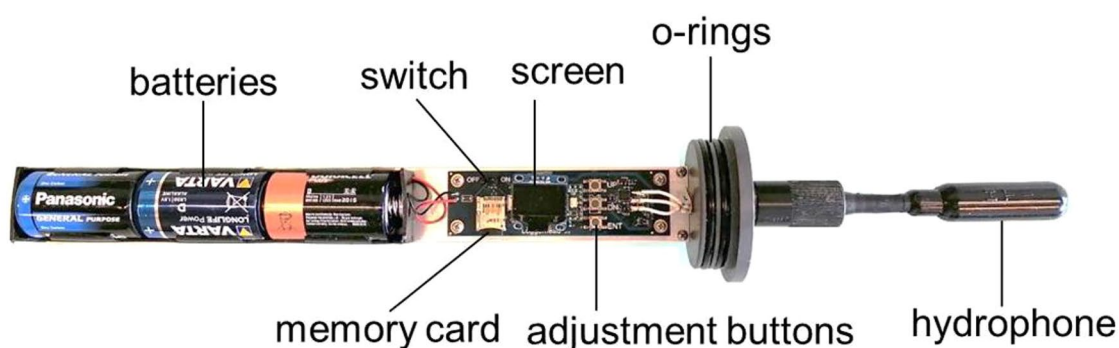


Fig. 3 SNAP acoustic recorder (Loggerhead Instruments, Sarasota, FL, USA) connected to an HTI-96 hydrophone (High. Tech. Inc., Long Beach, MS, USA). Photograph by the author.

Data Records

Rariphotic zone recordings are available at <https://doi.org/10.5281/zenodo.12580170>²⁵. These recordings were collected in July 2022 at a depth of 300 m off Moorea Island¹⁰. Recordings are organized into folders, one per day. Each folder contains audio files whose names begin with the recording date and time in the format DDHHMMSS (DD = day, HH = hour, MM = minute, SS = second). Local time was used (UTC−10).

Drifting recordings are available at <https://doi.org/10.5281/zenodo.7528211>²⁶. A total of 90 sites were recorded in 2016 along transects from the reef crest to 10 km offshore from Moorea Island². The dataset is organized by directories, each corresponding to a GPS location where the drifting antenna was deployed. Within each directory, files are named according to the recording start time (YYYY-MM-DD_HH-MM-SS). Local time was

Island	Depth (m)	Sensitivity (dB re 1 V μPa^{-1})
Bora Bora	20	-170.2
	60	-169.7
	120	-170.5
Mangareva	20	-169.7
	60	-170.2
Moorea	20	-169.7
	60	-170.2
	120	-170.5
Rangiroa	20	-169.7
	60	-170.2
	120	-170.5
Raroia	20	-170.2
	60	-169.7
	120	-170.5
Tikehau	20	-169.7
	60	-170.2
	120	-170.5

Table 1. Sensitivities of the HTI-96 hydrophones per deployment at 20, 60 and 120 m depth. Only SNAP recorders were used for these deployments.

Site	Period	Sensitivity (dB re 1 V μPa^{-1})
Vaiare	January and February	-170.1
Temaë	January	-170.2*
	February	-170.1
Nuarei	January and February	-170.0
Aroa	January and February	-169.9
Pihaena	January and February	-169.6
E2B	January and February	-169.7
Tetaiuo	Part 1 and 2	-170.1
Gendron	Part 1 and 2	-169.6
Tiahura	Part 1 and 2	-170.0
Papetoai	Part 1 and 2	-169.9

Table 2. Sensitivities of the HTI-96 hydrophones for each deployment at 10 m depth. *Recording carried out with a Cyclops rather than a SNAP Recorder.

used (UTC-10). The folder also contains an Excel file with information related to the GPS data collected by the team on site (Table 3).

Recordings from MCEs and corresponding altiphotic reefs are available at <https://doi.org/10.5281/zenodo.11960305>²⁷. This dataset includes 17 folders of wave files. Original files were used for a study on benthic invertebrates⁵, while subsampled versions were analyzed in studies on fish sounds⁶⁻⁸. Files are grouped by island (Bora Bora, Mangareva, Moorea, Rangiroa, Raroia, and Tikehau) and depth (20, 60, and 120 m), and then by month (format YYYY-MM). Within each folder, files are named DDHHMMSS. Local time was used (UTC-10).

Altiphotic reef recordings from marine protected areas (MPAs) and non-protected marine areas (nMPAs) around the northeast coast of Moorea Island in 2021 are available under several DOIs due to their large size. Recordings from Temaë collected in January are available at <https://doi.org/10.5281/zenodo.13954462>²⁸ and those from February are available at <https://doi.org/10.5281/zenodo.18538488>²⁹. This site is a nMPA located on the east side of the island (latitude: -17.5067, longitude: -149.7600). Recordings from Nuarei collected in January are available at <https://doi.org/10.5281/zenodo.13958536>³⁰ and those from February are available at <https://doi.org/10.5281/zenodo.18540017>³¹. This site is a MPA located on the east side of the island (latitude: -17.5006, longitude: -149.7546). Recordings from Pihaena collected in January are available at <https://doi.org/10.5281/zenodo.13959351>³² and those from February are available at <https://doi.org/10.5281/zenodo.18546639>³³. This site is a MPA located on the north side of the island (latitude: -17.4765, longitude: -149.8291). Recordings from Entre-deux-baies (E2B) collected in January are available at <https://doi.org/10.5281/zenodo.13963791>³⁴ and those from February are available at <https://doi.org/10.5281/zenodo.18549519>³⁵. This site is a nMPA located on the north side of the island (latitude: -17.4751, longitude: -149.8372). Additional recordings in nMPAs are available from Aroa (latitude: -17.4708, longitude: -149.7774) in January (<https://doi.org/10.5281/zenodo.18431776>³⁶) and February (<https://doi.org/10.5281/zenodo.18541031>³⁷) and from Vaiare (latitude: -17.5217, longitude: -149.7624) in January

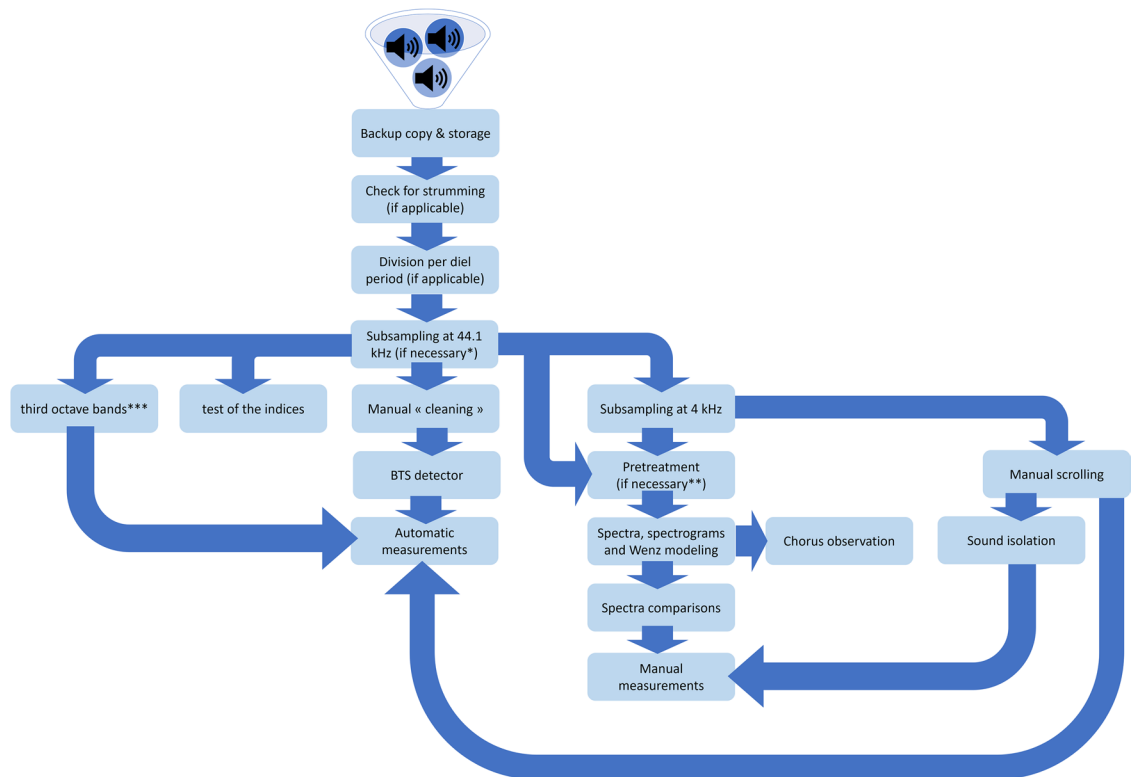


Fig. 4 Main recurrent steps in the acoustic analyses related to the dataset. * Done only for data with a sampling frequency of 48 or 96 kHz. ** Not always applicable. *** Alternative method.

(<https://doi.org/10.5281/zenodo.18478508>³⁸) and February (<https://doi.org/10.5281/zenodo.18538018>³⁹). All recorders were deployed at a 10 m depth on the outer slope of the barrier reef^{3,4}. File names follow the DDHHMMSS format (DD = day, HH = hour, MM = minutes, SS = seconds).

Altiphotic reef recordings from MPAs and nMPAs around the northwest coast of Moorea Island in January 2021 are also available under several DOIs due to their large size. Recordings from Tetaiuo (MPA, latitude: -17.5052 , longitude: -149.9275) are available at <https://doi.org/10.5281/zenodo.13968891>⁴⁰ and <https://doi.org/10.5281/zenodo.18482232>⁴¹. Recordings from Gendron (nMPA, latitude: -17.4995 , longitude: -149.9276) are available at <https://doi.org/10.5281/zenodo.18478655>⁴² and <https://doi.org/10.5281/zenodo.18482224>⁴³. Recordings from Tiahura (MPA, latitude: -17.4830 , longitude: -149.8998) are available at <https://doi.org/10.5281/zenodo.18478660>⁴⁴ and <https://doi.org/10.5281/zenodo.18482208>⁴⁵. Recordings from Papetoai (nMPA, latitude: -17.4829 , longitude: -149.8861) are available at <https://doi.org/10.5281/zenodo.18478672>⁴⁶ and <https://doi.org/10.5281/zenodo.18482199>⁴⁷. All recorders were deployed at a 10 m depth on the outer slope of the barrier reef^{3,4}. File names follow the DDHHMMSS format.

Marine sounds below 2 kHz recorded at the six aforementioned islands (sites at 20 m, 60 m, and 120 m depth) are available at <https://doi.org/10.5281/zenodo.12570714>⁴⁸. This dataset includes biological sounds, mainly from fish but not exclusively, extracted from wave files subsampled at 4 kHz and recorded in French Polynesia. The sound identification key for biological sounds below 2 kHz from mesophotic reefs in French Polynesia is available at <https://doi.org/10.5281/zenodo.10592329>⁴⁹. This key was developed using spectrograms (FFT = 256, sampling frequency = 4 kHz) from recordings collected at mesophotic reefs sites in French Polynesia. A figure compiling the spectrograms is available in the literature⁸, along with snippets of each sound, as presented above⁴⁸.

Data Overview

The recorded soundscapes encompass sounds produced by fish, benthic invertebrates, dolphins and baleen whales. The biophony varied along horizontal axes (offshore and lateral) and a vertical axis. In addition, these spatial axes are subject to temporal variations. From the reef to the open ocean, the biophony can propagate up to 90 km, although maximal detection distances vary depending on species and life stage, ranging from less than 0.5 km to 22 km². (measured at Moorea Island) In the Anthropocene, however, these distances can be diminished due to both meteorological conditions and anthropogenic noise. Lateral variations in the biophony depend on features such as benthic cover (e.g., coral or algae percentage). Along the vertical gradient, both benthic invertebrate⁵ and fish sounds^{6,8} exhibit stratification primarily driven by depth⁵⁰. Several sounds from MCEs shared similarities with those emitted by species from other environments, with comparable sonic morphologies to species found in Polynesian MCEs⁹. The temporal axis can be examined at multiple time scales. In photic reefs and upper MCEs, sounds produced by benthic invertebrates were louder at night but more abundant during the day⁵. In contrast, in lower MCEs, the activity rhythms of benthic invertebrates showed low or highly variable diel

Column	Definition
A	Directory: unique code for each deployment
B	Measure: unique code for each set of deployment (one measure contains several directories)
C	GPS waypoint of the beginning of the deployment
D	GPS waypoint of the end of the deployment
E	Bathymetry (depth, in m) at the beginning of the deployment
F	Bathymetry (depth, in m) at the end of the deployment
G	Longitude at the beginning of the deployment
H	Latitude at the beginning of the deployment
I	Longitude at the end of the deployment
J	Latitude at the end of the deployment
K	Date (DD-MM-YY)
L	Local time on the GPS (UTC−10) at the beginning of the deployment
M	Local time on the GPS (UTC−10) at the end of the deployment
N	Transect code
O	Daytime or nighttime
P	Targeted distance to the coast (in m)
Q	Distance to the coast (in m, mean)
R	Distance to the coast (in m, at the beginning of the deployment)
S	Distance to the coast (in m, at the end of the deployment)
T	Drifting distance
U	Tangential drift
V	Drift in percentage
W	Weather condition
X	Remarks

Table 3. Explanation of the column headings in the Excel file containing information related to the GPS data collected during the drifting recordings.

patterns⁵. Nevertheless, a distinct peak in the number of Broadband Transient Sounds (BTS) was observed between 7 and 9 PM at a depth of 120 m, potentially indicating cyclic activity of a particular species and supporting the existence of distinct invertebrate communities, especially in deep mesophotic reefs⁵. Diel cycles of fish sounds were also influenced by depth^{6–8}. At longer time scales, changes in the biophony have been observed between bleaching events in French Polynesia³, attributed to variations in coral cover².

Technical Validation

All datasets were carefully checked to ensure the reliability and consistency of the acoustic recordings. Each recorder was calibrated by the manufacturer. Gains were consistent between deployments. Recording units were deployed according to standardized protocols: hydrophones were positioned at fixed depths. Local time (UTC−10) was consistently used across all datasets. Audio files were screened for signal quality and potential artifacts. When the recorders were underwater, there is no major parts with clipping or electrical interference. Spectrogram inspection confirmed the presence of expected biological and environmental sound sources (fish, invertebrates, and abiotic sounds), and the absence of significant technical anomalies. Metadata were validated by cross-checking filenames, timestamps, and associated GPS coordinates. Directory structures and file naming conventions (e.g., DDHHMMSS or YYYY-MM-DD_HH-MM-SS) were verified to ensure temporal consistency.

For data reuse, it is important to consider the sampling frequency of the different deployments. For example, recordings acquired at 44.1 kHz allow analysis up to 22.05 kHz based on the Nyquist theorem (Fig. 5). Another limitation arises from strumming noise in the low-frequency range (i.e., below 200 Hz) of the drifting recordings. Strumming noise was minimal in most recordings, which were the ones used in the related publication², but increased when wind speeds were higher in the remaining recordings.

Additional considerations for users interested in automatic descriptors of high-frequency biophony (>1.5 kHz) to characterize benthic invertebrate sounds include the presence of odontocete vocalizations within the same frequency range. Similarly, at low frequencies (<2 kHz), where fish sounds are typically found, humpback whale vocalizations are present during the austral winter, primarily at Moorea Island and, to a lesser extent, at Bora Bora Island. Anthropophony, mainly from boat passages, is also present in the recordings.

Usage Notes

All recordings are provided in standard uncompressed WAV format and can be accessed directly through the corresponding Zenodo repositories listed above. They can be opened and analyzed using common audio or signal processing software, such as Audacity, Raven Pro, Raven Lite, Avisoft SAS Lab Pro, or via libraries in R, MATLAB, or Python. Spectrograms and power spectra can be generated using standard FFT-based methods; with users advised to adjust the FFT window size according to the frequency range of interest. When merging

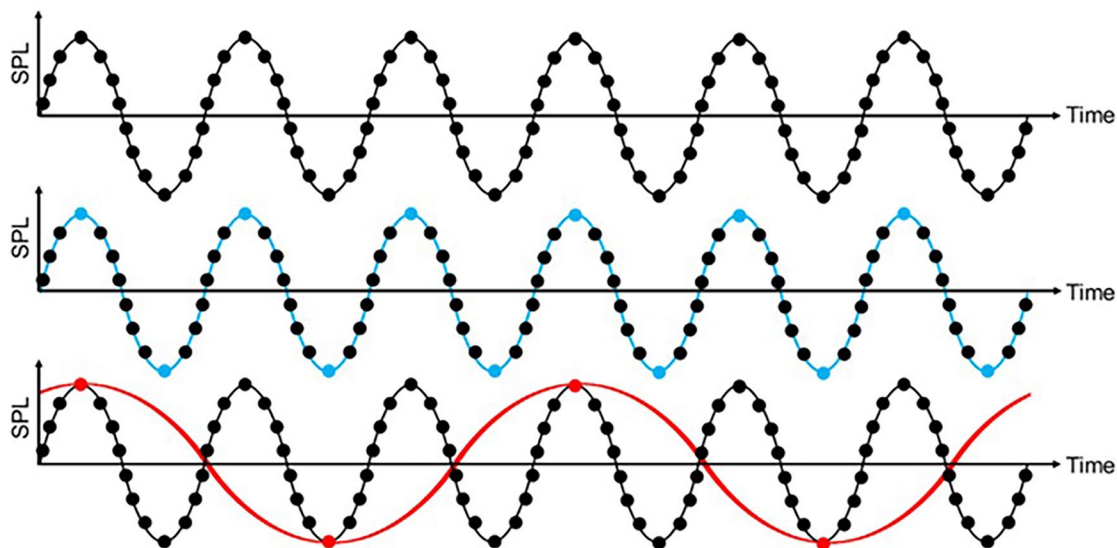


Fig. 5 Schematic representation of aliasing. The original signal is shown in black. When the signal is downsampled at the correct sampling rate, it is represented in blue. Downsampling at an incorrect sampling rate produces a distorted signal, shown in red, which differs from the original.

or comparing datasets, note that different recording systems, including distinct hydrophones and sensitivities, were used in some deployments. Detailed information is provided in the metadata.

Data availability

Recordings from the rariphotic zone are available at <https://doi.org/10.5281/zenodo.12580170>. Drifting recordings are available at <https://doi.org/10.5281/zenodo.7528211>. Recordings from MCEs and corresponding altiphotic reefs are available at <https://doi.org/10.5281/zenodo.11960305>. Altiphotic reef recordings from 2021 are available at the following locations: Temae, <https://doi.org/10.5281/zenodo.13954462> and <https://doi.org/10.5281/zenodo.18538488>, Nuarei, <https://doi.org/10.5281/zenodo.13958536> and <https://doi.org/10.5281/zenodo.18540017>, Pihaena, <https://doi.org/10.5281/zenodo.13959351> and <https://doi.org/10.5281/zenodo.18546639>, Entre-deux-baies (E2B), <https://doi.org/10.5281/zenodo.13963791> and <https://doi.org/10.5281/zenodo.18549519>, Aroa, <https://doi.org/10.5281/zenodo.18431776> and <https://doi.org/10.5281/zenodo.18541031>, Vaiare, <https://doi.org/10.5281/zenodo.18478508> and <https://doi.org/10.5281/zenodo.18538018>, Tetaiuo, <https://doi.org/10.5281/zenodo.13968891> and <https://doi.org/10.5281/zenodo.18482232>, Gendron, <https://doi.org/10.5281/zenodo.18478655> and <https://doi.org/10.5281/zenodo.18482224>, Tiahura, <https://doi.org/10.5281/zenodo.18478660> and <https://doi.org/10.5281/zenodo.18482208>, and Papetoai, <https://doi.org/10.5281/zenodo.18478672> and <https://doi.org/10.5281/zenodo.18482199>. Marine sounds below 2 kHz from French Polynesia are available at <https://doi.org/10.5281/zenodo.12570714> and the sound identification key for biological sounds below 2 kHz from mesophotic reefs in French Polynesia is available at <https://doi.org/10.5281/zenodo.10592329>.

Code availability

No custom code is relevant to this dataset.

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References

1. Raick, X. Diversity of the biophony of Polynesian photic and mesophotic coral reefs. *Cybiu*, <https://doi.org/10.26028/cybiu/2025-024> (2025).
2. Raick, X. *et al.* From the Reef to the Ocean: Revealing the Acoustic Range of the Biophony of a Coral Reef (Moorea Island, French Polynesia). *J. Mar. Sci. Eng.* **9**, 420, <https://doi.org/10.3390/jmse9040420> (2021).
3. Raick, X. *et al.* Highlighting the resilience potential of marine protected areas in the face of coral bleaching with passive acoustic monitoring. *R. Soc. Open Sci.* **12**, <https://doi.org/10.1098/rsos.241938> (2025).
4. Raick, X. & Baccus, B. Comparison of ichthyological acoustic communities based on ichthyological communities: A case study from protected and non-protected marine areas of Moorea Island (French Polynesia). *J. Nat. Conserv.* **87**, 127008, <https://doi.org/10.1016/j.jnc.2025.127008> (2025).
5. Raick, X. *et al.* Invertebrate sounds from photic to mesophotic coral reefs reveal vertical stratification and diel diversity. *Oecologia* **205**, 307–322, <https://doi.org/10.1007/s00442-024-05572-5> (2024).
6. Raick, X. *et al.* Fish sounds of photic and mesophotic coral reefs: variation with depth and type of island. *Coral Reefs* **42**, 285–297, <https://doi.org/10.1007/s00338-022-02343-7> (2023).
7. Raick, X. *et al.* Diel cycle of two recurrent fish sounds from mesophotic coral reefs. *Sci. Mar.* **87**, e078, <https://doi.org/10.3989/scimar.05395.078> (2023).

8. Raick, X. *et al.* Depth-dependent dynamics and acoustic niche partitioning of fish sounds in mesophotic coral reefs. *Estuar. Coast. Shelf Sci.* 109336, <https://doi.org/10.1016/j.ecss.2025.109336> (2025).
9. Raick, X., Lecchini, D. & Parmentier, E. Exploring potential fish sound producers in Polynesian lower mesophotic coral reefs. *Coral Reefs* <https://doi.org/10.1007/s00338-025-02699-6> (2025).
10. Raick, X., Vendrame, M., Lecchini, D. & Parmentier, É. Evidence of vertical stratification in marine environments: insights from passive acoustic monitoring in French Polynesia. *Deep Sea Res. Part I Oceanogr. Res. Pap.* 223, 104548, <https://doi.org/10.1016/j.dsr.2025.104548> (2025).
11. Raick, X. Potential vocalisations of Antarctic minke whales (*Balaenoptera bonaerensis*) in French Polynesia. Preprint, in revision in *JASA*, <https://hdl.handle.net/2268/341194> (2026).
12. Raick, X. The soundscape of the rariphotic zone. Preprint, in revision in *J. Mar. Biol. Assoc. United Kingdom* <https://hdl.handle.net/2268/341196> (2026).
13. Raick, X., Cabanne, E., Esposito, C. & Parmentier, E. Preliminary investigation of odontocete whistles in French Polynesia. Preprint, in revision in *RSMS* (2026).
14. Raick, X., Gervaise, C., Lecchini, D. & Parmentier, É. Limitations of α -acoustic diversity indices in assessing invertebrate sounds in coral reefs. *Bioacoustics* 1–14, <https://doi.org/10.1080/09524622.2025.2474482> (2025).
15. Raick, X. *et al.* “To be, or not to be”: critical assessment of the use of α -acoustic diversity indices to evaluate the richness and abundance of coastal marine fish sounds. *J. Ecoacoustics* 7, 1, <https://doi.org/10.35995/jea7010001> (2023).
16. Rancher, J. & Rougerie, F. L'environnement océanique de l'archipel des Tuamotu (Polynésie Française). *Oceanol. Acta* 18, 43–60, (1994).
17. Rougerie, F., Fichez, R. & Déjardin, P. Geomorphology and hydrogeology of selected islands of French Polynesia: Tikeahau (atoll) and Tahiti (barrier reef). in *Geology and Hydrogeology of Carbonate Islands. Developments in Sedimentology* 54, 475–502 (1997).
18. Bachet, P., Zysman, T. & Lefèvre, Y. *Guide des poissons de Tahiti et ses îles* (2010).
19. Élise, S. PhD thesis Développement d'indices écoacoustiques pour caractériser et suivre l'état et le fonctionnement des écosystèmes coralliens Université de la Réunion (2019).
20. Bertucci, F. *et al.* Local sonic activity reveals potential partitioning in a coral reef fish community. *Oecologia* 193, 125–134, <https://doi.org/10.1007/s00442-020-04647-3> (2020).
21. Bertucci, F. *et al.* Snapshot recordings provide a first description of the acoustic signatures of deeper habitats adjacent to coral reefs of Moorea. *PeerJ* 2017, <https://doi.org/10.7717/peerj.4019> (2017).
22. Bertucci, F., Parmentier, E., Lecellier, G., Hawkins, A. D. & Lecchini, D. Acoustic indices provide information on the status of coral reefs: An example from Moorea Island in the South Pacific. *Sci. Rep.* 6, 1–9, <https://doi.org/10.1038/srep33326> (2016).
23. Hartmann, W. *Signals, sound, and sensation. Physics Today* 51 (1998).
24. Cooley, J. W. & Tukey, J. W. An algorithm for the machine calculation of complex Fourier series. *Math. Comput.* 19, 297–301 (1965).
25. Raick, X. DATASET Acoustic recordings at 300 m in Moorea Island (French Polynesia) [Data set]. *Zenodo* <https://doi.org/10.5281/zenodo.12580170> (2024).
26. Raick, X. *et al.* DATASET From the Reef to the Ocean: Revealing the Acoustic Range of the Biophony of a Coral Reef (Moorea Island, French Polynesia) [Data set]. *Zenodo* <https://doi.org/10.5281/zenodo.7528211> (2023).
27. Raick, X. *et al.* DATASET Invertebrate sounds from photic to mesophotic coral reefs reveal vertical stratification and diel diversity [Data set]. *Zenodo* <https://doi.org/10.5281/zenodo.11960305> (2024).
28. Raick, X. Acoustic recording: Temae (Moorea Island) January 2021 [Data set]. *Zenodo* <https://doi.org/10.5281/zenodo.13954462> (2024).
29. Raick, X. Acoustic recording: Temae (Moorea Island) February 2021 [Data set]. *Zenodo* <https://doi.org/10.5281/zenodo.18538488> (2026).
30. Raick, X. Acoustic recording: Nuarei (Moorea Island) January 2021 [Data set]. *Zenodo* <https://doi.org/10.5281/zenodo.13958536> (2024).
31. Raick, X. Acoustic recording: Nuarei (Moorea Island) February 2021 [Data set]. *Zenodo* <https://doi.org/10.5281/zenodo.18540017> (2026).
32. Raick, X. Acoustic recording: Pihaena (Moorea Island) January 2021 [Data set]. *Zenodo* <https://doi.org/10.5281/zenodo.13959351> (2024).
33. Raick, X. Acoustic recording: Pihaena (Moorea Island) February 2021 [Data set]. *Zenodo* <https://doi.org/10.5281/zenodo.18546639> (2026).
34. Raick, X. Acoustic recording: E2B (Moorea Island) January 2021 [Data set]. *Zenodo* <https://doi.org/10.5281/zenodo.13963791> (2024).
35. Raick, X. Acoustic recording: E2B (Moorea Island) February 2021 [Data set]. *Zenodo* <https://doi.org/10.5281/zenodo.18549519> (2026).
36. Raick, X. Acoustic recording: Aroa (Moorea Island) January 2021 [Data set]. *Zenodo* <https://doi.org/10.5281/zenodo.18431776> (2026).
37. Raick, X. Acoustic recording: Aroa (Moorea Island) February 2021 [Data set]. *Zenodo* <https://doi.org/10.5281/zenodo.18541031> (2026).
38. Raick, X. Acoustic recording: Vaiare (Moorea Island) January 2021 [Data set]. *Zenodo* <https://doi.org/10.5281/zenodo.18478508> (2026).
39. Raick, X. Acoustic recording: Vaiare (Moorea Island) February 2021 [Data set]. *Zenodo* <https://doi.org/10.5281/zenodo.18538018> (2026).
40. Raick, X. Acoustic recording: Tetaiuo (Moorea Island) January 2021 part 1 [Data set]. *Zenodo* <https://doi.org/10.5281/zenodo.13968891> (2026).
41. Raick, X. Acoustic recording: Tetaiuo (Moorea Island) January 2021 part 2 [Data set]. *Zenodo* <https://doi.org/10.5281/zenodo.18482232> (2026).
42. Raick, X. Acoustic recording: Gendron (Moorea Island) January 2021 part 1 [Data set]. *Zenodo* <https://doi.org/10.5281/zenodo.18478655> (2026).
43. Raick, X. Acoustic recording: Gendron (Moorea Island) January 2021 part 2 [Data set]. *Zenodo* <https://doi.org/10.5281/zenodo.18482224> (2026).
44. Raick, X. Acoustic recording: Tiahura (Moorea Island) January 2021 part 1 [Data set]. *Zenodo* <https://doi.org/10.5281/zenodo.18478660> (2026).
45. Raick, X. Acoustic recording: Tiahura (Moorea Island) January 2021 part 2 [Data set]. *Zenodo* <https://doi.org/10.5281/zenodo.18482208> (2026).
46. Raick, X. Acoustic recording: Papetoai (Moorea Island) January 2021 part 1 [Data set]. *Zenodo* <https://doi.org/10.5281/zenodo.18478672> (2026).
47. Raick, X. Acoustic recording: Papetoai (Moorea Island) January 2021 part 2 [Data set]. *Zenodo* <https://doi.org/10.5281/zenodo.18482199> (2026).
48. Raick, X. DATASET Marine sounds below 2 kHz from French Polynesia [Data set]. *Zenodo* <https://doi.org/10.5281/zenodo.12570714> (2024).

49. Raick, X. Sound identification key for biological sounds below 2 kHz from mesophotic reefs in French Polynesia [Data set]. *Zenodo* <https://doi.org/10.5281/zenodo.10592329> (2024).
50. Raick, X. Advances in ecoacoustics of South Pacific mesophotic coral reefs. Preprint, In revision - Perspectives in Ecoacoustics. <https://hdl.handle.net/2268/341193>.

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Competing interests

The authors declare no competing interests.

Additional information

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