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Data Note

Microplastic ingestion data for 86 fish species across five Vanuatu communities: a reference for Pacific Island pollution monitoring

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Abstract

Objectives This microplastic dataset was collected to address critical gaps in understanding microplastic pollution in Vanuatu's coastal food fish. While microplastic contamination threatens marine ecosystems and human health across the Pacific, comprehensive data from Vanuatu's subsistence fisheries has been lacking. Collected in partnership with Vanuatu's Fisheries Department as an extension of creel surveys, this dataset aimed to provide essential baseline information across 86 fish species from five fishing communities. Although gathered as part of a broader regional project investigating microplastic exposure risks for Pacific fishing communities, this complete dataset is being published separately to ensure all stakeholders have access to the full range of findings. This resource will enable regional comparisons and support evidence-based management of marine plastic pollution.

Data description The dataset documents microplastic ingestion in 354 individual fish (from 86 species), detailing occurrence rates (4.8% of specimens [n = 17]), polymer composition (39% polyethylene [n = 5 of 13 analyzed particles]), particle morphology (95% fibers [n = 18 of 19 total observed particles]), and size distribution (predominantly 250–1000 µm). As Vanuatu's first comprehensive broad assessment of microplastics in subsistence fisheries, it establishes an important baseline for future research and policy decisions. The data is particularly valuable for Pacific Island Countries where the importance of coastal fisheries and traditional fish consumption practices (including gastrointestinal tracts) may increase microplastic exposure risks.

Abbreviations

MP	Microplastic
PICs	Pacific Island Countries
n	Sample size (e.g., n = 36)
GBIF	Global biodiversity information facility
H_2O_2	Hydrogen peroxide
FTIR	Fourier-transform infrared (spectroscopy)
PE	Polyethylene
PP	Polypropylene

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PVA Polyvinyl acetate
µm Micrometer (micron)

1 Objective

Microplastic pollution is a growing concern across the Pacific Island Countries (PICs), with growing evidence of contamination in marine waters, sediments, and organisms [1–4]. While studies have documented microplastics in Vanuatu's coastal waters, sediments and fish from around Port Vila and Mangaliliu on Efate Island [5, 6], data on coastal food fish remains limited in other main and remote islands despite their importance for local subsistence and livelihoods. Furthermore, the only study documenting microplastic within fish in Vanuatu had limited sample size (n = 36) and spatial coverage (the capital Port Vila) [5], finding a frequency of occurrence of 35%. The importance of Vanuatu's subsistence fisheries and range of island environments warrants further investigation of microplastic contamination in fish. This dataset addresses this critical knowledge gap by providing a comprehensive assessment of microplastic ingestion across 86 fish species from five rural Vanuatu communities on three different islands. Samples were collected in collaboration with Vanuatu's Fisheries Department during their annual creel survey in mid-2024.

Data was collected as part of a broader study (also from Fiji [7], Tonga [Fe'ao et al. in review], and Tuvalu [Alefaio et al. in review]) on microplastic exposure risks of subsistence fishers relative to their catch. This complete dataset is published separately to ensure full accessibility for researchers, policymakers, and coastal communities. These findings contribute to a growing dataset for monitoring marine plastic pollution in Vanuatu's fisheries and enable regional comparisons. The current study, thus, aims to fill in knowledge gaps by providing a more comprehensive baseline on the distribution of microplastics across multiple food fish species collected within five communities in Vanuatu. Furthermore, the findings will provide valuable insights into potential pathways of microplastic pollution in PIC marine ecosystems and will inform national and regional pollution mitigation efforts.

2 Data description

This study collected 354 fish from 86 species across five Vanuatu communities (Ifira [−17.747, 168.296], Mele [−17.701, 168.284], Takara Village A [−17.539, 168.453] on Efate Island, Peskarus [−16.526, 167.824] on Maskelyne Island, and Port Olry [−15.042, 167.074] on Espiritu Santo Island), with full specimen data available through Global Biodiversity Information Facility (GBIF) (see Table 1). Gastrointestinal tracts were preserved at −20 °C, then digested using 30% hydrogen peroxide (H_2O_2) at 60 °C and filtered through 250 µm, 125 µm, and 63 µm sieves based on methodologies described by Foekema et al. [8] and Rochman et al. [9]. Potential microplastics were identified and measured using a dissecting microscope (Prism Optical) and a scale bar [1]. Microplastics were assigned into size classifications of 125–250 µm, 250–1000 µm and > 1000 µm to ensure consistency with comparable datasets from Fiji [7], Tonga [Fe'ao et al., in review], and Tuvalu [Alefaio et al., in review]. For particles larger than 250 µm, the polymer composition was determined via Attenuated Total Reflectance Fourier Transform Infrared Spectroscopy (ATR-FTIR) (Perkin Elmer Spectrum Two), following established protocols by Jung et al. [10]. In summary, spectra were measured with the ATR-FTIR (4000–450 cm^{-1} range, 2 cm^{-1} resolution) and analyzed using Spectrum 10 (PerkinElmer) software. Each polymer was identified by comparing absorption bands to reference spectra from Jung et al. [10], requiring at least four diagnostic peaks for confirmation. Between samples, the ATR-FTIR diamond cell was cleaned with ethanol, and an 80 N contact force was applied to ensure optimal sample-crystal interaction.

To ensure contamination control, all digestion, extraction, and analysis procedures were conducted under consistent, sterile laboratory conditions across 12 processing runs (11 runs of 30 samples each and 1 run of 24 samples). For each run, three blank controls were included, totaling 36 control samples. These controls consisted of open, empty sterile beakers subjected to the same processing steps as the samples, including exposure to 30% H_2O_2. Equipment was thoroughly rinsed with filtered distilled water between uses to prevent cross-contamination. Airborne contamination was minimized by covering samples, beakers, and solutions with aluminum foil throughout digestion and extraction. Only one of the 36 control samples contained trace contamination (2 fibers, ∴ < 0.05 MP per beaker), with no particles found in samples of this run, indicating negligible to non-existent contamination during the study. The dataset documents

Table 1 Overview of data files/data sets

Label	Name of data file/data set	File types (file extension)	Data repository and identifier (DOI or accession number)
Data file 1	Vanuatu reef-associated food fishes observed under the Asia–Pacific Network for Global Change Researchproject	.csv	Global Biodiversity Information Facility https://doi.org/10.15468/tmqxr4

microplastic characteristics (morphological type, size class, and polymer composition) while providing complete fish collection records and morphometric data.

Of the 354 fishes sampled, microplastics were found in 17 individuals (from 10 species), resulting in a frequency of occurrence of 4.8%. A maximum of two MP were found per individual fish in *Lethrinus harak* and *Chlororus bleekeri*. A total of 19 microplastic particles were identified, comprising two morphological types, with fibers being the most frequent, accounting for 95% (n = 18) of the particles, followed by films at 5% (n = 1). The size distribution of microplastics revealed that particles in the 250–1000 µm range were the most abundant, representing 42% (n = 8) of the total, followed by particles in the 125–250 µm range, which accounted for 32% (n = 6). Microplastics larger than 1000 µm constituted 26% (n = 5) of the total.

A subset of 13 particles were analyzed for polymer composition. Four distinct polymer types were identified, with polyethylene (PE) being the most prevalent, accounting for 39% (n = 5) of the particles. Polypropylene (PP) and polyvinyl acetate (PVA) each represented 23% (n = 3) of the subset, while nylon constituted 15% (n = 2).

3 Limitations

The dataset has the following limitations, which should be considered when interpreting the results or reusing the data:

Polymer Analysis Constraints: Only microplastics > 250 µm were successfully characterized via FTIR spectroscopy due to technical limitations of the instrument. Smaller particles (125–250 µm) were counted and measured but could not be chemically identified.
Size Categorization: Microplastic sizes were collected and classified based on sieve mesh sizes (63 µm, 125 µm 250 µm) and optical measurement (125–250 µm, 250 µm–1000 µm, > 1000 µm), which may not capture exact particle dimensions. Furthermore, while studies using similar mesh sizes to analyze microplastics in fish gastrointestinal tracts with many overlapping species have found many more microplastics in these size ranges (e.g. [7]), we acknowledge that smaller microplastics (< 63 µm) could pass through the finest sieve. However, absence of microplastic within the 63 µm sieve indicates potentially low abundance of particles in this size range, though it may also reflect the inherent sensitivity limits of the detection approach used.
Variable Sample Sizes: Some fish species were represented by few individuals (e.g., *Variola louti*: n = 1), limiting statistical power for species-specific comparisons.
Geographical Scope: Sampling focused on five coastal communities; results may not reflect MP contamination in other regions of Vanuatu or deeper offshore habitats.
Temporal Variability: Data were collected during a specific time period (2024); seasonal or interannual variations in MP loads are not accounted for.

These limitations do not compromise the dataset's validity but highlight opportunities for future research, such as incorporating finer sieves or complementary techniques (e.g., Raman spectroscopy) for smaller microplastics.

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Author contributions Conceptualization was led by J.B.M., R.V., K.T.B., A.K.F., and J.D. Methodology was developed by A.H.M.S. H.F., A.K.F., R.V. and J.D. Formal analysis and investigation were conducted by J.V.B., E.D., A.H.M.S., H.F., J.H., R.K., R.K., and J.D. Data curation was performed by J.V.B. and K.T.B. Resources were provided by K.K., A.S., H.F., and J.B.M. The original draft was prepared by J.V.B., A.K.F., and J.D., with all authors contributing to review and editing.

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Data availability The data described in this Data Note can be freely and openly accessed on Global Biodiversity Information Facility under https://doi.org/10.15468/tmqxr4. Please see Table 1 and reference [11] for details and links to the data.

Declarations

Ethics approval and consent to participate This study received ethical screening approval from the University of the South Pacific's School of Agriculture, Geography, Environment, Oceans and Natural Sciences. The research did not involve human participants, and no animals were sacrificed specifically for this study. Gastrointestinal tracts were collected from fish already harvested by fishers participating in the Vanuatu Fisheries Department 2024 Creel Surveys. Additional research permits were obtained from the Vanuatu Department of Environmental Protection and Conservation. Clinical trial registration was not applicable to this study. Clinical trial number: Not applicable.

Consent for publication Not applicable.

Competing interests The authors declare no competing interests.

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