

**Tables (provided as a separate file)**

**Table S1.**

Summaries and major conclusions of research articles and reviews on environmental RNA viruses with specific focus on the ocean.

**Table S2.**

Protistan RNA virus isolates.

**Table S3.**

List of Tara Ocean studies related to this work.

**Table S4.**

List of RNA samples, their metadata, and their unique identifiers.

**Table S5.**

A full list of the RNA virus contigs identified in this study, along with their representative vOTU sequences, novelty and long-read matches, RdRp domain and genome completeness, and other statistics.

**Table S6.**

RdRp domain sequences across different datasets included in this study.

**Table S7.**

High-ranks taxonomic assignment for RNA viruses based on network-guided iterative clustering and phylogeny of the RdRp domains (pre-clustered at 50% identity and at least 90% complete; n=6,238).

**Table S8.**

Pairwise protein superfamily reliability scores calculated from experimentally resolved or predicted three-dimensional structures of RNA virus RdRps and other reverse transcriptases.

**Table S9.**

Domain annotations (section A) and enrichment analysis per megataxon (section B) for RNA vOTUs in this study (n=5,122 annotatable out of 5,504).

**Table S10.**

Detected RdRp domain motifs and their arrangement in the new megataxa discovered in this study.

**Table S11.**

Host prediction results for the RNA vOTUs identified in this study.

**Table S12.**

Inferring new RNA phages from prokaryotic Shine–Dalgarno sequences.