

## **Description of Additional Supplementary Files**

File Name: Supplementary Data 1

Description: The water column relative abundances of shallower and deep trap SASVs.

File Name: Supplementary Data 2

Description: Parameters of each power-law curve for the water column relative abundances of sediment trap-shared SASVs from each time point in the shallower depths.

File Name: Supplementary Data 3

Description: The specific SASVs identified in Fig. 3 and their taxonomic affiliations.

File Name: Supplementary Data 4

Description: The trap relative abundances of shallower and deep trap SASVs.

File Name: Supplementary Data 5

Description: The taxonomic affiliations of SASVs identified as enriched in 4000 m traps during SEP compared to non-SEP time periods.

File Name: Supplementary Data 6

Description: The sampling information and metadata of Station ALOHA time-series water samples

File Name: Supplementary Data 7

Description: The sampling information on PARAGON samples