

Big Stew: Microbial Community Difference Along Water Columns in Mediterranean Sea

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Microbial communities form a crucial part of the ocean ecosystem, which mainly consists of bacteria and archaea, as well as unicellular eukaryotes, connecting with each other via different ecological, biogeochemical networks. Studying such complex community is challenging, Deutschmann *et al.*, 2024 has utilized association interaction between species to assess differences in community structure, association patterns and interaction specificity between regional and global scale. Data used and published was originated from two expeditions, which displayed the best coverage of depth from surface to bathypelagic zone in Mediterranean Sea, comprising Amplicon Sequence Variants (ASV) abundance in different sampling sites and ecological parameters. We have conducted meta-analysis in regional scale from the Mediterranean subset, to further investigate the structure difference at different depth.

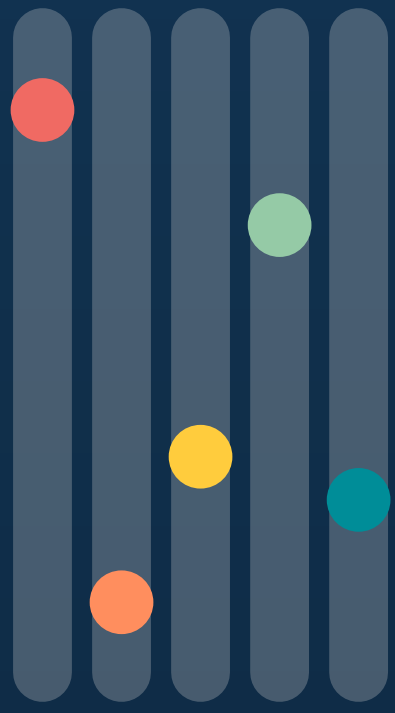
Depth Zone ~ Subnetwork

Network Indices

- Species togetherness
- Shannon diversity
- Linkage density
- Interaction strength asymmetry
- Interaction evenness

We divided the *OTU ~ Sample site* abundance matrix into subnetworks according to depth category. Network indices were calculated for each subnetwork for comparison.

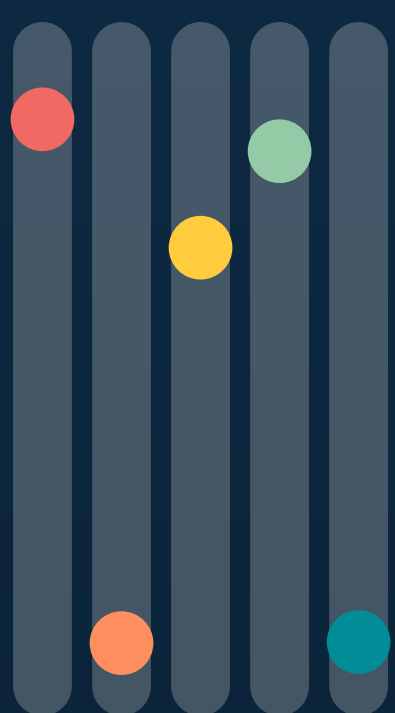
3 m Surface



Part of sunlit zone with the most solar resource. Home to many phytoplanktons, which forms the first tropical level of ocean ecosystem and provides oxygen.

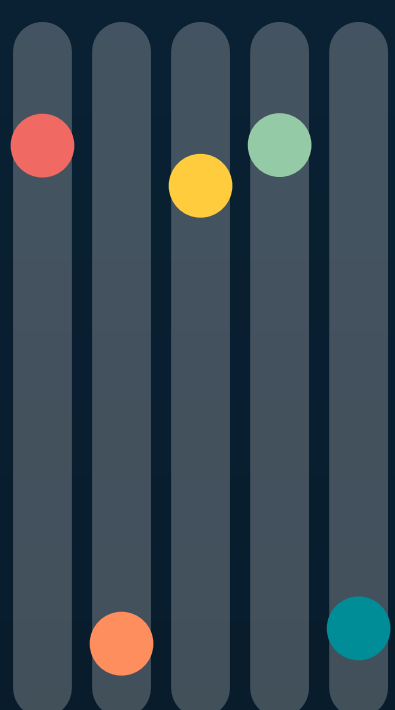
Surface network shows the highest species togetherness, indicating the strongest association in form of co-occurrence.

12 - 130 m Epipelagic



End of the sunlit zone, consists a thin layer of 2-3% the entire open ocean depth. Zooplanktons feeds here along with other microorganisms floating in this warmer water column and interacting with each other.

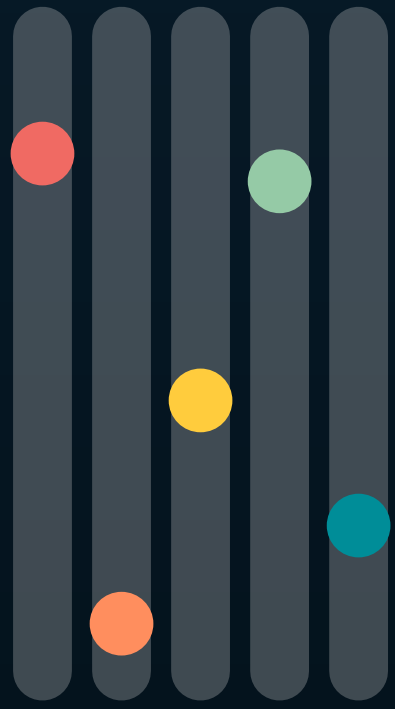
200 - 1000 m Mesopelagic



Also called the “Twilight Zone”, sun light is usable for photosynthesis is unable to reach this area. Although it’s home to fishes, larger crustaceans, squids, etc.

Lower species togetherness and high linkage density indicates a more complex structure.

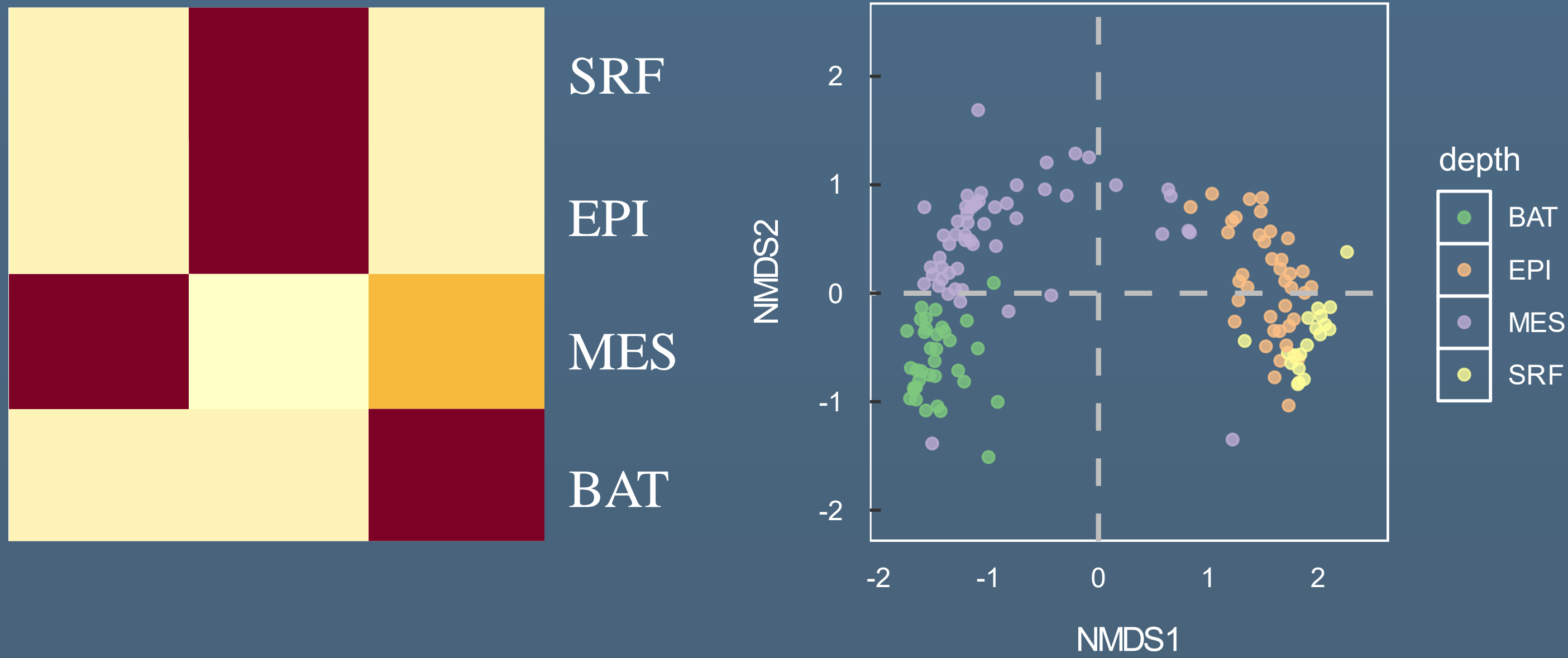
1100 -3300 m Bathypelagic



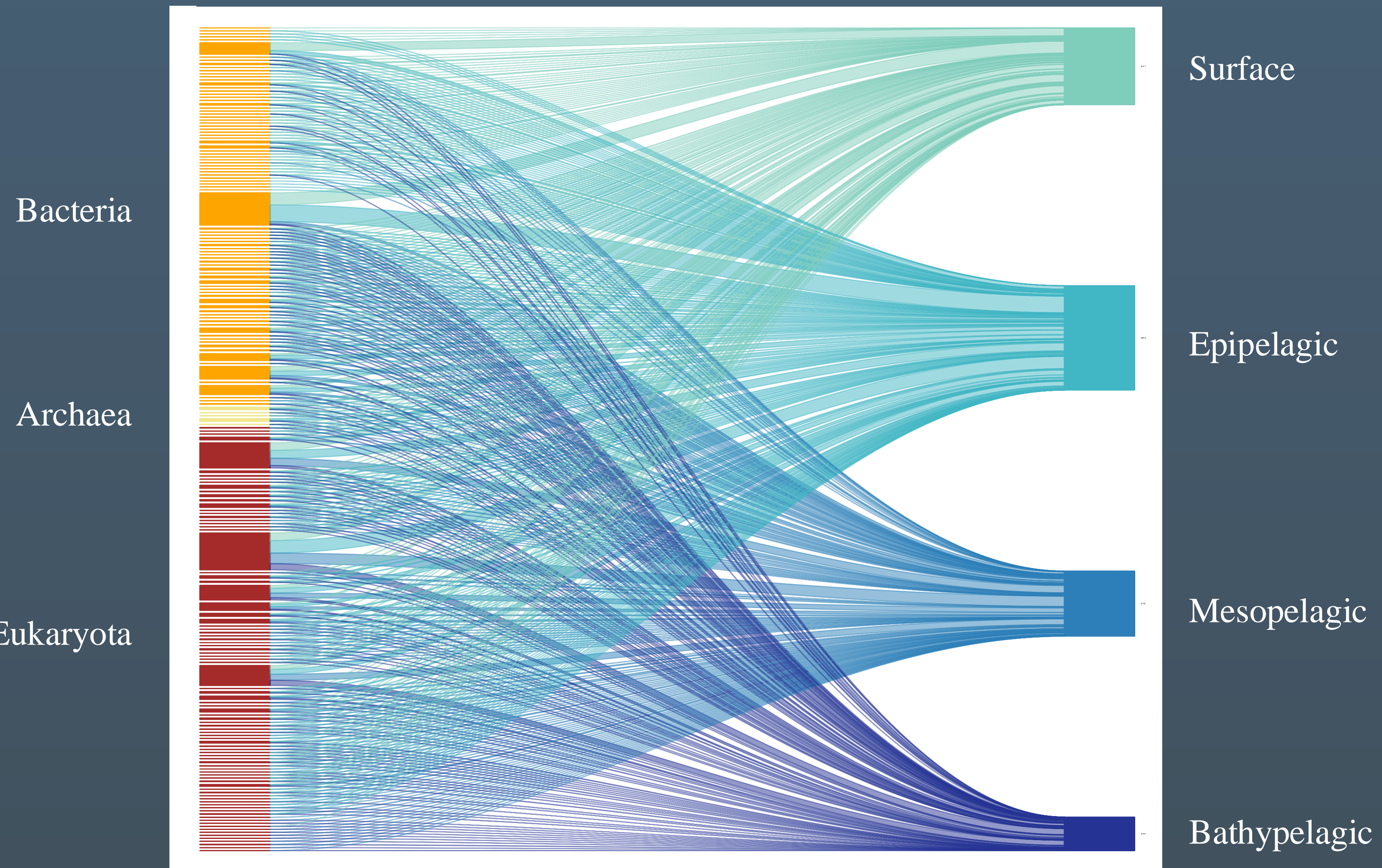
The “Midnight Zone”, even the least absorbed blue light disappears. The majority of Mediterranean Sea hits sea floor at this depth and microorganisms also interact with benthic fauna.

Similar network indices profile like surface layer shows higher degree of adaptation.

We were able to detect three modules, which resembled the subnetwork divided by depth and corresponds to clusters visualized in NMDS plot.



Bipartite network of taxa genus and the according depth of the water column they were found. Visible is a strong mixture of orders in all depth layers. Some orders are more represented in samples of the surface and epipelagic, while other orders are equally represented in all depth layers.



Modules corresponding to different depths reveal limited interaction between taxa across layers, indicating a possible specialization of the taxa in each layer. Mesopelagic and epipelagic layers show higher diversity and connectance could be observed in both indices comparison and NMDS, compare to surface and bathypelagic layers, which have a lower diversity, possibly indicating higher specialization.

