Hierarchical Clustering Analysis

The association of the consumption of PTE’s in individual fish species is observed by the hierarchical density-based clustering algorithm (HDBSCAN)1 with k=2, 3(As). *Anabas testudineus, Clupisoma garua, Cirrhinus reba* and *Tenualosa ilisha, Botia dario, Pseudambassis ranga* shows strong clustered in the enrichment of the most PTE’s.

The fish species of *Anabas testudineus, Clupisoma garua, Cirrhinus reba* and *Tenualosa ilisha, Botia dario* clustered in accumulation of Cr strongly. The consumption of Mn in fish species of *Botia dario, Pseudambassis ranga* and *Cirrhinus reba, Mystus vittatus, Anabas testudineus* clustered together. *Tenualosa ilisha, Botia dario, Pseudambassis ranga* and *Anabas testudineus, Cirrhinus reba* shows strong accumulation of Zn. Se accretion in *Tenualosa ilisha, Botia dario* with *Pseudambassis ranga*  and *Cirrhinus reba, Mystus vittatus, Anabas testudineus* showedclose cluster. The enrichment of Pb in *Neotropius atherinoides, Tenualosa ilisha, Botia dario, Pseudambassis ranga* with *Clupisoma garua, Cirrhinus reba* and *Anabas testudineus, Mystus vittatus* strong closeness is observed. The fish species of *Anabas testudineus, Clupisoma garua, Cirrhinus reba, Mystus vittatus* and *Neotropius atherinoides, Botia dario* with *Tenualosa ilisha, Pseudambassis ranga* strongly clustered in consumption of Hg. The accumulation of Fe in the fish species of *Anabas testudineus, Cirrhinus reba, Mystus vittatus* and *Botia dario, Pseudambassis ranga* with *Tenualosa ilisha* closeness is screened. *Anabas testudineus, Clupisoma garua, Cirrhinus reba, Mystus vittatus*  strongly clustered in consumption of Cu. The fish species of *Cirrhinus reba, Neotropius atherinoides, Tenualosa ilisha, Botia dario*  with *Pseudambassis ranga*  strongly clustered in accretion of Co. The fish species of *Tenualosa ilisha, Botia dario, Pseudambassis ranga* with *Neotropius atherinoides* and *Anabas testudineus, Clupisoma garua* clustered strongly in consumption of Cd. The accumulation of As in the fish species of *Tenualosa ilisha, Botia dario, Pseudambassis ranga* and *Anabas testudineus, Cirrhinus reba* with *Neotropius atherinoides* clustered strongly. The cluster analysis revealed patterns in consumption of PTE’s in different observed fish species.

1. *Campello, R.J.G.B., Moulavi, D., Sander, J. (2013). Density-Based Clustering Based on Hierarchical Density Estimates. In: Pei, J., Tseng, V.S., Cao, L., Motoda, H., Xu, G. (eds) Advances in Knowledge Discovery and Data Mining. PAKDD 2013. Lecture Notes in Computer Science(), vol 7819. Springer, Berlin, Heidelberg.* [*https://doi.org/10.1007/978-3-642-37456-2\_14*](https://doi.org/10.1007/978-3-642-37456-2_14)