Understanding the relationship between sound scattering layers (SSLs) and pelagic habitat characteristics is a substantial step to apprehend ecosystem dynamics. SSLs are detected on echo sounders representing aggregated marine pelagic organisms. In this study, SSL characteristics of zooplankton and micronekton were identified during an upwelling event in two contrasting areas of the Senegalese continental shelf. Here a cold upwelling-influenced inshore area was sharply separated by a strong thermal boundary from a deeper, warmer, stratified offshore area. Mean SSL thickness and SSL vertical depth increased with the shelf depth. The thickest and deepest SSLs were observed in the offshore part of the shelf. Hence, zooplankton and micronekton seem to occur more frequently in stratified water conditions rather than in fresh upwelled water. Diel vertical and horizontal migrations of SSLs were observed in the study area. Diel period and physicochemical water characteristics influenced SSL depth and SSL thickness. Although chlorophyll-a concentration insignificantly affected SSL characteristics, the peak of chlorophyll a was always located above or in the middle of the SSLs, regularly matching with the peak of SSL biomass. Such observations indicate trophic relationships, suggesting SSLs to be mainly composed of phytoplanktivorous zooplankton and micronekton. Despite local hypoxia, below 30m depth, distribution patterns of SSLs indicate no vertical migration boundary. The results increase the understanding of the spatial organization of mid-trophic species and migration patterns of zooplankton and micronekton, and they will also improve dispersal models for organisms in upwelling regions.

Applying Acoustic Scattering Layer Descriptors to Depict Mid-Trophic Pelagic Organisation: The Case of Atlantic African Large Marine Ecosystems Continental Shelf

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Hydroacoustic is a reliable and often used tool to monitor and study marine ecosystems. This study focus on acoustic scattered layers, which are the echosounder detection of pelagic marine organism of low trophic level, important in ecosystems functioning. Data have been recorded at 38 kHz in the three Atlantic African Large Marine Ecosystems (AA LME). To describe parsimoniously ecosystems, compare them and understand the difference, 14 descriptors have been used. Some of them are based on already used descriptors and others are new. The aim of this study is to ensure that these descriptors are relevant to monitor and compare systems. So, we first explore spatial (intra- and inter-LME comparisons) and then temporal dimension (inter-

annual variability). For such purpose, we use a large acoustic database collected over 15 years in the three AA LME: Canary Current LME, Guinea Current LME and Benguela Current LME. Our methodology is innovative, introducing original new descriptors to monitor pelagic compartment of each LME and should be efficiently used for environmental monitoring in case of perturbation as overfishing, climate change or marine pollution. Indeed the acoustic scattered layer are mainly composed of macrozooplankton and ichtyoplankton which are sensitive to environmental change.

Spatial functionnal analysis application on fisheries acoustics data coupled with fine scale environmental data

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In this work, we were interested in the application of functional, spatial data analysis (FSDA) on coupling acoustic (*Sv*) and environmental (water temperature, fluorescence, salinity and turbidity) data. To do this we use data from an acoustics fisheries surveys (R/V Thalassa, Ifremer, AWA campaign) carry out in West African waters using multifrequency echosounder (18, 38, 70, 120, 333 kHz) and a scanfish (high performance towed undulator). FSDA were compared to classical statistical methods namely multivariate functional principal component analysis, classical principal component analysis, classification on principal component scores, classical additive model, spatial functional additive model. The interest to improve such statistical analysis is appliedhere to the study the effect at fine scale of environmental parameters on the distribution of coastal sound scattered layers. We first considered an aggregated analysis of the environmental data then we considered a more complete analysis of the data via their functional characters.

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