distinct micronekton ecosystems using clustering algorithms on hull-mounted acoustics. The depth of scattering layers within each ecosystem was extracted and examined in relation to environmental parameters (temperature, salinity, fluorescence, oxygen), as well as current measurements from ADCP. We then described the specific characteristics of the warm pool ecosystem and the coherence between the structure of mid-trophic levels and environmental variables.

Key words: Micronekton, Warm pool, Mesopelagic, Clustering, Mid-trophic level

2.2. Monitoring the effects of a storm on near-surface anchovy using a glider-mounted echosounder

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Juvenile anchovy in the Bay of Biscay perform a gradual migration from the shelf waters to the coast in autumn. This migration occurs gradually in periods of meteorological stability. However, it has been hypothesized that after the autumn storms that mark the arrival of winter, the juvenile population abruptly accelerates its migration, causing juveniles to concentrate in coastal waters. In 2022, a conventional trawl-acoustic methodology of the JUVENA campaign was combined with an acoustic monitoring conducted from a glider. The glider, equipped with a CTD and an echosounder, traveled through a transect perpendicular to the coast. The experiment coincided with the arrival of an intense storm, allowing to obtain acoustic recordings of anchovy and hydrological conditions before and after the storm. The spatially extensive trawl-acoustic data combined with the temporally extensive data from the glider showed how the storm reinforced anchovy migration towards the coast. Moreover, a downwelling event was detected by the glider. The glider proved valid for sampling under rough climate conditions. However, bathymetries shallower than 80 m were not sampled for safety reasons, thus preventing us from locating the coastal end of the anchovy distribution and limiting the reliability of the study.

Keywords: *Engraulis encrasicolus*, glider, acoustics

2.3. Bottom-mounted echosounders shed light on pelagic fish in the Belgian part of the North Sea (BPNS)

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Five bottom-mounted split-beam echosounders (Simrad WBAT) with upward-facing transducers (70 and 200 kHz) have been deployed across the Belgian part of the North Sea (BPNS) since 2023. Within the context of the BAR (Brexit Adjustment Reserve) project, we aimed to detect and characterize schools of pelagic fish based on their size, depth, aggregation and presence throughout the 24-hour diel period. Echoview software was used to detect and characterize targets from both frequencies. The BPNS is characterized by strong tidal action, which often resulted in significant backscatter from entrained air bubbles, complicating the detection of fish schools. An entrained air boundary line was created through averaging and thresholding, effectively separating fish schools from entrained air bubbles. Analysis revealed a higher detection rate of schools during daylight hours (15-34% detection positive hours, DPH) compared to nighttime (6-17% DPH) across all stations. To infer possible species

of detected schools, an acoustic pelagic trawl survey was conducted in December 2023. Herring, pilchard, whiting and mackerel constituted 95% of the total catch weight during the survey.

The semi-continuous data generated from bottom-mounted echosounders offer insights into the distribution of pelagic fish, providing high temporal coverage that will benefit stakeholders engaged in monitoring pelagic fish.

Keywords: echosounder, trawling, school detection, entrained air, bottom-mooring, school characterization

2.4. Decadal spatiotemporal distribution of anchoveta (Engraulis ringens) in the Peruvian marine ecosystem between 1985-2024

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Our analysis examined the decadal relationship between anchoveta and the Pacific Decadal Oscillation index in the Peruvian marine ecosystem. The acoustic data were obtained from Pelagic Resources Assessment Hydroacoustic Surveys conducted by the Instituto del Mar del Peru, while oceanographic data came from satellite images of sea surface thermal anomalies between 1985 and 2024. Results showed that during cold decadal periods, anchoveta were found a little far from the coast, concentrated mainly in the central-northern region. In warm decadal periods, they were closer to the coast and with greater abundance towards the central zone. An exception was the 1985-1988 warm period, when anchoveta distribution was wide and generally dispersed. The biomass trend was negative in warm decadal periods and positive in cold decadal periods, influenced by the El Niño events: 1997-98 and 2015-16, with a decrease in biomass recorded in 1998 and 2015. The last cold period (2017-2024) was influenced by the warm year of 2023. Between 2000 and 2024, anchoveta biomass averaged 8.26 million tons, with an average biomass of 7.46 million tons for the north-central region between 2004-2024.

Keywords: Decadal spatial distribution; Distribution and concentration; Oceanographic environmental dynamics; Biomass estimation

2.5. A review of multifrequency split-beam applications to aquatic ecosystem science

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Biplanar split-beam processing of echosounder data facilitates coherent-phase detections of scatterers and estimates of their three-dimensional positions within the acoustic beam. This processing is robust when the phase is coherent across a range of wavelengths. Target scatterers may be biotic or abiotic, entire individuals or aggregations of animals, or facets of animals or the seabed. The three-dimensional positions of coherent-echo samples are compensated for transducer location and motion, and located in geographic coordinates. The sample intensities are compensated for beam directivity and propagation loss. These data are used to estimate fish aggregation shapes, densities, abundances, and behaviours, and to simultaneously detect and classify echoes from animals and the seabed. These data are used to improve estimations of seabed depth; sub-beam slope, hardness, roughness and lithology; and the height of the unresolved boundary region, the so-called dead zone, for each transmission and beam. These approaches are also applied to data from a swath of split-beams spanning a range of frequencies, i.e., from the Simrad ME70, to provide more classification and measurement possibilities.