{rokbox title=|Sampling area and location of stations :: Image: Authors| thumb=|images/stories/ieo/imagenespublicaciones/centro-oceanografico-baleares-ieo-csic-swimbladder-properties-cyclothone-atlantic-ocean-mediterranean-sea-sarmiento-et-al-2023-thumb.jpg|}images/stories/ieo/imagenespublicaciones/centro-oceanografico-baleares-ieo-csic-swimbladder-properties-cyclothone-atlantic-ocean-mediterranean-sea-sarmiento-et-al-2023.jpg{/rokbox}

Airam N. Sarmiento-Lezcano, M. Pilar Olivar, María José Caballero, María Couret, Santiago Hernández-León, Arturo Castellón and **Marian Peña**, 2023. **Swimbladder properties of *Cyclothone* spp. in the northeast Atlantic Ocean and the Western Mediterranean Sea.**
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Abstract: Non-migratory bristlemouth fishes (*Cyclothone* spp.) are the most abundant vertebrates on Earth and play an important role in the biological carbon pump by remineralizing organic carbon in deep ecosystems. Acoustic data and net sampling are often used in combination to estimate fish and zooplankton biomass, but this procedure may be subject to several sources of error when applied to mesopelagic species. For instance, the allocation of echoes to species has often been biased by not considering *Cyclothone* spp. due to the use of nets targeting larger fish. Furthermore, the acoustic properties of the target organisms must be well understood to convert acoustic density into numerical density. The characteristics of a fish's swimbladder are the most relevant features necessary to assess its acoustic properties. This study provides information on the swimbladder properties of six *Cyclothone* species inhabiting the meso- and bathypelagic layers in the North Atlantic Ocean and Mediterranean Sea, including swimbladder location within the body, fat tissue content, morphology, morphometry (only available for *C. braueri* and *C. pseudopallida*), and fish body-mass density (only available for *C. braueri*, *C. pseudopallida*, *C. pallida*, and *C. pygmaea*

). The studied species showed a functional physoclistous swimbladder, with well-developed gas glands and rete mirabile and numerous capillaries in the case of the shallower species *C. braueri* and *C. pseudopallida* (mainly distributed from 400 to 600 m depth), and a fat-invested swimbladder in species with deeper vertical distribution (*C. livida* , *C. microdon* , *C. pallida* , and *C. pygmaea*). The fat content in the swimbladder (*C. pallida* and *C. microdon*) increased with depth and latitude, reducing the space in the swimbladder that could contain gas. Changes in swimbladder size and volume during growth were analyzed for shallower species, where swimbladder volume and equivalent radius followed negative allometric growth in relation to body length. Finally, values of body-mass density (ρ) and gas content required for neutral buoyancy (VG) were estimated for *C. braueri* and *C. pygmaea* collected between 350 and 550 m (ρ = 1.052–1.072 g·cm–3, VG = 2%–4%; ρ = 1.052–1.062 g·cm–3, VG = 3.6%), and for *C. pallida* and *C. pseudopallida* sampled in the 450–700 m layer (ρ = 1.052–1.062 g·cm–3, VG = 2.6–3.1%; ρ = 1.052–1.062 g·cm–3, VG = 2.8%–3.25%). Results in this study highlight the change in scattering behavior of *Cyclothone* species from gas-bearing organisms (those that contain gas in their swimbladder) in the upper mesopelagic zone to the fluid-like scattering (with fat-filled swimbladders) of the deeper and northern individuals. The data presented in this manuscript are important for parametrizing acoustic backscattering models built to estimate the echo of *Cyclothone* species, although further work is needed, particularly for individuals with partially invested swimbladders with an irregular fat-free shape.

Keywords: micronekton, bristlemouth, swimbladder, gas, fatty-tissue, histology, bodymass density