Observing zooplankton layers with acoustics at close range

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Multi-frequency acoustics continues to mature as a tool for observing and measuring zooplankton layers from standard research vessel surveys. Signal processing techniques for separating zooplankton from fish backscattering may also help in isolating the zooplankton backscatter. Layers deeper than 100 to 200 meters, however, cannot be evaluated from the vessel mounted transducers due to pure physics. The sound absorption at higher frequencies, typically used on zooplankton, is severe, and thin layers and weak scatterers are easily missed at range. Dipping the scientific echo sounders systems down into the deep may represent a simple solution.

In this presentation the focus will be on survey design and computational examples of typical patchiness, or lack of patchiness in large zooplankton layers, and how to sample these layers by point or adaptive sampling. Examples from standard scientific echo sounders transmitting vertically and horizontally will be presented from coastal, oceanic and arctic ecosystems. The utilization of standard narrowband and wideband pulses will be demonstrated, along with estimates of absolute animal abundance (mean number per m^{-3}), with associated statistics for both systems. Simultaneous measurements of hydrography and sea current velocity can help the acoustic interpretation, along with combining acoustics with stereo-photography for density measurements and target identification. The measurements will be discussed in relation to the real catch efficiency of some traditional sampling gears. Isolated examples of problematic situations, where acoustics is not the correct tool are also discussed.

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