pandemic, limits on personnel; furthermore, they struggle to get close to certain habitats, particularly man-made marine structures such as oil and gas platforms and offshore windfarms. Here we present experience of an uncrewed surface vehicle (USV) survey of these habitats. We focus on some of the challenges and benefits of the USV and describe how it was operated remotely from the desk of navigators and sensor operators. Notable benefits include, in-situ calibration, getting very close to certain platforms, surveying straight through an offshore windfarm, and obtaining ancillary data such as regular 360° imagery for seabird detection. Challenges include the lack of alternative evidence for the acoustic data, acoustic noise at longer ranges and somewhat limited survey range. However, these challenges are not unsurmountable, so prospects for USV applications look good.

Recognizing the Influence of Turbulence-Induced Entrained Air When Monitoring for Risk to Fish at Ocean Energy Installations

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For those tidal energy installations where it is required to quantify the potential risk to fish posed by the introduction of energy conversion devices into the habitat, scientific hydroacoustic echosounders provide quantifiable, stratified sampling of the whole water column with sufficiently high resolution in time and space. However, the impressive currents that are favourable to energy development are often turbulent and result in air entrainment into the water column. Entrained air limits the use of acoustic-based sampling systems to only those portions of the water column not contaminated with entrained air. To help regulators and developers recognize the potential implications to the understanding of fish presence, distribution, and abundance in ocean energy sites, we undertook a study of the proportion of water column obfuscated by entrained air as a function of tide direction, current speed, and season. Our findings demonstrate that site-specific localized hydrodynamics and seasonal winds can have a major impact on the observable portion of the water column. This information is critical for determining an optimal data collection site, establishing reasonable monitoring goals in dialogue with regulators, developers, and stakeholders, and for identifying periods of time when active acoustic technologies may not be an effective tool for monitoring.

Species identification of fish shoals combining multibeam and split-beam echosounders with visual observations from diving

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One challenge of acoustic observations of marine organisms is the identification of species, particularly in shallow waters where high diversity occurs. We deployed combining split-beam EK80 (70, 120 and 200 kHz) and M3 multibeam (500 kHz) echosounders to detect monospecific fish shoals in coastal shallow waters (5-60 m). Innovative protocols for the specific allocation were tested, using (i) scuba divers census on fish shoals and (ii) towed scuba diver. Stereoscopic video system was also used to assess fish length and abundance and compare with the visual estimations of divers. Several independent replicates of monospecific shoals from 5 fish species were obtained. The combined used of the echosounders allows to have complementary morphologic, acoustic and spatial descriptors to correctly discriminate the shoals. In addition, as the stereoscopic system has shown to provide precise measurements of individuals and could overcome the visual diver observations, our results suggest that a system equipped with cameras like a remotely controlled towed instrumentation platform could be used in a near future for ground trust in shallow and clear waters.

Using histogram equalization to visualize acoustic and ancillary data

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Echogram visualization and processing is one of the most time-consuming tasks for fisheries acousticians. Analyzing target species or features is often based on experience while visualization settings are inherited from colleagues or established for standardization purposes within international efforts. Acoustic data is often visualized with a standard minimum threshold for Sv that varies with target species. For instance, small pelagic fishes are often visualized in European waters from − 60 dB re 1 m2 m− 3 while echograms of the mesopelagic zone (200–1000 m depth) usually employ a − 90 or − 80 dB re 1 m2 m− 3 minimum threshold. However, numerical volume density changes greatly with depth (particularly beyond the shelf), time of the day and season, and thus setting an incorrect threshold may mask part of the population at some times or areas. Following on Blackwell et al. (2019) that showed the best colormaps to be employed in fisheries acoustics, this presentation focus on further parameters (general thresholds and location of the color limits) of the colorbar. Most colormaps employ linear relationship between data and color, where every color represents a similar range of values. This can hide interesting features in only one or two colors. Histogram equalization is a non-linear interpolation technique that locates thresholds and color limits at the quantiles of the image data. Examples using acoustic and ancillary data will be shown to highlight the benefits of this technique. While no definite conclusion is provided, some food for thought on the influence of the number of colors employed will also be provided.

Target classification of individual zooplankton in *ex-situ* broadband acoustic data using supervised machine learning

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