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Conference report

ICES International Symposium on Fisheries and Plankton Acoustics (organized under the auspices of ICES by the Marine Laboratory, Aberdeen, Scotland) 12–16 June 1995, Aberdeen, Scotland.

The use of sound for the observation and monitoring of aquatic life has become increasingly important since its inception over 50 years ago. It now plays a major role in the success of commercial fishing operations, as well as in fisheries research. In recent years the use of sound has extended down the size spectrum to include zooplankton and micronekton. The continuous, non-intrusive nature of acoustic techniques has dramatically changed our perceptions of the spatial and temporal distribution of aquatic animals, and acoustics has now achieved widespread acceptance. Surprisingly, there has not been a major international symposium on fisheries acoustics since the ICES-sponsored meeting in Seattle in 1987. The recent International Symposium on Fisheries and Plankton Acoustics was aimed at addressing this communication gap in the field, bringing together a large proportion of this growing community to report on the many developments that have occurred in the last 8 years.

The Symposium, co-sponsored by the Institute of Acoustics (IOA), the Acoustical Society of America (ASA) and the Société Française d'Acoustique (SFA), provided a review of recent technological developments, re-assessed the status of old problems and identified future research directions and requirements. The 105 oral and 61 poster presentations, many of a very high standard, reflected the multidisciplinary approach that is required nowadays to make an impact in this field, with engineers, mathematicians and biologists joining together to solve complex problems. Unfortunately, the parallel sessions often covered overlapping topics, and the decision on which to attend was difficult and often frustrating. However, evident in all sessions was the degree of maturity that the discipline has attained, having successfully established roots in an increasing number of oceanographic fields. For example, there were contributions on the relationships between fish, plankton and their physical environment (11 oral papers), target strength determination methods, models and measurements (21), signal classification and identification (14), fish and plankton behaviour and reactions (12), analytical and technical methodologies (18), validation of acoustic methods and comparison with other methods (17), temporal changes (5), three-dimensional acoustics (4) and survey design (3). From such a wide spectrum of contributions, I can highlight just a few specific points according to my biased acoustical ear. For a more complete overview, do not miss the special issue of *ICES Journal of Marine Science* (expected in early 1996), in which more than 50 selected, peer-reviewed contributions will be published.

On a general note, it was obvious that developments in computer technology have dramatically enhanced our ability to store, access and analyse large acoustic data sets. As a consequence, enormous efforts have been focused recently on developing complex, yet rapid, post-processing systems. Examples of geographical information (GIS), data management and 3-D visualization systems were presented, reflecting the high

degree of sophistication achieved in the processing of acoustic signals. It is important, however, that in this quest for more sophisticated systems we do not forget also to improve upon the quality of the basic signal, or we may end up putting the cart before the horse. Looking back to the Seattle 1987 symposium, it seems that some old problems have been solved (e.g. systems calibration), or have become less controversial (e.g. survey design, where nonetheless there still exists some confusion related to inherent differences between design and model-based approaches to variance estimation). Work in difficult environments, such as near physical boundaries, showed progress thanks to improved technology, such as towed bodies for the assessment of deep resources, or forward scattering and refined tracking techniques for riverine systems.

Many contributions tried to deduce quantitative information from direct measurements of target strength *in situ*, not only because such information is required to scale acoustic estimates of stock size, but also, one suspects, because modern echosounder systems provide this information at the touch of a button! The problem is that the success of most single-target recognition systems appears to be density dependent, which can lead to gross overestimation of target strength and hence to severe underestimation of biomass. Some possible ways of exploring this problem were outlined, such as using new recognition algorithms, tracking targets over consecutive signals, or linking targets recognized by several frequencies. We may yet require major technological and instrumental developments and a better understanding of the mechanisms of echo-formation from biological scatterers before the final paper on target strength is written.

Another field where much progress was reported is that of signal classification and species identification. This progress is largely attributable to the high degree of sophistication in signal analysis. Some workers have concentrated on extracting morphological and internal information on fish schools through analysis of echosounder and sonar images, not only to identify the species, but also to examine school structure, dynamics and behaviour in relation to environmental factors. Others went further and performed amplitude PDF and spectral analysis of narrow-band signal envelopes in an attempt to classify the insonified targets to species level. However, success seems to have been limited in both approaches. As a result, high expectations were placed on the capabilities of wide-band systems and artificial neural networks to identify species. Future symposia will reveal if the research attention shifts towards developing these techniques or towards further use of 'low-quality' signals.

Progress achieved in the field of plankton acoustics was noteworthy, including a healthy scepticism over early simple relationships between volume backscattering and biomass. With increasing knowledge of the backscattering properties of basic zooplankton scatter-types, our chances of success in estimating plankton density should increase substantially. It was clear, however, that multifrequency systems will be required to achieve this. Exciting developments in the use of acoustics to investigate small-scale zooplankton patchiness and individual zooplankter behaviour were also presented, based on high-resolution systems, multibeam sonars and complex three-dimensional visualization systems. Zooplankton acoustics seems to be taking off in a big way, in a thought-provoking and innovative fashion.

Given the high quality and diversity of the research presented at the Symposium, I believe that biological hydroacoustics has established itself firmly in both academic and

applied spheres, and it has expanded its range of applications since the last symposium in 1987. The meeting may have also witnessed what Dr Van Holliday called in his closing remarks "the changing of the guard": new faces, new ideas, renewed enthusiasms. It will be a daunting task to elevate the discipline above the high levels to which he and his generation of scientists have brought it over the past decades. It will be an exciting task too, and one worth following closely. I am sure that new results will be forthcoming soon, and that we will not have to wait another 8 years to see them in the next symposium.

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