

Editorial

There is an increasing concern in the world about the potential effect that human pressure and climate change may introduce into the environment, and especially in marine ecosystems. Due to the fact that this ecosystem approach is recent, although many scientific observations and results show that climatic changes are already appearing, very little is known about the way marine communities are adapting to or affected by these changes. This ecological and ecosystem approach brings two constraints:

- there is a need to strengthen the capacity to detect, understand and predict the effects of the global change;
- this requires developing or adapting cost effective, reliable and efficient technologies, in order to be able to collect rigorous scientific data to develop indicators on the status of the ecosystem.

In the particular case of large pelagic ecosystems, the fish populations as well as the other animal groups remain difficult to study, as their dimension and variability do not allow performance of accurate, economic or synoptic observation of the different system parameters with the current state of technology. Thus, there is a strong need for adapted methods of direct observation.

These remarks have already lead ecologists towards the use of acoustic methods and techniques to sample and survey the ecosystem. For this reason, the sixth ICES Symposium on Acoustics in Fisheries and Aquatic Ecology (SAFAE) (France, June 2002) was the first to explicitly call for papers on the “Aquatic Ecosystem”. In its three sessions (including behavioural ecology) 74 papers were devoted to this particular case.

This is certainly due to the fact that underwater acoustics represents an ideal tool for ecological analysis because it:

- allows a huge quantity of data to be collected in a rather short time;
- enables data collection at extreme scales: a single tool can obtain simultaneous information on zooplankton and large fish, with high definition (centimetres) at large range (hundreds of metres);
- is not intrusive (null or weak effect of the observer on the ecological medium);
- can be collected in conjunction with other data (on fisheries and biology, chemistry and physical oceanography, etc).
- Finally, the format of data acquired permits comprehensive use of the latest analysis methods: geostatistics, GAM, GLM, SIG, etc.

This ecological surveying and monitoring has to be done at several scales, and in some of them acoustic data can provide important information.

- At a large scale, it is important to be able to map the distribution of “global marine production”, in terms of general biomass, regardless of the kind of organisms that form this biomass. Such data can help, for instance, to identify “hot spots” in the oceans, and through links with remote sensing data, to bring valuable information on the general distribution and abundance of marine life.
- At a fine scale, a more detailed series of observations can be made on the spatial distribution of biomass patches identified at the larger scale. These results are more dynamic, and relate to shape, size and density of the patches, persistence of the spatial structures, temporal patterns, etc., which underlie the process and function in ecological interaction. Here too, this kind of data are easily linked to remote sensing information, such as temperature and pressure which may structure biomass distribution and persistence.
- A singular advantage of acoustics over traditional methods (e.g. optical observation, net sampling) is the range of space—in 3D—which can be continuously sampled. When combined with net sampling (groundtruthing acoustical information) it is possible to identify and extrapolate the distribution of the major trophic groups, from micronekton to zooplankton to fish and other upper trophic species.
- Finally, fishing pressure in the last several decades has caused a significant change in the distribution and abundance of marine biodiversity in the world’s oceans. Although we know the effects on major stocks, little work has been done on the other pelagic species indirectly affected by this loss of upper trophic biomass. However, significant amounts of information on these species are already contained within existing acoustic data, albeit unprocessed.

The ICES SAFAE was held in Montpellier, France, from 10 to 14 June 2002. There were 303 participants from 37 countries, emphasising the strongly international character of the meeting. This Symposium was the sixth organised on fisheries acoustics, and the fifth sponsored by ICES in a series concerned with acoustics in fisheries and related fields. The first of these was in Horten (1954), then there were two in Bergen (1973 and 1982), one in Seattle (1987) and the most recent was in Aberdeen (1995; *ICES Journal of Marine*

Science, Vol. 53, no. 2). To complete the historical picture, two Symposia on the special problems of shallow-water acoustics should be mentioned, held in London (1997) and in Seattle (1999; *Aquatic Living Resources*, Vol. 13, no. 5). By 2002, however, it was seen that shallow-water, marine and freshwater acoustics required a joint approach to problem solving and sharing of experience. It was therefore decided that the SAFAE would encompass all these applications within the general theme of acoustical methods for the study of aquatic biota and their exploitation.

The primary sponsors of the SAFAE were the ICES, the Institut de Recherche pour le Développement (IRD), and the Institut Français de Recherche pour l'Exploitation de la Mer (IFREMER); co-sponsors were the Acoustical Society of America, the UK Institute of Acoustics, the US National Marine Fisheries Service, and the Société Française d'Acoustique. The Symposium was convened by François Gerlotto (IRD) and Jacques Massé (IFREMER). They were assisted by a Scientific Steering Committee comprising Pablo Carrera (Spain), David Farmer (Canada), Masahiko Furusawa (Japan), D. Van Holliday (USA), Bill Karp (USA), Ole-Arve Misund (Norway), John Simmonds (UK), and Will Tesler (Russia). The conference Secretariat was efficiently organised by Laurence Vicens from the Centre Halieutique of the IRD which provided much logistical support, as did IFREMER, especially through the editorial work of Brigitte Milcendeau.

The main objectives of the SAFAE were to bring together scientists with diverse interests in fisheries and aquatic acoustics, covering a broad range of environments; to present their research in this rapidly evolving field; to review what can be achieved with new technology and theoretical approaches; and to consider future directions of study. There was a large response to the call for papers. The 256 submitted abstracts were allocated between the following 10 theme sessions:

1. Acoustic survey design, including data analysis.
2. Combination of methods, to compare acoustic and other methods of assessment.
3. Technology, innovations in equipment and data processing.
4. Identification and classification of echo-traces.
5. Ecology, freshwater.
6. Ecology, marine water.
7. Avoidance—the response of fish to vessel noise, and biological acoustics.
8. Fish and plankton behaviour, and physiological studies.
9. Target strength, methods and results.
10. Target strength, modelling and theory.

There were 106 verbal presentations, and 140 posters, which together gave participants a unique overview of a huge amount of multi-disciplinary research. Symposia like the SAFAE are essential if scientists are to have any chance of keeping up with the rapid pace of developments in this field.

The publication of proceedings is an important part of any symposium. The number of proposed manuscripts resulting from the SAFAE was substantial. It was therefore arranged that symposium papers would be published in special issues of two journals¹—*Aquatic Living Resources* (this volume) and the *ICES Journal of Marine Science*. Papers were selected for each journal according to the relevant theme session. This volume contains 30 papers which are mainly on ecological or biological topics (themes 2, 5, 6, 7 and 8 above), A further 36 papers will be found in Vol. 60 of the *ICES Journal of Marine Science*, those mainly on technological or physical topics (themes 1, 3, 4, 9 and 10 above).

Readers are encouraged to consult both special issues, which together comprise the full SAFAE proceedings. Indeed, it is important to consider the full range of the activities explored at the SAFAE. This shows how cooperation between specialists from many disciplines can achieve much more than narrowly focussed research. Whatever the background, there is a common purpose in this work, namely the study and protection of sustainable aquatic resources.

The timely publication of these proceedings owes much to the referees (listed on last page), who prepared prompt and comprehensive reviews, and to the authors who made the required revisions to their manuscripts within tight deadlines.

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¹ Nota: **Acoustics in Fisheries and Aquatic Ecology.**

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Part 2. *Aquatic Living Resources*, vol. 16, n° 3, 2003 (this issue).