

WODA Underwater Sound Workshop – Paris, France – 26 March 2015

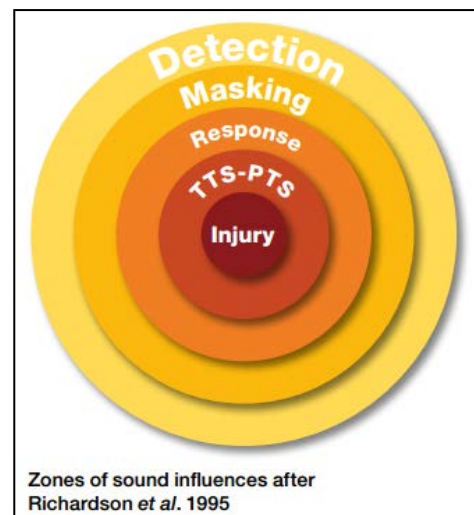
Report by Gerard van Raalte, WODA Expert Group Underwater Sound, Boskalis Hydronamic, Netherlands

People standing at the base of the Eiffel Tower in Paris can have all kinds of thoughts, but not likely on the topic of Underwater Sound. Yet this was the topic of the workshop held at that location, well organised by CEDA on behalf of WODA, the World Organisation of Dredging Associations, with support of CEDA's French members. The workshop was opened by Jan Vandenbroeck, member of the CEDA Board of Directors, also of SDI, France, who was pleased to welcome a good 50 participants, scientists, regulators, policy-makers and practitioners working in dredging and associated fields from 6 countries. On behalf of the host country, Paul Scherrer, Ministry of Environment and Sustainable Development and Energy (MEDDE), France welcomed the guests. During this one day workshop, participants were informed of and discussed the state-of-the-art knowledge of dredging and underwater sound, on basis of the 2 papers recently published by CEDA and WODA.

'Jacques Cousteau was wrong' stated René Dekeling (Ministry of Infrastructure and the Environment, Netherlands) when in 1955 he launched his famous movie on 'Le Monde du Silence' (The Silent World), for the first time showing the richness of the underwater world. We now know there are many sounds, most of these natural, but more and more being added by man. As with most anthropogenic contributions awareness is growing that potential effects deserve more attention. This has led CEDA and WODA to a pro-active role in investigating the possible influence of dredging in this world of silence.

Dr Frank Thomsen (bioacoustician with DHI, Denmark), the Chairman of the 2 Working Groups that had drafted the CEDA Position Paper on 'Underwater Sound in relation to Dredging' (November 2011) and the WODA Technical Guidance on the same subject (June 2013), chaired the workshop and in the first presentation of the day he set the scene.

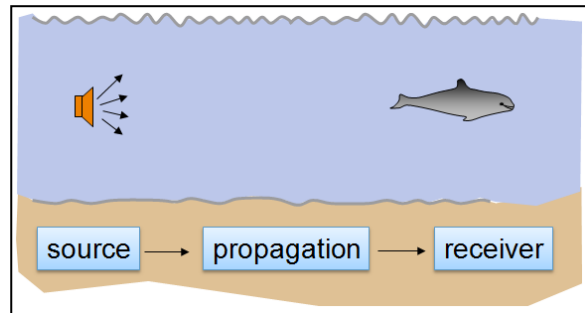
His summary of existing knowledge, illustrated with several sound recordings, clearly demonstrated that sound is a critically important sense for aquatic species, and we still have an incomplete understanding of many aspects about underwater sound. In particular we need to know more about how sound propagates in shallow waters, how it potentially impacts on different species and what short-term and long-term effects might be. The use of the 'zone influence model' can be helpful in identifying risks of sound impacts, but it is obvious that quite some research effort is needed before more accurate and reliable assessments can be made.



In the next presentation Dr Christ de Jong (acoustician with TNO, Netherlands) explained how to assess the exposure of marine life to underwater sound of dredgers.

He warned that several different acoustic quantities are being used which are all expressed in 'decibels', which cannot directly be compared with each other. He made a strong plea for international standardisation of underwater acoustic terminology and measurement procedures that is under development at ISO. A lot of work remains to be done. Standardized procedures are now available only for ship radiated sound measurements in deep water, while dredging frequently is a shallow water operation.

Presently various acoustic propagation models are available to calculate the spreading of sound in the environment. However, selection of the appropriate model depends on the specific application (frequency range and environment) and general guidelines or standardization are lacking.



Christ also reported on the extensive underwater sound investigations that were done during the Port of Rotterdam's Maasvlakte 2 construction. Based on results of that study he stated that dredging adds 4 dB to the ambient sound of the Rotterdam's regular shipping traffic, but what that means for fish or marine mammals is largely unknown'.

The work done so far to 'characterise' the dredging sources of underwater sound were presented by Stephen Robinson (acoustician with NPL, UK). He showed that in various parts of the world studies have been made, describing the source per type of dredger and trying to distinguish the contribution of various factors like soil type, mode of operation and also size and state of the vessel. He showed that all these factors contribute to the radiated sound, but that quantification is influenced by various factors acting simultaneously. Major generalisations are that the highest sound pressures produced by dredgers are in the lower frequency band (<1kHz) and that dredging is not louder than commercial shipping. In response to a question he stated that if TSHD dredgers want to perform more quietly, focus should be on reducing sound during the loudest phase of the cycle, sailing between the dredging and placement sites.



The person challenged to answer the 'how serious is it?' question was Dr Doug Clarke (fisheries biologist with HDR Inc., USA). After summarizing existing knowledge on the hearing capabilities of

diverse aquatic organisms in essence he confirmed that 'little is known concerning the thresholds of sound that induce biologically meaningful responses'. For example, only a few valid audiograms have been established for the approximately 34,000 species of fish. These studies indicate highest sensitivity in the lower frequencies, where dredgers are loudest. Although most marine mammals are more active in the higher frequency range, dredging sounds that overlap with their lower audible range can induce 'masking' of frequencies used for communication and echolocation. Also impulsive sounds (piling, sonar) are found to be more harmful than continuous sounds: dredging is generally described as consisting of 'continuous sound', but mechanical dredging certainly shows a pulsating pattern, although at lower source levels. A consensus exists that dredging sounds do not pose a substantial risk of mortality or permanent injury, but that the scales of masking effects and implications of behavioural responses remain largely unknown.

An interesting development in the recent science concerns the comparative importance of the sound pressure component of propagated sound versus that of the particle motion component. It seems that for many species (particularly fish and invertebrates) particle motion is more important than pressure. Sound propagation in the form of particle motion decays faster over distance, suggesting that critical underwater sound carries less far than often feared. It is still too early to draw firm conclusions, but this certainly is a topic for further study.

At present there is little legislation on underwater sound, but a lot of activities are ongoing, as was informed by René Dekeling of Ministry of Infrastructure and the Environment, Netherlands and by Edward Kleverlaan of IMO, UK. Within the EU underwater sound is described under 'descriptor 11' of the Marine Strategy Framework Directive, where dredging sounds fit under the indicator 'ambient sound'. Present position is that underwater dredging sounds are of comparably low level of impact as mainly causing masking and behavioural response, for which quantitative criteria will be very hard to set. Focus of regulation could be on protection of sensitive areas and on sensitive species. In Europe, the Natura2000 network of protected areas can be used for first identification.

At the global scale many regulations for airborne noise from shipping are already in place, with traditional emphasis towards 'personnel on board'. In the last few years more effort has been spent on providing useful guidance for limiting underwater sounds, which for commercial shipping is mainly related to reducing propeller cavitations. Non mandatory guidance was issued by IMO in April 2014 (MEPC.1/Circ.833) for international shipping, which to a certain degree will also be applicable for dredgers. Both speakers warned that, although the dredging industry is ahead in awareness compared to the shipping industry, new developments are emerging rapidly and that dredging industry should be prepared to take appropriate action.



Workshop speakers (l-r): Stephen Robinson (NPL, UK), Christ de Jong (TNO, Netherlands), Frank Thomsen (DHI, Denmark), Douglas Clarke (HDR, USA) Edward Kleverlaan (IMO, UK), René Dekeling (Ministry of Infrastructure and the Environment, the Netherlands).

Following this series of very informative presentations a question and answer / discussion session was held, in which the highly interested audience sought more clarity on several aspects. Worth mentioning is the discussion on 'who has the onus on underwater sound assessments?' For projects the responsibility to manage underwater sound basically rests with the regulator to set the standards and with the developer to assure adherence. Because site-specific guidance is still scarcely available it is 'tempting' to rely on precautionary approaches, which might complicate the works and hamper the opportunity to increase knowledge. At present the initiative for expanding the relevant knowledge base lies with specialised research institutes and universities, but it was emphasized that international regulatory organisations, such as IMO, or OSPAR with which the dredging professional community must interact (for instance through WODA), can and should play a leading role in setting research targets, interpreting information from science and from field experiences, and in providing the substantiation for improved future guidance.

Based on the events of the workshop your 'rapporteur' makes the following observations.

- Where the industry talks about 'sound', regulator language is on 'noise'. One might say that sound becomes noise when a threshold that poses a risk of detrimental impact is exceeded. In that case, noise needs to be regulated.
- The effects of underwater sounds produced by dredging are mainly 'masking' or behavioural responses, for which quantifiable standards will be difficult to set.
- It is challenging to compare the impact of underwater sound by dredging on fish with the impact of commercial fishing on fish.
- The statement 'we lack information' was made more than once. It underlines the importance for broad, multi-disciplinary cooperation in research and regulatory frameworks.

In conclusion, it was an excellent workshop, with highly informative sessions followed by a very good opportunity for networking. This was confirmed by the general feeling that in France one-hour lunches are much too short, although the table discussions were at such a sound level that quite some 'masking' occurred.

Video recordings as well as copies of the workshop presentation files will be available at www.dredging.org, for CEDA Corporate Members free of charge.

The CEDA position paper and the WODA Technical Guidance on 'Underwater Sound in relation to Dredging' can also be downloaded from www.dredging.org.