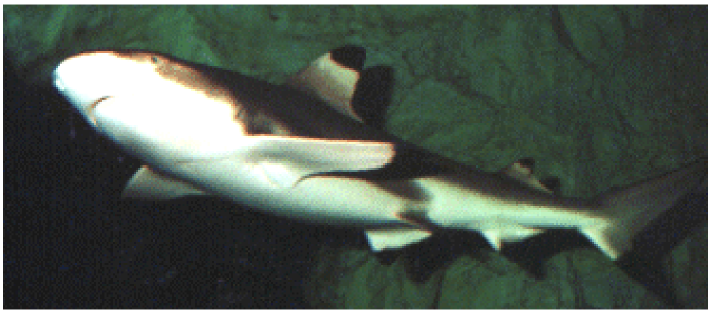
The effect of disco noise on sharks.



A Blacktip Reef Shark at the centre.

> *"We want to build a nightclub next to the Sea Life Centre in Blackpool and wondered if you could predict the likely effect of the noise and vibration on the sharks?"*

This must surely be one of the strangest requests I have ever received as an acoustic consultant. After the initial shock had worn off and I realised that my potential client was serious, it was time to scratch the grey cells. The obvious first question was how sensitive are sharks to vibration and noise?

Library books were no great help nor were my children's encyclopaedias and this included the CD ROM versions. It was time to go surfing the Web to look for information on sharks. In the MBL/WHOI library I found references to a number of books by Dr A. A. Myrberg (1&2). These books yielded the following pearls of wisdom:-

"Most of the studies have shown that rapid, irregularly pulsed, broad-band sounds with spectral frequencies below 600Hz can attract sharks……An important point in all studies was that sharks rapidly habituated to such sounds so long as they received no rewards, e.g. food, attraction ceased after 5 to 10 repetitions".

Disappointingly the research did not yield any threshold limit values or sensitivity figures. Our client wisely consulted James Ellis, BSc PhD a marine biologist who referred not only to Dr Myrberg's papers but to three further books (3,4&5).

Dr. Ellis' view is summarised as:-

"If there is no increase in the ambient airborne sound and water-borne vibration levels, then there should be no adverse affect on maintained sharks. Sounds produced by the aquarium systems will be a major sound source in the tank, as will daytime visitors tapping on the glass."

This simple statement then became our criteria by default.

The Site

The proposed discotheque was to be situated on the ground floor of a building which is an independent three storey steel framed building with infil masonry walls and reinforced concrete floors. The building does not share foundations with any other structure.

Our visual inspection revealed that the Sea Life Centre also appeared to be an independent three storey steel framed structure. Both buildings have separate party walls each constructed using a cavity and two layers of blockwork.

The shark tank, together with the majority of the Sea Life Centres' facilities, is located at first floor level. Between the shark tank and the party walls of interest lies a large restaurant, shop, walk-through exhibition and exit stair well. This stairwell leads down to ground level.

Airborne Sound Insulation

Our first attempt to measure the airborne sound using a B&K 4224 sound source not surprisingly failed for lack of energy. Consequently we resorted to hiring in a large disco rig from CTS (6). This was used to produce typical disco levels at the party wall and still it was inaudible in the Sea Life Centre.

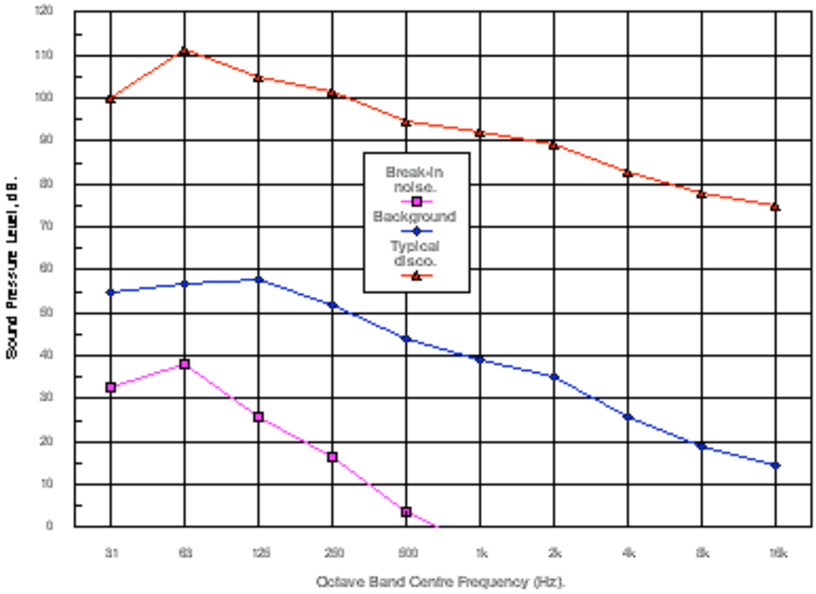
We eventually produced a sound level at the wall that we could hear and measure in the Sea Life Centre stairwell. This was achieved by filtering the sound system to produce the following levels at the party wall:-

Frequency, Hz	31	63	125	250	500
SPL, dB	93.0	120.1	96.8	84.0	81.0

In the stairwell the break-in noise was both audible and measurable unfortunately at the shark tank it was neither. At the shark tank the following levels were measured:-

Frequency, Hz	31	63	125
Disco 'On'	55.0	57.0	58.0
Disco 'Off'	55.0	57.0	58.0

Despite being unable to actually measure the sound insulation we can at least deduce a value which it must be greater than. This is done by using the fact that all the energy is being produced principally at 63Hz. The disco noise level was 120.1dB and since no increase in noise level could be measured at the shark tank it is reasonable to conclude that the break-in noise is less than 47.0dB at 63Hz. Consequently the sound insulation is better than 73.1dB at 63Hz. Using mass law this can be extrapolated to other frequencies.



The graph shows the typical disco levels at a wall of 98.7dB(A), the maximum possible break-in noise of 15.2dB(A) and the background noise level of 48.0dB(A). Clearly the airborne noise criteria of no increase is met.

Vibration

The next problem was to measure the vibration coupling between the buildings. Clearly from the structure a conventional tapping machine would be unlikely to be of any use. We know that the vibration from a pneumatic drill could be felt in the Sea Life Centre when road-works took place on the road outside.

Regrettably we could not use a pneumatic drill as we could not justify the breaking up of the ground floor level slab to our client. We eventually settled for a dose of brute force. We used a heavy paving mallet to put a vibration impulse into the floor with simultaneous measurements being made in both buildings.

Even this failed to produce any detectable vibration transfer. The vibration level in the various structures in the Sea Life Centre was absolutely constant. We could not detect the vibration of vehicles passing on the road only metres away. The reason for this was that the air conditioning system and the aquarium systems were generating vast levels of vibration and no vibration insulation precautions had been taken.

Bearing in mind that logically absence of evidence is not evidence of absence we still felt reasonably secure in our assessment that vibration from the footfalls of dancers would not cause any measurable increase in vibration in the shark tank.

Conclusion

We concluded that the disco noise and vibration would not have a detrimental effect on the sharks and thought our troubles were over. This was not true. The incredulity the case caused in court was a new revelation.

Noise evidence in court is usually fraught with danger and staggering potential for obfuscation. Well we moved into a different league in trying to explain why the sharks were not going to be disturbed. Eventually we managed to convince the judge that there would be no problem on the grounds of noise and vibration.

References

(1) Sensory Biology of Sharks, Skates and Rays, edited by Hodgson E.S and R.F Mathewson, published by U.S Government Printing Office sponsored by the U.S Office of Naval Research.

(2) Bioacoustics and Studies on Sharks by A.A Myrberg Jr., A Banner and J.D Richard. Published by the University of Miami, Institute of Marine Sciences, 1969.

(3) Hearing in Elasmobranchs. Backus, P.H (1963) Published in "Sharks and Survival" (P.W.Gilbert, ed.) D.C Health and Company, Boston.

(4) Use of Sound in Predation by Young Lemon Sharks. A.Banner (1972).

(5) Sharks, The Search For a Repellent. T.W Brown (1972), Angus and Robertson (Publishers), Sydney.

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