Comments on "Killer whale (*Orcinus orca*) behavioral audiograms" [J. Acoust. Soc. Am. 141, 2387–2398 (2017)] (L)

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Branstetter and his colleagues present the audiograms of eight killer whales and provide a comprehensive review of previous killer whale audiograms. In their paper, they say that the present authors have reported a relationship between size and high-frequency hearing but that echolocating cetaceansC

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The recent paper by Branstetter and his colleagues (2017) presents additional information on the behavioral audiogram of killer whales (*Orcinus orca*) as well as a helpful summary of previous killer whale audiograms. They note that we have found a relationship between animal size and high-frequency hearing to which echolocating Odontocetes (i.e., killer whales, porpoises, and dolphins) may be a special case. We agree that echolocating mammals, bats as well as cetaceans, are special cases, but not as special as they might at first seem. Our view is that mammals evolved high-frequency hearing for passive sound localization, enabling them to use the binaural intensity-difference cue and pinnae cues (although cetaceans, lacking pinnae, do not use the latter cue). These cues require that an animal's head and pinnae be sufficiently large to modify sounds. Although we begin with head measurements of mammals, these must be converted into

predicted based on non-echolocating mammals. Specifically, we previously reported that echolocating bats hear on average 0.7 octaves higher than an average non-echolocator having the same interaural distance (Heffner *et al.*, 2013). At that time, we noted that the same seemed to apply to echolocating cetaceans. Although the killer whale originally appeared to be an exception because it was below the regression line, the audiograms of Branstetter *et al.* and Szymanski *et al.* show that it is not.

When comparing air and underwater audiograms, there are two factors to be considered. The first is to correct for the different reference levels as the SPL in air is referenced to 20 μPa, whereas the SPL for underwater measurements is referenced to 1 μPa. To do this adjustment, one subtracts 26 dB from the underwater thresholds. The second is to equate the audiograms in terms of watts, which takes into account the different densities of the media. For this, one subtracts an additional 35.5 dB from the underwater thresh-old (e.g., Wodinsky and Tavolga, 1964).

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predicted by *functional*

Heffner, R. S., Koay, G., and Heffner, H. E. (**2015**). “Sound localization in common vampire bats: Acuity and use of the binaural time cue by a small mammal,”