instance in which conservative thresholds are selected (i.e., selecting the lowest TTS threshold in a small sample size), and TTS onset in these instances should be described as potential, not actual. This distinction is important because the Draft Guidance defines TTS, not "potential TTS," as Level B harassment, and how Level B harassment is estimated has important relevance to the "small numbers" and "negligible impact" determinations that must be made in support of MMPA incidental take authorizations.

2. Functional Hearing Groups, Weighting Functions, and Threshold Criteria

In general, knowledge of basic hearing is still limited for most species of marine mammals. Finneran and Jenkins (2012) provided the most updated list of species whose hearing has been scientifically measured. Although some groupings of marine mammals that hear similarly may be appropriate, the extrapolated hearing ranges presented in the Draft Guidance are not consistent with the best available science (Southall et al. (2007) and Finneran and Jenkins (2012)) in a number of respects.

First, the extension of the hearing range of low-frequency cetaceans is not supported by empirical evidence. There is no evidence indicating that mysticetes hear above 20-22 kHz, and there are no empirical data to support the Draft Guidance's expansion to 30 kHz. The data presented in the Draft Guidance do not provide additional scientific information to justify expanding the hearing of low-frequency cetaceans to 30 kHz.

Southall et al. (2007) indicated that vocalizations are unlikely to always predict hearing ranges. Animals tend to hear best around the frequencies they use for communication and echolocation (Ketten 2002), but can also extend below and above the range of frequencies they use. There is empirical evidence that animals can produce sounds that they cannot necessarily hear and, therefore, Au et al. (2006) should not be used in determining the hearing range of low-frequency cetaceans. For instance, Nachtigall et al. (2007) showed that white beaked dolphins do not hear past 181 kHz, even though they are often recorded producing sounds up to 305 kHz (Mitson 1990) and clicks have secondary peak at 250 kHz (Rasmussen et al. 2002). Therefore, harmonics above 20 kHz do not necessarily imply hearing in mysticetes. The Draft Guidance cites Tubelli et al. (2012) and Ketten and Mountain (2009), which are predictions based on anatomical modeling and are yet to be validated by empirical data.[7]

Moreover, the frequency weighting functions in Figure 2 of the Draft Guidance are based on no empirical data and imply that low-frequency cetaceans are much more sensitive to acoustic exposure than was formerly believed or than what the current research supports. There is also no clear explanation or support for the low-freqeuncy cetacean auditory weighting function

[7] Tubelli and Stein (2007) reported only potential response to 22 kHz signals.

parameters presented in Table 3. The low-frequency criteria should be based on Southall et al. (2007) and Finneran and Jenkins (2012).

Second, the hearing ranges of otariids and phocids, as proposed in the Draft Guidance, are different than the hearing ranges stated in Finneran and Jenkins (2012) (respectively, 75 Hz to 75 kHz and 100 Hz to 50 kHz). Southall et al. (2007) defined the hearing range limits as being approximately 80 dB above the lowest thresholds. However, in Kastelein et al. (2009), thresholds for phocids are more than 80 dB above the most sensitive thresholds and should not be considered to be within the functional hearing range. Likewise, Hemilä et al. (2006)'s data were based on anatomical studies, not empirical hearing data and should not substitute for actual hearing measurement data. Accordingly, for establishing reliable hearing ranges for otariids and phocids, the Draft Guidance should use the thresholds reported in Finneran and Jenkins (2012) and in Reichmuth et al. (2013). Recent work by Sills et al. (2014) provides additional support that the 70-80 kHz range encompasses the high frequency cut-off for phocids with a threshold of 101 and 102 dB at 72.4 kHz. For otariids, Finneran and Jenkins (2012) reviewed all of the best available data and recommended an underwater hearing range of 100 Hz to 50 kHz (100 Hz to 35 kHz in air). The Draft Guidance does not clearly explain why 40 kHz was selected as a high frequency cut-off for otariids instead of 50 kHz and there is no recent empirical study to support that proposed modification.

Third, the Associations are concerned with the proposed criteria for both impulsive and non-impulsive sound for high-frequency cetaceans. For impulsive sound, the proposed high-frequency cetacean thresholds are based on the underlying data from a single study involving a single animal (harbor porpoise) (Lucke et al. 2009) in which large variations in ambient noise may have caused confounding effects on the SEL_{cum} and SPL_{peak} threshold estimates.[8] For non-impulsive sound, the extrapolation for high-frequency cetaceans is based on a single study involving only two animals (Popov et al. 2011), and the non-impulsive SPL_{peak} values are extrapolated from data on impulsive sounds rather than using the data available for non-impulsive sounds. Popov et al. (2011) recognized that their data might be biased due to multiple exposures in one day and the absence of data on the variability of baseline thresholds, which could add uncertainty and confounding factors to the TTS estimates. This highlights the need for flexibility in the implementation of the final acoustic criteria in future regulatory processes.

3. Addressing Limited Data

[8] Finneran and Jenkins (2012) separated harbor porpoises from other high-frequency cetaceans for their behavioral thresholds because there is evidence showing that this species reacts to quieter sounds than most high-frequency cetaceans. Accordingly, using the harbor porpoise as a surrogate species for high-frequency cetaceans is unlikely to be representative.