



MARINE MAMMAL COMMISSION

26 June 2023

Dr. Amy R. Scholik-Schlomer, Fishery Biologist
Permits and Conservation Division
Office of Protected Resources
National Marine Fisheries Service
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Dear Dr. Scholik-Schlomer:

The Marine Mammal Commission (the Commission), in consultation with its Committee of Scientific Advisors on Marine Mammals, has reviewed the National Marine Fisheries Service's (NMFS) Draft 2023 Update to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 3.0): Underwater and In-Air Thresholds for Onset of Auditory Injury and Temporary Threshold Shifts (Updated Technical Guidance). The Updated Technical Guidance provides guidance for evaluating the potential impacts of anthropogenic sound on the hearing of marine mammals under NMFS's jurisdiction and is based upon NMFS's original and revised Technical Guidance (NMFS 2016 and 2018, respectively), as well as Finneran (2022; Appendix A in the Updated Technical Guidance). The Commission is pleased to see that NMFS included in-air thresholds in the Updated Technical Guidance and considered auditory injury (AUD INJ) that does not result in a permanent threshold shift (PTS).

Otariids in water (OW)¹

The Updated Technical Guidance is based on Finneran (2022) and provides revisions to the various auditory thresholds and associated weighting functions for each functional hearing group from NMFS (2016 and 2018). Those updates are based on new audiogram and TTS data that have been published or collected primarily since 2016. For OW specifically, new TTS data from publications that are in prep or in review were the basis for reducing TTS thresholds by up to 20 dB. Inclusion of the most recent data is paramount when updating or revising the Technical Guidance. Therefore, it is unclear why unpublished OW audiogram data that are available coincident with the TTS data were not used to revise the composite audiogram that forms the basis for the weighting function.

California sea lion audiogram data exist at the most basic level in each of the references that provide the TTS data used to inform the updated thresholds (Kastelein et al. 2021, 2022a and b, and 2023). For example, hearing thresholds were measured from 2 to 32 kHz by Kastelein et al. (2022a; Figure 14) when investigating TTS at 6 and 8 kHz. Additional California sea lion hearing threshold data were provided down to 600 Hz in Kastelein et al. (2022b; Figure 11). Given the dearth of

¹ This functional hearing group also includes other marine carnivores such as walruses, sea otters, and polar bears that are under the jurisdiction of the U.S. Fish and Wildlife Service.

usable California sea lion audiogram data and the documented greater sensitivity of the species compared to previous studies, all hearing threshold data should have been used to inform the composite audiogram. The Commission recommends that NMFS incorporate the California sea lion hearing threshold data from Kastelein (2021, 2022a and b, and 2023), and any other hearing threshold data that are in prep or in review, in the derivation of the OW composite audiogram and revise the weighting function accordingly. The Commission further recommends that NMFS investigate whether available hearing threshold data from TTS studies² of other species should have been used to update the composite audiograms for OW and the other functional hearing groups, including pinnipeds in-air, and update the audiograms appropriately.

Accumulation time for stationary sources

Consistent with the Commission's [31 August 2015 letter](#) and [11 July 2017 letter](#) on previous versions of the Technical Guidance and numerous letters since that time, the Commission continues to assert that NMFS must determine the appropriate accumulation time for implementing cumulative sound exposure level (SEL_{cum}) thresholds for stationary sources when animat modeling is not employed. The Commission agrees that the 24-hour accumulation period is appropriate for moving sound sources and for action proponents that are able to use animat modeling for stationary sound sources. However, the 24-hour accumulation period is inappropriate otherwise, as it results in Level A harassment zones that far exceed Level B harassment zones. Such scenarios imply that an animal would experience an AUD INJ before behaviorally responding and avoiding the area.

The Commission understands that NMFS formed an internal committee a number of years ago to address the accumulation issue and had previously consulted with external acousticians and modelers. Despite the pressing need to do so, this issue has not been resolved. In the absence of relevant recovery time data for marine mammals, the Commission continues to maintain that animat modeling that considers various operational and animal scenarios should be used to inform the appropriate accumulation time for stationary sound sources. Such modeling could be incorporated into NMFS's user spreadsheet that estimates the Level A harassment zones for PTS, which is termed AUD INJ for the Updated Technical Guidance. The Commission recommends that NMFS prioritize resolving the issue of an appropriate accumulation time for SEL_{cum} thresholds in the near future and, if a simple accumulation time is not able to be determined or used, incorporate animat modeling into its user spreadsheet for stationary sound sources.

Multiple sound sources

The Commission indicated in its [31 August 2015 letter](#) that the SEL_{cum} thresholds should account for the use of multiple sources by the relevant action proponent(s) in the same general area during the same timeframe³, but NMFS has yet to consider the use of multiple sources⁴ in estimating the ranges to TTS or PTS. The agency does not propose to do so in the Updated Technical Guidance either. This is not an intractable task. A simple way to incorporate multiple impulsive sources is by, for example, summing all of the hammer strikes that would occur in a given

² In the absence of published audiograms of the study animals.

³ e.g., multiple impact hammers or impact and vibratory (or down-the-hole (DTH)) hammers used in the same area, various types of sonar and/or explosive sources used during a military exercise.

⁴ Although NMFS has accounted for use of multiple vibratory hammers in the same immediate area.

area in a given day if the same type and size of piles were being driven. The Commission understands that the source level would not necessarily increase because two (or more) hammers are not striking the pile at the very same time, but animals in the area would be accumulating the energy emitted by all of the hammers in use. The analyses would be more complicated when different pile types and sizes and different source types (both impulsive and non-impulsive) are used. However, consideration of these factors is not insurmountable and could be incorporated into the user spreadsheet or by other means (e.g., Shiny app). Therefore, the Commission recommends that NMFS provide a tool that incorporates the sound emitted from multiple sound sources operating in the same general area during the same timeframe for estimating ranges to the SEL_{cum} thresholds for AUD INJ and TTS, when applicable.

NMFS's continued approach of maintaining the dichotomy between sounds being either impulsive or non-impulsive does not reflective real-world conditions where animals are exposed to various types of sound. Rather, it is a simplified way of estimating impacts. Very rarely do animals perceive only impulsive or only non-impulsive sound during the course of a day. As such, TTS studies involving complex sound should be conducted (Appendix B, section 1.5.2 of the Updated Technical Guidance; Guan et al. 2022). Complex sound includes multiple types of sound sources, as well as single sources that emit both impulsive and non-impulsive sound (e.g., DTH pile installation). Applying either the impulsive or non-impulsive threshold to compare SEL_{cum} of complex sound results in either an overly conservative estimate or an underestimate of impacts. As such, the Commission recommends that NMFS partner with other federal agencies and industry to fund and/or develop TTS studies that involve complex sound to better represent real-world conditions to which marine mammals are exposed.

Updates to other types of thresholds

NMFS continues to require action proponents to use criteria and thresholds based on various guidance documents, informal policies, and/or applicable regulations. Although NMFS's behavior thresholds from 2005 are outdated and do not represent the best available science, it is unclear how and when NMFS plans to update them. Criteria and thresholds for mortality, injury, and behavioral disturbance for explosive sources and behavioral disturbance for active acoustic sources⁵ have been developed historically by the U.S. Navy (Navy) and then used by NMFS. However, NMFS has not formally adopted any of those criteria or thresholds by way of a Technical Guidance. Since the impetus for NMFS to update its Technical Guidance was the Navy's revisions to the TTS and PTS thresholds and weighting functions for its upcoming Phase IV rulemakings, the Navy's revisions to its other criteria and thresholds for explosive and active acoustic sources should be similarly incorporated into Technical Guidance. Therefore, the Commission recommends that NMFS (1) prioritize updating its behavior thresholds and (2) provide the criteria and thresholds for mortality, injury, and behavioral disturbance for explosive sources and behavioral disturbance for active acoustic sources for public review and formalization via Technical Guidance in the near term.

⁵ Including various types of sonar, sonobuoys, countermeasures, torpedoes, and other transducers.

Additional comments

The Commission appreciates NMFS's effort to update its Technical Guidance. In its review, the Commission identified some minor errors⁶, incalculable information, and inconsistencies⁷ in the Updated Technical Guidance. The Commission has provided NMFS with these various additional comments separate from this letter and recommends that NMFS incorporate them into or address them accordingly in the Updated Technical Guidance before it is finalized.

The incalculable nature of some of the impulsive SEL_{cum} thresholds resulted in a 14- or 16-dB difference⁸ in the TTS and AUD INJ thresholds in Tables ES3 and 6 of the main text and Tables A.E-2 and A.9 of Appendix A. For example, the AUD INJ SEL_{cum} threshold for OW would be 185 dB using the parameters in Table A.8⁹. Tables ES3, 6, A.E-2, and A.9 however specify 186 dB, which is 16 dB greater than the TTS threshold¹⁰. The Navy and NMFS have indicated that the differences are due to rounding issues—that is, the thresholds are rounded to the nearest even integer when the fractional part is exactly equal to 0.5. That rounding approach is inconsistent with the manner in which NMFS rounds for other applications (e.g., numbers of takes, source levels, etc.) and should have been specified in the Updated Technical Guidance.

Further, because the K values in Table A.8 were rounded to the nearest dB, it is unclear what the fractional K_{TTS} and $K_{AUD INJ}$ thresholds are. Thus, numerous thresholds in Tables ES3, 6, A.E-2, and A.9 cannot be recreated based on the information provided in Table A.8. For example, the impulsive AUD INJ threshold for LF is 183.12 based on Table A.8, not 183.5 as denoted by the agencies. It is unclear whether K_{TTS} is 183.38, 183.4, or some other value. To ensure transparency and enable the public and users of the Updated Technical Guidance to calculate the resulting weighted thresholds, the Commission recommends that NMFS (1) specify how rounding was conducted for the various thresholds and provide the fractional K_{TTS} and $K_{AUD INJ}$ impulsive thresholds in a table similar to Table 8 in the main text and (2) require the Navy to include the fractional K_{TTS} and $K_{AUD INJ}$ for both impulsive *and* non-impulsive sources in Table A.8 of Appendix A for completeness, as well as transparency.

⁶ For example, the Updated Technical Guidance indicated that the generalized hearing range was chosen based on the ~65 dB threshold from the normalized composite audiogram, amongst other sources. However, normalized composite audiograms were not used in the Updated Technical Guidance, the actual composite audiograms were. Multiple references also are missing from Table 2 or are inconsistent with those included in Table A.1-1 for the derivation of the composite audiograms.

⁷ As an example, the “PK” acronym has two different definitions specified in the acronym list, and the metric “peak sound pressure level” is represented by both “PK” and “PK SPL” in the main text.

⁸ AUD INJ SEL_{cum} thresholds are to be 15 dB greater than the TTS thresholds, consistent with the current Technical Guidance.

⁹ The weighted threshold is based on $K + C$ in Table A.8 (and Table A.E-1); $183 + 2.49 = 185.49$ dB.

¹⁰ The AUD INJ SEL_{cum} thresholds for low-frequency cetaceans, otariids in air, and phocids in air also are not 15 dB greater than the TTS threshold, and the TTS SEL_{cum} thresholds for high-frequency cetaceans and sirenians are 1 dB greater than what would be calculated based on the parameters provided in Table A.8.

Please contact me if you have questions concerning the Commission's recommendations or rationale.

Sincerely,



Peter O. Thomas, Ph.D.
Executive Director

cc: Jolie Harrison, Chief of the Permits and Conservation Division

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