23 August 2018

Ms. Jolie Harrison, Chief
Permits and Conservation Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910-3225

Dear Ms. Harrison:

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) 1 August 2018 notice (83 Fed. Reg. 37638) and the letter of authorization application submitted by the Alaska Fisheries Science Center (AFSC)[1] seeking issuance of regulations under section 101(a)(5)(A) of the Marine Mammal Protection Act. The taking would be incidental to fisheries research surveys during a five-year period.

Background

AFSC plans to conduct fisheries research surveys in the Gulf of Alaska, Bering Sea, Arctic Ocean, and off the U.S. west coast[2]. The objectives are to monitor fish stock recruitment, abundance, survival, biological rates, geographic distribution, ecosystem process changes and conduct marine ecological research. Researchers would conduct approximately 58 survey programs during the five-year period. The surveys could occur on NMFS-owned and -operated vessels or chartered vessels during daytime and nighttime hours.

AFSC requested authorization to take by Level A harassment, serious injury, or mortality individuals from up to 19 species incidental to gear interactions. The takes would occur through marine mammal interactions with fisheries survey gear. AFSC would use towed nets and trawls, longline gear, gillnets, seine nets, traps/pots, other gear (e.g., plankton nets, camera traps, dredges, etc.), and remotely operated vehicles to conduct the surveys. However, marine mammals are likely to interact only with trawls, longlines, and gillnets based on historical data from research surveys and commercial fisheries. Researchers would implement standard mitigation measures including using a move-on rule, pingers, and/or visual monitoring. In addition, AFSC would conduct concurrent hydrographic, bathymetric, and oceanographic sampling. Researchers could use multi-frequency, narrow-beam echosounders, multibeam echosounders, single-frequency omni-directional sonar (i.e., fish-finding sonar), acoustic Doppler current profilers, and net monitoring systems that operate at frequencies from 18 to 300 kHz at source levels of 226.7 to 230 dB re 1 µPa at 1 m. AFSC has

[1] Activities of the International Pacific Halibut Commission (IPHC) are included as well.
[2] AFSC's activities would occur in the Gulf of Alaska, Bering Sea, and Arctic Ocean; while IPHC's activities would occur in the Bering Sea and Gulf of Alaska, and off of the U.S. west coast.

requested to take by Level B harassment individuals from numerous marine mammal genera, species, and stocks incidental to use of the acoustic sources and vessel presence. Researchers would implement various monitoring and reporting measures during the proposed activities. Further, AFSC has contacted numerous Native communities to identify and resolve concerns regarding the activities' effects on subsistence hunting and has developed a communications plan to minimize impacts on the availability of marine mammals for subsistence use by Alaska Natives.

Appropriate threshold for non-impulsive, acoustic sources

Although NMFS has proposed to authorize the taking by Level B harassment from the use of echosounders and other sonars by the AFSC, NMFS has not provided consistent guidance for determining when prospective applicants should request such taking. On multiple occasions, NMFS has determined that sound emitted from echosounders, other sonars (side-scan and fish-finding), and subbottom profilers[3] have the potential to cause Level B harassment. However, NMFS has yet to adopt generally applicable guidance or to follow a consistent approach in assessing when such authorizations are needed (e.g., for the National Science Foundation and associated entities, oil and gas industry, geological and geophysical survey operators and researchers, shipping industry, or the general public).

The Commission understands that NMFS plans to continue its examination of the effects of sound on marine mammal behavior and to focus its work in the coming years on developing guidance regarding the effects of anthropogenic sound on marine mammal behavior (83 Fed. Reg. 36372). In the meantime, the Commission recommends that NMFS provide interim guidance to applicants and the public by developing criteria (e.g., based on source level, peak frequency, bandwidth, signal duration and duty cycle, affected species or stocks) for determining when prospective applicants should request taking by Level B harassment from the use of echosounders, other sonars, and subbottom profilers.

The Commission continues to believe that NMFS is using an outdated and incorrect behavior threshold for echosounders, other sonars, and subbottom profilers. A decade ago, NMFS categorized sound sources as either impulsive or continuous when determining its generic thresholds for Level B harassment based on behavioral disturbance (160 vs 120 dB re 1 μPa, respectively; 70 Fed. Reg. 1871). Since that time, the U.S. Navy (the Navy) has twice updated the criteria and thresholds[4] it uses for non-impulsive, acoustic sources (i.e., sonar and other acoustic sources) and impulsive[5] explosive sources (i.e., underwater detonations; see Finneran and Jenkins (2012) and Department of the Navy (2017) for the Navy's current criteria and thresholds). NMFS instructs applicants who plan to use underwater detonations during their proposed activities to utilize the Navy's current criteria and thresholds for explosives. However, for non-impulsive, acoustic sources, NMFS continues to rely on the generic thresholds from the 2005 guidance, which do not reflect the best available science.

[3] For subbottom profilers that are considered 'chirps' or are used in 'chirp' mode.
[4] The Navy uses NMFS's generic thresholds only for vibratory pile-driving, impact pile-driving, and airgun activities (120 and 160 dB re 1 μPa, respectively).
[5] Including thresholds for mortality, injury, permanent threshold shift (PTS), temporary threshold shift (TTS), and behavior.

Numerous studies have been published in recent years, and are forthcoming in the near term, regarding behavioral effects on marine mammals, dose response functions, and suggested thresholds. Thus, the Commission recommends that NMFS make it a *priority* to update its generic behavior thresholds and formulate a strategy for updating those thresholds for all types of sound sources (i.e., impulsive and non-impulsive, which can be either intermittent or continuous) and for incorporating new data regarding behavior thresholds as soon as possible—such revised behavior thresholds should be peer-reviewed, made available to the public for review, and finalized within the next year or two.

As discussed in previous letters to NMFS regarding echosounders, other sonars, and subbottom profilers[6], those sources have temporal and spectral characteristics which suggest that a lower, more precautionary Level B harassment threshold of 120 dB re 1 µPa would be more appropriate than the 160-dB re 1 µPa threshold that continues to be used. Numerous researchers[7] have observed various species of marine mammals, including the same species that could be harassed by AFSC, responding to sound from sources (e.g., acoustic deterrent devices, acoustic harassment devices, pingers, echosounders, multibeam sonars) with characteristics similar to those used by AFSC at received levels below 160 dB re 1 µPa. Specifically, harbor porpoises and beaked whales respond at some of the lowest source levels (Culik et al. 2001, Kastelein et al. 2001, Carlstöm et al. 2002, Barlow and Cameron 2003, Caretta et al. 2008).

More recently, Quick et al. (2017) determined that short-finned pilot whales changed their heading more frequently when a narrow-beam echosounder was active than when not. NMFS noted that although those less overt responses to sound exposure are difficult to detect by visual observation, they may have important consequences if the exposure interferes with biologically important behavior (83 Fed. Reg. 83666). Cholewiak et al. (2017) also found that beaked whales both detected the sound from and changed their behavior when narrow-beam echosounders were active. The researchers indicated that those responses could indicate interruption of foraging activity or vessel avoidance. Although NMFS did not discuss Cholewiak (2017), the findings are pertinent. All these observations support Lurton and DeRuiter's (2011) suggestion that 130 dB re 1 µPa would be a reasonable rough estimate for the behavioral response threshold of marine mammal species that are sensitive to those sources. The Navy already uses Level B behavioral harassment thresholds for non-impulsive, acoustic sources that are much lower than 160 dB re 1 µPa. In its Phase III documents, the Navy used unweighted thresholds[8] of 120 dB re 1 µPa for harbor porpoises and a dose response function for beaked whales[9] with a 50 percent probability of response at 144 dB re 1 µPa (Department of the Navy 2017).

In addition, the terms impulsive and continuous are not dichotomous and should not be used in a mutually exclusive manner. Rather, sources should be characterized as impulsive or non-impulsive. As stated in NMFS's 2018 revision to its final technical guidance regarding thresholds for

[6] See the Commission's 23 June 2016 letter.
[7] See Watkins and Schevill 1975, Olesiuk et al. 1995, Kastelein et al. 1997, Kastelein et al. 2000, Kastelein et al. 2001, Morton 2000, Culik et al. 2001, Johnston 2002, Morton and Symonds 2002, Kastelein et al. 2005, Barlow and Cameron 2003, Kastelein et al. 2006a and 2006b, Carretta et al. 2008, Carlström et al. 2009, Lurton and DeRuiter 2011, Brandt et al. 2012 and 2013, Götz and Janik 2013, Hastie et al. 2014, Kastelein et al. 2015a and 2015b, Tougaard et al. 2015.
[8] NMFS's generic thresholds also are unweighted step functions.
[9] The Navy's Phase II documents used an unweighted threshold of 140 dB re 1 µPa for beaked whales.

PTS and TTS[10], impulsive sources are transient, brief (less than 1 second), and broadband and typically consist of high peak pressure with rapid rise time and rapid decay (American National Standards Institute (ANSI) 1986, National Institute for Occupational Safety and Health (NIOSH) 1998, ANSI 2005). In contrast, non-impulsive sources can be broadband, narrowband or tonal, brief or prolonged, continuous or intermittent and typically do not have a high peak sound pressure with rapid rise/decay time that are indicative of impulsive sounds (ANSI 1995, NIOSH 1998)[11]. The Commission does not consider echosounders, other sonars, or subbottom profilers to be impulsive, even if they have intermittent characteristics[12], because those sources lack the high peak pressure and rapid rise time of an impulsive source. Indeed, NMFS has indicated that the proposed sources are relatively high frequency, directional, and brief repeated signals—characteristics that are not reflective of impulsive sources.

Although the Commission has made many of these points in previous letters and NMFS recently issued a final rule for the Northwest Fisheries Science Center's (NWFSC) fisheries research surveys in which it attempted to respond to Commission recommendations, NMFS has yet to address or counter any of these points. As such, the facts provided continue to support using 120 dB re 1 μPa as the Level B harassment threshold. Therefore, for non-impulsive, acoustic sources (including echosounders, other sonars, and subbottom profilers) that NMFS plans to regulate and until such time that NMFS revises its generic Level B harassment thresholds for non-Navy-related acoustic sources, the Commission recommends that NMFS require AFSC to estimate the numbers of marine mammals taken based on the 120- rather than the 160-dB re 1 μPa threshold.

Category 1 sources

NMFS has delineated two categories of acoustic sources, Category 1 (>180 kHz) and Category 2 (10–180 kHz), in the *Federal Register* notice. NMFS indicated that Category 1 sources are outside the known functional hearing capability of any marine mammal, but that sound emitted from those sources may be audible if sufficiently loud (e.g., Møhl 1968). In addition, NMFS stated that Category 1 sources are highly unlikely to be of sufficient intensity to result in behavioral harassment and any individual marine mammal would be unlikely to even receive a signal that would almost certainly be inaudible.

NMFS did acknowledge two recent studies that demonstrated behavioral responses by marine mammals to acoustic signals at frequencies above 180 kHz (Deng et al. 2014, Hastie et al. 2014). Deng et al. (2014) determined that three commercially available sonars[13] generated sound at frequencies below the center frequency (center frequency ranging from 200–260 kHz and sub-harmonic sounds ranging from 90–130 kHz) and within the hearing range of some marine mammals (e.g., mid- and high-frequency odontocetes). Those sounds were likely detectable by the animals

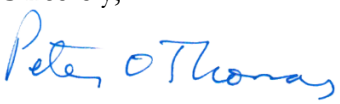
[10] Similar definitions are given in the preamble in the *Federal Register* notice as well and have been provided in NMFS's numerous draft and final technical guidance documents since 2014.
[11] NMFS stated that those definitions are not meant to reflect how it has previously characterized sound for behavioral thresholds. However, the Commission continues to believe that NMFS is not basing that characterization on best available science.
[12] Which NMFS has repeatedly used as the basis for its characterization of echosounders, other sonars, and subbottom profilers as impulsive rather than continuous.
[13] Kongsberg SM2000 200-kHz multibeam imaging sonar, BioSonics DT-X split-beam scientific echosounder operated at 210 kHz, and Imagenex model 965 260-kHz multibeam imaging sonar.

over distances of up to several hundred meters (see Table 1) and could affect the behavior of marine mammals in fairly close proximity to the sources (Deng et al. 2014). Hastie et al. (2014) conducted behavioral response experiments with captive gray seals exposed to two sonars[14] and determined that both sonars had significant effects on the seals' behavior—effects that would be deemed Level B harassment by NMFS. When the 200-kHz sonar was active, the seals spent significantly more time hauled out. Although the seals did not haul out when the 375-kHz sonar was active, they did surface at locations farther from the source than when the sonar was inactive. Hastie et al. (2014) indicated that, although peak sonar frequencies may be above marine mammal hearing ranges, high levels of sound can be produced within those hearing ranges that elicit behavioral responses—the 200- and 375-kHz sonars had source levels of 166 and 135 dB re 1 µPa at 1 m, respectively, at 20 kHz.

Although NMFS mentioned those two references in the *Federal Register* notice[15], it indicated that detectability of the sources by the animals was in reference to ambient noise[16] rather than to NMFS's established 160-dB re 1 µPa threshold. NMFS based that assessment on the source levels (135–166 dB re 1 µPa at 1 m) being either below NMFS's generic 160-dB re 1 µPa threshold or the sound attenuating to such a level within a few meters of the source. The Commission would not refute those suppositions if the (1) generic 160-dB re 1 µPa threshold was applicable for assessing Level B harassment from non-impulsive, acoustic source, which clearly is contradicted by the Hastie et al. (2014) study or (2) responses above ambient, and specifically those that reflect clear avoidance and displacement, were not the very behavioral reactions that constitute Level B harassment. Rather than reassessing the applicability of its generic threshold, NMFS has chosen to apply that threshold to situations in which it is not appropriate. The Commission has provided similar comments in previous letters. However, NMFS has yet to address these points but should do so for this proposed rule. Therefore, until such time that NMFS amends its generic Level B harassment thresholds, the Commission again recommends that NMFS estimate numbers of takes associated with those acoustic sources (or similar acoustic sources) with frequencies above 180 kHz that have been shown to elicit behavioral responses above the 120-dB re 1 µPa threshold.

The Commission hopes you find this letter useful. Please contact me if you have questions regarding our rationale or recommendations.

Sincerely,



Peter O. Thomas, Ph.D.,
Executive Director

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[14] CodaOctopus Echoscope 2 375-kHz multibeam sonar and the BioSonics DT-X 200-kHz split-beam scientific echosounder used by Deng et al. (2014).
[15] And in its preamble to the NWFSC's final rule (83 Fed. Reg. 36372).
[16] Which is closer to NMFS's 120-dB re 1 µPa threshold.

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