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Errata

Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects

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On page 131, Kastelein (2013) was incorrectly identified as a new study of TTS from impulsive noise when it should have been listed as a new study of TTS from non-impulsive noise in the preceding paragraph.

There is a typographical error in Table 5 on page 149. What is indicated as parameter "B" should be parameter "b," which is consistent with "b" in Eq.(2) W(f) on page 146.

There are four typographical errors in Table 7 on page 156. The corrected table is provided on the following page:

- For PCA, the value in column "TTS onset: Peak SPL" should be 155 (rather than 138) and the value in column "PTS onset: Peak SPL" should be 161 (rather than 144).

- For OCA the value in column "TTS onset: Peak SPL" should be 170 (rather than 161) and the value in column "PTS onset: Peak SPL" should be 176 (rather than 167).

Data for the blue whale (*Balaenoptera musculus*) was inadvertently omitted from Appendix 1, Table 1 during publication. The corrected table for "Low-Frequency Cetaceans" is provided herein with the blue whale data included. All the references associated with the blue whale that are referred to in this table were provided within the appendix as it was published.

We apologize for the errors.

Table 7. TTS- and PTS-onset thresholds for marine mammals exposed to impulsive noise: SEL thresholds in dB re 1 μPa^{2}s under water and dB re (20 μPa)^{2}s in air (groups PCA and OCA only); and peak SPL thresholds in dB re 1 μPa under water and dB re 20 μPa in air (groups PCA and OCA only).

Marine mammal hearing group	TTS onset: SEL (weighted)	TTS onset: Peak SPL (unweighted)	PTS onset: SEL (weighted)	PTS onset: Peak SPL (unweighted)
LF	168	213	183	219
HF	170	224	185	230
VHF	140	196	155	202
SI	175	220	190	226
PCW	170	212	185	218
OCW	188	226	203	232
PCA	123	155	138	161
OCA	146	170	161	176

Appendix 1, Table 1. Weighting functions: Low-frequency (LF) cetaceans

Taxon	Ear type	Auditory modeling	Sound production	References
Balaena mysticetus Bowhead whale	Mysticete middle ear, Type M cochlea	0.6[b] to 32[b] kHz	0.02 (moan) to 6 kHz (warble)	Audiometry: No data Anatomical modeling: Ketten, 1994[b]; Ketten et al., 2014[a] Acoustic: Ljungblad et al., 1980, 1982; Clark & Johnson, 1984; Cummings & Holliday, 1987; Würsig & Clark, 1993; Blackwell et al., 2007; Stafford et al., 2008; Delarue et al., 2009; Tervo et al., 2009, 2011, 2012
Eubalaena australis Southern right whale	Mysticete middle ear	--	0.02 (pulse) to 2.2 kHz (pulse, belch)	Audiometry: No data Anatomical modeling: No data Acoustic: Cummings et al., 1971, 1972, 1974; Payne & Payne, 1971; Saayman & Tayler, 1973; Clark, 1982; Parks et al., 2007a
Eubalaena glacialis North Atlantic right whale	Mysticete middle ear, Type M cochlea	0.016[a, b] to 25[b] kHz	0.02 to 22 kHz (gunshot)	Audiometry: No data Anatomical modeling: Ketten, 1994[b]; Parks et al., 2007b[c], Ketten et al., 2014[a] Acoustic: Matthews et al., 2001; McDonald & Moore, 2002; Vanderlaan et al., 2003; Parks & Tyack, 2005; Parks et al., 2007a; Trygonis et al., 2013
Eubalaena japonica North Pacific right whale	Mysticete middle ear	--	0.07 to 0.2 kHz (up calls)[1]	Audiometry: No data Anatomical modeling: No data Acoustic: McDonald & Moore, 2002; Mellinger et al., 2004; Munger et al., 2008, 2011
Balaenoptera acutorostrata Common minke whale	Mysticete middle ear, Type M cochlea	0.010[d, f] to 34[e] kHz	0.09 to 9 kHz (star wars, boing)	Audiometry: No data Anatomical modeling: Tubelli et al., 2012a[d], 2012b[f], Ketten et al., 2014[a, c] Acoustic: Beamish & Mitchell, 1973; Edds-Walton, 2000; Mellinger et al., 2000; Gedamke et al., 2001; Rankin & Barlow, 2005; Oswald et al., 2011; Risch et al., 2014a
Balaenoptera bonaerensis Antarctic minke whale	Mysticete middle ear	--	0.05 (downsweep, bio-duck) to 1 kHz (bio-duck)	Audiometry: No data Anatomical modeling: No data Acoustic: Schevill & Watkins, 1972; Risch et al., 2014b
Balaenoptera borealis Sei whale	Mysticete middle ear	--	0.02 (LF sweep) to 4 kHz (FM sweep)	Audiometry: No data Anatomical modeling: No data Acoustic: Knowlton et al., 1991; Rankin & Barlow, 2007; Baumgartner et al., 2008; Calderan et al., 2014; Romagosa et al., 2015
Balaenoptera edeni Bryde's whale	Mysticete middle ear	--	0.1 (LF tonal) to 0.9 kHz (pulsed moan)	Audiometry: No data Anatomical modeling: No data Acoustic: Edds et al., 1993; Oleson et al., 2003; Heimlich et al., 2005; Figueiredo, 2014; Rice et al., 2014; Širović et al., 2014; Viloria-Gómora et al., 2015

Balaenoptera musculus Blue whale	Mysticete middle ear, Type M cochlea	0.012[a] to 15[b] kHz	0.01 (B call) to 0.4 kHz (pulse, HFS)[2]	Audiometry: No data Anatomical modeling: Ketten, 1994[b]; Ketten et al., 2014[a] Acoustic: Cummings & Thompson, 1971; Edds, 1982; McDonald et al., 1995b; Thompson et al., 1996; Rivers, 1997; Stafford et al., 1998, 2001; Thode et al., 2000; Mellinger & Clark, 2003; Berchok et al., 2006; Oleson et al., 2007; Buchan et al., 2010; Frank & Ferris, 2011
Balaenoptera omurai Omura's whale	Mysticete middle ear	--	0.01 to 0.05 kHz (AM call)	Audiometry: No data Anatomical modeling: No data Acoustic: Cerchio et al., 2015
Balaenoptera physalus Fin whale	Mysticete middle ear, Type M cochlea	0.02[e] to 20[e] kHz	0.01 (rumble, thud, 20-Hz signal) to 1 kHz (slam)	Audiometry: No data Anatomical modeling: Cranford & Krysl, 2015 Acoustic: Watkins et al., 1987; Edds, 1988; Thompson et al., 1992; McDonald et al., 1995a; Charif et al., 2002; Širović et al., 2007, 2013; Weirathmueller et al., 2013
Megaptera novaeangliae Humpback whale	Mysticete middle ear	0.018[a] to 15[b] kHz	0.02 (moan, grunt, creak, pulse train) to 24 kHz (mid-frequency tonal wail)	Audiometry: No data Anatomical modeling: Ketten, 1994[b]; Ketten et al., 2014[a] Acoustic: Hafner et al., 1979; Payne & Payne, 1985; Thompson et al., 1986; Simão & Moreira, 2005; Au et al., 2006; Dunlop et al., 2007; Stimpert et al., 2007, 2011; Zoidis et al., 2008
Caperea marginata Pygmy right whale	Mysticete middle ear	--	0.06 to 0.1 kHz (thump)	Audiometry: No data Anatomical modeling: No data Acoustic: Dawbin & Cato, 1992
Eschrichtius robustus Gray whale	Mysticete middle ear	--	0.01 (moan) to 20 kHz (clack)	Audiometry: No data Anatomical modeling: No data Acoustic: Cummings et al., 1968; Poulter, 1968; Fish et al., 1974; Norris et al., 1977; Crane & Lashkari, 1996; Stafford et al., 2007; Dahlheim & Castellote, 2016

[1]See Beamish & Mitchell (1971) for suggestion of clicks extending to 31 kHz.

[2]Note that Crance et al. (2017) recently added gunshot calls to the species' repertoire. While not reporting frequency range, their figures show that these gunshots have energy exceeding 2 kHz and are consistent with data from the North Atlantic and southern right whale showing that at close range, these gunshots are broadband-pulsed calls with energy extending to substantially higher frequencies.