NOAA FISHERIES

# NOAA Draft Guidance for Assessing Effects of Anthropogenic Sound on Marine Mammals

## Acoustic Threshold Levels for Onset of Permanent and Temporary Threshold Shifts

**Public Meeting/Webinar – January 14, 2014**

# What is the Draft NOAA Acoustic Guidance?

- **Updated acoustic threshold levels (received dB level):**
  - Permanent and Temporary Threshold Shifts (PTS & TTS) onset (information synthesis): all underwater sources
  - Updates best available science, not regulatory application

- **First time threshold levels written in one place**

- **They are not:**
  - The entirety of an impact assessment (rather they serve as a tool to help evaluate effects & make findings).
  - Meant to address mitigation measures that may be associated with particular activities.
  - Applicable to marine species other than marine mammals under NOAA jurisdiction (i.e., doesn't cover fishes, sea turtles, walruses, etc.).

# Sections of Draft Guidance

- **Main document (summary)**
  - What most people will use
  - Contains:
    - Updated PTS & TTS onset threshold levels (based on 26 peer reviewed studies)
    - Regulatory context (MMPA, ESA, NMSA)
    - Process for updating Guidance

- **Appendices (more detailed)**
  - Development of PTS & TTS onset threshold levels (all sources)
  - Peer review process
  - Glossary

# Proposed PTS Onset Threshold Levels

- **Sources divided into 2 groups**
  - Impulsive: explosives, seismic, impact pile driving
  - Non-impulsive: drilling, sonar, vibratory pile driving

- **Dual metric threshold levels**
  - Peak pressure
  - Cumulative sound exposure level ($SEL_{cum}$)

- **Marine mammals divided into functional hearing groups**
  - Low-, mid-, and high-frequency cetaceans
  - Phocid and otariid pinnipeds

- **Auditory weighting functions incorporated**

# Marine Mammal Functional Hearing Groups

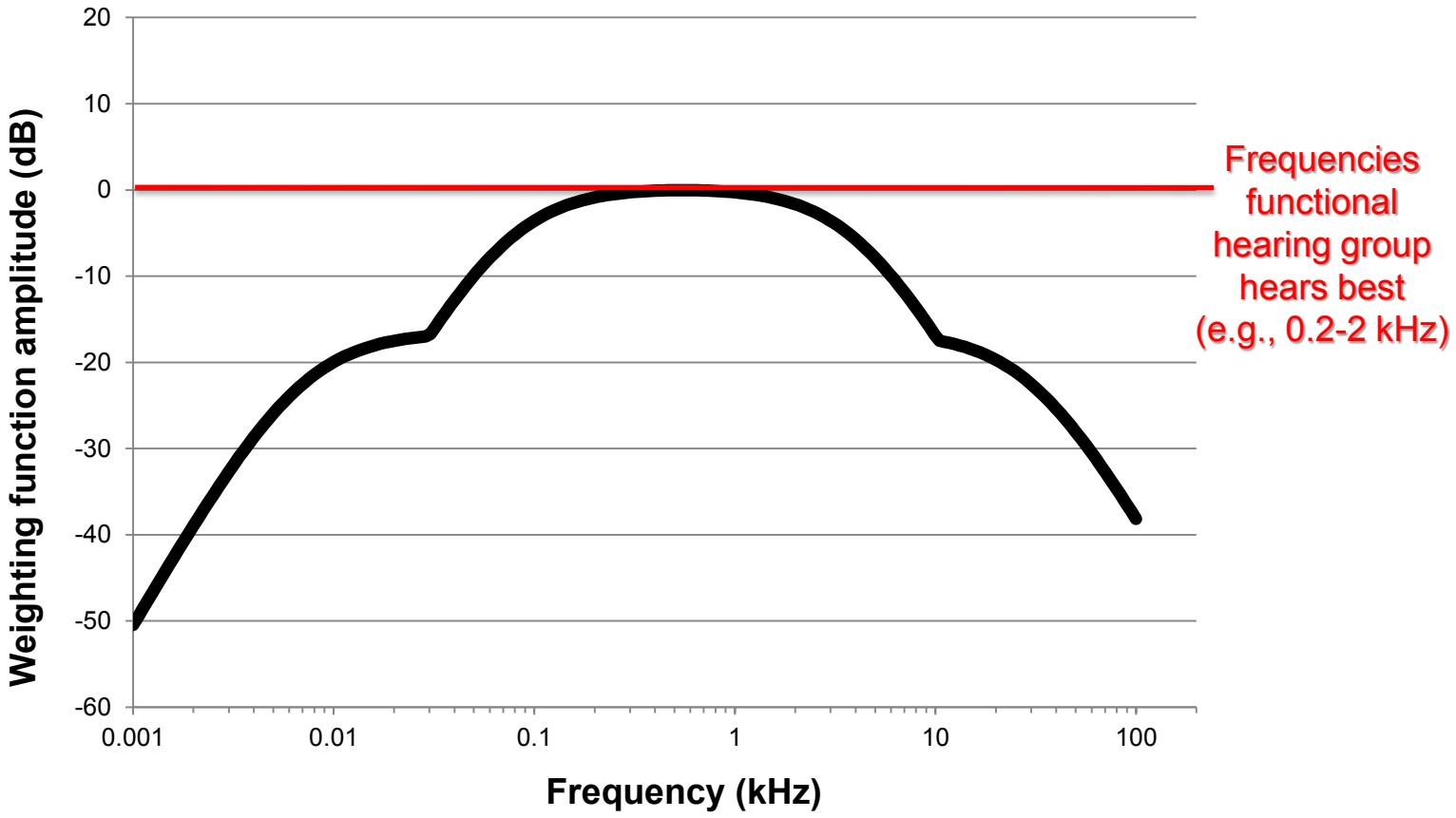
| Functional Hearing Group | Functional Hearing Range* |
|---|---|
| Low-frequency (LF) cetaceans+ (baleen whales) | 7 Hz to 30 kHz |
| Mid-frequency (MF) cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales) | 150 Hz to 160 kHz |
| High-frequency (HF) cetaceans (true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* and *L. australis*) | 200 Hz to 180 kHz |
| Phocid pinnipeds (true seals) | 75 Hz to 100 kHz |
| Otariid pinnipeds (sea lions and fur seals) | 100 Hz to 40 kHz |

* Represents frequency band of hearing for entire group as a composite (i.e., all species within the group), where individual species' hearing ranges are typically not as broad.

**+** Estimated hearing range for low-frequency cetaceans is based on behavioral studies, recorded vocalizations, and inner ear morphology measurements. No direct measurements of hearing ability have been successfully completed.

Some changes from what was proposed in Southall et al. 2007

# Marine Mammal Auditory Weighting Functions



# Proposed PTS Onset Threshold Levels

| | PTS Onset* (Received Level) | |
|---|---|---|
| **Hearing Group** | **Impulsive** | **Non-impulsive** |
| Low-Frequency (LF) Cetaceans | 230 $dB_{peak}$ **&** 187 dB $SEL_{cum}$ | 230 $dB_{peak}$ **&** 198 dB $SEL_{cum}$ |
| Mid-frequency (MF) Cetaceans | 230 $dB_{peak}$ **&** 187 dB $SEL_{cum}$ | 230 $dB_{peak}$ **&** 198 dB $SEL_{cum}$ |
| High-Frequency (HF) Cetaceans | 201 $dB_{peak}$ **&** 161 dB $SEL_{cum}$ | 201 $dB_{peak}$ **&** 180 dB $SEL_{cum}$ |
| Phocid Pinnipeds (Underwater) | 235 $dB_{peak}$ **&** 192 dB $SEL_{cum}$ | 235 $dB_{peak}$ **&** 197 dB $SEL_{cum}$ |
| Otariid Pinnipeds (Underwater) | 235 $dB_{peak}$ **&** 215 dB $SEL_{cum}$ | 235 $dB_{peak}$ **&** 220 dB $SEL_{cum}$ |

* Dual criteria: Use one [$dB_{peak}$ or dB $SEL_{cum}$] exceeded first. All $SEL_{cum}$ thresholds (re: 1 $\mu Pa^2$-s) are weighted.

**Developing companion User Guide to provide examples and help applicants employ Guidance correctly.**

# Application of Guidance

- **Updates science, not regulatory application**

- **Recognizes complexity with updated thresholds**
  - Best reflect current science
  - Difficult to directly compare with previous NOAA thresholds

- **Provides alternatives for applicants unable apply more complex thresholds/weighting to exposure modeling**
  - Auditory weighting functions (Table 7 in Guidance)
  - $SEL_{cum}$ metric (Section 2.3.1.1 in Guidance)

- **User Guide (in development)**
  - Assists with application of updated thresholds
  - Released with Final Guidance

# MLSOC Marine Mammals Teleconference 6 March 2014

- Carolyn Ruppel (USGS)
- Helene Carton (LDEO)
- Larry Mayer (U New Hampshire)
- Bruce Applegate (Scripps)
- Bill Lang (Resource Access International)
- MLSOC
  - Dale Sawyer (Rice)(MLSOC Chair)
  - Bill Lang (Resource Access International)
  - Debbie Hutchinson (USGS)
  - Paul Baker (Duke)
  - Nathan Bangs (UTIG)
  - Sandy Shor (Hawaii)
  - Jeff Rupert (LDEO)
  - Sean Higgins (LDEO)
- NSF
  - Holly Smith
  - Bob Houtman
  - Jim Holik

- Modeling by LDEO (Helene Carton) so far indicates that, using the new guidelines A) the significant criterion is for cumulative exposure (not peak exposure); and B) the exclusion zones get SMALLER compared to what we're using now. This is a good result! Science-based methods are showing that the initial assumptions we've been working under were arbitrary, resulting in exclusion radii that are too wide. More work needs to be done, but appears promising.
- Modeling by UNH (Larry Mayer) using more accurate characterization of multibeam transmissions indicates a much smaller (on the order of 1/180th) exposure to animals compared to seismics -- animals would rarely get ensonified and when they did it would only be for short time and they could very quickly/easily move out of the beam.

Notes from Bruce Applegate

- Regarding non-seismic sound sources, USGS has changed their approach -- they are "done" with being conservative. They think the very large exclusion zones being imposed for sparkers and boomers (which are determined using the most conservative assumptions possible) are inappropriately large. USGS has changed approach to create much smaller exclusion radii. They will use this approach with all non-airgun sources.
- Agencies (NSF, USGS, BOEM) have been working closely on this issue together, and input into NMFS seems good
- All on the telecon were in agreement that it's premature to submit written comments on NMFS guidelines at this point -- best to continue letting prime movers at agencies continue their work, supported by subject matter experts as needed.

Notes from Bruce Applegate

- Initial NMFS guideline draft (late 2013) included greatly-expanded changes to Level B (potential to disturb) that were troubling to everybody. However, the re-released draft (the current version) did not include any of those Level B changes. That's good, but not sure if new level B criteria will be put back in.
- Valid concern remains: although current focus is on airguns, what's to prevent regulation of all sound sources? Or put another way, by keeping language in the guidelines about non-airgun sources there's an opportunity for lawsuits against the use of non-seismic sound sources. This is how regulation has been driven in the past (ie, by lawsuits).

Notes from Bruce Applegate