BOEM: Best Management Practices Workshop for Atlantic Offshore Wind Facilities



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### Overview of NMFS 2016 Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing

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# **Marine Mammal Guidance**

- Finalized: 31 July 2016
- Published as a NOAA Tech. Memo.
- Sompanion, optional User Spreadsheet
- Federal Register Notice (81 FR 51693)
  - Responses to public comments
- Not over....implementation stage

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Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts



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http://www.nmfs.noaa.gov/pr/acoustics/guidelines.htm

# **Technical Guidance**



Updated marine mammal acoustic thresholds: Hearing (TTS/PTS onset)

# **NOAA** Broadly applied across internal/external (consistency)

- First time thresholds provided in one place
- Mechanism to update with new science

### What it is <u>not</u>:

- The entirety of an impact assessment (tool)
- Applicable to protected fishes & sea turtles



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Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing

Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts



# Contents

### Main document (summary)

- Updated weighting functions
- Updated PTS onset thresholds

### Appendices (more detailed)

- Finneran Technical Report (Appendix A)
- Research Recommendations (Appendix B)
- Peer Review & Public Comment Processes (Appendix C)
- Alternative Methodology (Appendix D)
- Glossary (Appendix E)

# **PTS Onset Thresholds**

#### Sources

- Impulsive: explosives, seismic, impact pile driving
- Non-impulsive: drilling, vibratory pile driving

### Metrics

- Peak sound pressure level (PK): impulsive only
- Cumulative sound exposure level (SEL<sub>cum</sub>)
   Performended 24 b accumulation period
  - Recommended 24-h accumulation period
- Marine mammals hearing groups
  - Low- (LF), mid (MF)-, and high-frequency (HF) cetaceans
  - Phocid (PW) and otariid (OW) pinnipeds

### Auditory weighting functions







	PTS Onset <sup>*</sup> (Received Level)				
Hearing Group	Impulsive	Non-impulsive			
Low-Frequency Cetaceans (LF)	PK: 219 dB SEL <sub>cum</sub> : 183 dB	SEL <sub>cum</sub> : 199 dB			
Mid-Frequency Cetaceans (MF)	PK: 230 dB SEL <sub>cum</sub> : 185 dB	SEL <sub>cum</sub> : 198 dB			
High-Frequency Cetaceans (HF)	PK: 202 dB SEL <sub>cum</sub> : 155 dB	SEL <sub>cum</sub> : 173 dB			
Phocid Pinnipeds (PW)	PK: 218 dB SEL <sub>cum</sub> : 185 dB	SEL <sub>cum</sub> : 201 dB			
Otariid Pinnipeds (OW)	PK: 232 dB SEL <sub>cum</sub> : 203 dB	SEL <sub>cum</sub> : 219 dB			
Dual thresholds (impulsive): Use on	e resulting in largest effect distance (iso	pleth).			

+  $\ensuremath{\mathsf{SEL}_{\mathsf{cum}}}$  thresholds incorporates weighting functions

\*Replaces previous RMS: 180 dB (cetacean)/190 dB (pinniped)

Behavior: <u>Still</u> relying upon 120 dB (continuous)/160 dB (impulsive)





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# **Implementation Considerations**

### SEL<sub>cum</sub> thresholds & weighting functions

- Recognize challenge of using these new factors
  - Differing capabilities among applicants
- Developed *optional* user tools (Appendix D & User Spreadsheet)
  - Weighting Factor Adjustments (WFA)
  - Accumulate SEL for mobile & stationary sources
    - Asking for new information (e.g., strikes per pile, piles per day, etc.)





# Weighting Factor Adjustment (WFA)

All applicants uses same thresholds



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# Allows for an adjustment (-dB) for each hearing group (single frequency)

- <u>Narrowband Sounds</u>: primary frequency (easier)
- <u>Broadband Sounds</u>: 95% frequency contour (similar concept used for RMS: 90% cumulative energy window, but upper frequency containing 95% energy of sound)

Spreadsheet UPDATE: Currently exploring options to incorporate weighting functions over entire spectrum of broadband sounds vs. single frequency via WFA.



# Mobile: Safe Distance\*

- Simple source movement
  - Constant velocity & direction
- Receiver is stationary
  - No horizontal (avoid/attract to source) or vertical movement
- Distance between "pulses" for intermittent sources is consistent
- Assumes spherical spreading

\* Sivle et al. 2014

# **Stationary: 24-h Accumulation Isopleth**

- Total exposure (isopleth) over 24-h (or less if activity is less than 24 h)
- Receiver is stationary



# **New Information Needed**

- Realize challenging for everyone!
- New/Additional metrics needed
- Need to account for exposure duration (need more specifics)
  - How long activity in 24-h period?
  - Number of strikes per pile/piles per day?
  - Pulse duration, repetition rate?

### What if information is not available?

- Default values: pulse duration, spectrum, etc.
   o Inherently conservative
- Can defaults always be provided (variability)?
- Working on adapting User Spreadsheet & providing more guidance on appropriate defaults
- How does exposure translate to animal?
  - Understanding source: Easier
  - Understanding animal: Hard!
    - o Transient/resident
    - How using area? Context?

# one!





## Next Steps

#### Internal/external check-ins

Separation ATMOSPIE

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- Feedback (please!)
- Lessons learned/adaptation
  - Benefit for update & future documents  $\bigcirc$

### Continue to evaluate/monitor new data

Predict updates every 3-5 years 

### Next on "To Do" List?

- Marine mammal behavior
- Fishes/sea turtles
- Etc.....including updates!









# Thanks for listening!









#### http://www.nmfs.noaa.gov/pr/acoustics



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# Optional User Spreadsheet Examples



## **User Spreadsheet**

Updated Technical Guidance is more complex than current NMFS thresholds
 Use of spreadsheet is optional

- Applicants are not obligated to use this tool
- Spreadsheet provides default tools to help with:
  - SEL<sub>cum</sub> thresholds (account for level and duration of exposure)
    - For impulsive sources, users are responsible for also considering thresholds expressed in PK metric
  - $\circ$  Weighting functions currently via WFA
  - More information on alternative methodology found in Appendix D of Technical Guidance



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