BOEM: Best Management Practices Workshop for Atlantic Offshore Wind Facilities

NOAA FISHERIES

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

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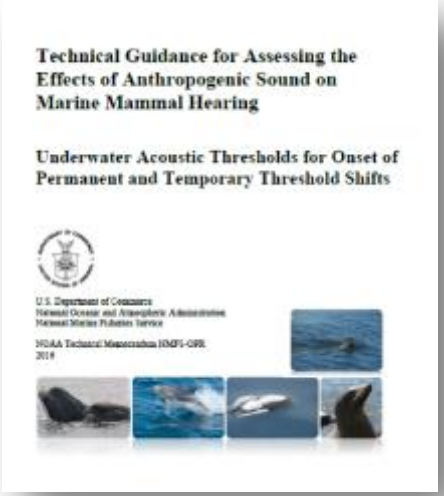
Marine Mammal Guidance

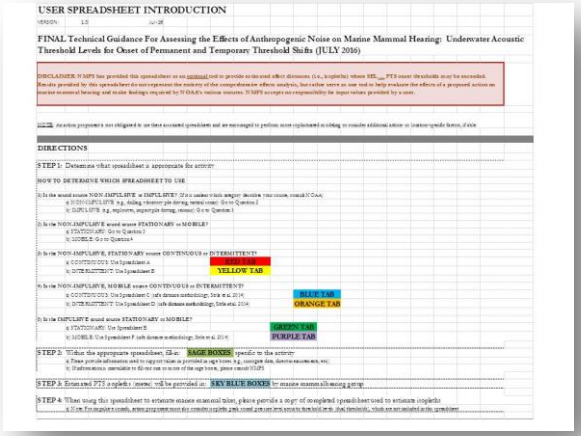
- **Finalized: 31 July 2016**
- **Published as a NOAA Tech. Memo.**
- **Companion, *optional* User Spreadsheet**
- **Federal Register Notice (81 FR 51693)**
  - Responses to public comments
- **Not over….implementation stage**


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

Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

NOAA Technical Memorandum NMFS-OPR
2016


USER SPREADSHEET INTRODUCTION

FINAL Technical Guidance For Assessing the Effects of Anthropogenic Noise on Marine Mammal Hearing: Underwater Acoustic Threshold Levels for Onset of Permanent and Temporary Threshold Shifts (JULY 2016)

DIRECTIONS

STEP 1: Determine what spreadsheet is appropriate for activity

HOW TO DETERMINE WHICH SPREADSHEET TO USE

YELLOW TAB

BLUE TAB
ORANGE TAB

GREEN TAB
PURPLE TAB

STEP 2:

STEP 3:

STEP 4:

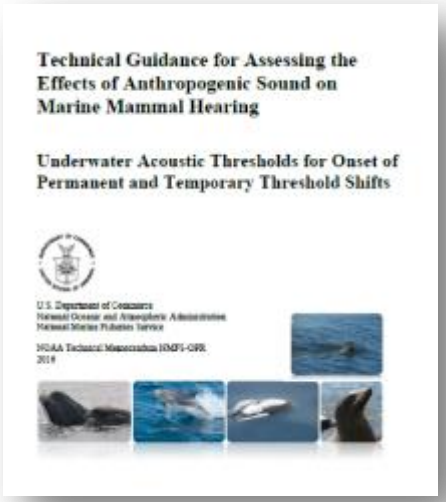
http://www.nmfs.noaa.gov/pr/acoustics/guidelines.htm

Technical Guidance

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

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_{cum})
    - 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**

Hearing Group	PTS Onset* (Received Level)	
	Impulsive	Non-impulsive
Low-Frequency Cetaceans (LF) 	PK: 219 dB SEL_{cum}: 183 dB	SEL_{cum}: 199 dB
Mid-Frequency Cetaceans (MF) 	PK: 230 dB SEL_{cum}: 185 dB	SEL_{cum}: 198 dB
High-Frequency Cetaceans (HF) 	PK: 202 dB SEL_{cum}: 155 dB	SEL_{cum}: 173 dB
Phocid Pinnipeds (PW) 	PK: 218 dB SEL_{cum}: 185 dB	SEL_{cum}: 201 dB
Otariid Pinnipeds (OW) 	PK: 232 dB SEL_{cum}: 203 dB	SEL_{cum}: 219 dB

- Dual thresholds (impulsive): Use one resulting in largest effect distance (isopleth).
- SEL_{cum} thresholds incorporates weighting functions

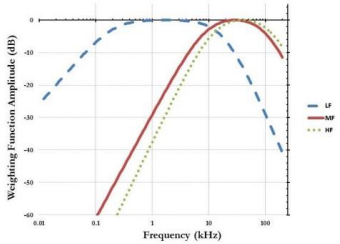
***Replaces previous RMS: 180 dB (cetacean)/190 dB (pinniped)**

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

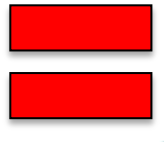
Implementation Considerations

- **SEL_{cum} 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.)

SEL_{cum}



Weighting Functions



Weighting Factor Adjustment (WFA)

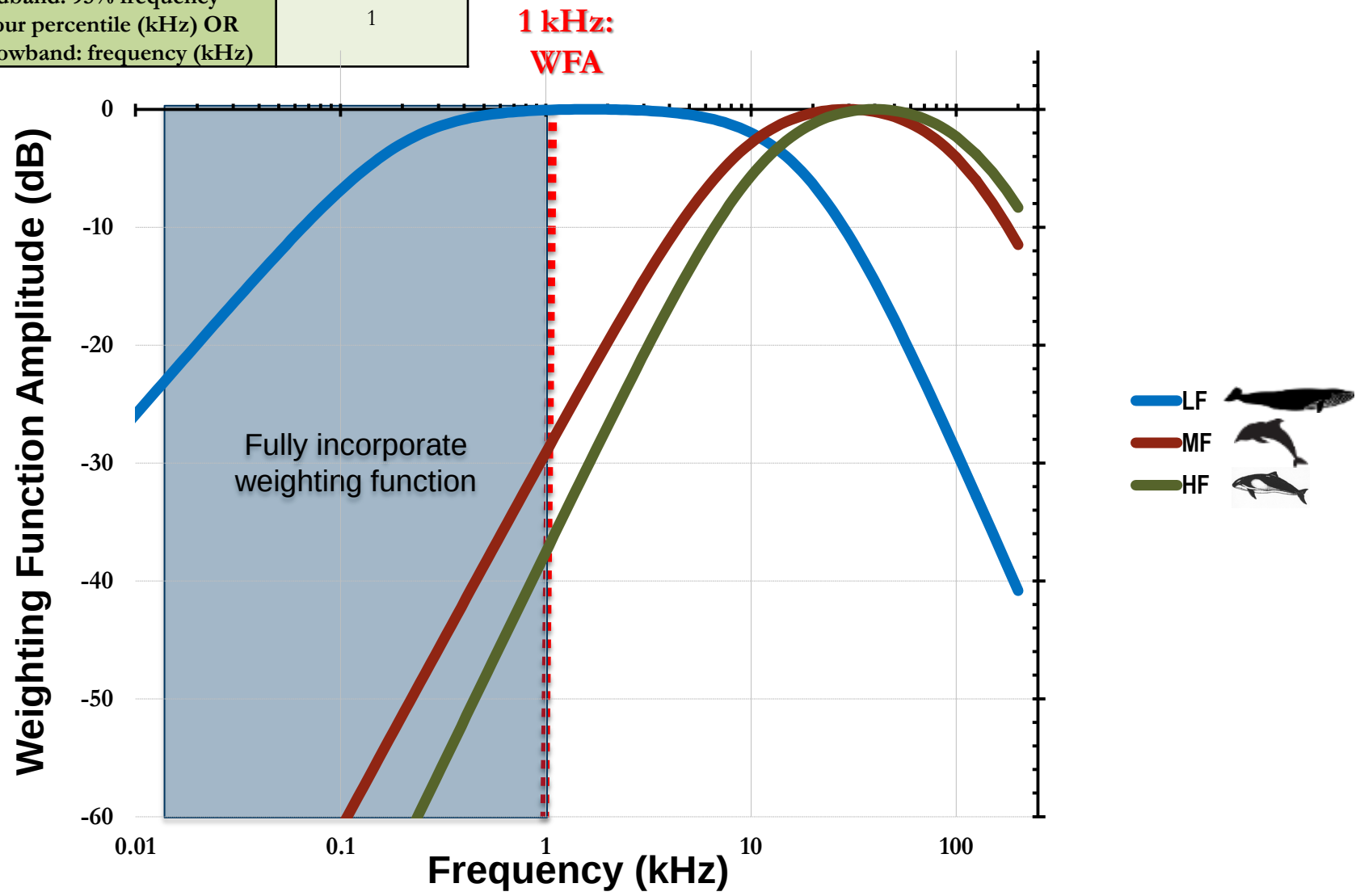
- **All applicants uses same thresholds**
- **Allows for an adjustment (-dB) for each hearing group (single frequency)**
  - Narrowband Sounds: primary frequency (easier)
  - Broadband Sounds: 95% frequency contour (similar concept used for RMS: 90% cumulative energy window, but upper frequency containing 95% energy of sound)

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

Example Using WFA

	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans
Adjustment (dB)	-0.06	-29.11	-37.55

Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz)	1



Mobile: Safe Distance*

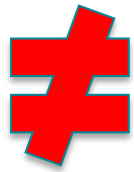
- **Simple source movement**
  - Constant velocity & direction
- **Receiver is stationary**
  - No horizontal (avoid/attract to source) or vertical movement
- **Distance between "pulses" for intermittent sources is consistent**
- **Assumes spherical spreading**

* Sivle et al. 2014

Stationary: 24-h Accumulation Isopleth

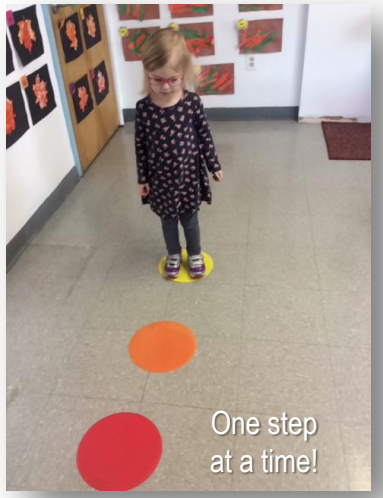
- **Total exposure (isopleth) over 24-h (or less if activity is less than 24 h)**
- **Receiver is stationary**

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.
    - 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!
    - Transient/resident
    - How using area? Context?

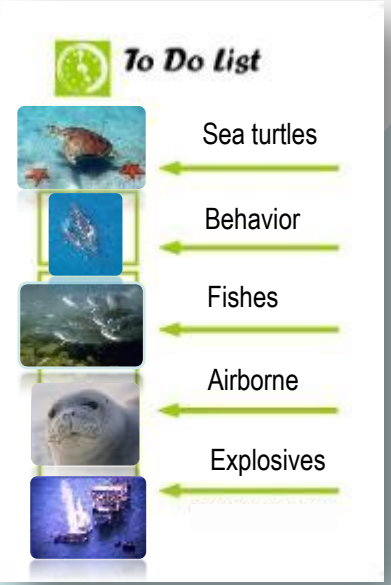
Next Steps



- **Internal/external check-ins**
  - Feedback (please!)
  - Lessons learned/adaptation
    - Benefit for update & future documents

- **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!

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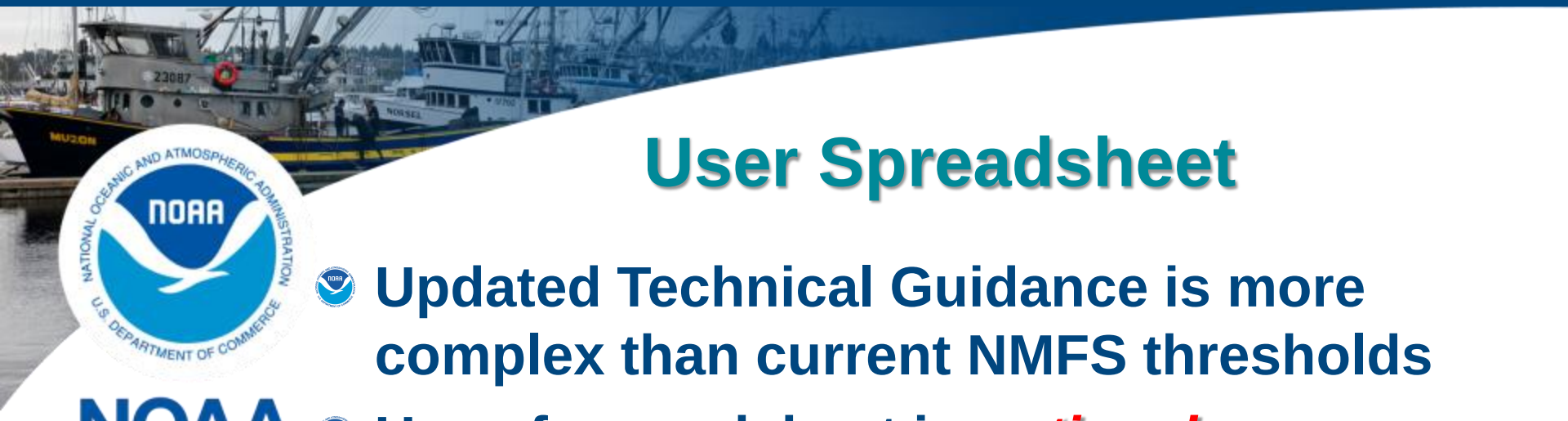
Optional User Spreadsheet Examples



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_{cum} thresholds (account for level and duration of exposure)
      - For impulsive sources, users are responsible for also considering thresholds expressed in PK metric
    - Weighting functions currently via WFA
    - More information on alternative methodology found in Appendix D of Technical Guidance