

National Marine Mammals and Sound: Science and Application Workshop

13-14 July 2010

Washington Navy Yard Conference Center
Washington, D.C.

*Session A, Biologically significant effects of sound
exposure: baseline data and assessment*

Overall Themes for Session:

- Baseline data on distribution, abundance, and behavior in absence of sound/other stressors is **ABSOLUTELY CRITICAL** (see current GOM)
 - * More effort needed in collecting, standardizing, and using/making available what we have*
- Management decisions based too heavily on traditional visual survey methods (importance of PAM)
- Standardized, accessible, federally-supported marine mammal/sound data bases (with portals) should exist
- Federal agencies should primarily be responsible for baseline monitoring (not action entities)
- Primary considerations for determining biological significance is impacts on vital rates

Overall Themes for Session (cont.):

- Overarching context-dependence of behavioral responses (WAY more than RL)
- Use of “representative” species should occur in n-dimensions (multiple considerations)
- Sub-lethal physiological responses are potentially important and poorly understood
- Essential biological parameters and trends of populations more important than just #s
- BOTH acute and chronic impacts are important considerations in different conditions
- Third-party funding mechanisms (streamlined - without increasing bureaucratic load) desirable

(1) Basic Biological Research for Representative Marine Mammal Species

Themes, Conclusions, Recommendations

- Baseline data on distro/abundance/behavior critical
 - Utilization of existing infrastructure/piggybacking and importance of partnerships (*e.g.*, IOOS, NOAA-Navy/Nat. Marine Sanctuaries)
- Concepts of behavioral ecology and acoustic ecology as guiding principles for basic research
- Research and management cannot occur serially

(2) Standardized Marine Mammal and Sound Database(s)

Themes, Conclusions, Recommendations

- Standardized, accessible, federally-supported marine mammal/sound data bases (with portals) should exist
- NOAA, Navy, BOEM should support/manage
 - Long-term commitment should be provided by government to support portal and databases
 - This could be accomplished through cooperative agreements involving government, academia, and industry

(3) Predictive Tools for Density/Distribution Estimation

Themes, Conclusions, Recommendations

- Many applicable tools/technologies exist and are being used
- Different environments require different tools from the toolbox
- Density estimates from PAM are possible in certain applications
- Predictive models need to be cross-checked before use for management purposes

(4) Acoustic Behavioral Response Research for Representative Marine Mammal Species

Themes, Conclusions, Recommendations

- Primary considerations for biological significance is impacts on vital rates (foraging, survival, reproduction)
 - *Key considerations: displacement, disruption of social bonds; acoustic isolation, chronic exposure, short-term high-energy responses*
- Overarching context-dependence of behavioral responses (RL-based thresholds limited/wrong)
- Use of “representative” species can occur in n-dimensions
 - *Social structure (group size), phylogeny, foraging ecology, functional hearing groups, sensitive/shy species-cryptic, predator-prey dynamics, migratory behavior, conservation status*

(5) Non-Behavioral Responses to Sound

Themes, Conclusions, Recommendations

- Replace ‘noise stress and immune function’ with ‘sub-lethal physiological responses’
 - Critical considerations: Baseline stress measures, relation of measures of stressors in blood to sampling likely to be conducted in the wild, heart rate relationship to stressors
- Comparative approach (noisy vs. not-noisy areas)
- Bubble formation can't be ruled out as a symptom of acoustic exposure
- Understanding of key elements of auditory fatigue (TTS/PTS) is FAR from “done” and still important

(6) Biologically Significant Impacts

Themes, Conclusions, Recommendations

- Proposed definitions
 - *At the level of individual animals, changes in current and expected future reproductive success would determine biological significance*
 - *At the level of populations, changes in growth rate (λ or r), variance in growth rate, etc. would determine biological significance*
- Essential biological parameters and trends of populations more important than just #s (*Size, insular/localized population, whether population is already 'stressed'*)
- Integrated approach to assessment of biological significance (*using relatively well-known examples*)





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*Session B, Understanding and Reducing Sound
Generation and Propagation*

Overall Theme for Session:

- Sound is an important component of the Marine Environment
- Efforts should be made to Characterize and Reduce Anthropogenic Sound in the Ocean
- A Decision should be made as to which Federal Agency (or Agencies) are Responsible for Monitoring Sound in the Ocean

(1) Sound Source Identification and Review

With reference to the List of Anthropogenic Sound Sources:

- Data needed for Sound Source Characteristics and Where, When, How sounds are produced
- Need to Model the Ocean Soundscape contribution for listed sources

(2) Ambient Noise

- Recommendation is for a Centralized Database of Ambient Noise
- Need for Historical, Long-term, Regional and Seasonal/Annual Ambient Noise data

(3) Quieting Technologies

- User Fees collected to Fund Research on Quieting Technology
- Noise Budget Banking (e.g., sound cap and trade, focus budget on highest sound producers)

(4) Cumulative Contributions of Multiple Sound Sources to Marine Noise

- Physics is available to Sum Received Sound levels at the animal
- Complex Biological Problem

(5) Sound Propagation Prediction Tools

- Agencies need to have Technical Expertise in Underwater Acoustics (capacity issues)
- Need investment in Global Geoacoustic Data

(6) Standardized Marine Mammal and Sound Database(s)

- Ship Tracks and Source Characteristics from Oil Exploration be made available
- Product from Navy's SPORTS system documenting use of Sonar be made available
- Compilation of Global AIS Data be made available





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SESSION C

Session C

- Themes:
 - Acoustic Behavioral Harassment Criteria
 - Masking
 - Cumulative Impacts
 - Mitigation
 - Monitoring

1) Acoustic behavioral harassment criteria:

- **To resolve: use of SPL vs. SEL in predicting behavioral harassment—current data availability dictates use of SPL, but do we want to move to SEL in future through requiring those data be collected or incorporating duration in other ways**
- **Models for assessing behavioral harassment (take) should at the very least consider: 1) amt of time exposed 2) frequency 3) repetition rate of source 4) context of sound source 5) predisposition of animal**
- **A matrix framework incorporating context by categorizing species, activities, geographic areas to develop series of step-like functions based on available literature documenting behavioral links**

2) Masking:

- **Need good baseline noise budget information**
- **Although acknowledge probable links to vital rates, need more assessment of functional consequences for populations where this is possible (e.g. N Atl right whales)**
- **Conservation prioritization: populations already heavily impacted by multiple stressors and/or effects of masking are particularly strong given communication behavior/ambient noise (SNR) etc.**

3) Cumulative Impact Assessment

- **Cumulative impacts can be assessed more or less quantitatively depending on how much data at the individual level is available for translating to vital rates: multivariate modeling approaches are available for model populations and mapping approaches for incorporating noise in relativistic ecosystem models**
- **Modify as necessary NMFS stock assessments to include more comprehensive examination of stressors**
- **Focus on information needs to focus studies—interdisciplinary approach, work cooperatively**

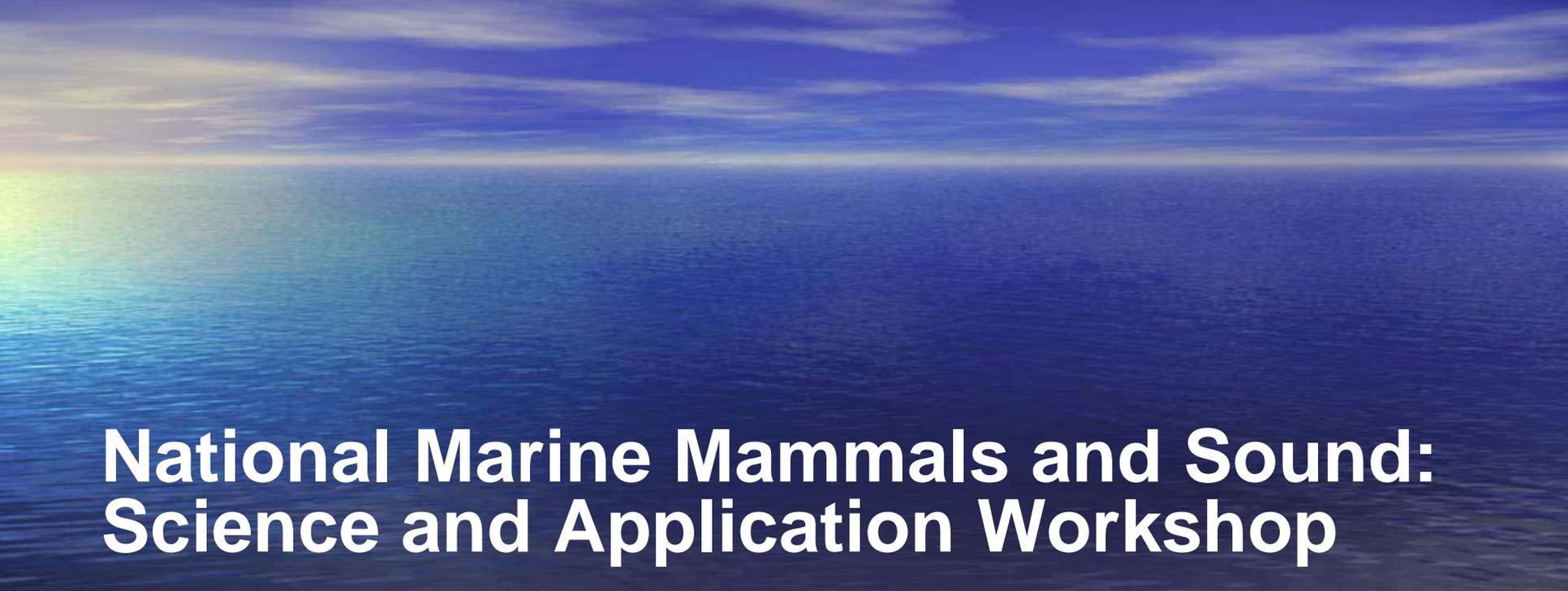
4) Mitigation

- **Early in planning (e.g., initial scoping/site planning, MSP etc.) is often the best time to incorporate spatial and temporal modifications and technology advances (quieting)**
- **Need better propagation modeling tools to get better predictions of noise exposure**
 - **Need more source level verification and model validation in the field to support modeling**
- **Need new tools in addition to visual detection, including PA, to improve mitigations like shut-downs in response to presence of animals (i.e., real time, localization)**

5) Monitoring

- **Looking for changes, positive or negative, necessitates baseline info (needed prior to additional activity, in concert with visual monitoring)**
 - **Research is the tool to give us baselines: should be done proactively not only as requirement by NOAA**
 - **Long-term trends by activity: if we'd started 30 years ago we'd know more now!**
 - **Agencies should collaborate on filling the gaps, i.e. long-term trends in population status and acoustic budgets (possible nation-wide program and/or region-specific)**
- **NMFS should organize a nation-wide panel to prioritize monitoring focal points which should include all groups and agencies that will use or regulate**





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*SESSION D, Improving Monitoring Techniques
(Technology and Methodology), POLLING*

Session D: Nuggets

- Technology Drives the Research: ARGOS the Sequel
- Workshop on Technology: Recruitment outside the field
(Steve Jobs where are you?)
- Basic Biology (Map Behavior to measurement parameters; eg. Vocal behavior mapped to physical data)
- Ground truth/validation critical: Ranges/Comparative Tests/Jaws

Session D: Nuggets

- Coordination/Availability of Government/Make data available as part of regulation and permitting Industry Data
 - Is there a place to store it? Dimension of Biodiversity Program? (NSF) OBIS?
- FAA for UAV utilization
- Make use of active if available recognizing it needs significant validation
- Ancillary tools are important: eg. Prey mapping
- Need to integrate technologies to get the most “bang for the buck”; no one tool stands alone
 - Research collaboration