Using Acoustic Recorders as Cost Effective Monitoring for Marine Bioacoustics and Ambient Noise Simultaneously

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Topics

- Brief introduction to Bioacoustics
- What can the SM2M+ Product Family do?
- Hardware
- Hydrophones
- Power & Data Storage
- Programing the units
- Deployment options
- Data Analysis
What is bioacoustics monitoring

- Animals can often be identified by their recorded vocalizations
- Provides automated, non-invasive and cost-effective method to assess wildlife activity.
  - More reliable and efficient than point count surveys.
  - Data can be independently reviewed by multiple experts.
  - More complete survey for threatened species.
  - Assess relevant information on species location, type and density in the off season.
Analyzing Sound as a Waveform

- Efficiently review recordings made by Song Meter or other recording equipment. Spectrogram viewer enables scrolling through large audio files to visually inspect spectrograms of long recordings.
- Recognize the visual patterns corresponding to the vocalizations of interest.
- Viewing audio files as spectrograms with your eyes is 10-20 times more time efficient than listening to the same recordings.
Sample Unattended Recording by Song Meter SM2M+

Sample Unattended Recording by Song Meter SM2M+
What can the SM2M+ Product Family do?
SM2M+ Product Family

- SM2M+ Platform
  - Core Technology from SM2+
  - 10,000 units sold
What Acoustic Data can I collect?

- Animal Vocalization Recorder
  - Detecting Animals
  - Presence of a specific species
  - Inventory of all species
- Noise Logger
  - Quantify Sound Pressure Levels
  - Ambient Noise Baseline
  - Loud Noise Monitor
SM2M+

- PVC Construction
- 150-meter Depth Rating
- 123 cm Long (including cage)
- 17 cm diameter
- 13.5 Kg (31 Lbs) in air (fully populated)
- 1.5 kilograms of buoyancy in water
SM2M+ Housing Design

- 316 Stainless Anchor Bolt
- Hydrophone Connector &
  - 316 Stainless Steel Cage
SM2M+ Submersible Deep Water Unit

Feature Upgrades

- Durable Aluminum Housing
- Submersible to 1,500 meters
- Double the Power capacity
SM2M+ Submersible Deep Water Unit

- **Rough Dimensions:**
  - 17 cm diameter
  - 150 cm length

- **Weight**
  - 24 kilograms in air (without batteries)
  - 34 kilograms in air (with batteries)
  - From 1kg to – 10 Kg buoyancy in water
SM2M+ Storage

- Included with Purchase
  - Wheeled for easy transport
  - Locking latches for security
• MARINE BIOACOUSTICS MONITORING SYSTEMS

Hydrophones
SM2M+ Family Frequency and SPL Ranges

- Sample rates from 4kHz to 384Khz
- 2Hz to 192Khz recording capability
- Dynamic range of 56 dB SPL to 240dB SPL
Hydrophone Options

- Standard Acoustic Hydrophone
- Ultrasonic Upgrade
- Low Noise Upgrade
- High-SPL Option
Standard Acoustic Hydrophone

- Recording bandwidth 2Hz – 48kHz
- Sensitivity -165dB re:1v/µP
- Record 78 dB SPL to 165 dB SPL
Ultrasonic Hydrophone Upgrade

- Recording bandwidth of 2Hz – 192kHz
- Sensitivity -165dB re:1v/µP
- Record 81 dB SPL to 165 dB SPL
- Used with Ultrasonic upgrade to provide 2 high sample frequencies of 192 and 384 KHz
Low-Noise Hydrophone

- For ultra-quiet environments
- Sea State 0
- Recording bandwidth of 2Hz – 48kHz.
- Sensitivity is -165dB
- Record 56 dB SPL to 165 dB SPL
High-SPL Hydrophone Option

- 2Hz up to 48kHz
- Lower recording sensitivity - 240 dB re:1v/µP
- 160 dB SPL to 240 dB SPL
- Combined 78 dB SPL up to 240 dB SPL when combined with standard acoustic
Sound Pressure Levels

- RMS recording levels logged continuously
- Ambient and Peak Noise Levels logged
  - RMS levels (100 ms)
  - Ambient and peak levels (5 m)
- Time stamped Data
- Time-based assessment can be generated
Inside The Housing
Inside the Submersibles

- 4 SD Card Slots
- Main Battery Trays
- Hydrophone Connector
- Clock Batteries Tray
Physical Battery Capacity

- SM2M+ 4 to 32 D Cells
- SM2M+ Deep Water 4 to 64 D Cells
- Battery types
  - 1.2 Volt LSD NiMH
  - 1.5 Volt Alkaline
  - 3.0 Volt Lithium manganese
## Battery Power

(Duration in Days)

<table>
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<th>Number of Batteries</th>
<th>4kHz - 96kHz Sample Rate</th>
<th>192kHz/384kHz Sample Rate</th>
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<tr>
<td></td>
<td>Li-MnO2</td>
<td>Alkaline</td>
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<tr>
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<td>26</td>
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<td></td>
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<td></td>
<td>84</td>
<td>163</td>
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On-board Data Storage

- SD Cards
  - SDHC
  - SDXC
Memory Card Capacity at WAC0 (DAYS)

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<th>SAMPLE RATE (kHz)</th>
<th>TOTAL CARD CAPACITY</th>
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<tr>
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<td>16</td>
<td>19</td>
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</table>

Uncompressed WAV format will approximately half these values. Use Triggers based on frequency and amplitude to trigger a recording and further save on card capacity.
Programing the unit directly

- Full programming capabilities and utilities are available directly on the unit
- Programming buttons
- LCD Screen

**Song Meter Main Menu**
- Schedule (advanced)
- Settings
- Utilities
- Visualize Recording Times, Power & Storage
- Custom Advanced Schedules
- Configuring Multiple SM2M+ Units
Deploy

- Surface Tethered Deployments
- Divers
- Acoustic Release
- Floats

Al Sweeting, JR
Dolphin Communication Project

Matthew Witt
University of Exeter
Data Analysis
Automating the Analysis

- Automatically scan recordings

Process:

- Annotate known vocalizations
- Generate a recognizer
- Search field recordings with one click
- Sift easily through thousands of hours of audio recordings to find the most likely occurrences of a specific vocalization of interest.
Create a Song Scape

▸ Visualize sounds on large temporal scales.
▸ Measuring in months/years instead of seconds.

▸ Example: Song Scape created from 3,530 individual recordings made hourly through the spring and summer of 2009.
▸ Multi-year monitoring effort at a specific wetland in the U.S
Customer Testimonials

“The SM2M recorder works very well to record anthropogenic noise and marine mammal vocalizations. The software is easy to configure in the field, it is simple to rig for the marine environment, runs for weeks without changing batteries, and records months of data on SD cards.” Lee Shores, Marine Acoustics, Inc.

“We have now used the SM2M in two different locations to record dolphin sounds and ambient noise levels. Wildlife Acoustics supported us every step of the way with great advice.” Kathleen M. Dudzinski, PhD, Director of the Dolphin Communication Project and Senior Marine Scientist, Geo-Marine, Inc

“We just successfully recovered our first SM2M following an eight month deployment off the BC north coast (October 2011-June 2012). It worked really well, recording 7 min every half hour. The batteries held out for the whole time recording in WAV mode” John K.B. Ford, PhD, Cetacean Research Program, Pacific Biological Station, Fisheries and Oceans Canada
Thank you

- Questions?

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