ADVANCES IN TELEMETRY/BIOLOGGING INSTRUMENTS: FROM TAG ATTACHMENT TO NEW SENSOR DEVELOPMENT

Melinda Holland
Marine Mammal Commission Meeting
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• 31 years in business
• 250+ tag configurations available
• 2,650 publications to date
• 544 partnering organizations
• 72 different countries with active projects
What is Biologging and Telemetry all about?

- Sensors and data collection
- Tag deployment, attachment and recovery
- Remote recovery (telemetry) of collected data
- Shared databases and analysis routines
Argos Doppler Locations and Fastloc® GPS remain the workhorse technology for locating marine animals.

An emerging technology, RAFOS, receives acoustic signals from moored sound sources, allowing triangulation of geographic position underwater. The range of the tiny receivers can be over 100km.
Triangulation Using RAFOS sound sources
<table>
<thead>
<tr>
<th>SENSORS AND DATA COLLECTION:</th>
<th>Accelerometers, coupled with cameras, are providing insight to behaviors such as foraging</th>
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<tbody>
<tr>
<td>Where is the animal?</td>
<td>This is made possible by the commercial availability (= readily available and low-cost) very small, low-power accelerometers and large memories</td>
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<td><strong>What is it doing?</strong></td>
<td>Small, low-power, low-light cameras verify the signals in the accelerometers as a proxy for behaviors</td>
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<td>What is it’s environment?</td>
<td>Large memories allow collection of huge quantities of sensor data</td>
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<td>Who is it interacting with?</td>
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SENSORS AND DATA COLLECTION:

Where is the animal?

What is it doing?

What is it’s environment?

Who is it interacting with?

Conductivity, high-resolution temperature and depth (CTD) can be collected with the accuracy useful to oceanographers and meteorologists and are now available for large cetaceans.

Sensors that can measure other parameters such as Dissolved Oxygen, Chlorophyll, Muscle Temperature are available as prototypes.

Long-term (up to 30 days) Digital Acoustic recorders combined with multiple sensors and are being deployed.
CTD tag for large cetaceans
CTD tag deployed on a bowhead whale
GPS locations along with CTD casts
SENSORS AND DATA COLLECTION:

Where is the animal?

What is it doing?

What is its environment?

Who is it interacting with?

Prey or Predator?

Stellar sealions and sleeper sharks

Harbor seals and salmon smolt
Life History Tag
Autopsies from space: who killed the sea lions?

In cold blood: evidence of Pacific sleeper shark (Somniosus pacificus) predation on Steller sea lions (Eumetopias jubatus) in the Gulf of Alaska.

Author(s): Horning, Markus; Mellish, Jo-Ann E.
How many juvenile coho are harbor seals eating? A pilot study incorporated a RFID reader to help answer this question.

Seals blamed for drop in juvenile salmon stocks: study
http://mmru.ubc.ca/research/into-the-field/

https://www.psf.ca/blog/seal-beanies-reach-milestone
Yellow dots indicate a RFID-tagged salmon was eaten.
Getting the tag on the animal

Keeping it on

Getting it back (when you can resight your animal)

Collaborations between the field researcher and tag manufacturer holistically address tag designs to include deployment and attachment

Shapes are “bespoke”: new shapes that have a minimal impact and maximum retention are constantly being developed

Technologies in other disciplines such as medical device and aerospace such as 3-D printing are bringing advancements in manufacturing animal tags, increasing their reliability
Payload Recovery Device

A STTR-funded project has yielded field-tested Payload Recovery Devices (Remote Release Device)
And when you can't get the tag back…

Telemetering the data

The Argos Satellite system remains the primary way of getting data from animals at-sea because of its ability to receive data globally from small, low-powered tags

- Data throughput is augmented by land-based receivers (Wildlife Computers Motes)
- “Internet of Things” (IOT) is driving the development of new nanosatellite constellations such as Astrocast and ArgosNext, but these are still years away from being operational
Wildlife Computers Mote on Vancouver Island

Motes enhance data recovery from satellite-relayed biologgers and can facilitate collaborative research into marine habitat utilization; Animal Biotelemetry, July 2017
Mote on Ningaloo Island
Making the most with what you got

Shared databases

Shared analysis routines

Manufacturers’ Data Portals

U.S. Animal Tracking Network (ATN)

Australian Integrated Marine Observing System (IMOS)

European EO4Wildlife

Increasing value of collected data; statistical analysis and modeling

Increasing number of shared r Routines (github)
THANK YOU