

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



Melinda Holland
Marine Mammal Commission
Meeting
29 May 2018

- 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



SENSORS and DATA COLLECTION

*Where is the
animal?*

What is it doing?

What is it's
environment?

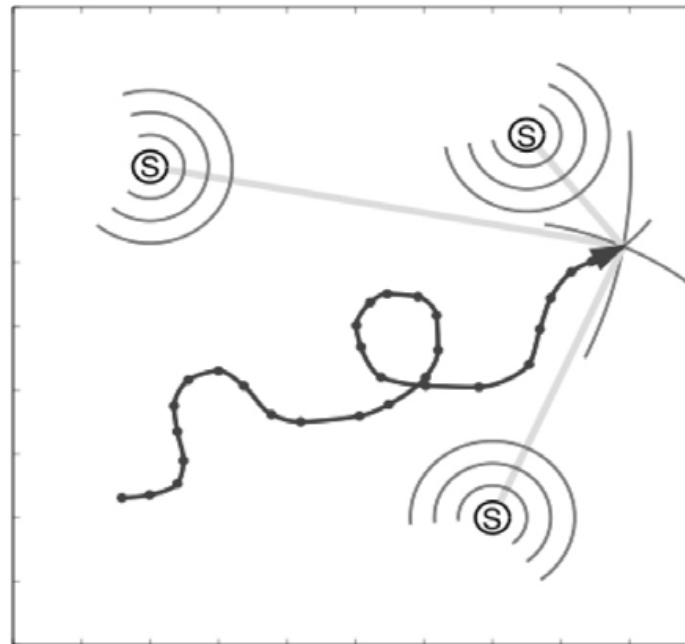
Who is it interacting
with?



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



INTERNATIONAL COUNCIL FOR THE
EXPLORATION OF THE SEA

ICES CM 2006/Q:16
Use of data storage tags to reveal
aspects of fish behaviour important
for fisheries management

Development and Application of 'RAFOS Fish Tags' for Studying Fish Movement

by Conrad W. Recksiek, Godi Fischer,
H. Thomas Rossby, Steven X. Cadrin, and Prasan Kasturi

SENSORS AND DATA COLLECTION:

Where is the animal?

What is it doing?

What is it's
environment?

Who is it interacting
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Accelerometers, coupled with cameras, are providing insight to behaviors such as foraging

This is made possible by the commercial availability (= readily available and low-cost) very small, low-power accelerometers and large memories

Small, low-power, low-light cameras verify the signals in the accelerometers as a proxy for behaviors

Large memories allow collection of huge quantities of sensor data

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.

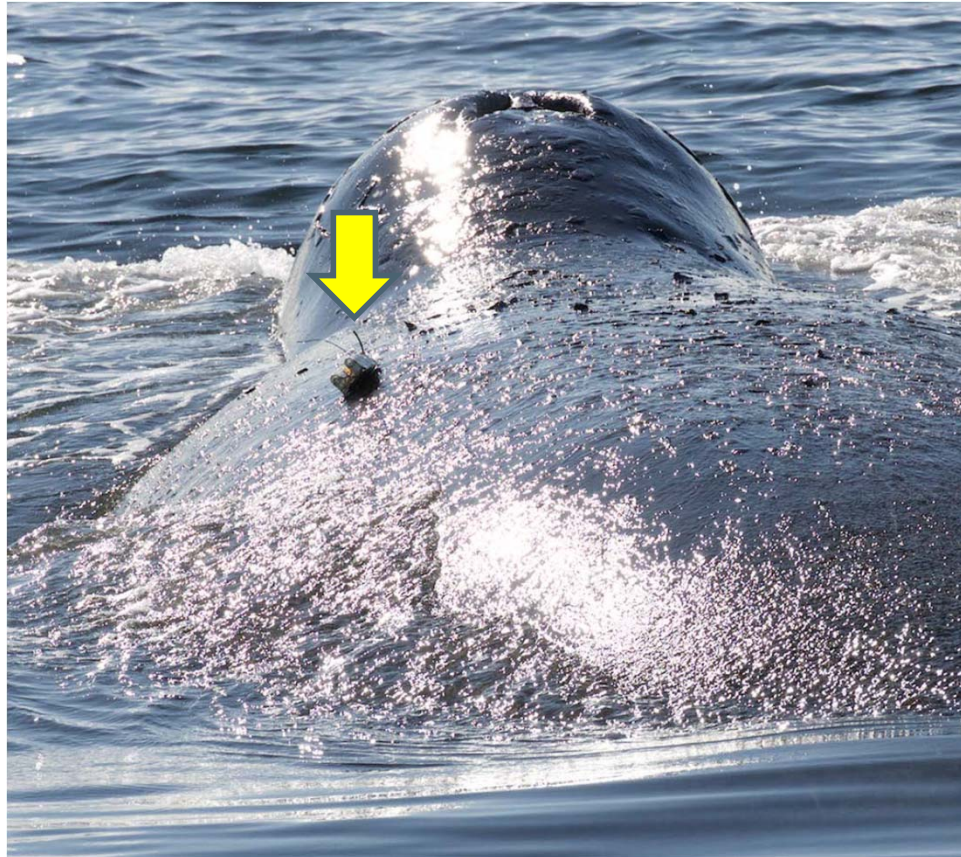
Sensors that can measure other parameters such as Dissolved Oxygen, Chlorophyll, Muscle Temperature are available as prototypes

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



Slide 9

MH2

Melinda Holland, 5/29/2018

GPS locations along with CTD casts



SENSORS AND DATA COLLECTION:

Where is the animal?

What is it doing?

What is it's
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?



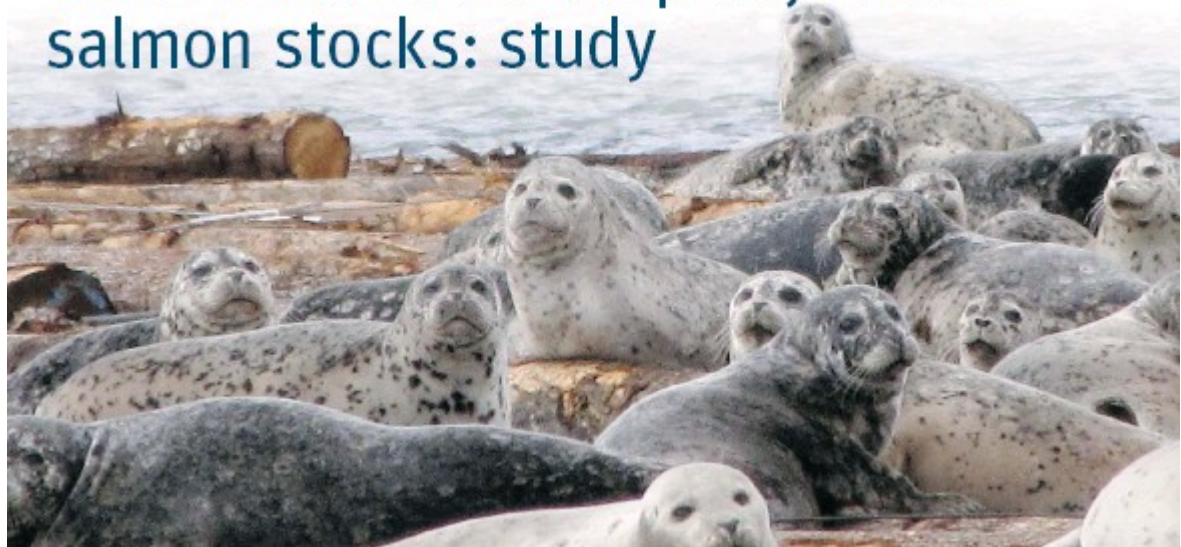
In cold blood: evidence of Pacific sleeper shark (*Somniosus pacificus*) predation on Steller sea lions (*Eumetopias jubatus*) in the Gulf of Alaska.

- **Source:** Fishery Bulletin . Oct2014, Vol. 112 Issue 4, p297-310. 14p.
- **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.



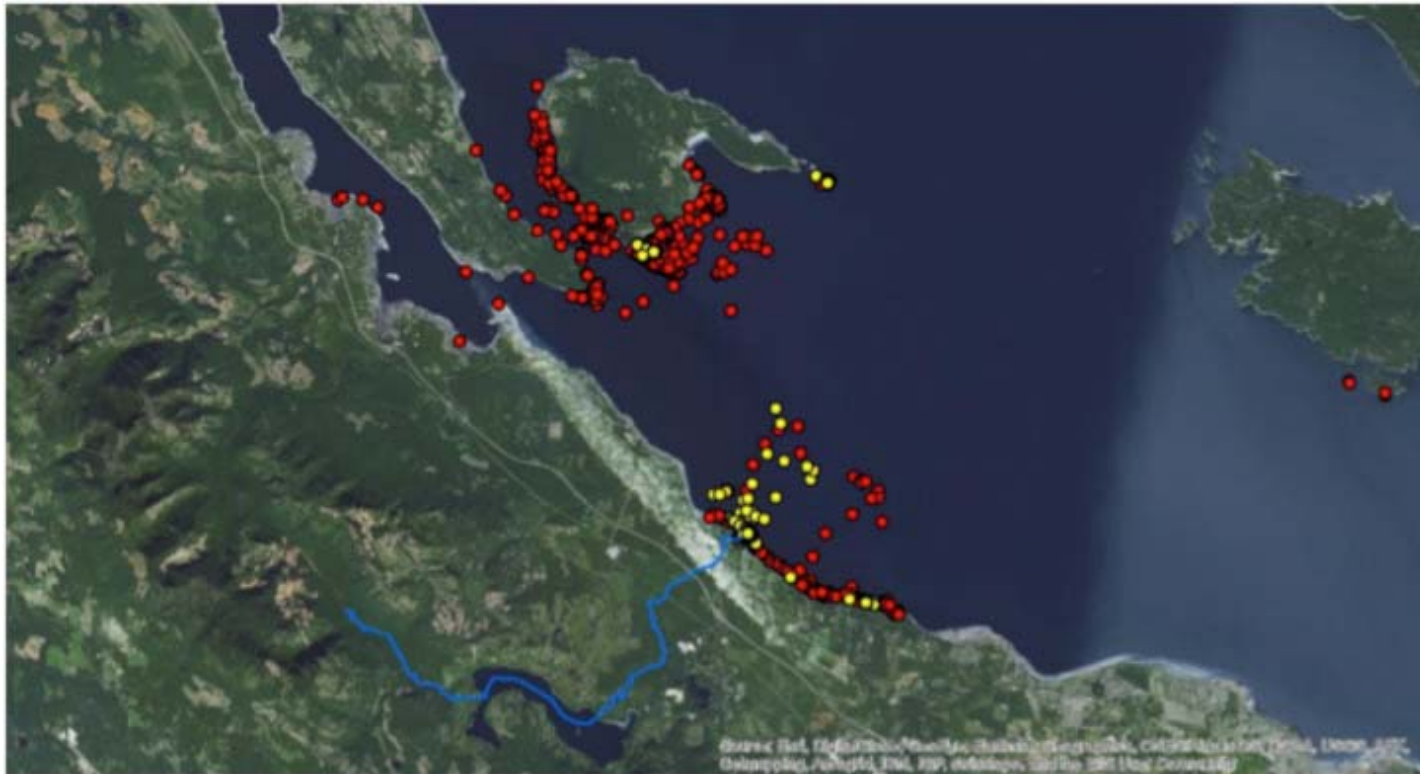
Seals blamed for drop in juvenile salmon stocks: study





<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...

Telemetrying 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

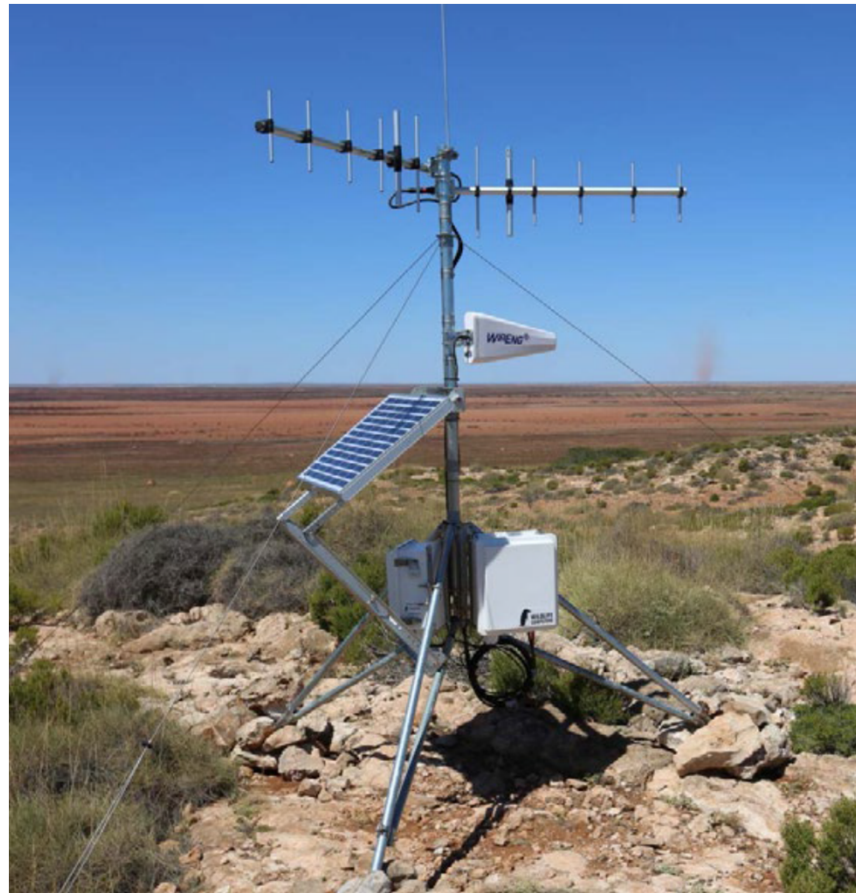
- Data throughput is augmented by land-based receivers (Wildlife Computers Motes)
- “Internet of Things” (IOT) is driving the development of new nanosatellite constellations such as Astrocast and ArgosNext, but these are still years away from being operational

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)

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THANK YOU

