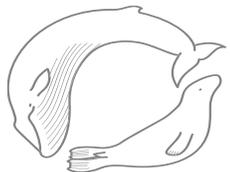


# IoT and the internet of the sea

Bernie McConnell



University of  
St Andrews



Sea Mammal  
Research  
Unit

# Harbour seal decline

50, 000 UK population

70% decline in E and N Scotland in last 10 years !

marinescotland

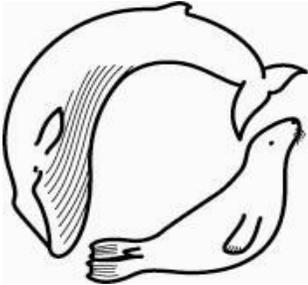


What is the cause?

What can be done?

Can the IoT assist?





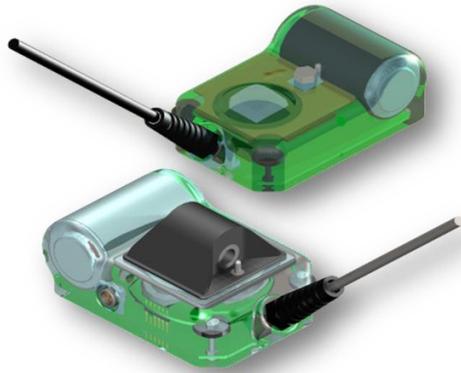
# Sea Mammal Research Unit



# Sea Mammal Research Unit Instrumentation



# Anatomy of a SMRU-IG tag



sensors  
on-board processing  
data relay ( c. 5 Kbytes day<sup>-1</sup>)  
attachment

## design constraints

energy



opportunity



# Sensors

location

pressure

acceleration / attitude -> behaviour, feeding, condition, fine-scale movement

sound

conductivity / salinity temperature

fish tag identification

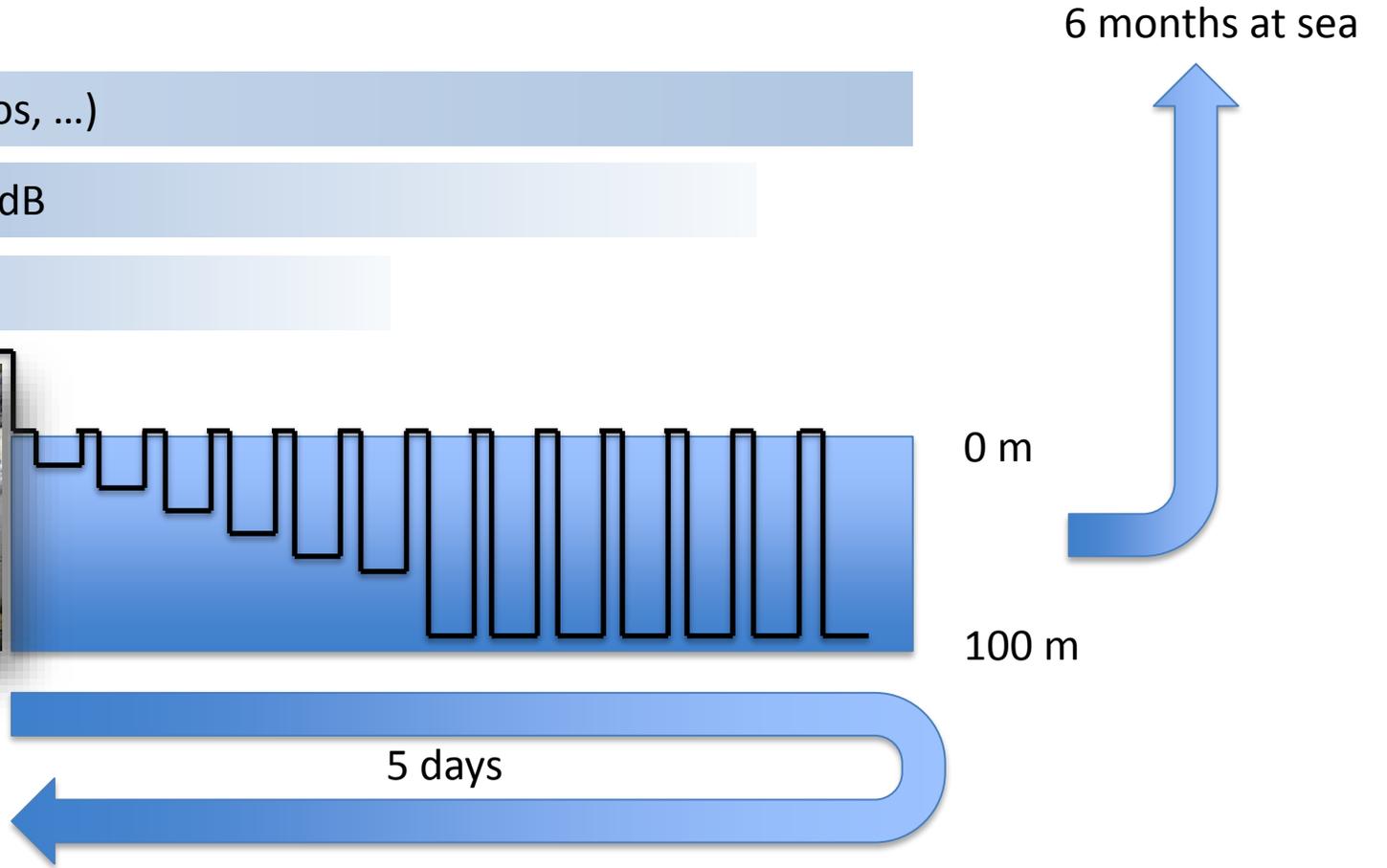
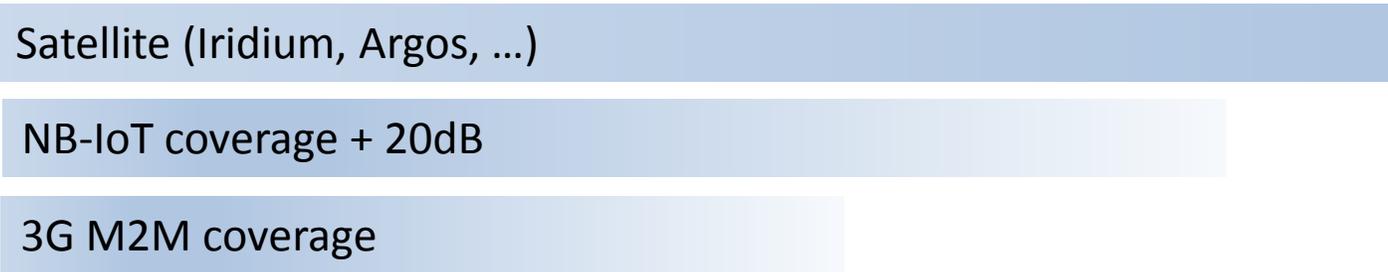
...

Marine mammal fit bits

Wearable tech

# Seals extend the sensory reach of the IoT

seawards and underwater



# Coverage extension

ad hoc network extension

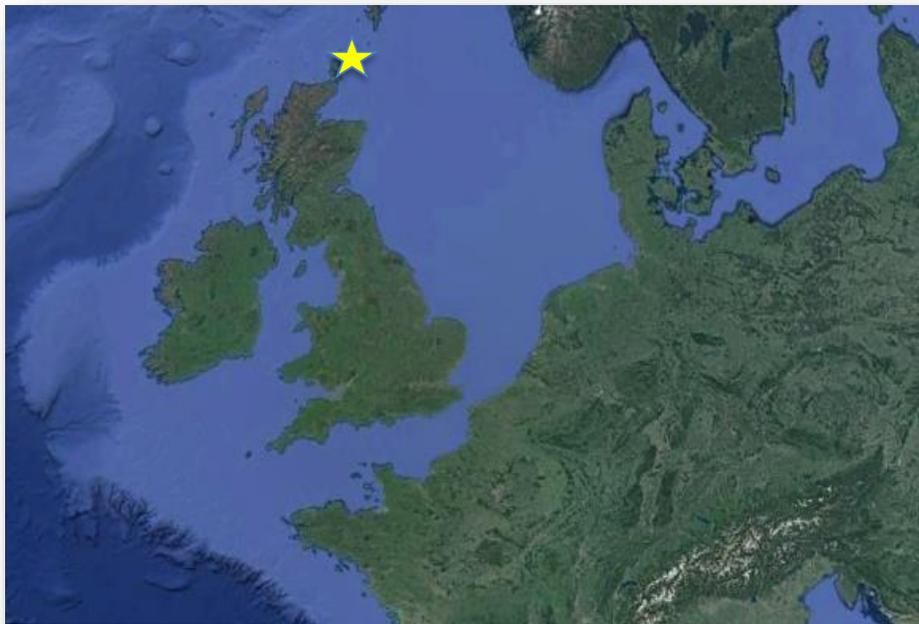


peer2peer data sharing



# Harbour seal decline study :: tagging

© Mònica Arso - SMRU



© Mònica Arso - SMRU

March 2016: 10 harbour seals tagged for three months until breeding/moult





Sea Mammal  
Research  
Unit



vodafone

259



260



257



263



258

261



Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Image Landsat

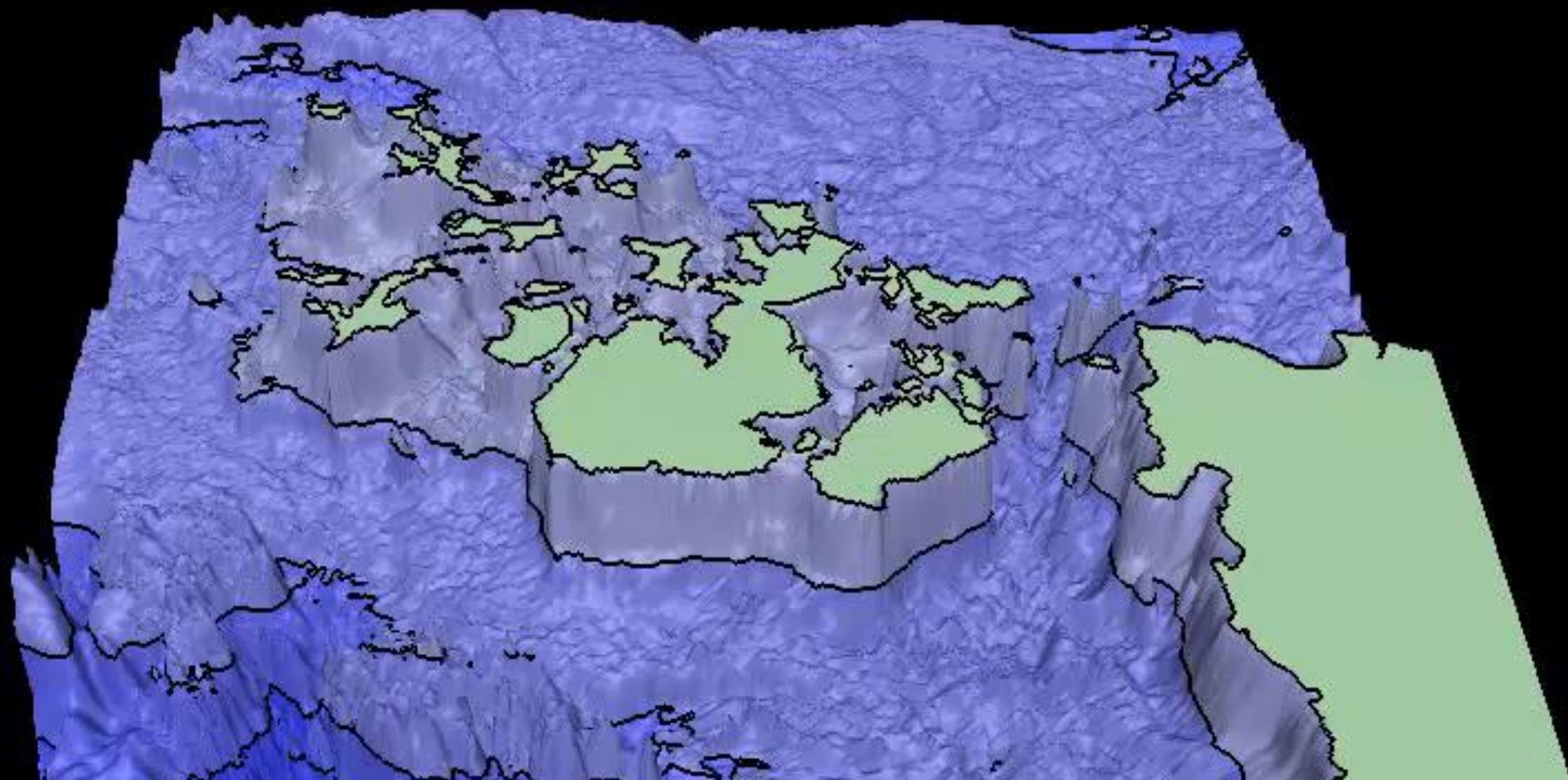
Google earth

2016-04-11 13:00:00Z

Tail 1 day

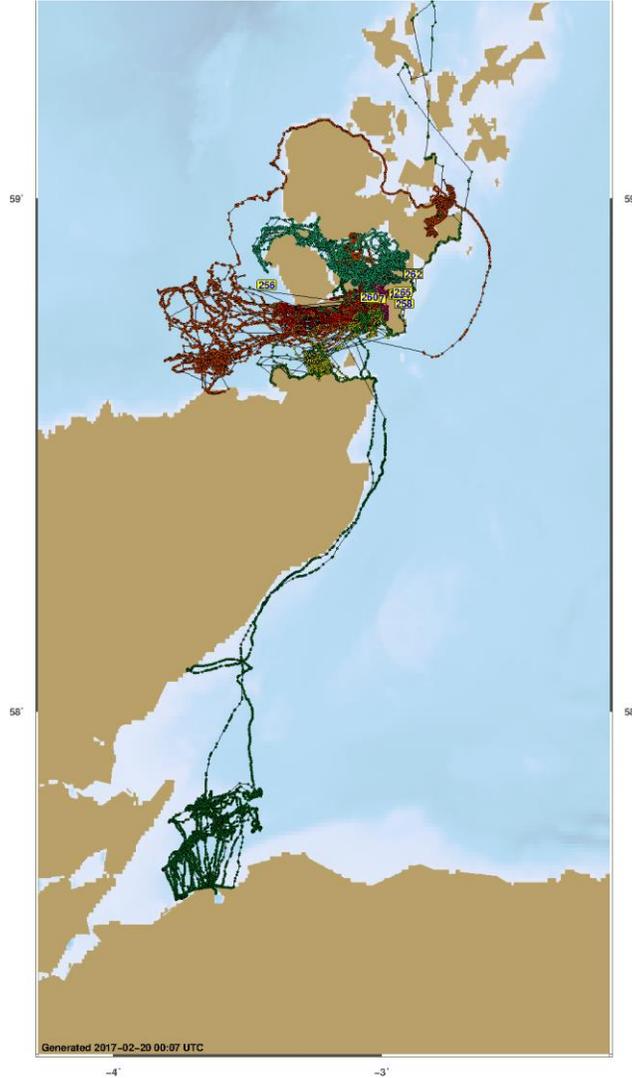


Sea Mammal  
Research Unit  
Instrumentation



# Harbour seal decline

what have we learned from M2M tags so far



- Identified at feeding area. Targeted for extensive study
- Followed individuals to their July breeding sites
- Quantified their geographical movement

## Future of long term study:

- More tagging in other areas with contrasting population trends
- Smaller NB-IoT tags



## the IoT, an ecologist's perspective

- low-energy sensors and comms
- determine behaviour
- determine population behaviour
- determine processes that drive behaviour
- predictive models



# Internet of the sea - vision



Universities  
Regulators  
Outreach  
Conservation  
**Telecoms Industry**

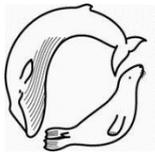
Statistical modelling  
Sensor development  
Low-energy systems  
Autonomous systems  
Material science  
Satellite comms

2018 Decade of Bio-Logging

# Marine Bio-Telemetry Centre



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Unit**



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Research Unit  
Instrumentation**

