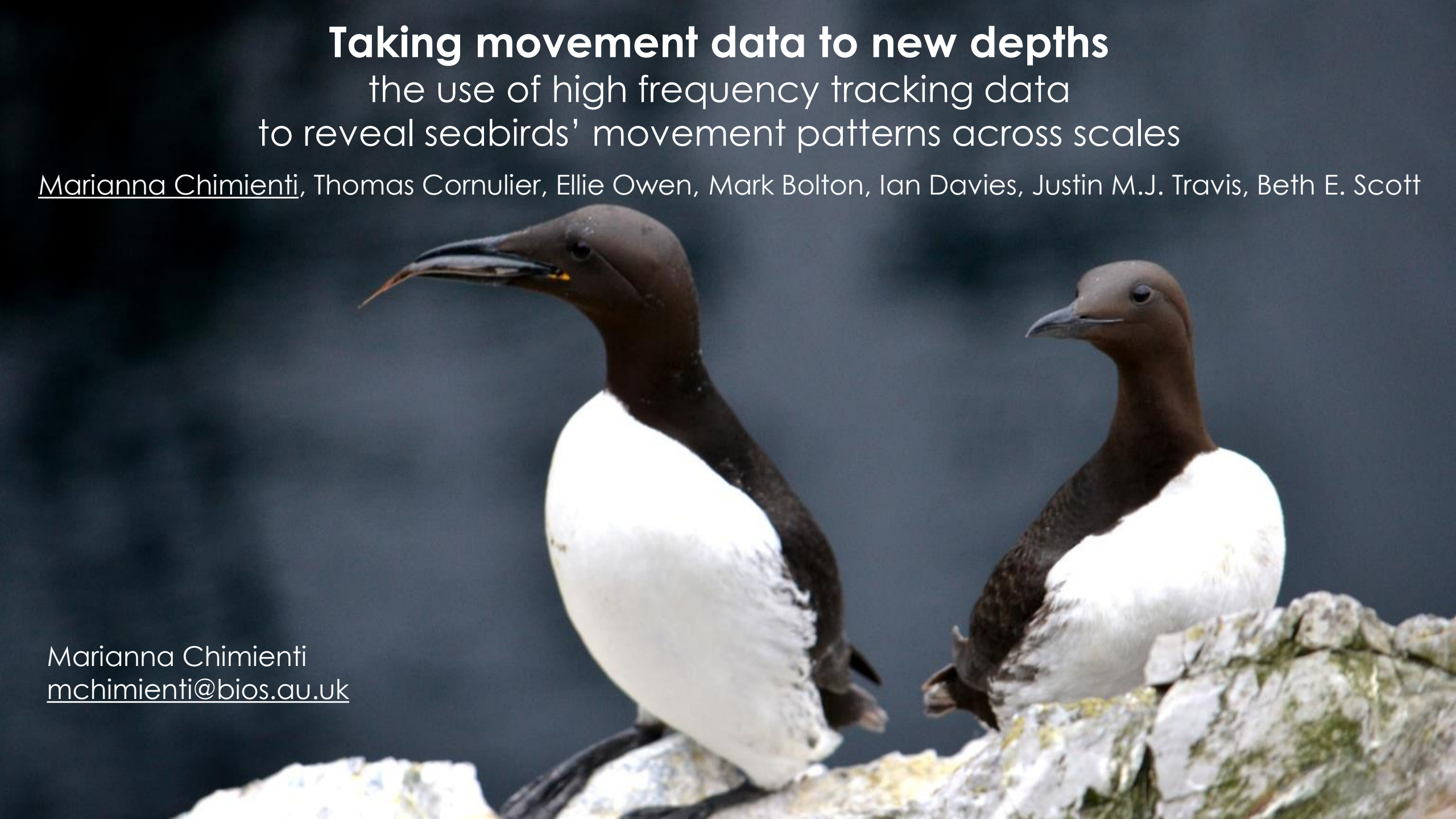
Taking movement data to new depths

the use of high frequency tracking data to reveal seabirds' movement patterns across scales

Marianna Chimienti, Thomas Cornulier, Ellie Owen, Mark Bolton, Ian Davies, Justin M.J. Travis, Beth E. Scott



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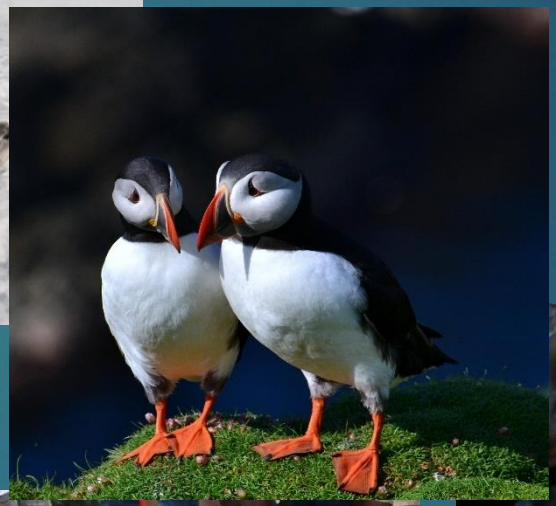
Why do we use movement data?

Marine environment

Terrestrial environment



….THE MARINE ENVIRONMENT IS DIFFICULT TO MONITOR

Animals move in 3 dimensions

High variability of resources in space and time

Monitoring how animals relate to their environment and make decisions is still poorly understood

The case of foraging seabirds

Top predators move in multiple dimensions (and environments):

horizontal movements

Used to move between food locations

vertical movement (diving)

Used to locate, chase and catch prey

prey capture

Large scale (100 Km, Days) GPS

Fine scale (meters, Seconds) Accelerometer

DATASET USED

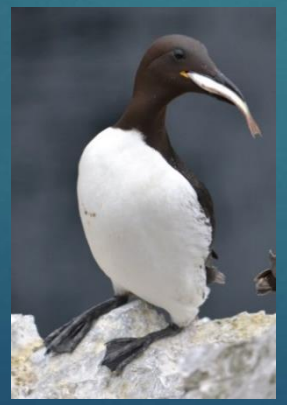
Data collected:

GPS + Accelerometer

- Position in space and time
- Depth
- Temperature
- Body Orientation
- Acceleration in 3D

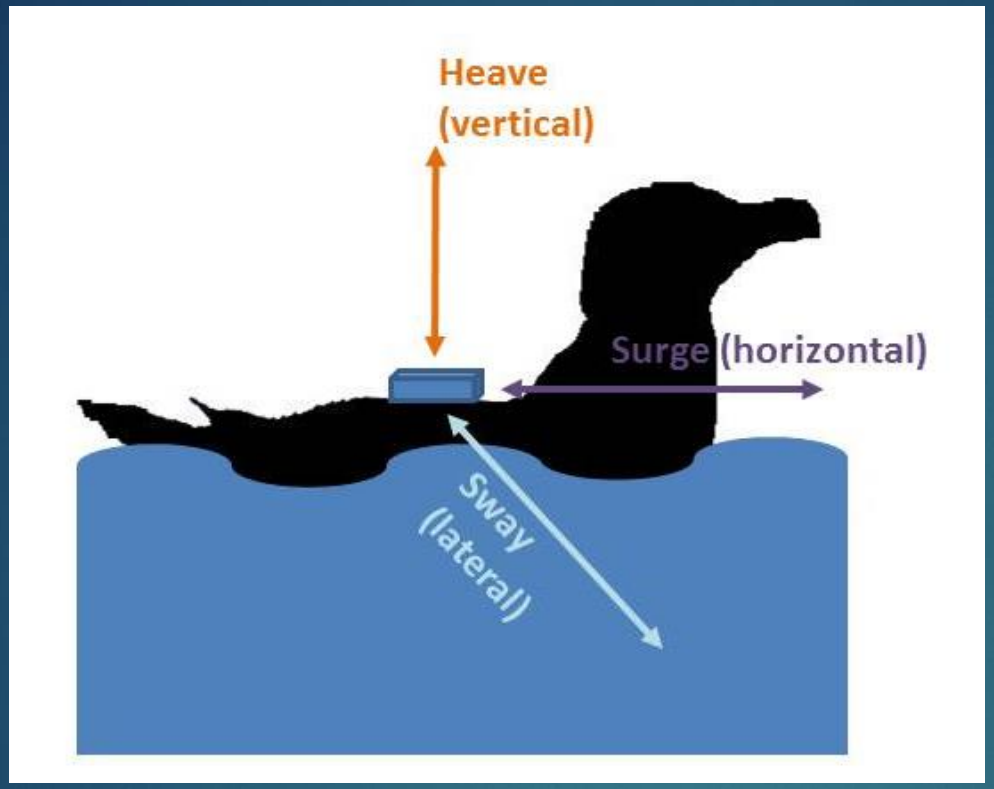
Study Species:

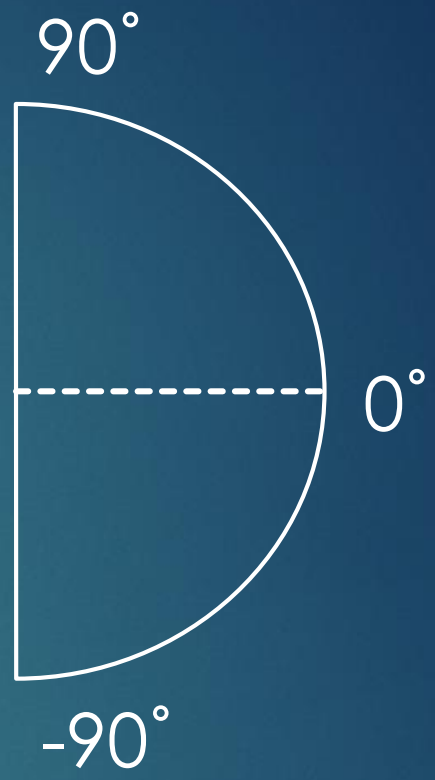
4 x Common guillemot (Uria aalge)



5 x Razorbill (Alca torda)

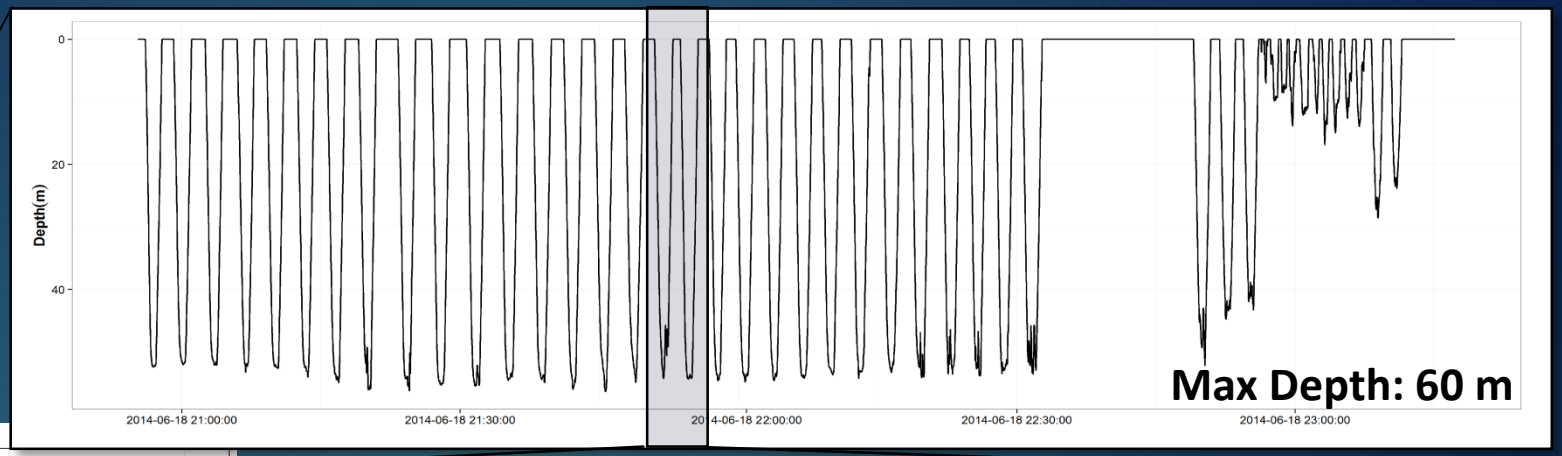
What can accelerometers tell us?

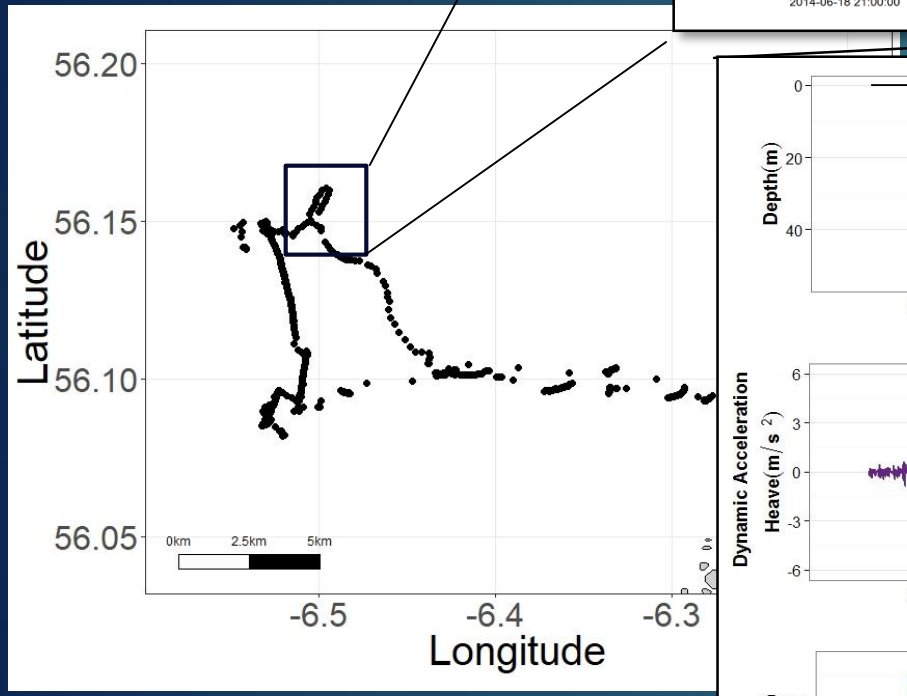


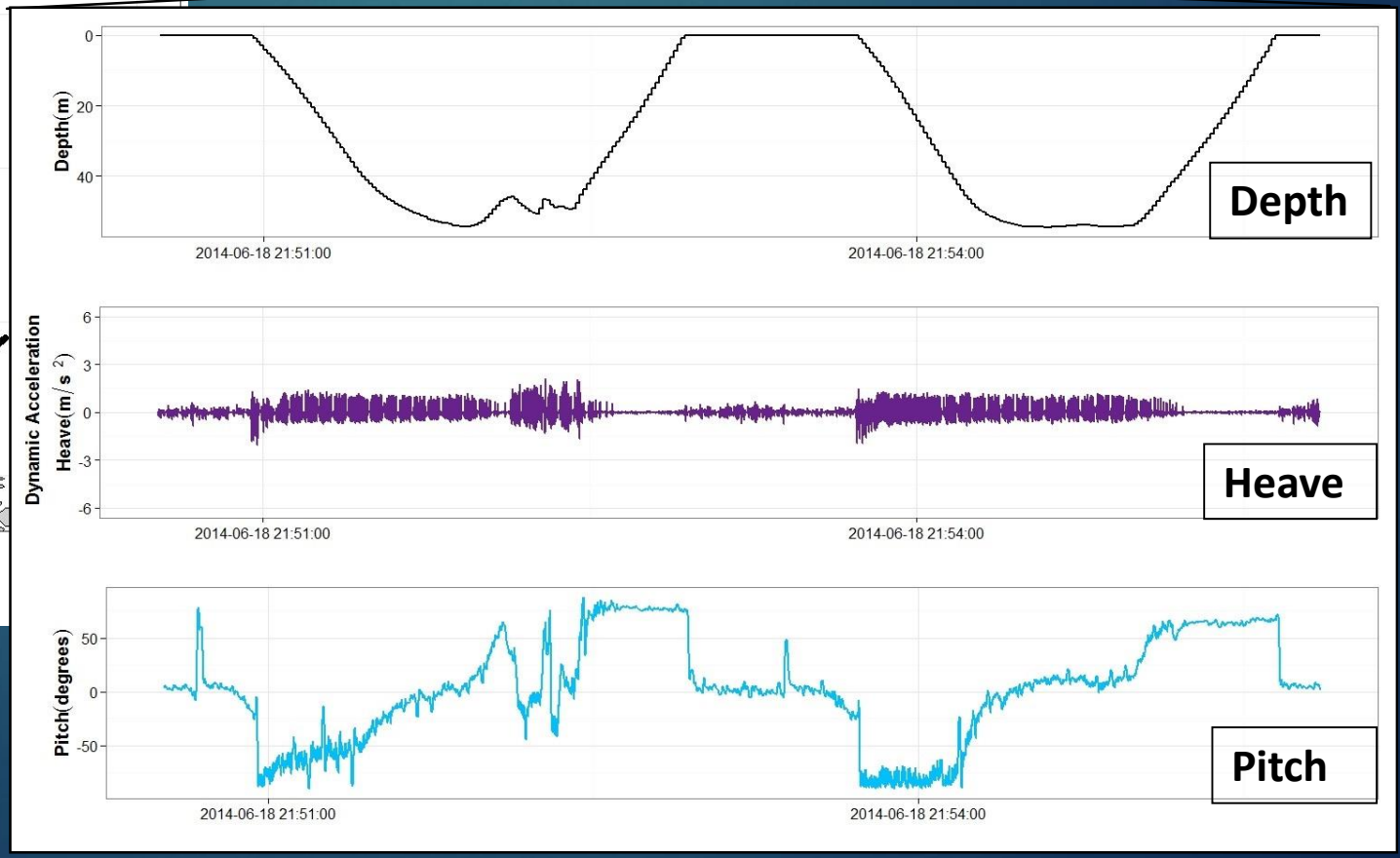


- ✓ Static Acceleration: measure of the body angle of the instrumented animal
- ✓ Calculation of the body Pitch: vertical orientation of the body angle
- ✓ Dynamic Acceleration: measure of the change in velocity as a result of body motion.

Common guillemot (*Uria aalge*)







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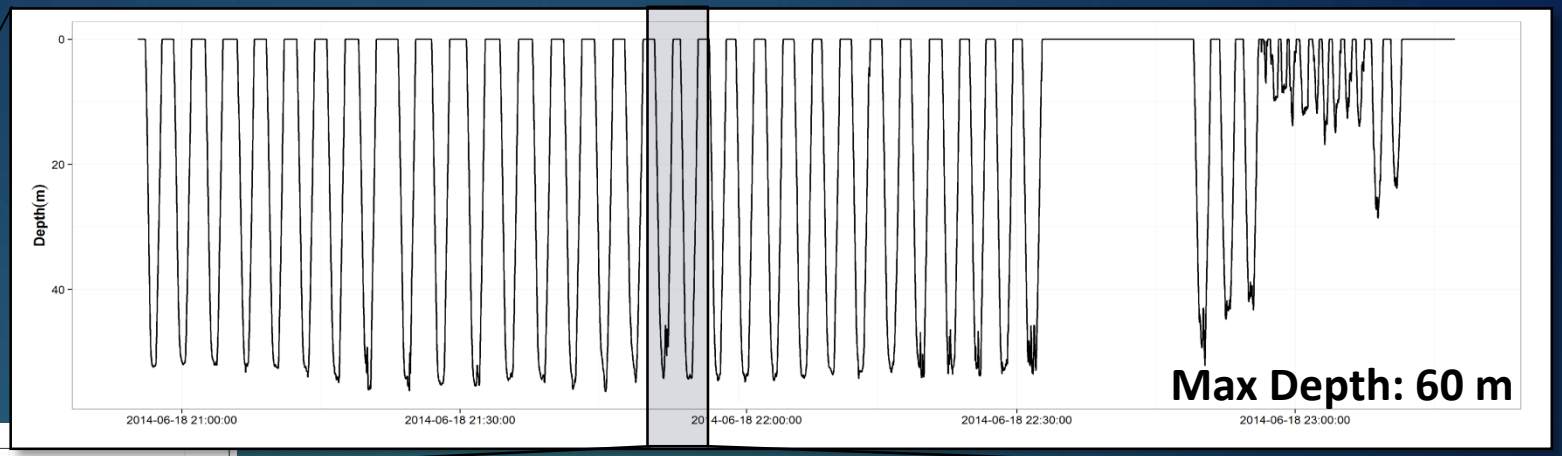
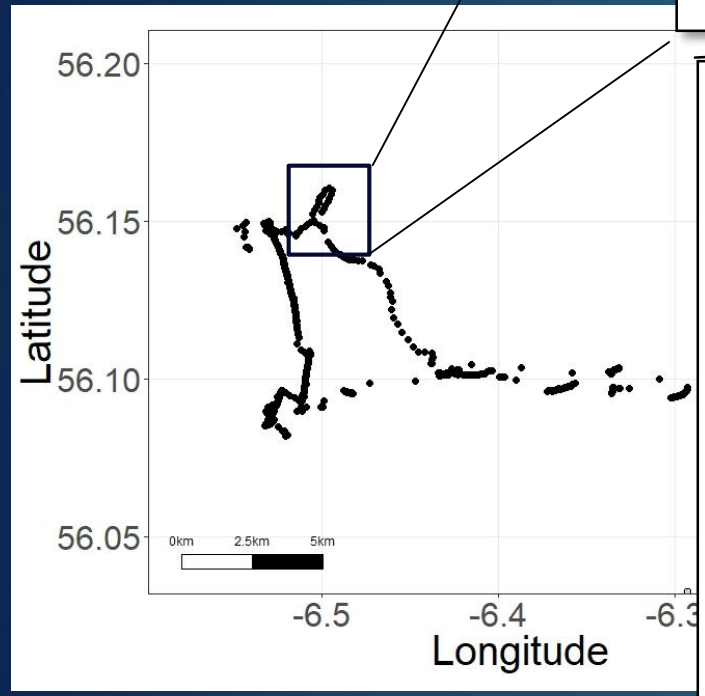
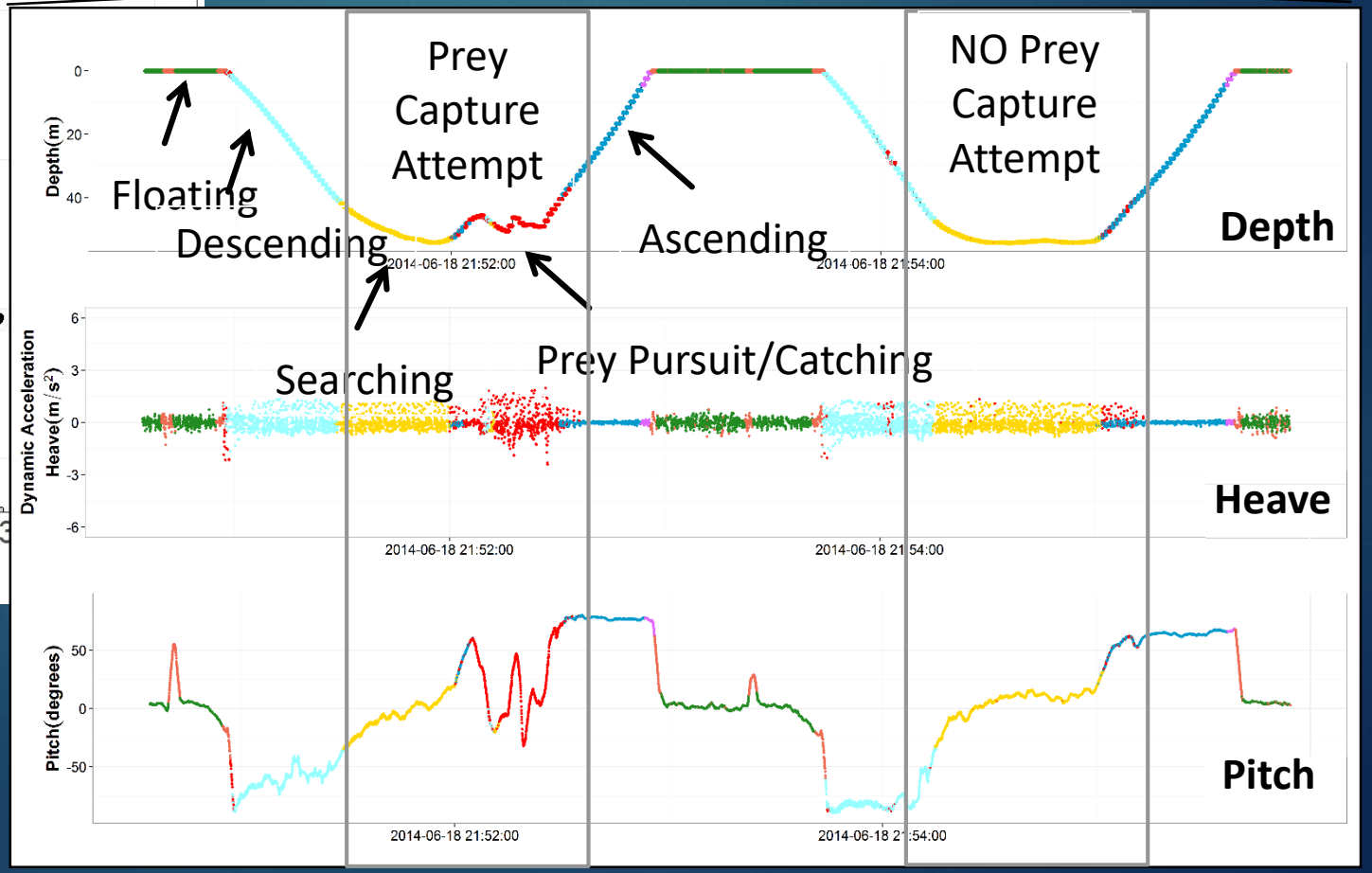
Common guillemot (*Uria aalge*)







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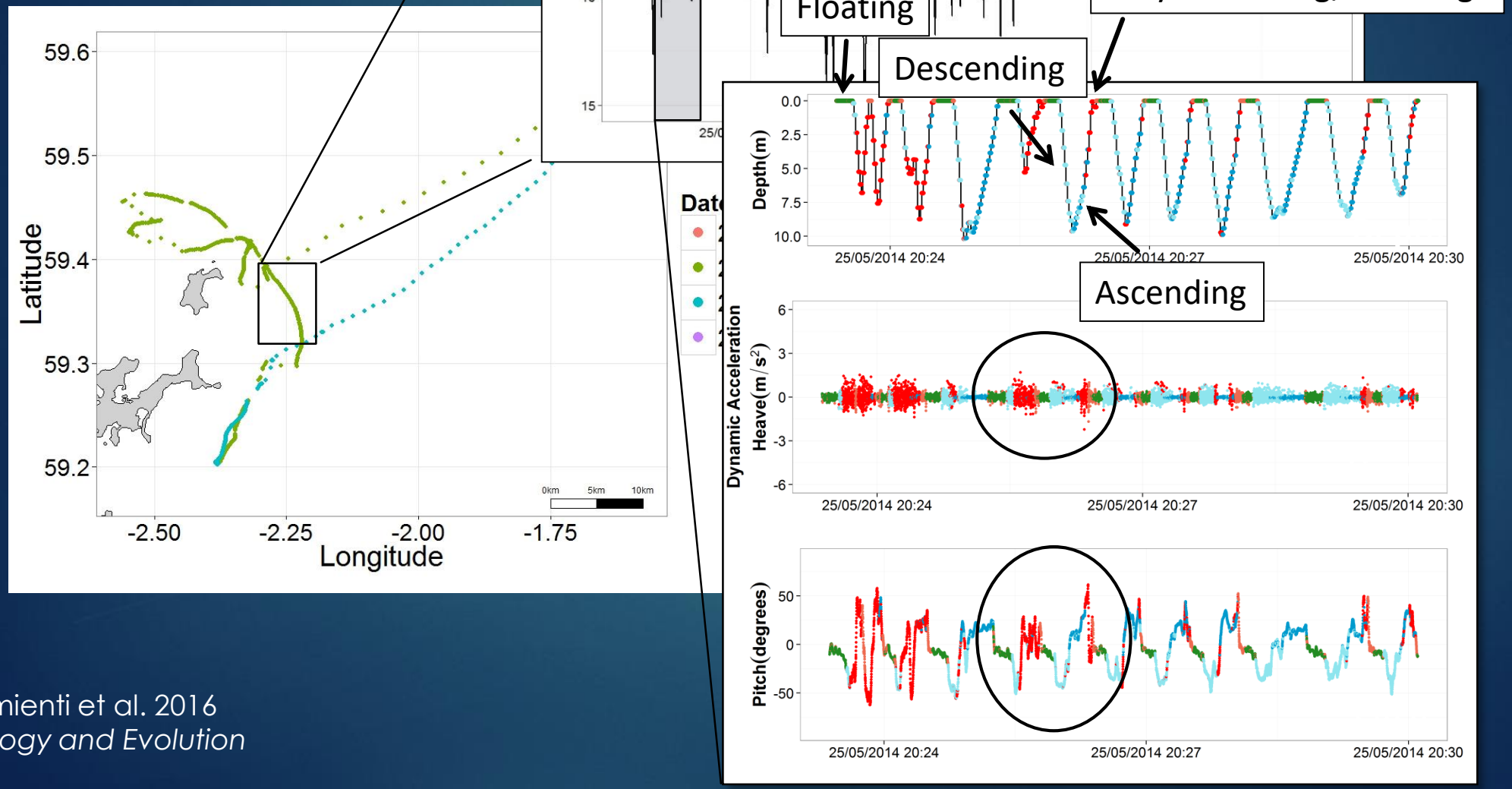
Razorbill
(*Alca torda*)



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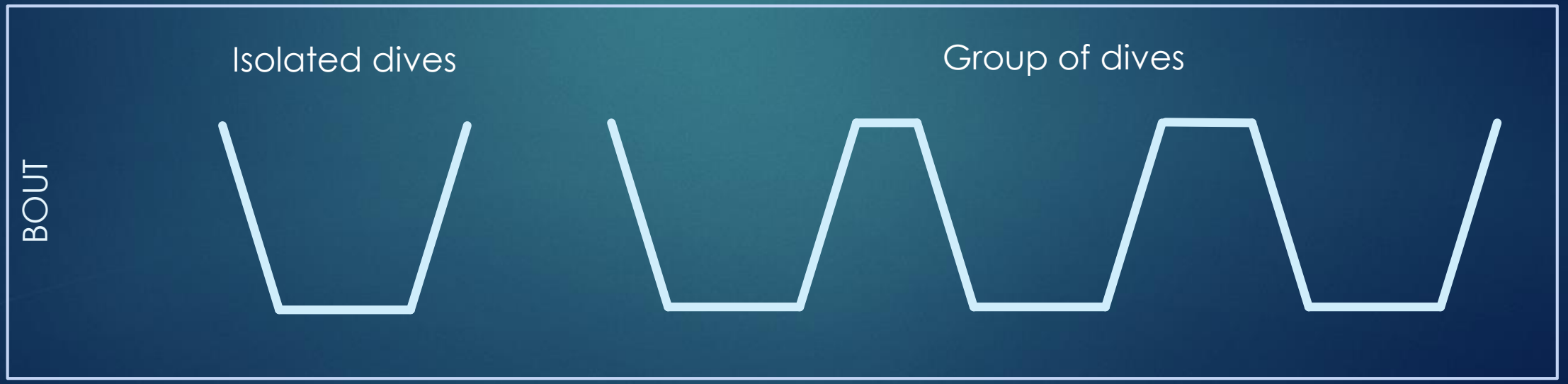
Analysis of foraging events and Prey Capture Attempts



Underwater foraging effort:

Number of Prey Capture Attempts as response of dive duration and depth for each individual dive

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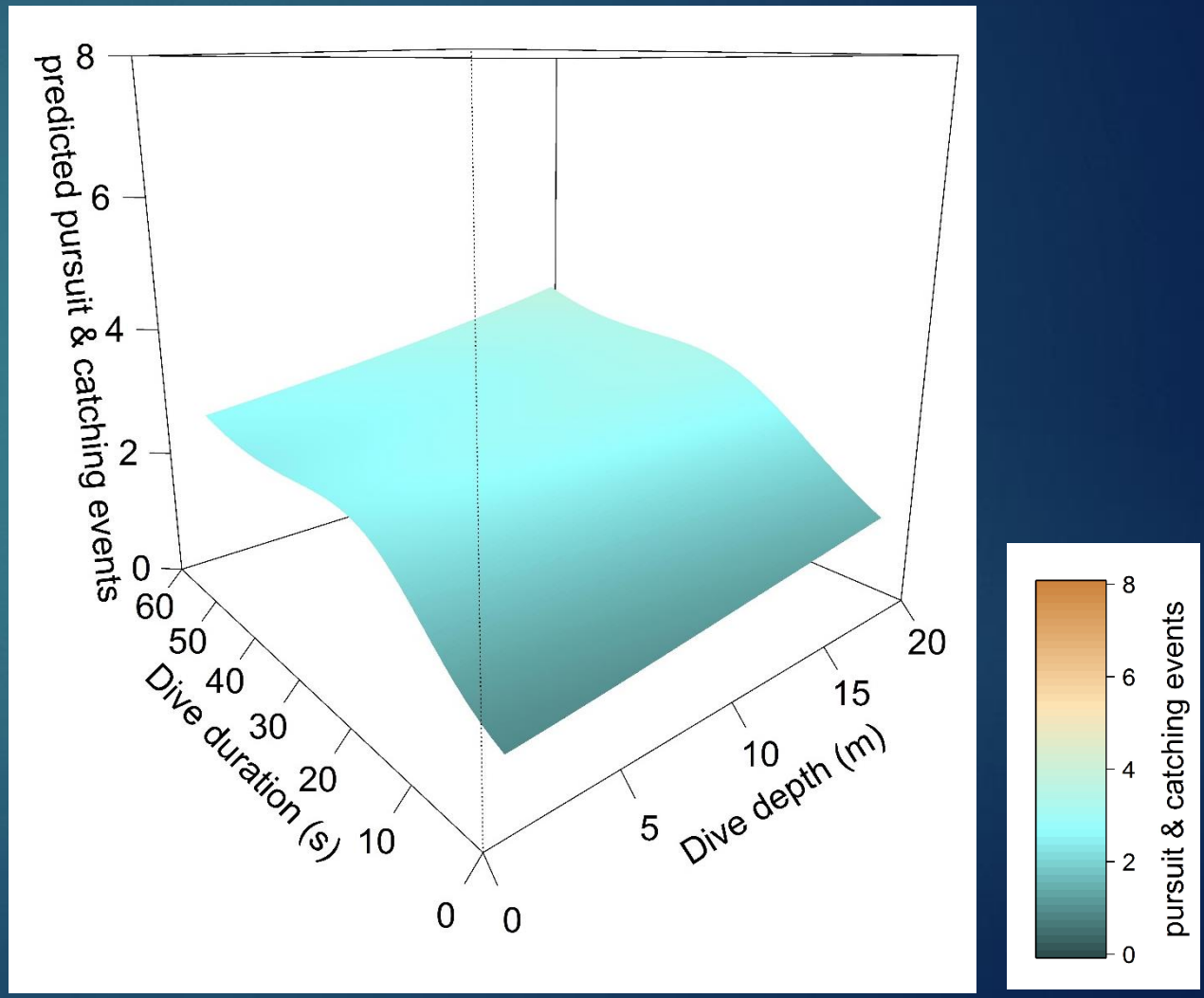
Number of Prey Capture Attempts as response of dive duration and depth for each individual dive

Rapid increase with dive duration

Intense effort between 20-40 s at shallow depths: targeting shallow fish aggregations?



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Underwater foraging effort:

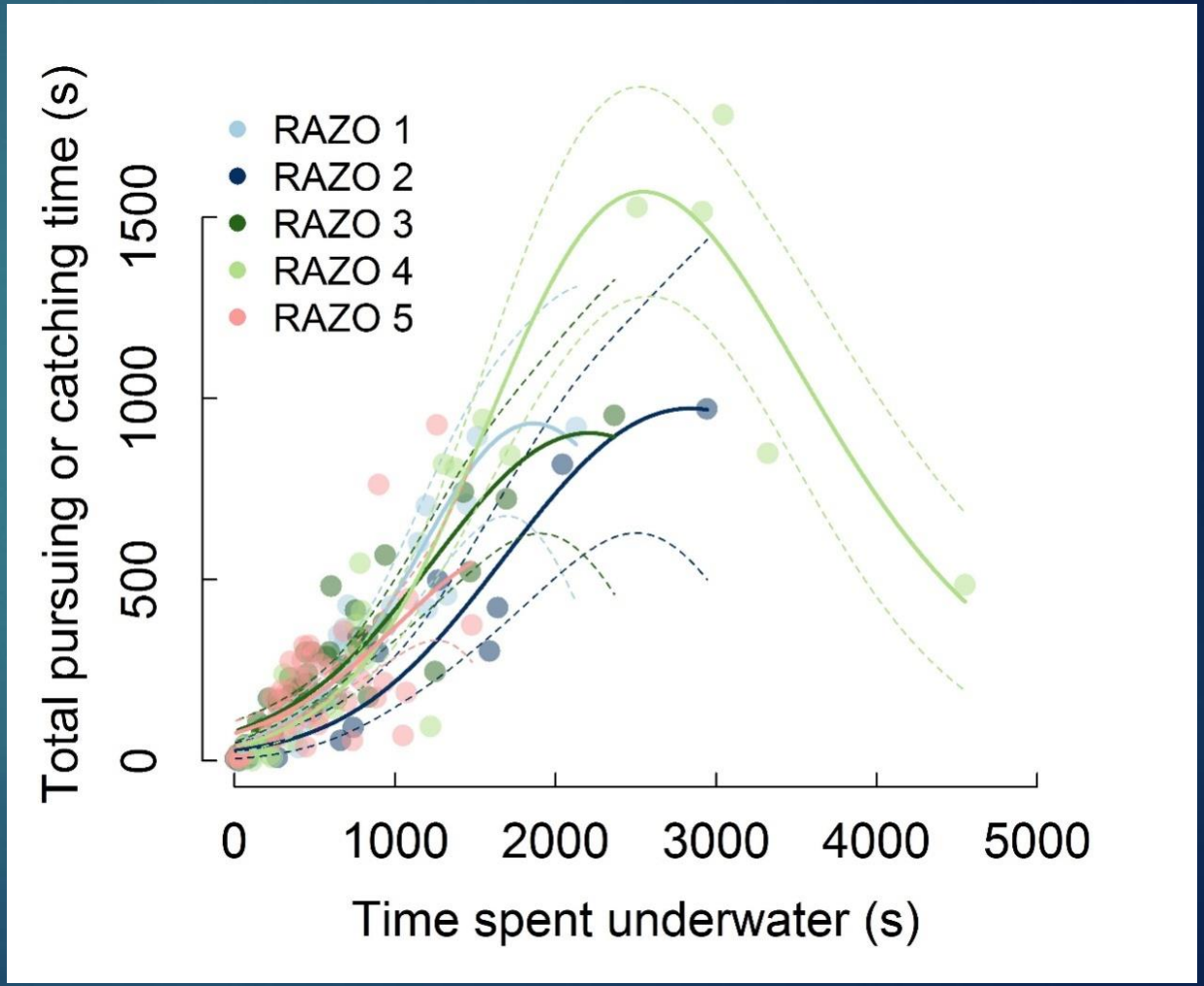
Total time spent catching as a response of time spent underwater in a dive bout

Underwater foraging effort:

Total time spent catching as a response of time spent underwater in a dive bout

When is the animal leaving the patch?

How the experience of the previous patch is affecting the behaviour performed in the current patch?



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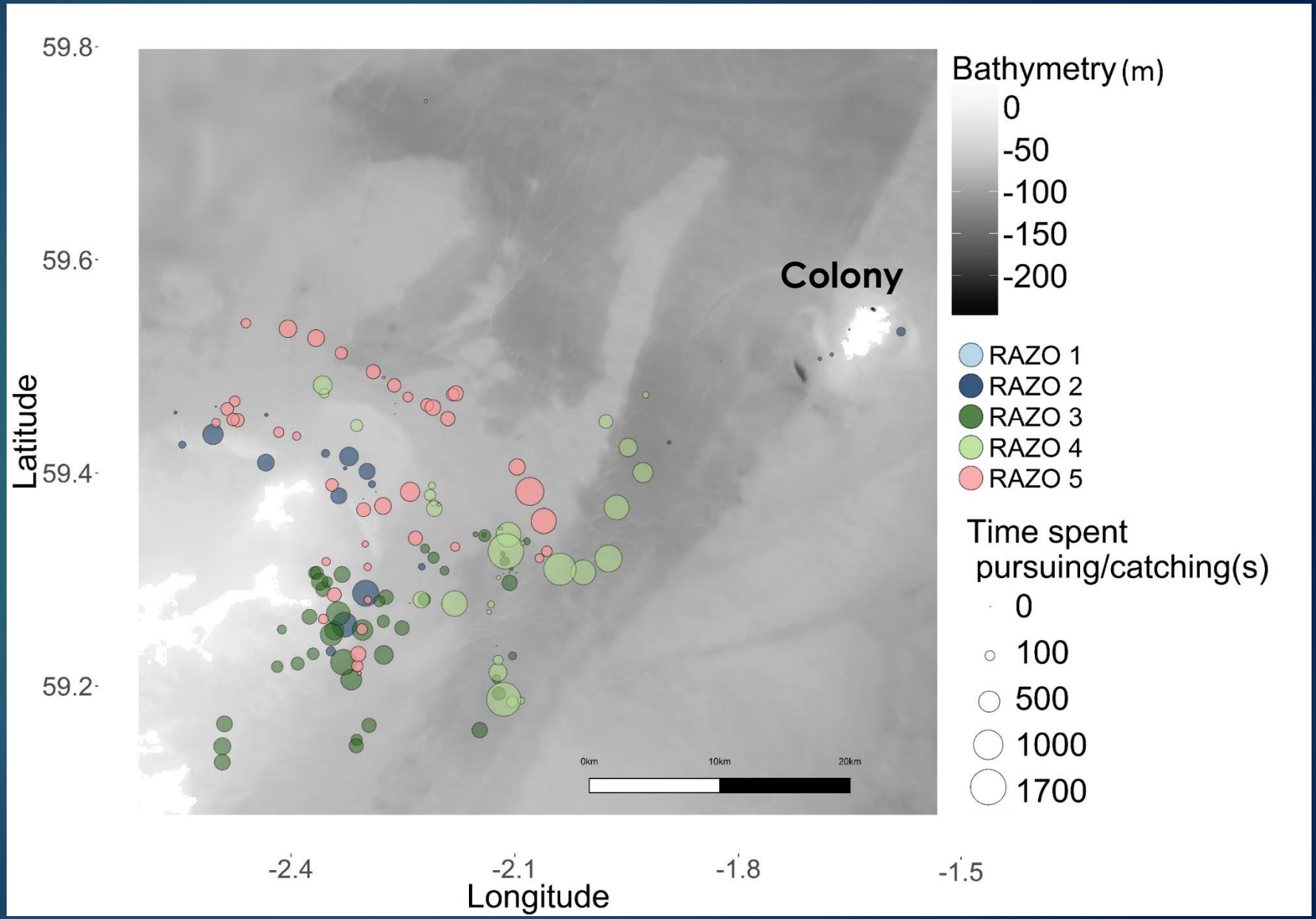
Razorbill (*Alca torda*)

Consistency of foraging areas used:

Between different foraging trips

effort invested in specific areas



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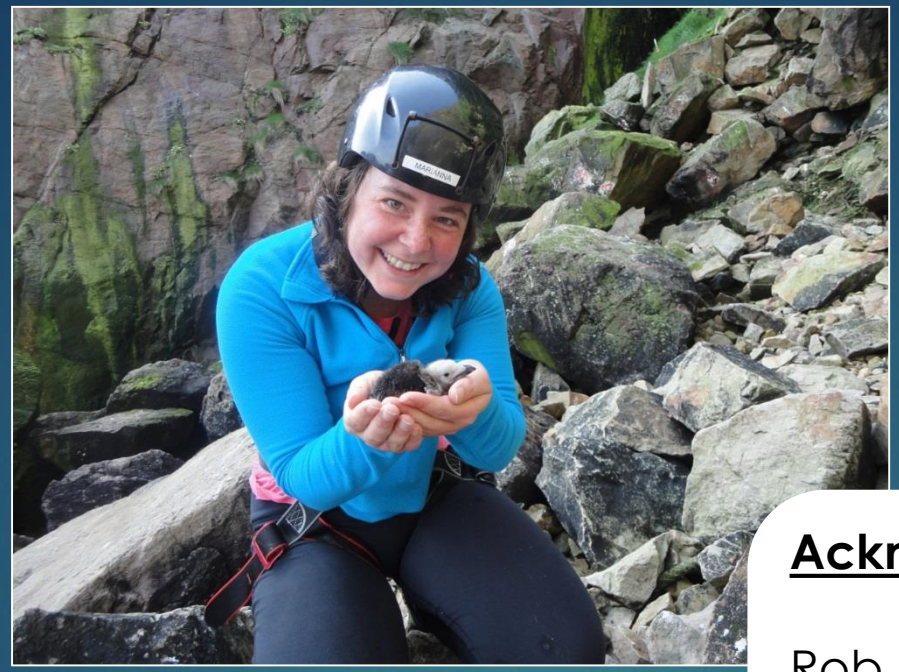
CONCLUSIONS: the use of high frequency movement data as an opportunity to explore the movements of foraging seabirds across scales

Prey capture attempts and time spent chasing or catching can be an indicator of effort invested while foraging

These new modelling approaches in conjunction with fine scale data about prey density and distributions will play an important role in clarifying type of habitat and prey selected as well as effort invested in specific areas.

Approach performed on few individuals and at very fine scale. However it provides solid foundations for the analysis of long-term movement datasets and for informing species monitoring approaches and marine spatial planning.



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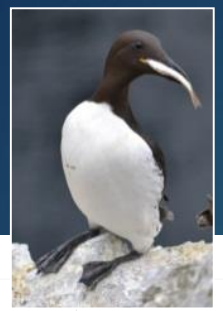

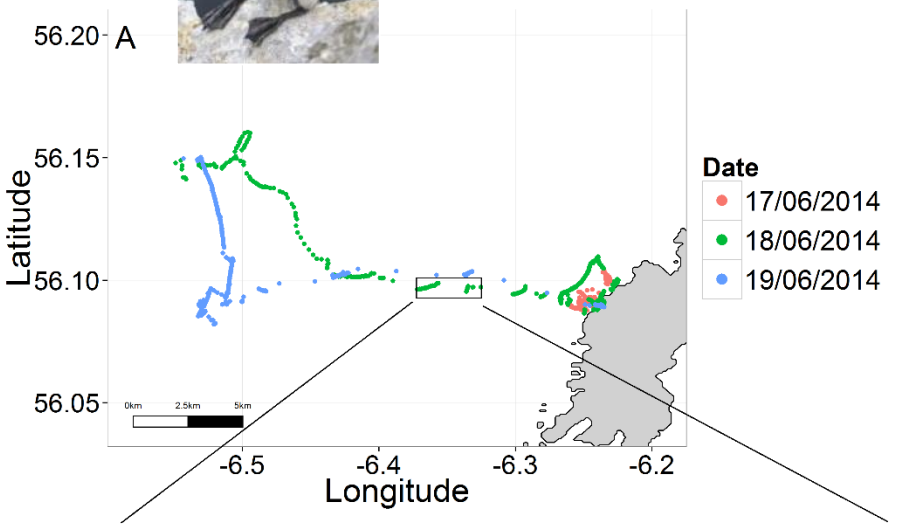
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56.15
56.10
56.05
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-6.4
-6.3
-6.2
Longitude
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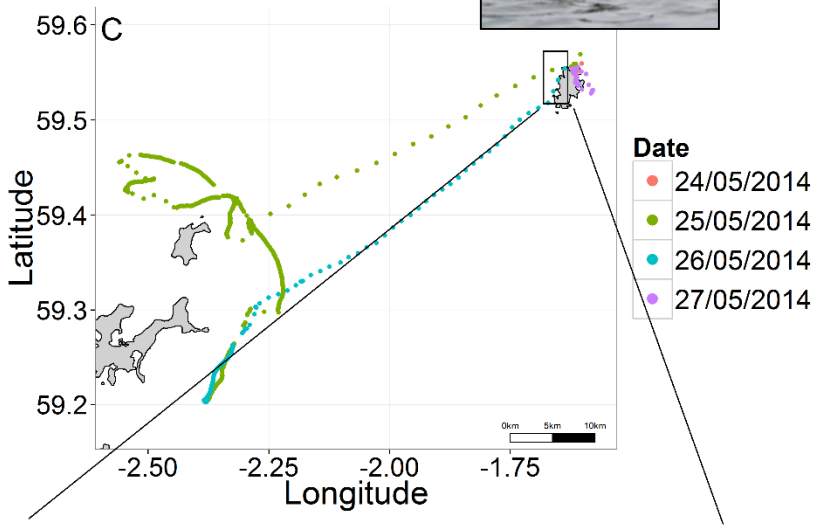
5km
Date
17/06/2014
18/06/2014
19/06/2014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59.2
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Date
24/05/2014
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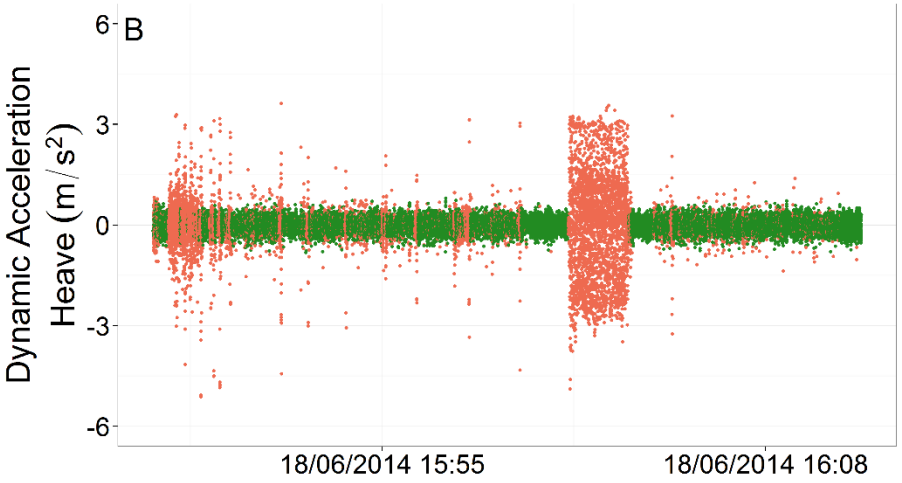
26/05/2014
27/05/2014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Dynamic Acceleration
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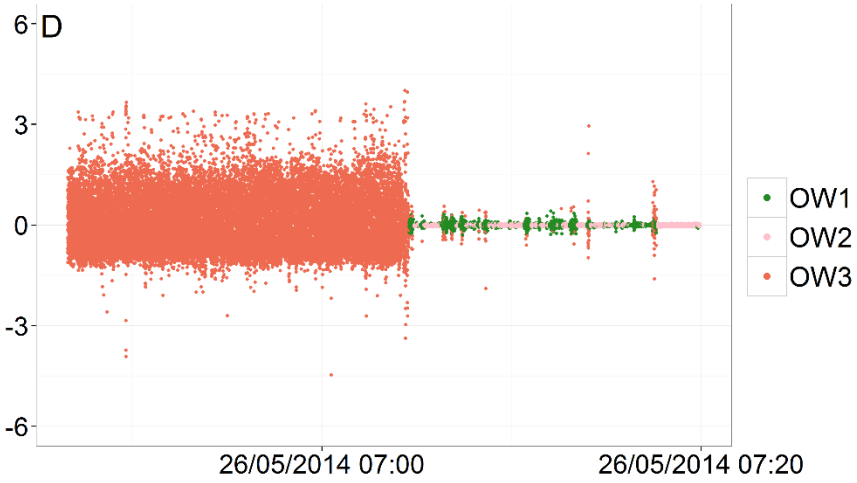
18/06/2014 16:08


D
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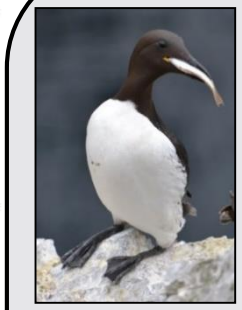
OW1
OW2
OW3

How do they use the water column?

Common guillemot (*Uria aalge*)



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