

FLOWBEC Integrated Monitoring Platform and Integrated Surveys

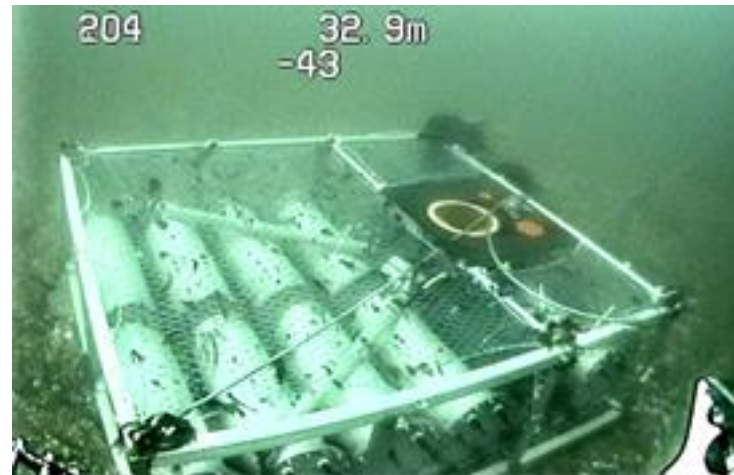
Benjamin Williamson, Beth Scott, Philippe Blondel, Paul Bell
Ana Couto, James Chapman, James Slingsby



FLOWBEC Integrated Monitoring Platform

Detection, tracking, classification and kinematic metrics:

- Fish (prey), bird and marine mammal distribution
- Animal behaviour, predator-prey interactions
- MRED interactions, encounters, collision risk
- Entire water column (vertical/horizontal evasion)
- **24/7** irrespective of visibility / illumination, continuous across **spring-neap** cycle
- Concurrent physical explanatory variable (bio-physical forcing)
- Predictability and **transferability** of results between sites



FLOWBEC Instrument Suite

Need **concurrent** information on:

- Hydrodynamics



ADV & ADCP



- Animal distribution
and identification



EK60 echosounder



- Animal behaviour
(predator-prey and animal-turbine interactions)



Multibeam echosounder



Fluorometer /
turbidimeter

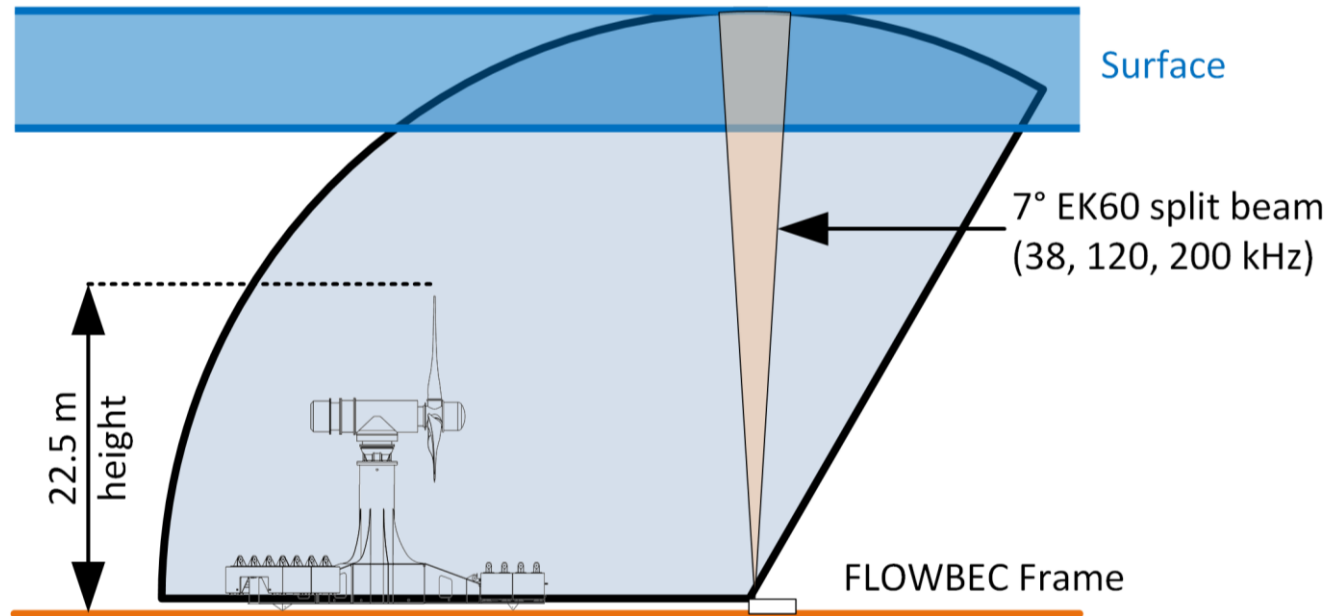


Camera



PAM (hydrophones)

Target Co-registration



Multibeam (260 kHz):

- Target velocity, behavior
- Predator-prey interaction
- Turbine encounter (e.g. evasion)
- School morphology

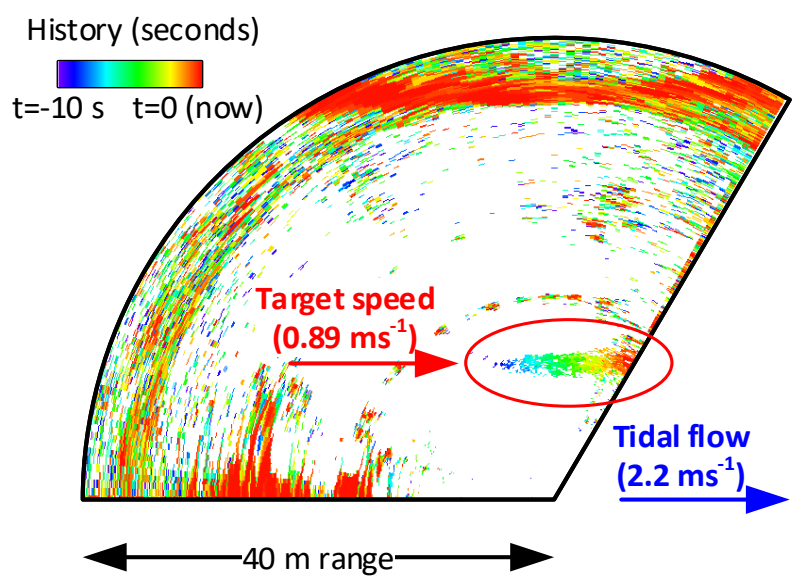
Co-registered targets information combined

EK60 (38, 120, 200 kHz):

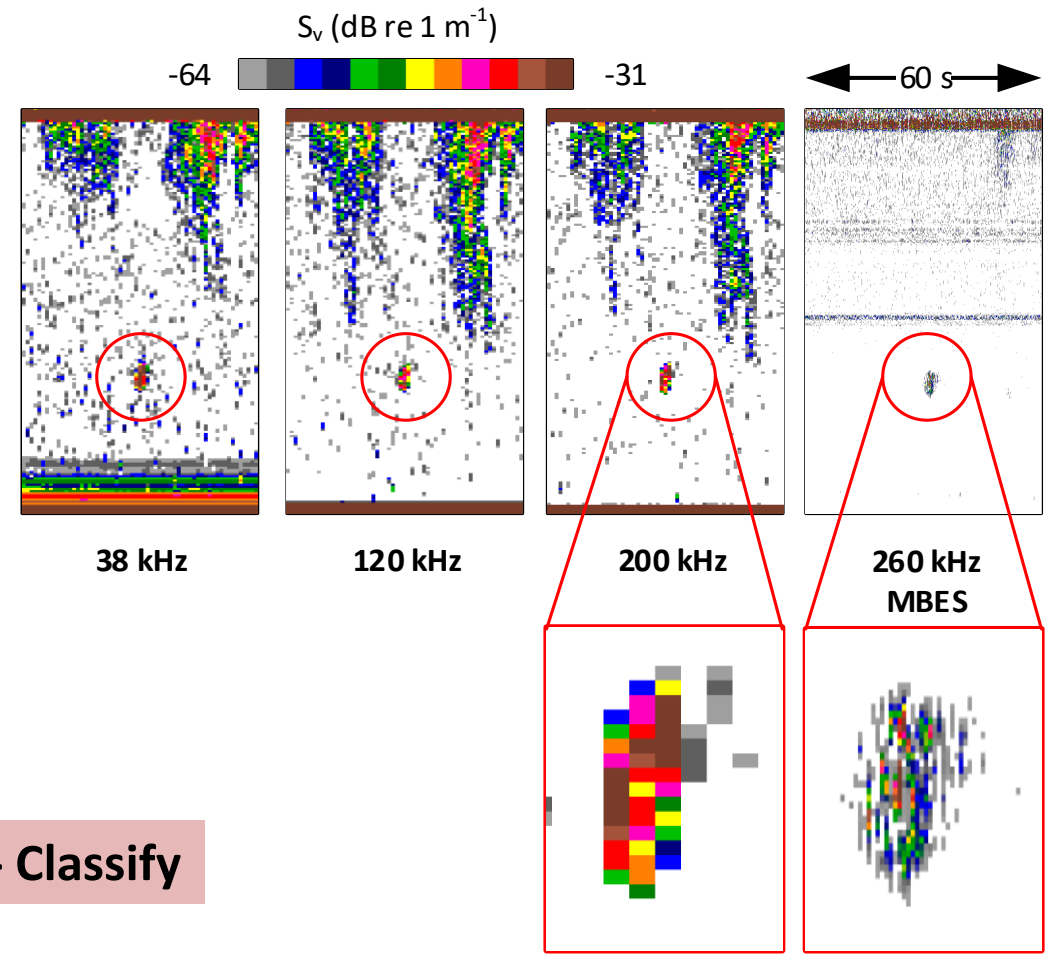
- Higher sensitivity
- Calibrated multi-frequency ID
- Quantitative abundance
- Turbulence morphology

Target Co-registration

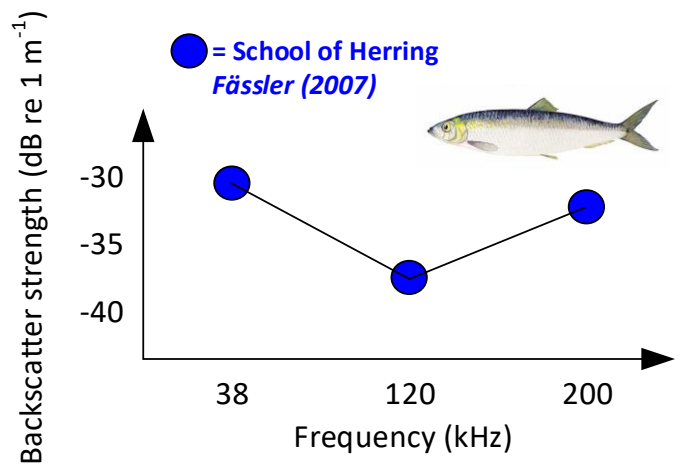
2 - Track



1 - Detect



3 - Classify



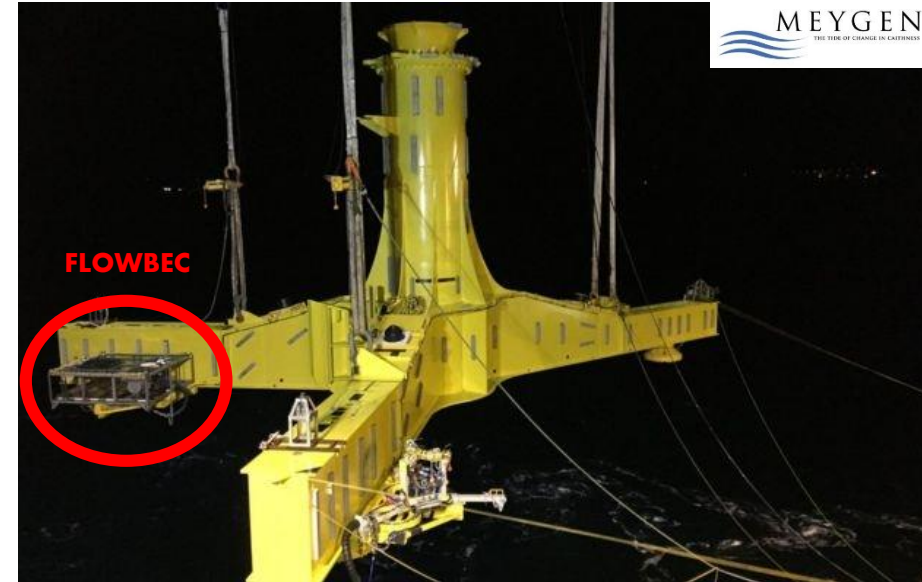
Autonomous or Cabled Configuration



66+ kWh batteries for 2 week – 3 month deployment, depending on sensors

Before/after or control/impact studies, floating or seabed turbines...

Rechargeable in 24-h neap window
Recovery using small ROV to attach lift line



Or cabled to a structure (e.g., tidal turbines, wind turbine pilings)...

Realtime data, longer endurance

Predictable Changes in Fish School Behaviour around Structures

- 1.74 times more fish (prey) around turbine structure
- Vertical distribution changes
- 5.66 times more in low-speed wake (blue bars)

Why it's important...

<http://tinyurl.com/FLOWBECfish>



Predictable changes in fish school characteristics due to a tidal turbine support structure

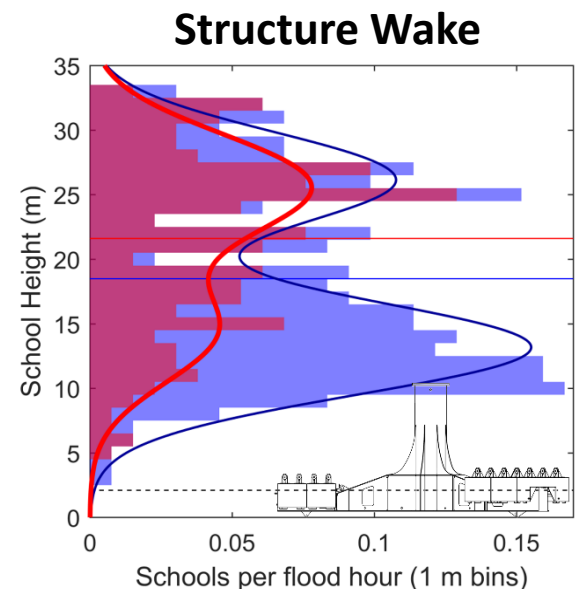
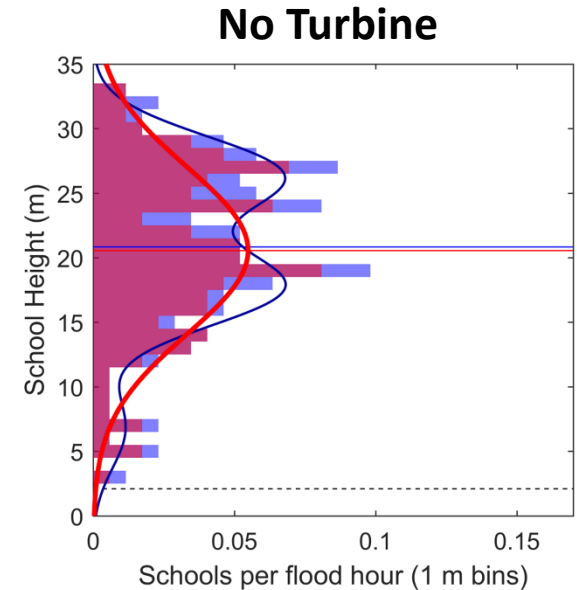
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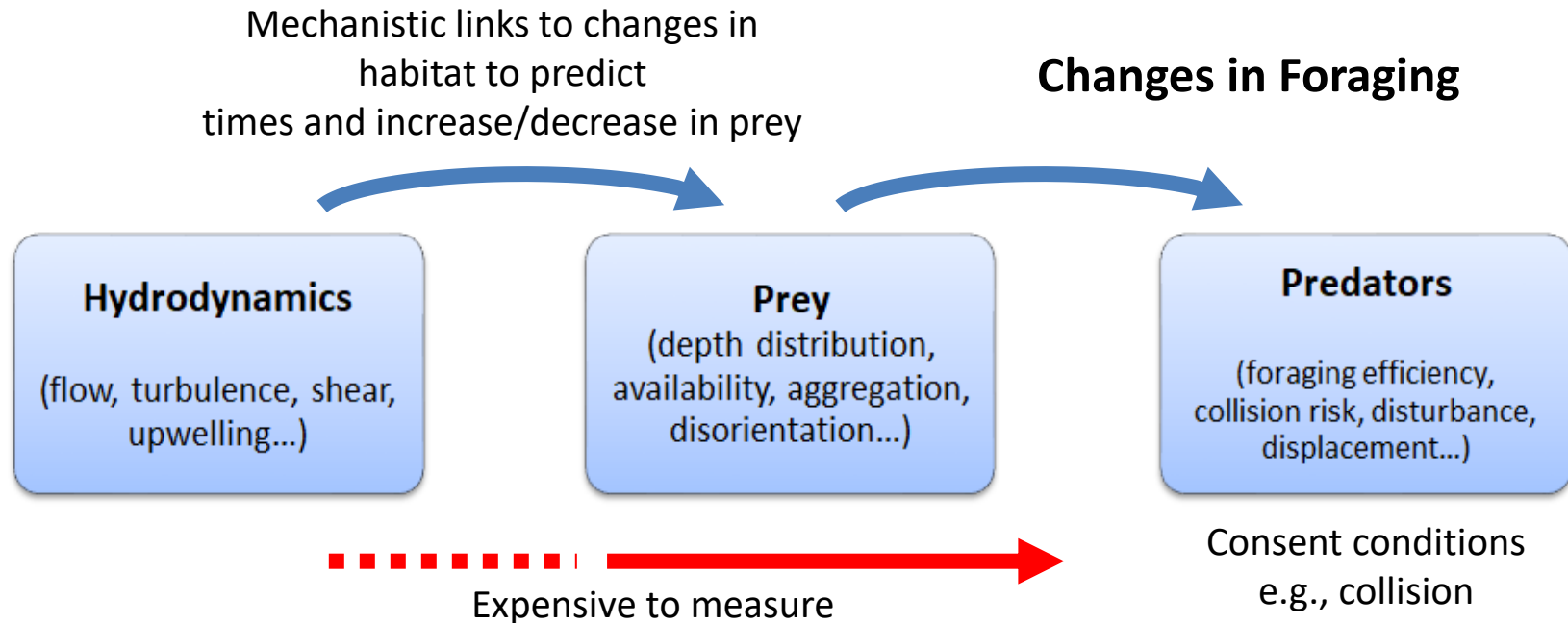
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Integrated Platforms – The Bigger Picture

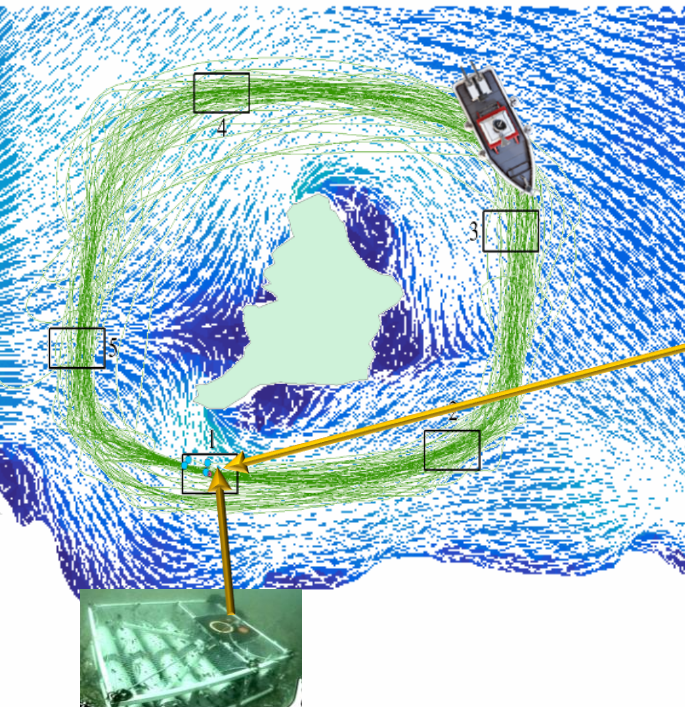


Why are we measuring the physics and the prey together – when consenting risks are mainly about top predator populations?

If we can predict high/low times of risk of collisions from presence of prey or even just from hydrodynamics – cost of monitoring and mitigation techniques will decrease substantially

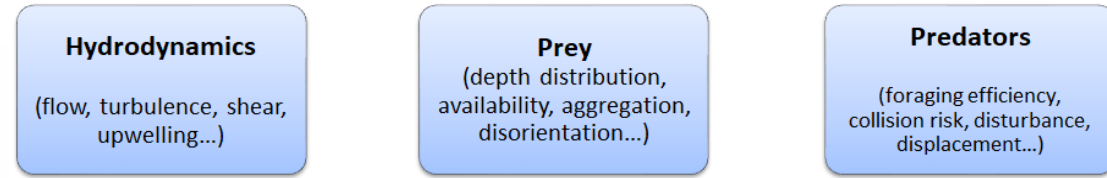
Integrated Platforms – The Bigger Picture

Using physical habitat to predict important foraging areas



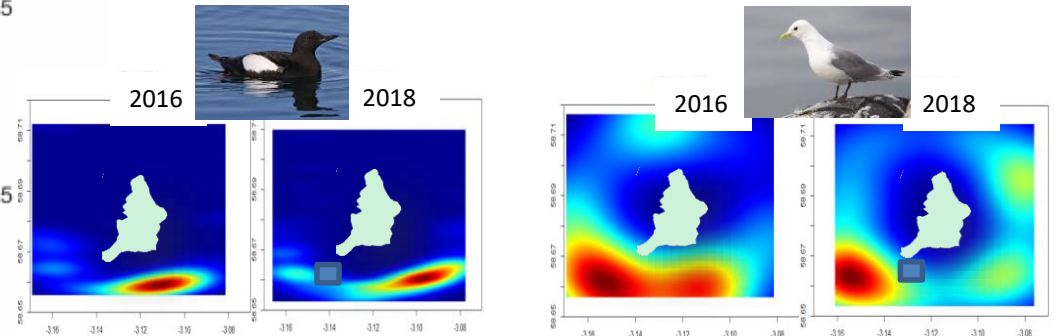
Mechanistic links to changes in habitat to predict times and increase/decrease in prey

Changes in Foraging



Expensive to measure → Consent conditions e.g., collision

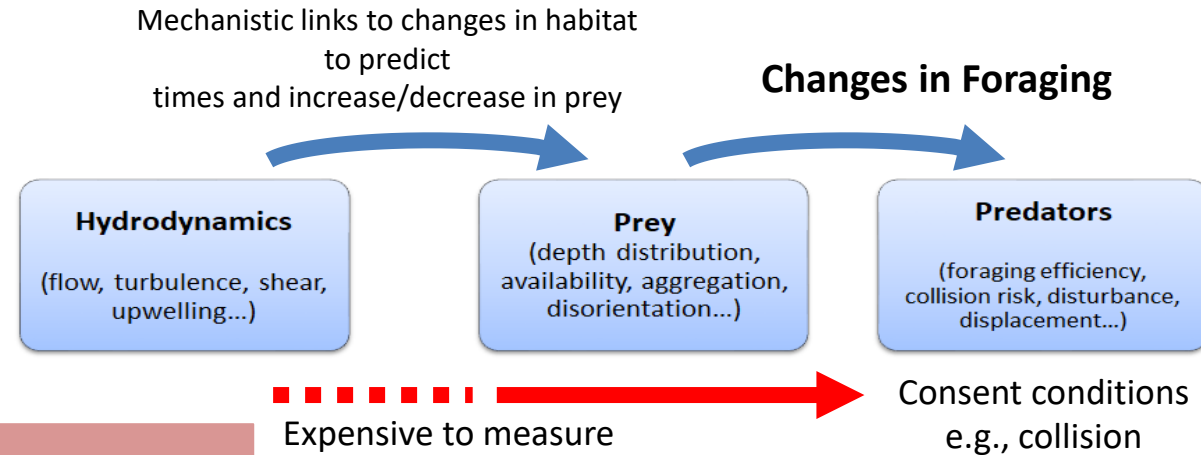
Before and After turbines: To understand the physical effects of turbines – predict effect on prey and change in predator behaviour.



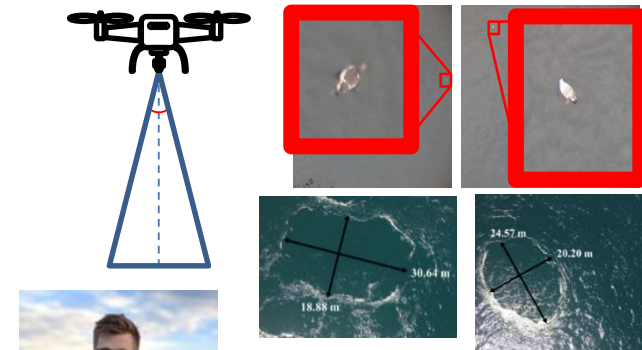
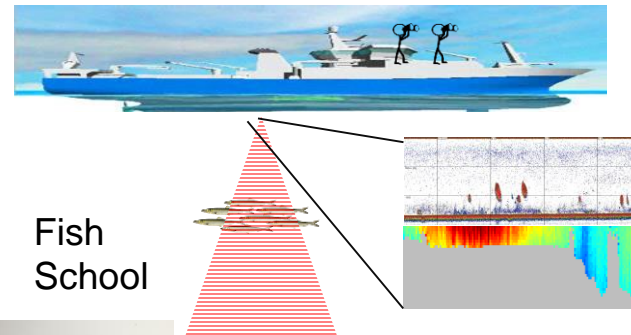
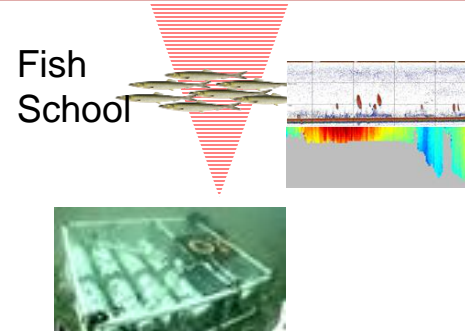
Integrated Platforms – The Bigger Picture

Current PhDs

- JC - Linking changes in habitat to populations
- AC - Linking physics to prey to predators
- JS - Using drones to understand predator/habitat links



Email EIMR2020@uhi.ac.uk to view




James Chapman



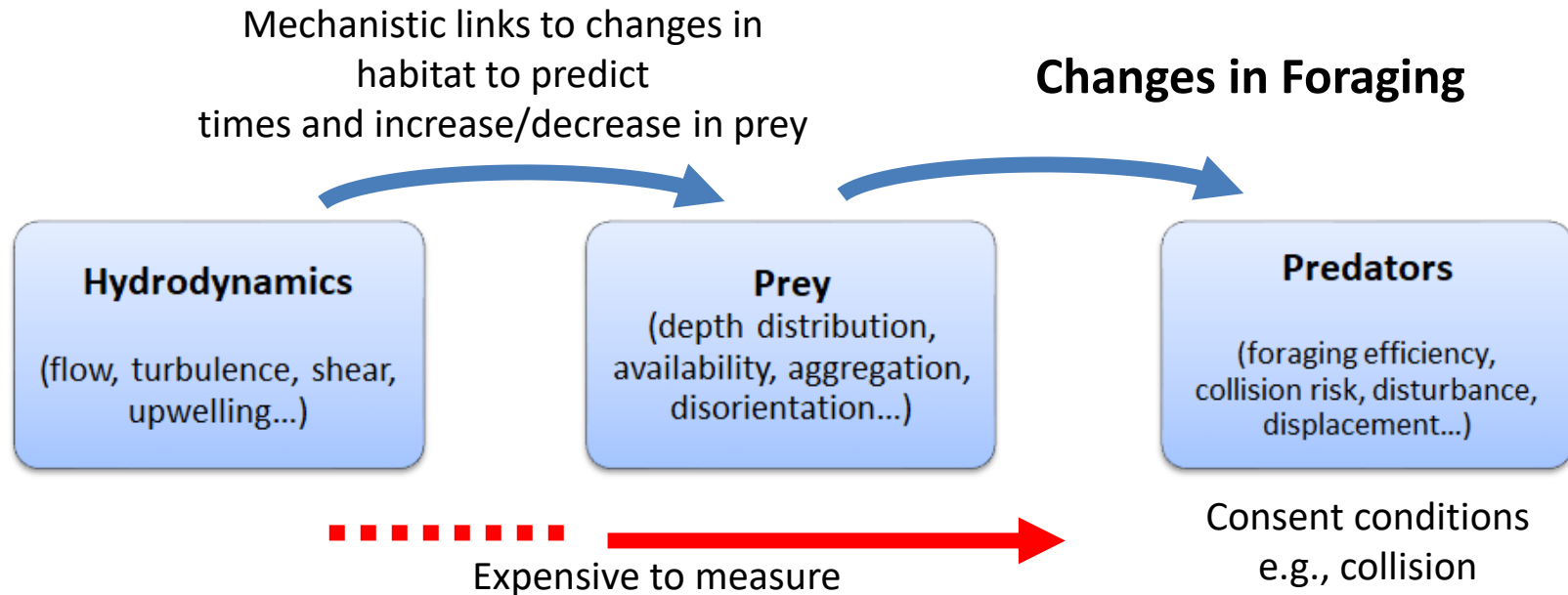

Ana Couto




James Slingsby



Integrated Platforms – The Bigger Picture



- **By measuring the physics, prey and predators simultaneously - we are gaining insights into predictable predator foraging use high energy environments.**
- **Useful for predictive power in population level changes of predators at all sites.**
- **In the long run, this approach will evolve to very cost-effective monitoring.**

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