

Insights into harbour porpoise distribution and foraging

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The Scottish
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Harbour porpoise (*Phocoena phocoena*)

- Most common cetacean in UK
- Encountered in most offshore developments
- Unknown seasonal distribution
- Killed by bottlenose dolphins

Aims

- Develop better understanding of porpoise distribution to inform management
 - Are there particular high density areas?
 - Are these consistent between summer/autumn
 - How might inter-specific competition influence distribution?

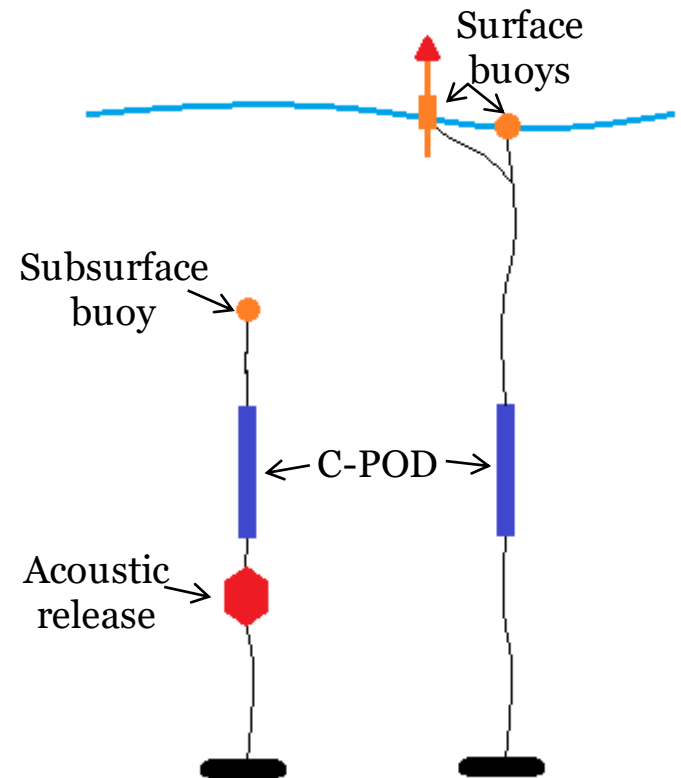
Passive Acoustic Monitoring

- Harbour porpoise vocalise continuously
 - Navigation, communication, foraging
- Echolocation recorders



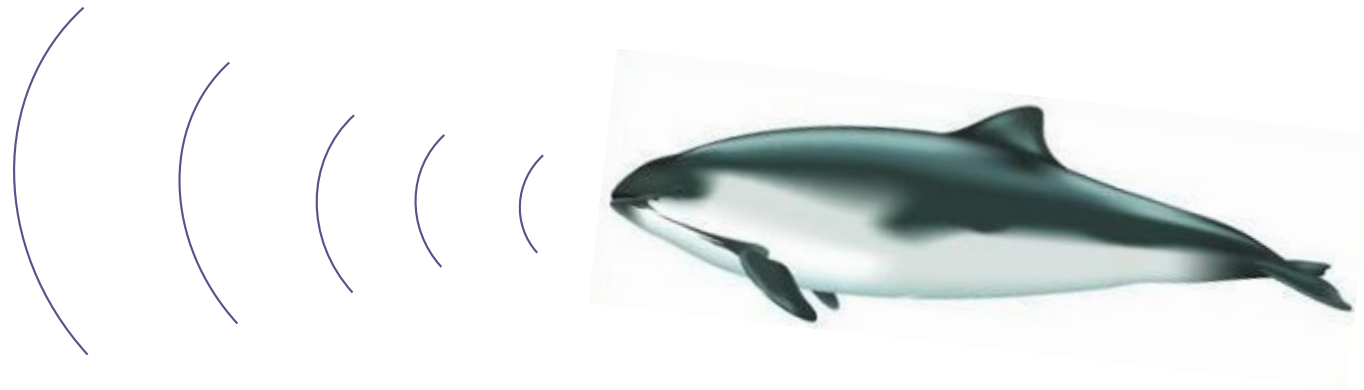
C-POD Chelonia Ltd. 2014

- Long time series data
- Records time of detections
 - Presence / absence
 - Foraging buzzes
- Differentiate between porpoise and dolphins

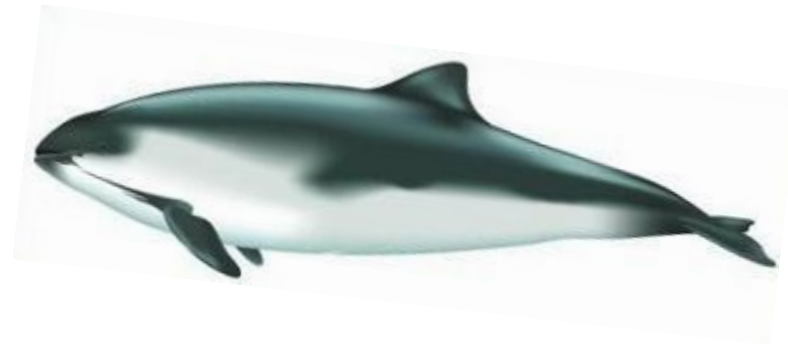


C-POD Mooring System

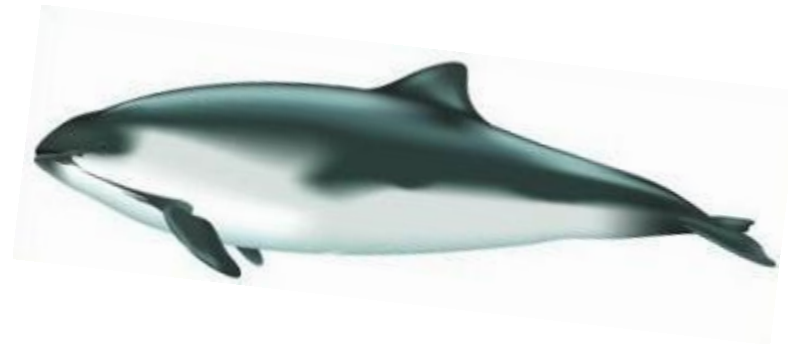
Echolocation - normal click



Echolocation - foraging buzz

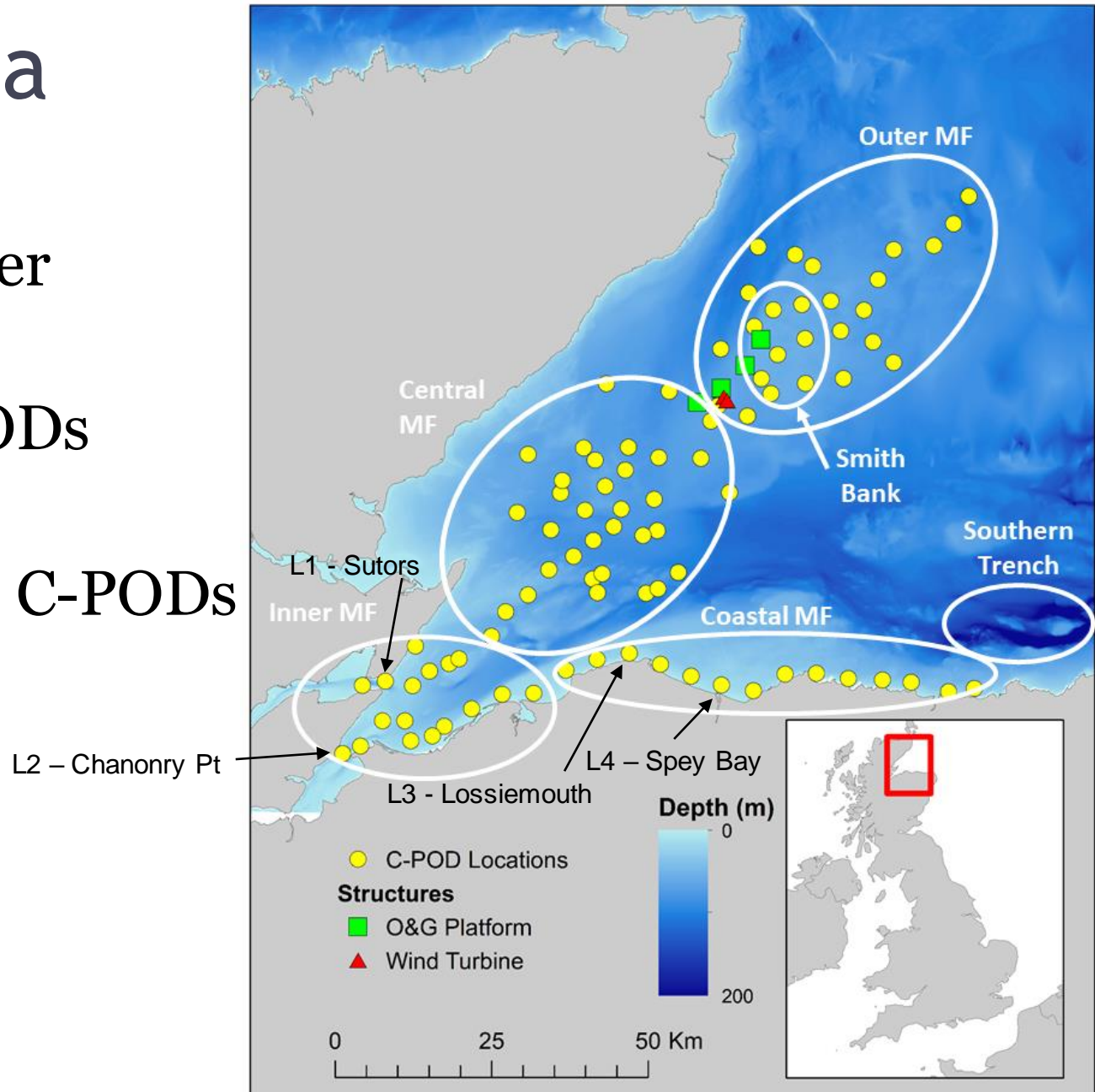


Echolocation - foraging buzz



Study Area

- July-October
- 2009-2011
- 48-65 C-PODs
- 4 sites with C-PODs year-round



Modelling distribution

- Hierarchical Bayesian modelling
 - Integrated nested Laplace approximation (INLA)
 - Fitted in R using `inlabru`
- 1 - Overall detection
 - Number of detection positive hours / day (Poisson)
- 2 – Buzz probability (proxy for foraging)
 - In a detection positive hour
 - Proportion of clicks that are buzzes (Binomial)

Harbour Porpoise Detection

- Detection positive hours / day

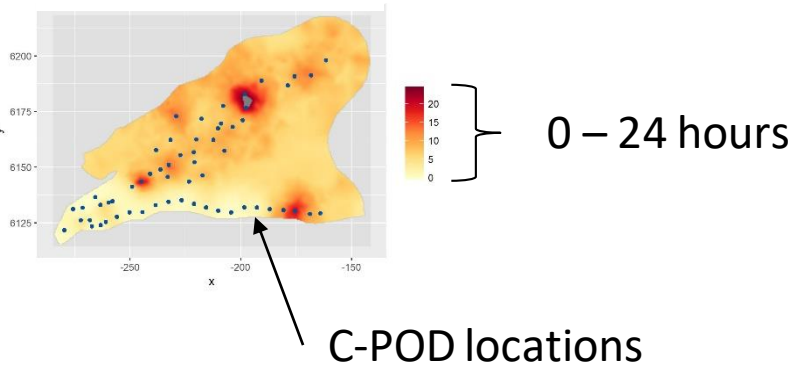
July

August

September

October

2009



C-POD locations

2010

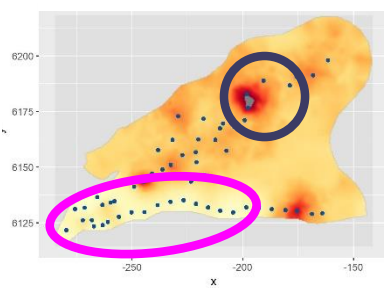
2011

Harbour Porpoise Detection

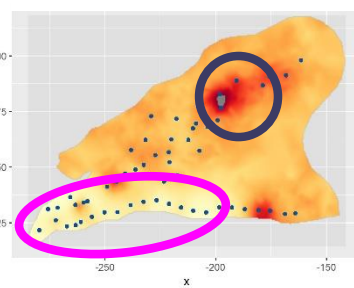
- Detection positive hours / day

2009

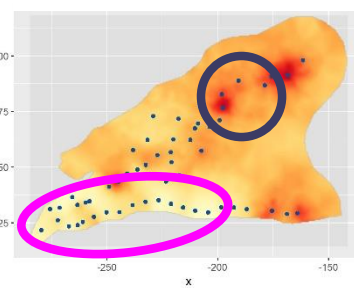
July



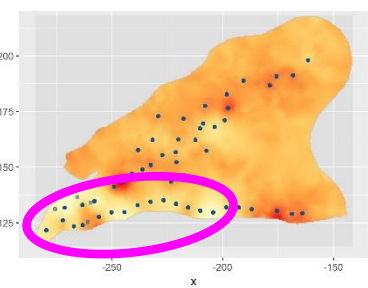
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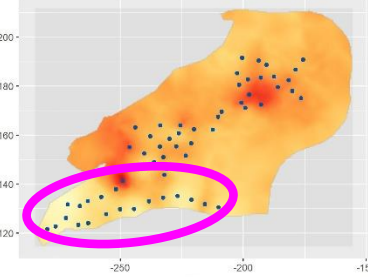
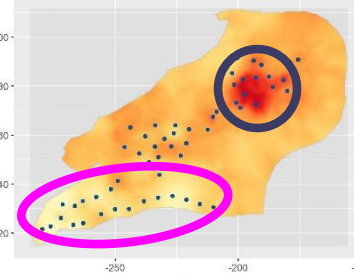
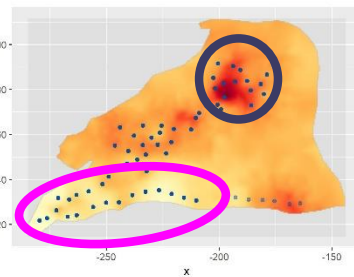
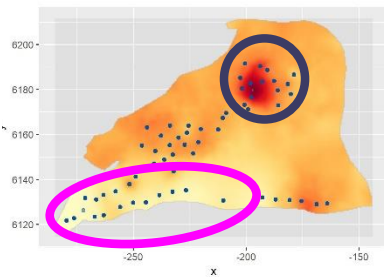
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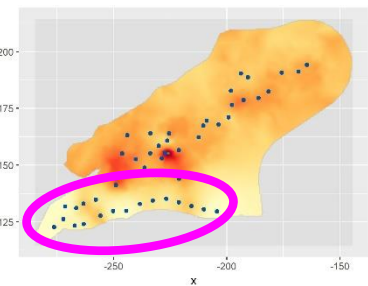
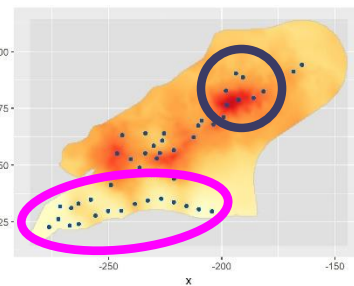
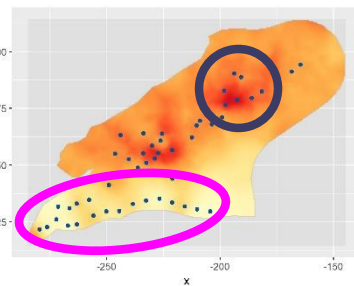
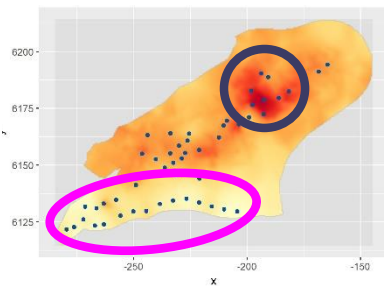
October



2010

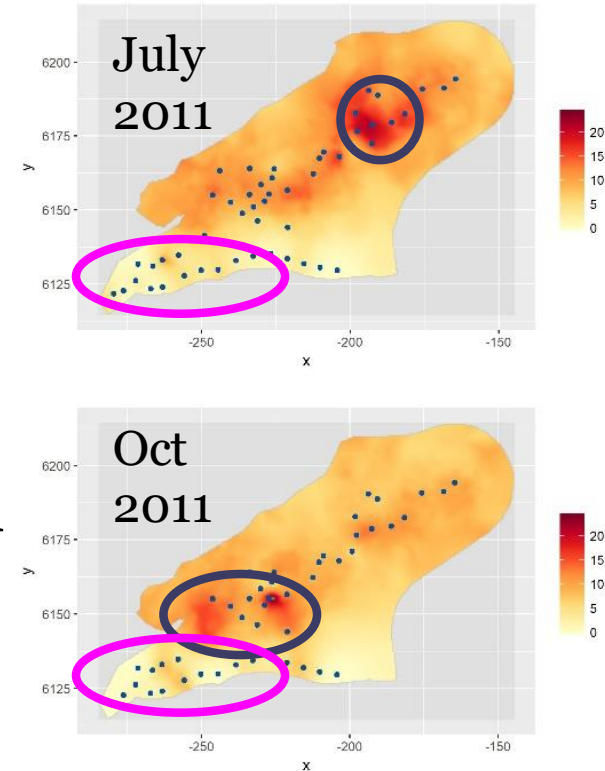


2011



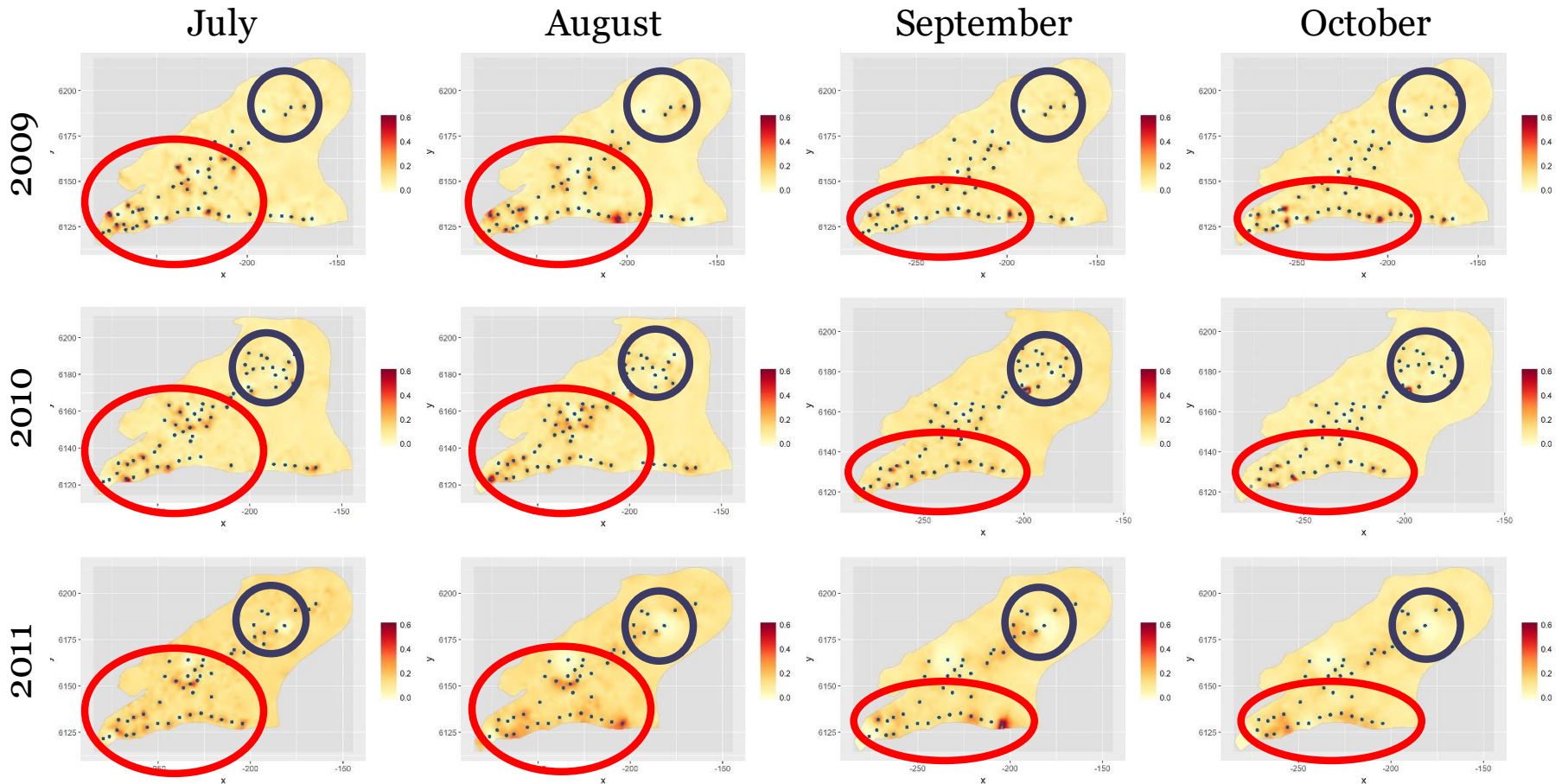
Seasonal Trends

- Smith Bank in July-Sept
 - Sandeel
- Central Moray Firth in October
 - Squid, whiting, sprat, mackerel?
- Low detection in inner Moray Firth
 - Bottlenose dolphins



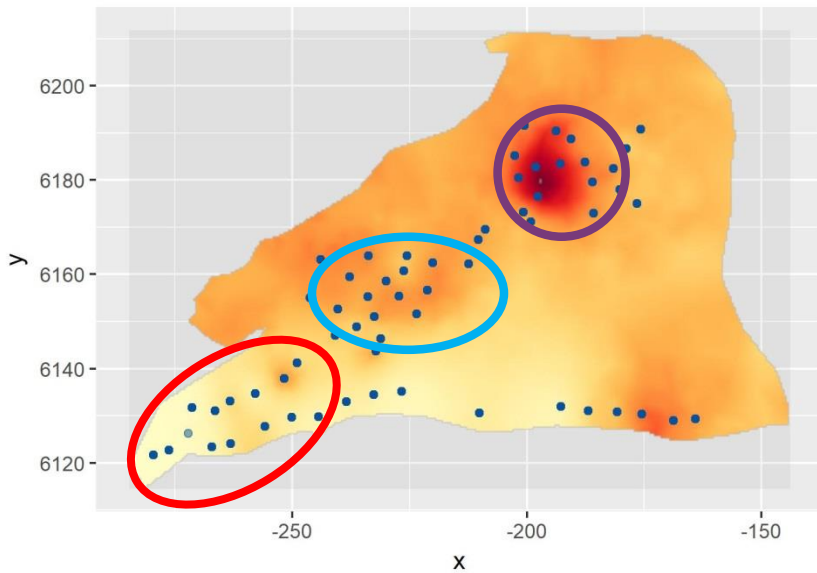
Harbour Porpoise Buzzing (Foraging)

- Proportion of clicks that are buzzes

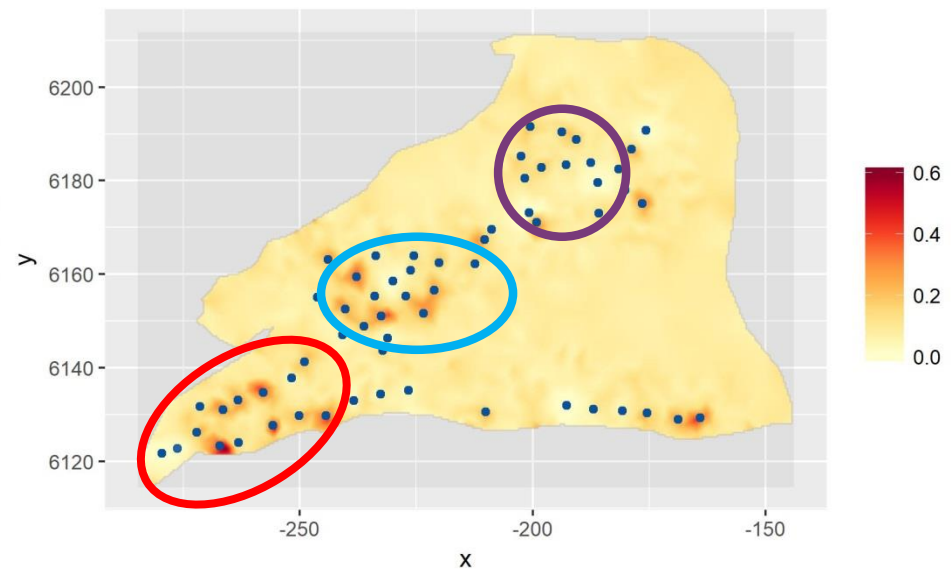


July 2010

Overall Detection
Detection positive hours / day

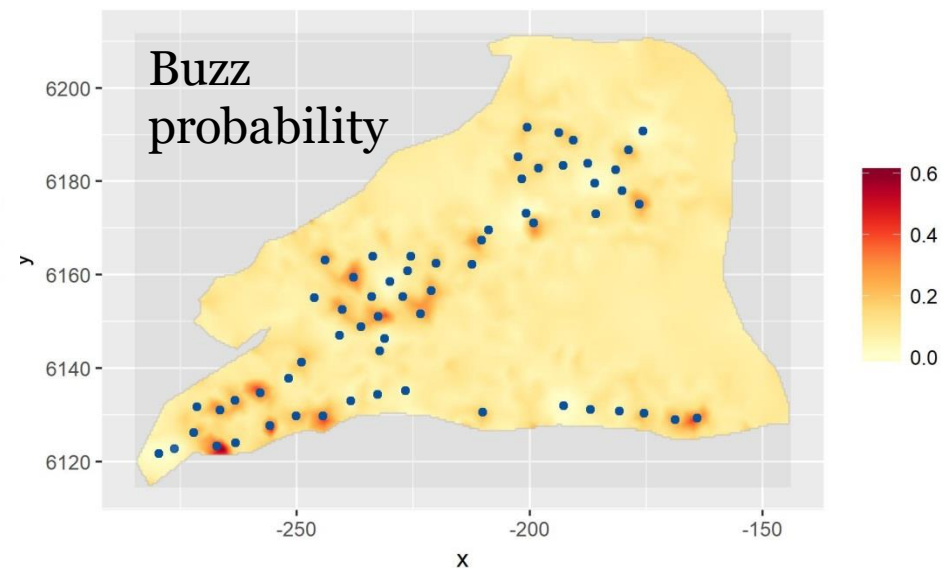
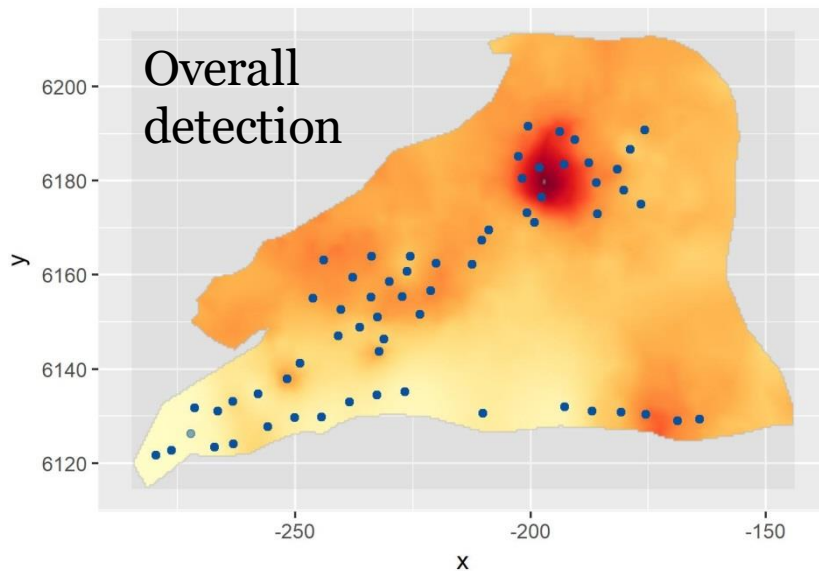


Buzz Probability
Proportion of clicks that are buzzes



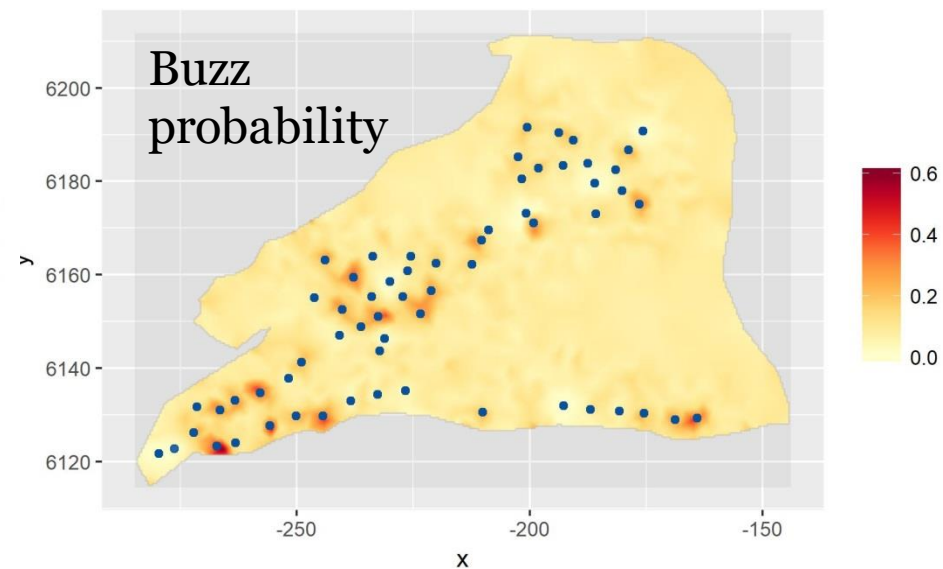
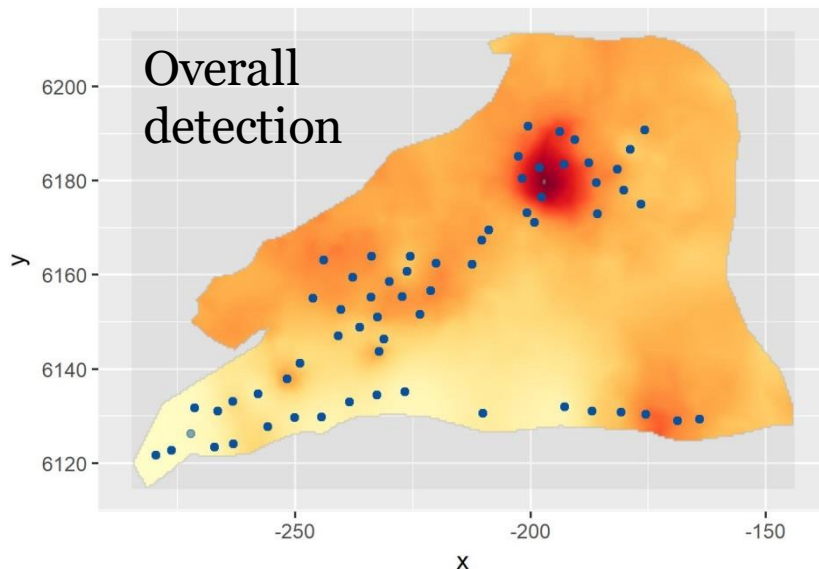
Differences in buzz probability

- Different behaviours in different habitats
1. Go to specific areas for different activities?



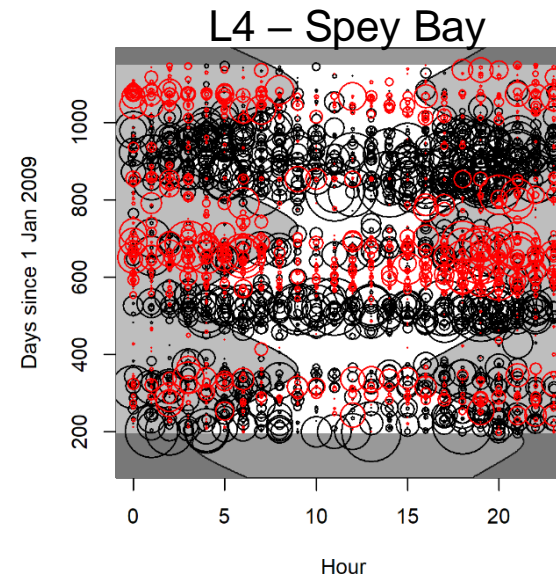
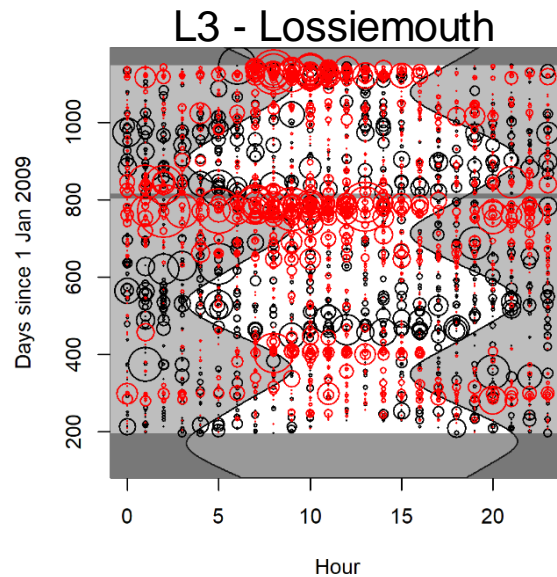
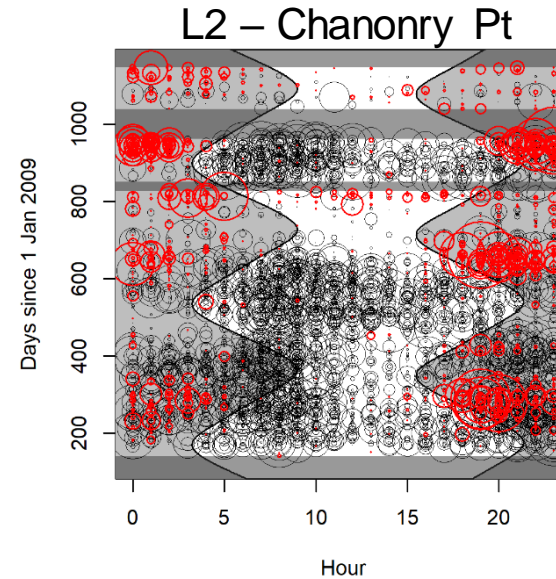
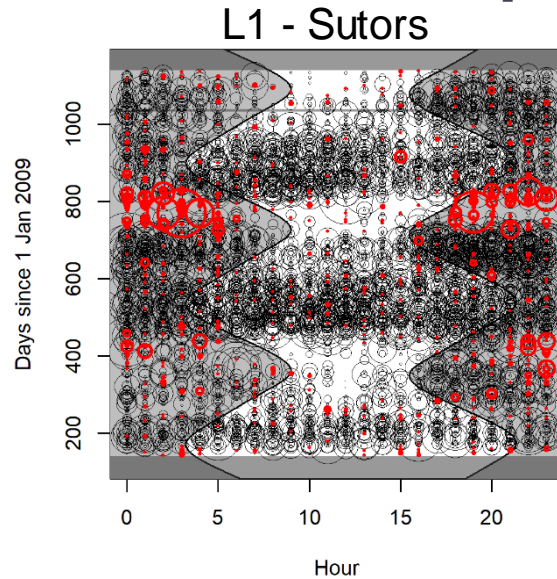
Differences in foraging probability

- Different behaviours in different habitats
 1. Go to specific areas for different activities?
 2. Different foraging strategies in different habitats?
 - Different prey? Activity budget? **Avoiding predators?**
 - Behaviours not equally detectable by C-POD?



Porpoise vs. dolphin detection

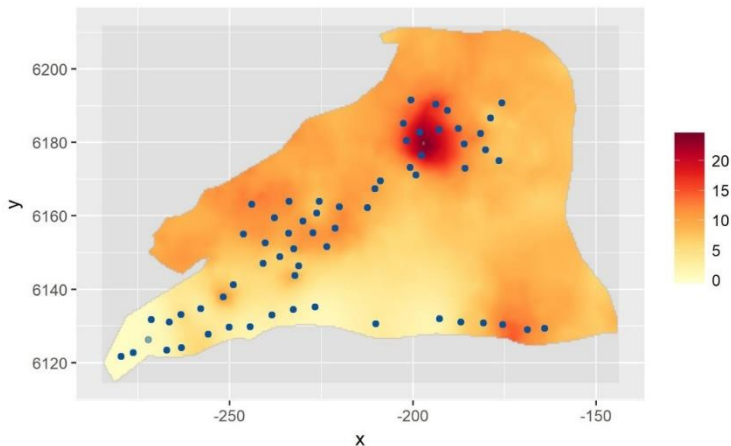
Porpoise
Dolphin



Conclusions

Develop better understanding of distribution

- Identified high density areas
- Identified shift in distribution between summer & autumn
 - Following prey?
 - Targeting different prey?
- Suggest there are differences in foraging behaviour
 - Using different foraging strategies in different habitats?
 - Targeting different prey?
 - C-POD detection?



- Temporal partitioning of sites with dolphins?
 - Intentional or through different habitat preferences?
- Implications for management
 - Seasonal shifts in distribution
 - Foraging outside high-density areas

Acknowledgements

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 - Beth Scott
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 - Janine Illian, Fabian Bachl
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 - Moray Offshore Renewables Ltd.
 - Collaborative Offshore Wind Research into the Environment (COWRIE)



Modelling interactions with dolphins

- Data subset into areas of high, medium and low dolphin detection
- Modelled time of porpoise detection in relation to dolphin detection
- Generalized Additive Models (GAMs)

Porpoise vs. dolphin detection

