



Porcupine Basin Autonomous Acoustic Recorder (AAR) Cetacean Study 2014

Results support planning for two 2016 seismic operations



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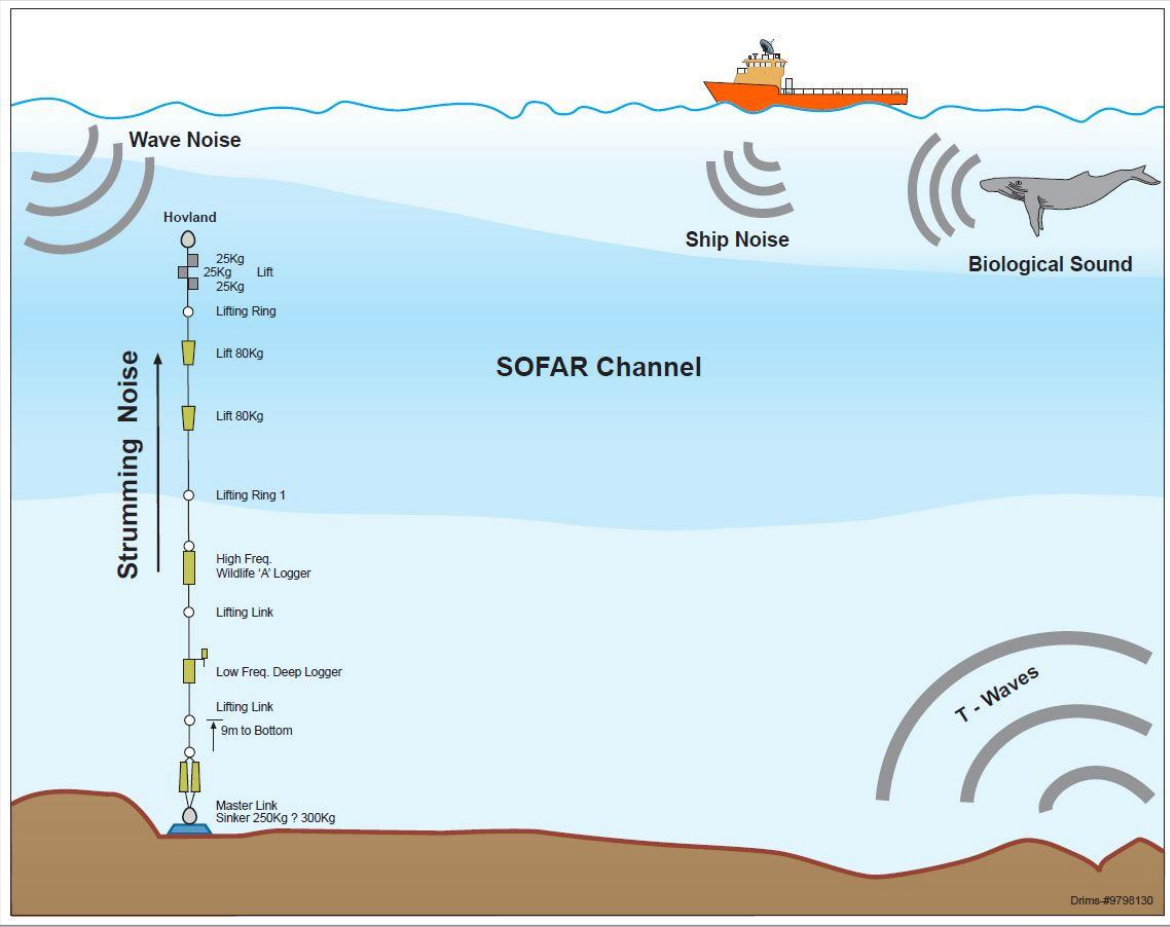
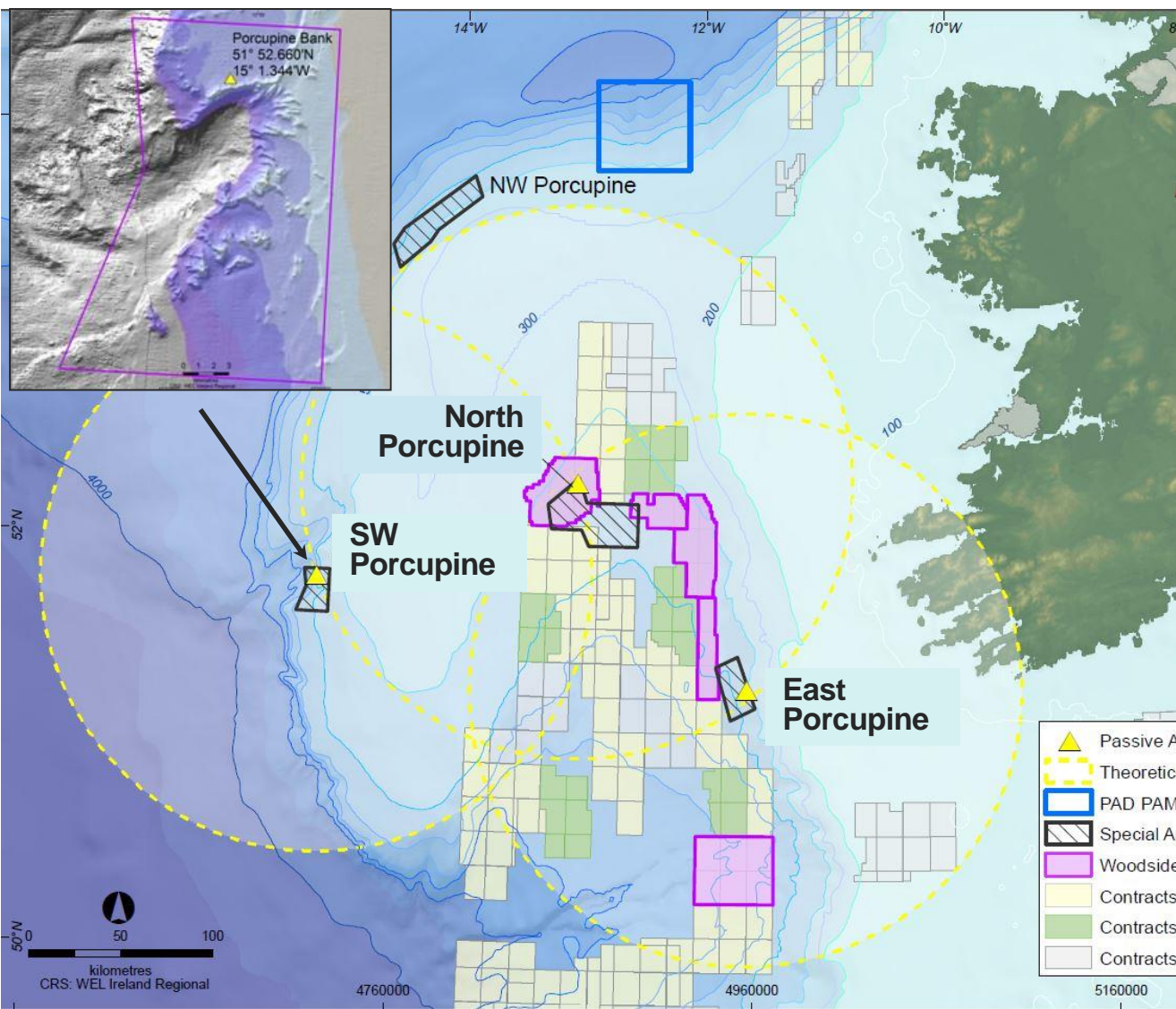
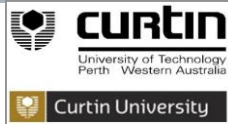
Science underpins the Woodside approach



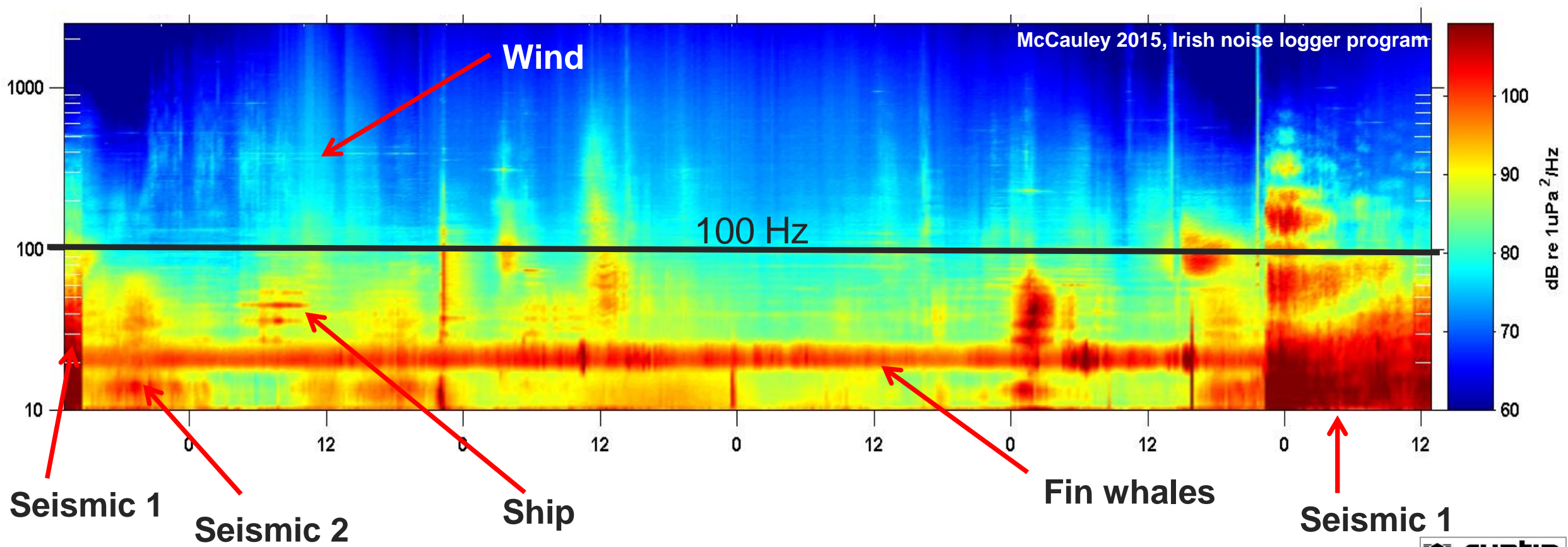
- Strong partnerships, sound research and transparency are the key elements of Woodside's approach to the environment.
- A far range of science programs are funded and supported (in key focus areas).
- Focus areas have included coral reefs, deepwater biodiversity, cetaceans and turtles.
- In the last eight years, our science collaborations have produced over 120 international peer-reviewed publications, four videos and three books.



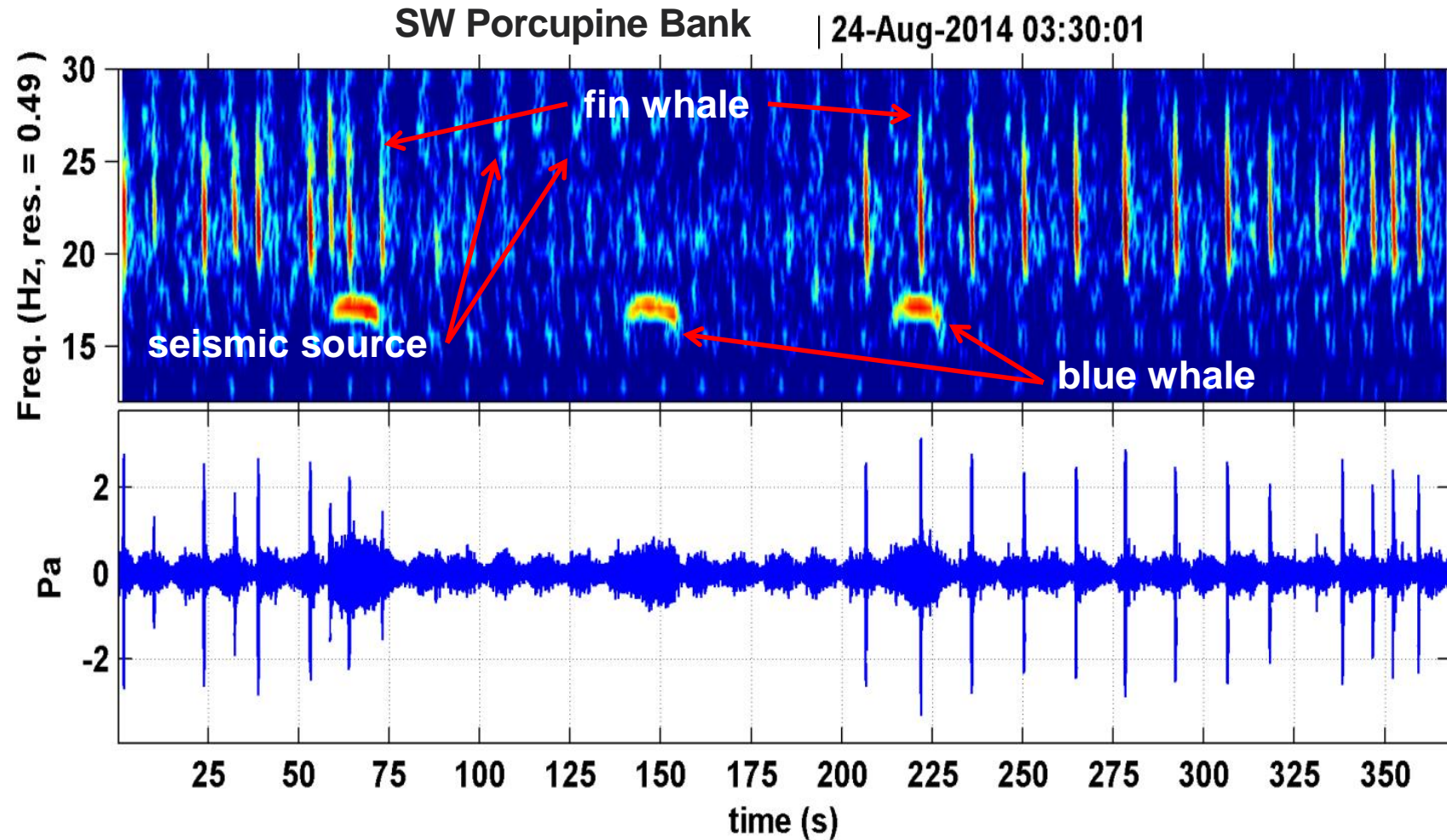
2014 Study



East Porcupine 5 days stacked LF August



Processing the data

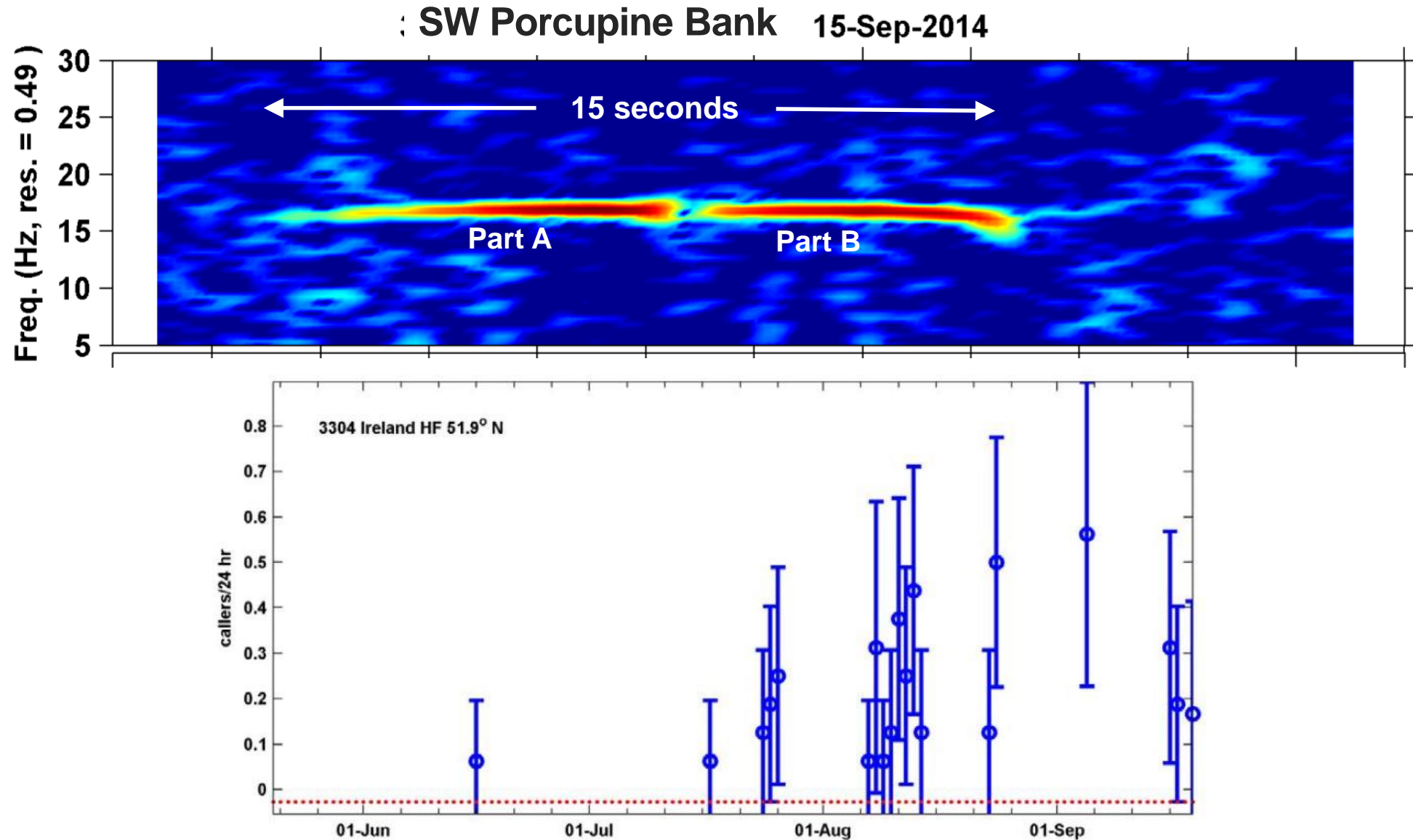


| Analytical Group | Freq. Range |
|------------------|--------------|
| Baleen Whales | |
| 1. Fin | 18 - 80 Hz |
| 2. Blue | 10 - 100 Hz |
| Toothed Whales | |
| 3. Sperm Whales | 1 - 20 kHz |
| 4. Dolphins | 1.5 - 20 kHz |
| 5. Beaked Whales | 30 - 96 kHz |
| 6. HF Echo | >35 kHz |

- Six 'analytical groups'

Blue whale detection

- Algorithm searched for peaks in spectrogram > 5 dB over ambient in frequency range of 5-20 Hz, also looking for consecutive or 'sets' of peaks spanning > 3.5 s and < 25 s
- 27 individuals were detected SW Porcupine site only, 96% of these detections in Aug and Sept



Fin whale detection

- Couldn't use a simple spectrogram threshold due to presence of multiple calls both near and those channelled for further away and exploration seismic signals
- Used a time series cross correlation of a normalised sample waveform
- All 'hits' were time stamped and manually checked

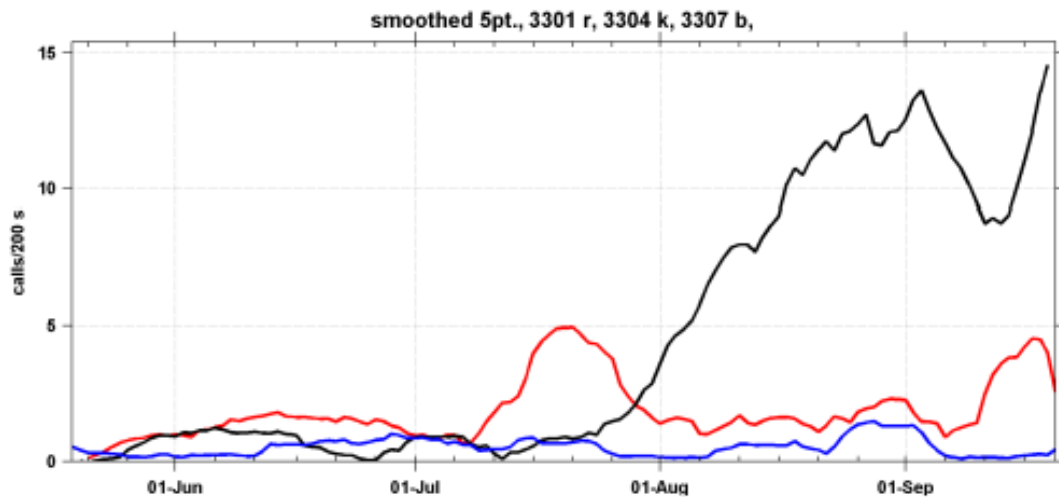
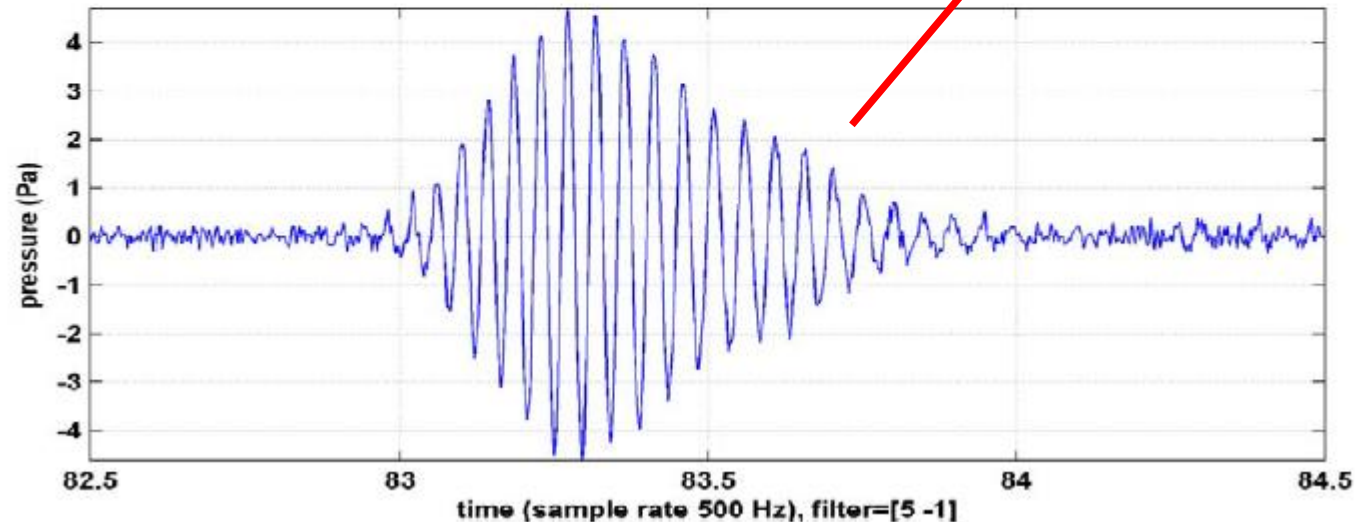
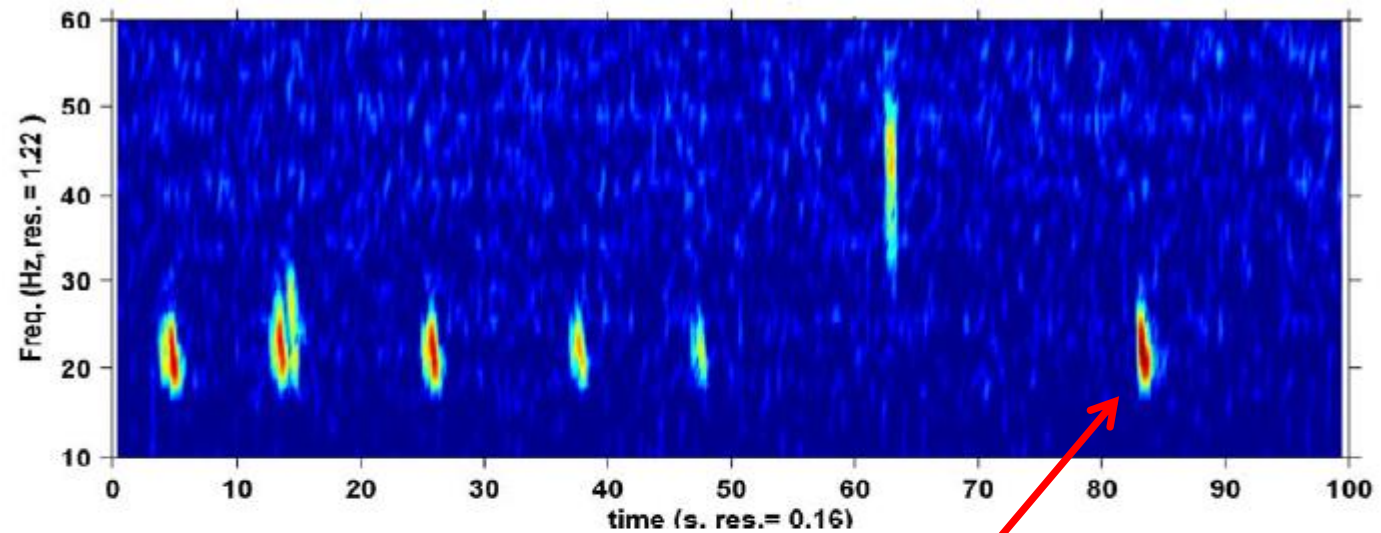
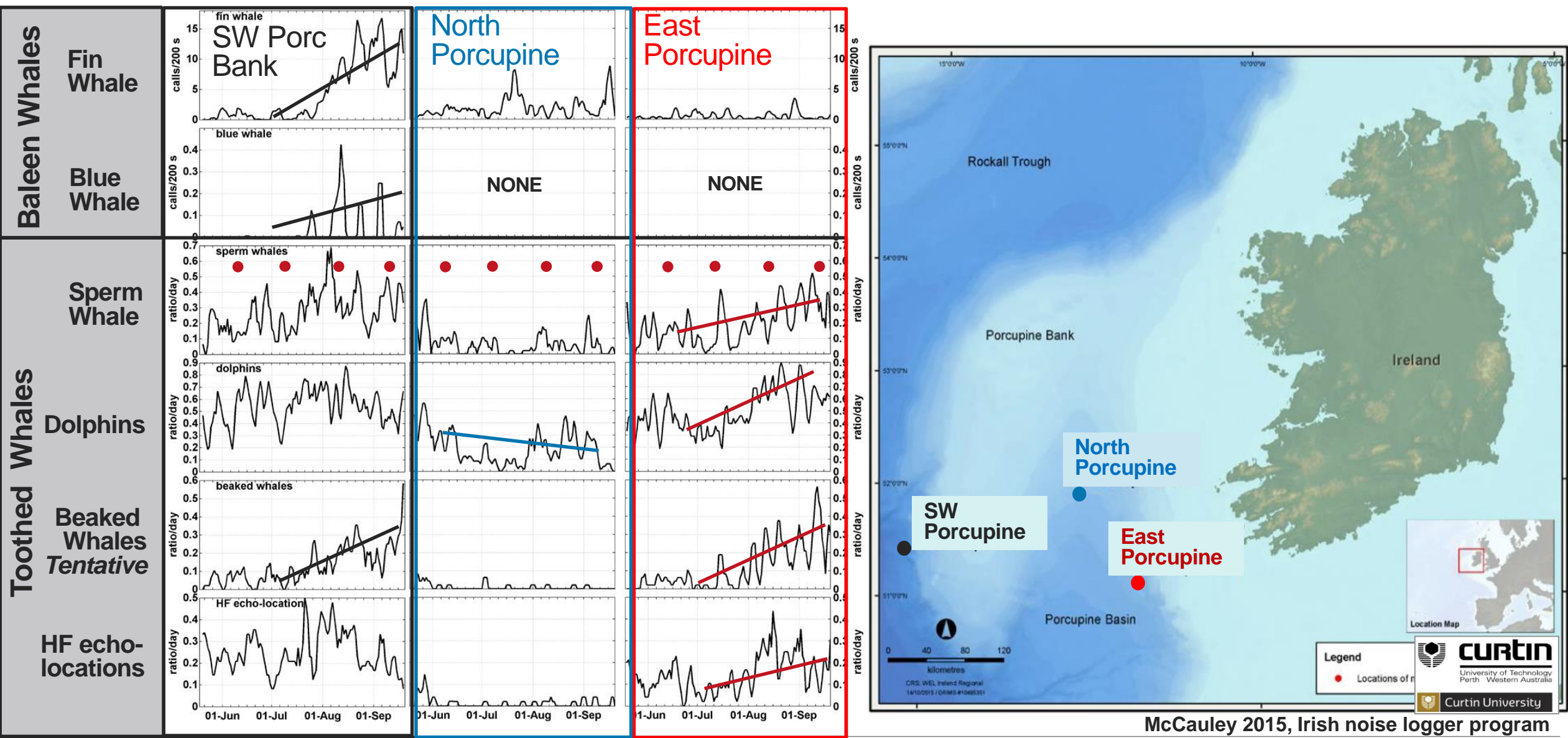


Figure 5: Smoothed trends of fin whale calls/200s averaged across a 24 hour period from: SW Porcupine (3304, black curve); East Porcupine (3301, red curve); and North Porcupine (3307, blue curve).



McCauley 2015, Irish noise logger program

Results summary



McCauley 2015, Irish noise logger program

Seismic surveys in 2016 – Minimise footprint

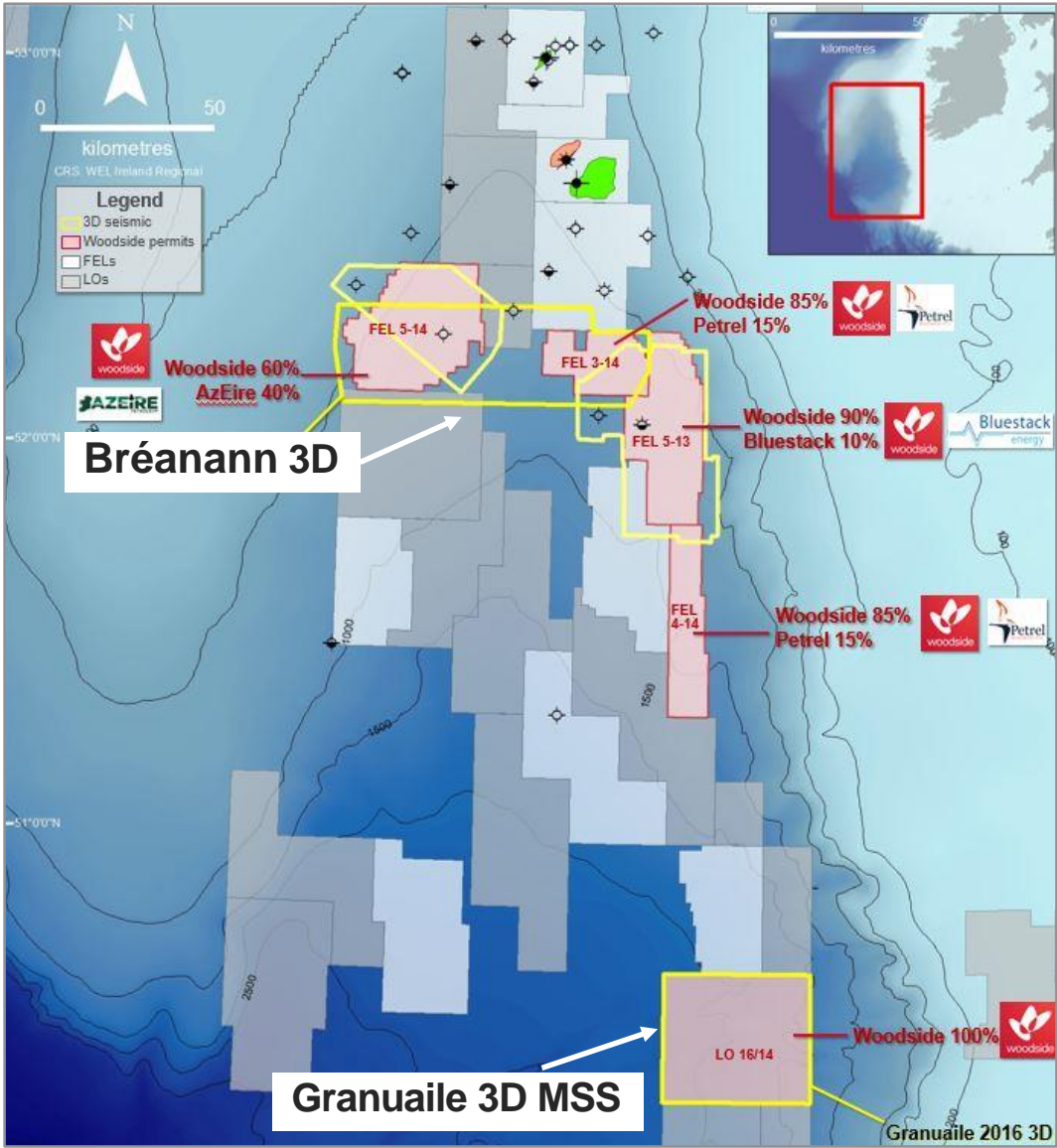


2014 Study Trends – 18 categories

| Location | Fin Whales | Blue Whales | Dolphins | Sperm Whales | Beak Whales (Tentative) | Minke, Humpback and Sei whales |
|--------------------------|--|---------------------------|----------------------------|-------------------------------------|---------------------------------------|--------------------------------|
| Northern Porcupine Basin | Moderate – with two small peaks during study | No recorded vocalisations | Low – higher in Aug/ Sept | Low – periodicity in abundance | Low – intermittent during deployment | No signals detected |
| East Porcupine Basin | Low – no seasonality | No recorded vocalisations | High – higher in Aug/ Sept | Moderate – periodicity in abundance | Moderate – some increase in Aug/ Sept | No signals detected |
| Southwest Porcupine Bank | High – major increase during Aug/ Sept | High – more in Aug/ Sept | High – higher in Aug/ Sept | High – periodicity in abundance | Moderate – some increase in Aug/ Sept | No signals detected |

| | North Porcupine Breanann 3D MSS | South Porcupine Granuaile 3D MSS |
|----------------------------|---------------------------------------|--|
| Commerical fishing | July onwards preferable Prawn fishery | Leave by early August ideal - Tuna fishery |
| Concurrent seismic surveys | No ops planned in area | Mid-June other seismic planned |
| Whales and dolphins | No clear trend | Leave by early August ideal |

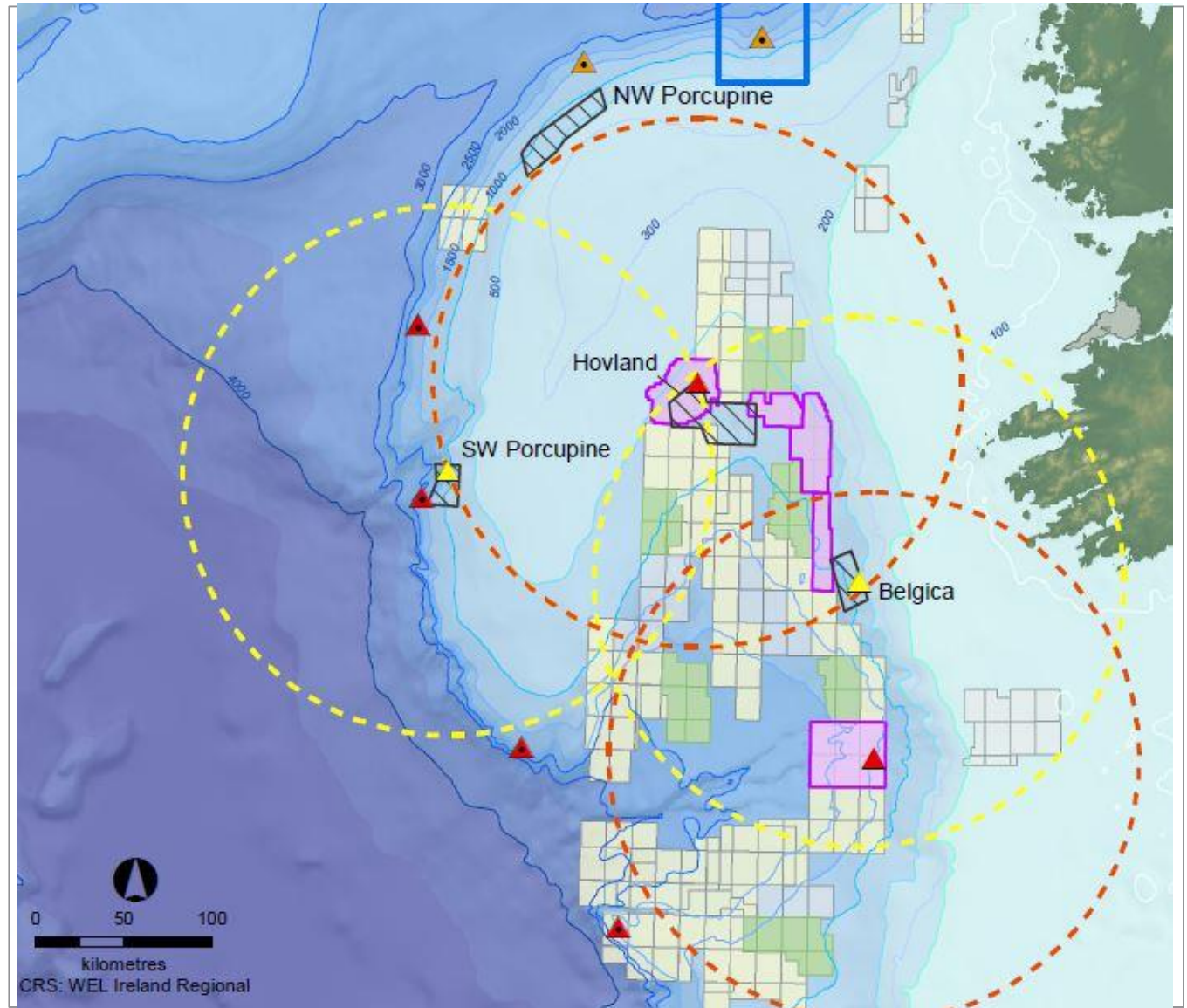
- First - Early as possible
- Second - Later



Woodside – Extended offshore cetacean study 2016



- Extended AAR study in 2016
- Repeat the north Porcupine site
- New site in newly acquired LO 16/14
- Same equipment as DCCAE-NPWS ObSERVE program (AMARs). Comparable to our 2014 study equipment
- Deployed June-November 2016
- Broadband AARs
- Some of the same 2014 study partners



Ongoing partnership



Woodside Irish Cetacean PhD Scholarship



Dr Joanne O'Brien

Ms Myrto Tourgeli

Dr Simon Berrow

