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Passive Acoustic Monitoring for Cetaceans from Glider Platforms

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Why ?

Abundance

How many animals are in a region ?

Is the population going up or down ?

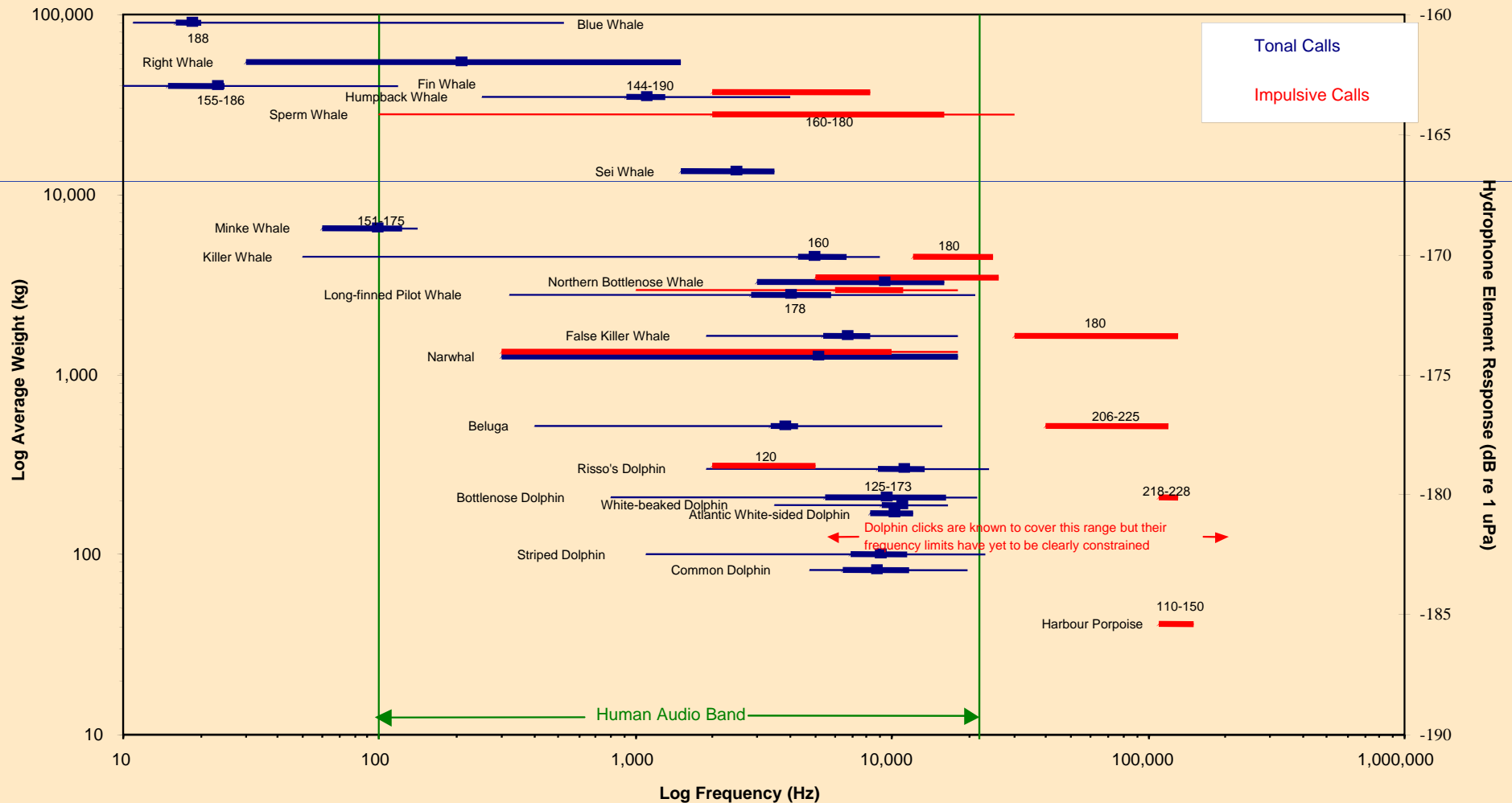
Mitigation

Are there any within mitigation zone around my big bad sonar ?

Biology

Why are the animals where they are ? How are they affected by prey / oceanography ?

Vocalisation Frequency



Data volume

Sample Rate	Number Channels	Species / System	/Second	/ hour	/ day	/30 days	/year
1Hz	4	SMRU tag	8 B	28 kB	675 kB	19 MB	241 MB
30Hz	1	Baleen	60 B	211 kB	4.9 MB	148 MB	1.8 GB
1kHz	1	Baleen	1.9 kB	6.9 MB	165 MB	4.8 GB	59 GB
48kHz	1	Large odontocetes	94 kB	330 MB	7.7 GB	232 GB	2.8 TB
48kHz	2	Large odontocetes	188 kB	660 MB	15.4 GB	463 GB	5.5 TB
100kHz	1	Small odontocetes	195 kB	687 MB	16.1 GB	483 GB	5.7 TB
500kHz	2	Harbour Porpoise	1.9 MB	6.7 GB	161 GB	4.7 TB	57.4 TB

Automatic Detectors

Several well established packages for different call types. Many detectors encapsulated into open source PAMGUARD software.

Can give data reductions of 1000's. e.g.

- ◆ Whistle and click detectors operating on mooring in Moray Firth reduced 250 Gbytes to 250 Mbytes (10 Mbytes per day)
- ◆ Click detector reduced > 1 Terrabyte to 500 Mbytes when surveying Vaquita. (70 Mbytes a day)

Gliders use to date

(Probably not an exhaustive list !)

Who	What / Where
Mark Baumgartner WHOI	Array of 4 gliders in Gulf of Maine. Comparing Sei whale vocal activity with oceanographic and prey conditions. Recording only. (Slocum)
DFO Canada	Interest in Beaked whales. Have run some glider trials at AUTECH. Recording only (PC104 based system I think)
Dave Mellinger & Co. Oregon State	Real time detection of beaked whales using an ARM based processor. (Seaglider)
Walter Zimmer. NURC	Strong interest in gliders for mitigation monitoring

Embedded processing

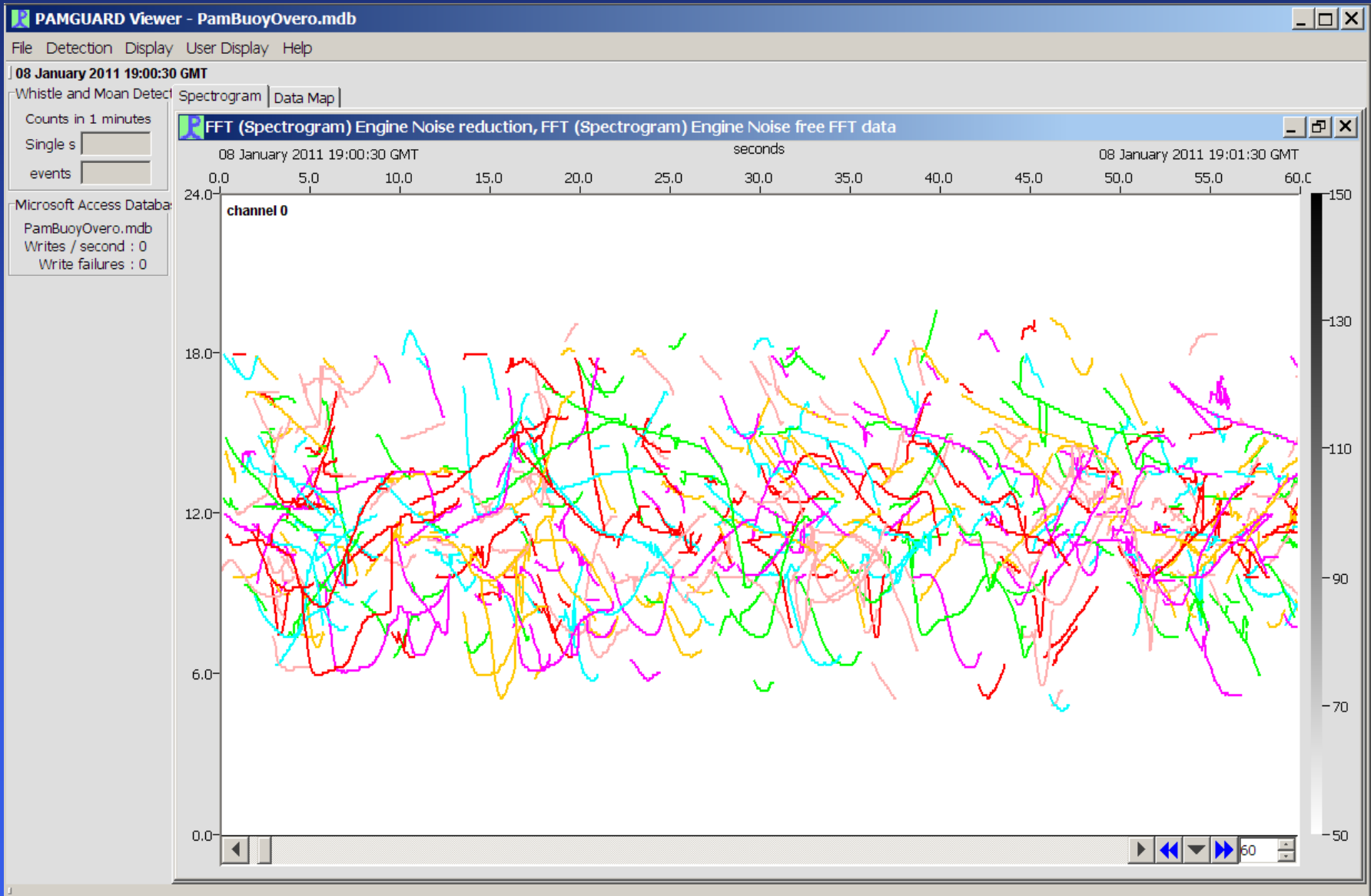
- Mellinger (Oregon State). ARM based processor. Custom software. 2 Channels at 96/192?? kHz.
- Johnson (WHOI) DMON – open source / open hardware system using TI DSP. 3 Channels at up to 480kHz. Under US export control order.
- Me (SMRU/SMRU Ltd). Developing TI OMAP (ARM + DSP) based system (Best and worst of both of the above). 4 Channels at up to 500kHz. 1 – 2 W consumption.



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Detector Output



Summary

- PAM from gliders has been successful
- Most species require automatic detectors
- Several groups working to produce efficient processing platforms.
- Given resources, PAM from gliders in UK waters for UK species seems very feasible.