

# In search of the elusive clickers: experiences of an external mature student

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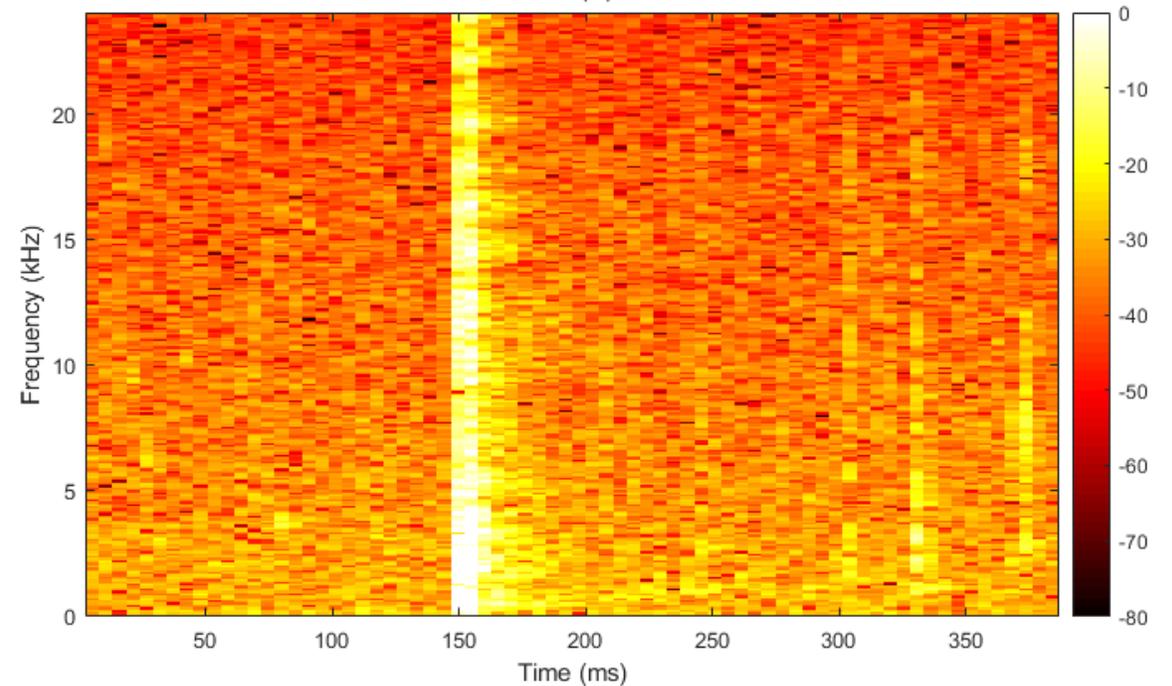
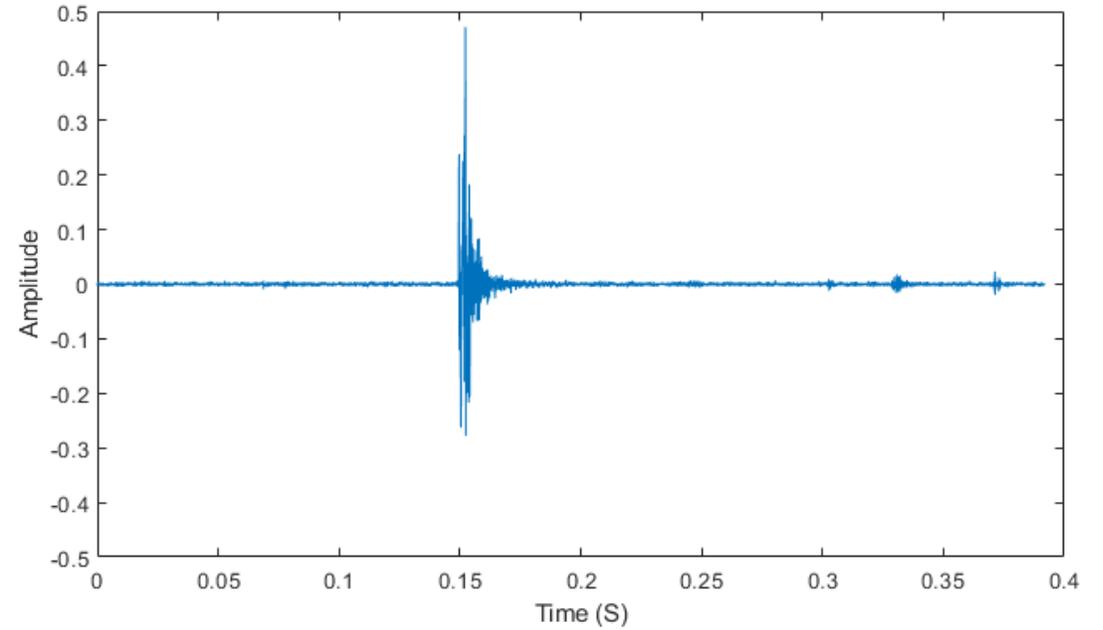
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Deploy a hydrophone in shallow water in the southern half of the UK and you will often hear a clicking sound. The sound is often assigned to 'snapping shrimp' but this has not been proven, and snapping shrimp should not be in UK waters.

Depending on the time and location the sound can be very loud and can dominate the ambient noise field.



# History

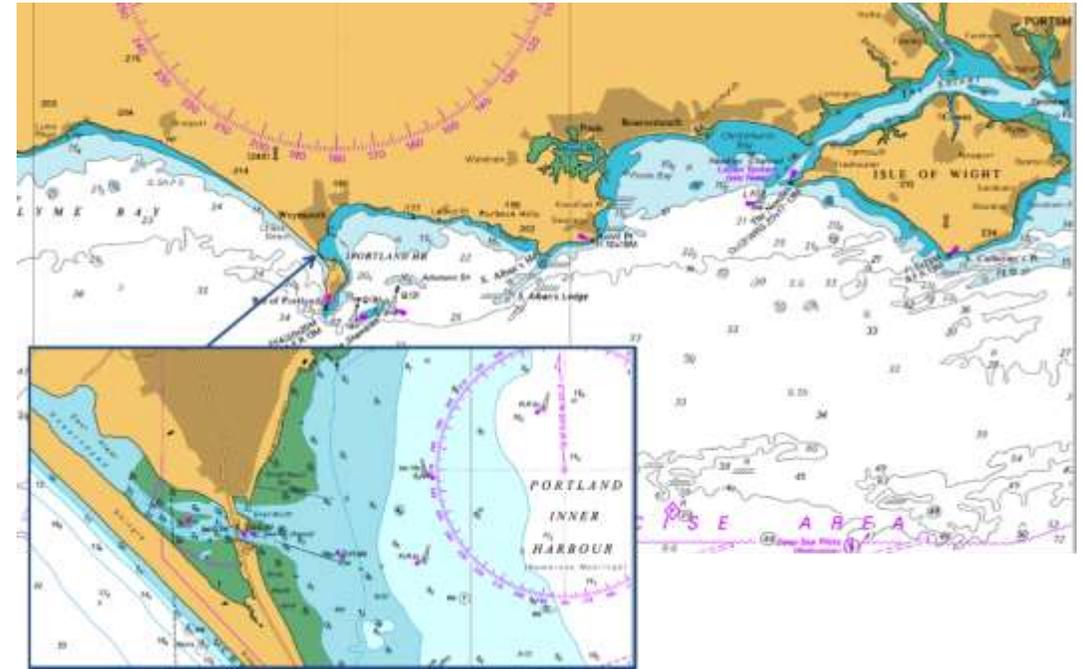
- I first heard the sound in Gibraltar Harbour while testing sonar equipment in 1994.
- On return to the UK I found I could hear a very similar sound along the coast of Dorset
- I was very busy with a major sea trials programme and offered the project to a number of institutions. Only one took up the offer but failed to identify the source.
- When I retired I took up the challenge of identifying the source of the clicks and started a PhD project with ISVR, Southampton University

# Aims of the project

- Characterise the clicks:
  - Temporal: click length, repetition rates, no of clickers
  - Spectral
  - Spatial distribution from very local to national
- Literature search
  - Has anyone else found similar clicks
  - Has anyone identified a species making clicks
  - Identify candidate species that may make clicks
  - Eliminate anthropogenic sources
- Develop techniques to aid the identification of the click source
- Identify the source of the clicks

## Study site

The initial spatial distribution work identified a convenient site where there were many clicks, the water was sheltered and shallow, and there was a nearby research station with power available that I could use as a base.



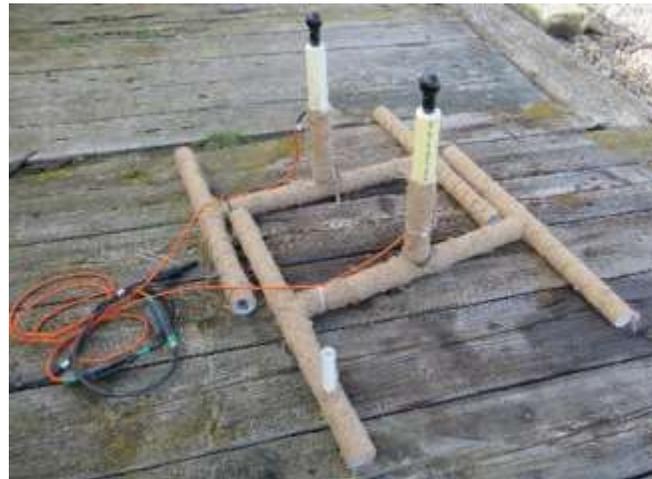
A hydrophone was installed on the seabed and cabled into the research station with a PC running MATLAB to monitor click activity



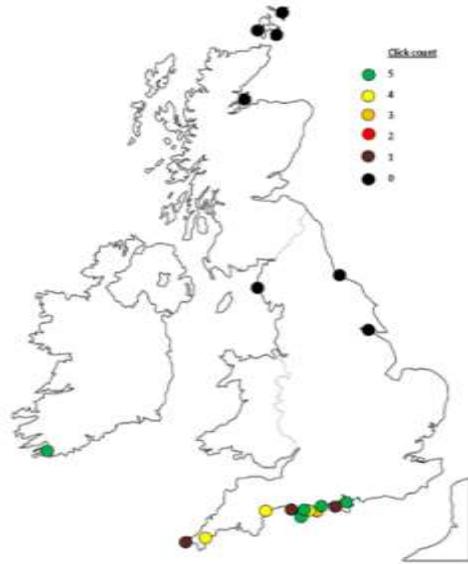
# Characterisation equipment

A number of portable hydrophone systems were designed and constructed to study the clicks

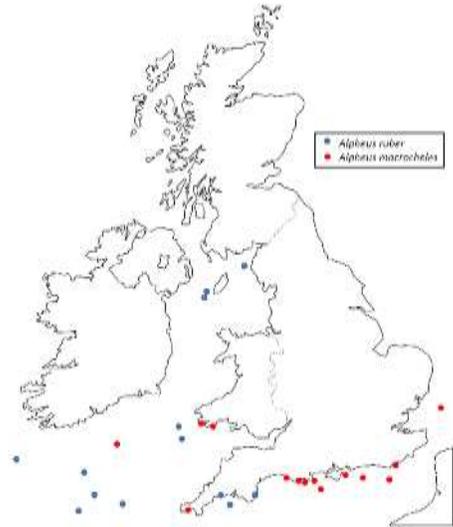
- Single hydrophone portables
- Dual horizontal hydrophones
- Dual vertical hydrophones



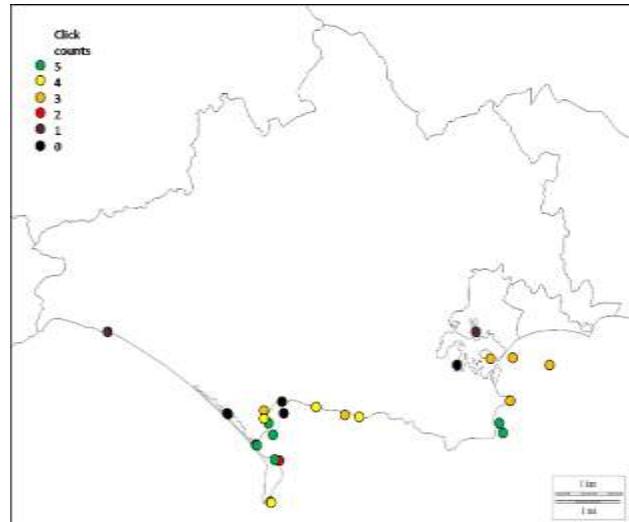
# Characteristics of the clicks



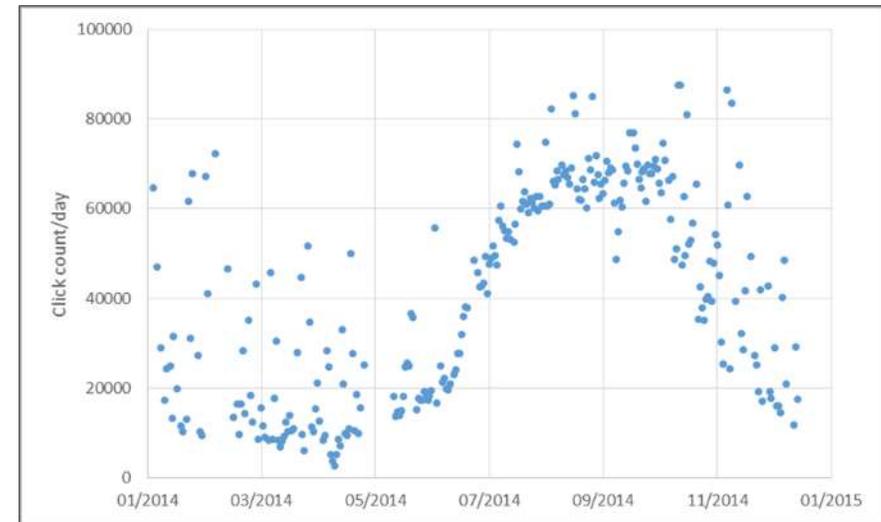
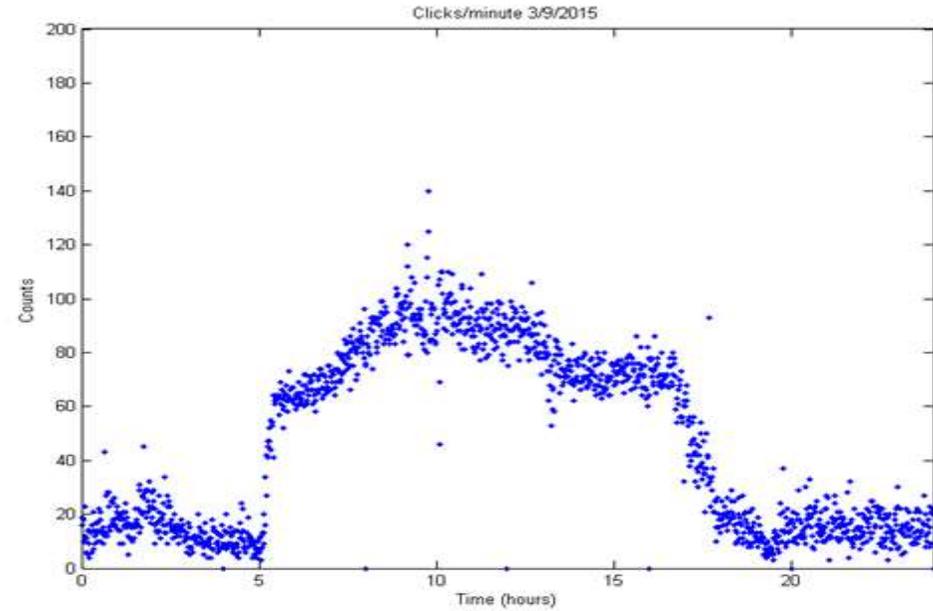
Spatial distribution



Snapping shrimp



# Temporal distribution



## Species identification equipment

Various frameworks incorporating cameras and hydrophones were built and deployed to try and capture an animal 'in the act' of clicking



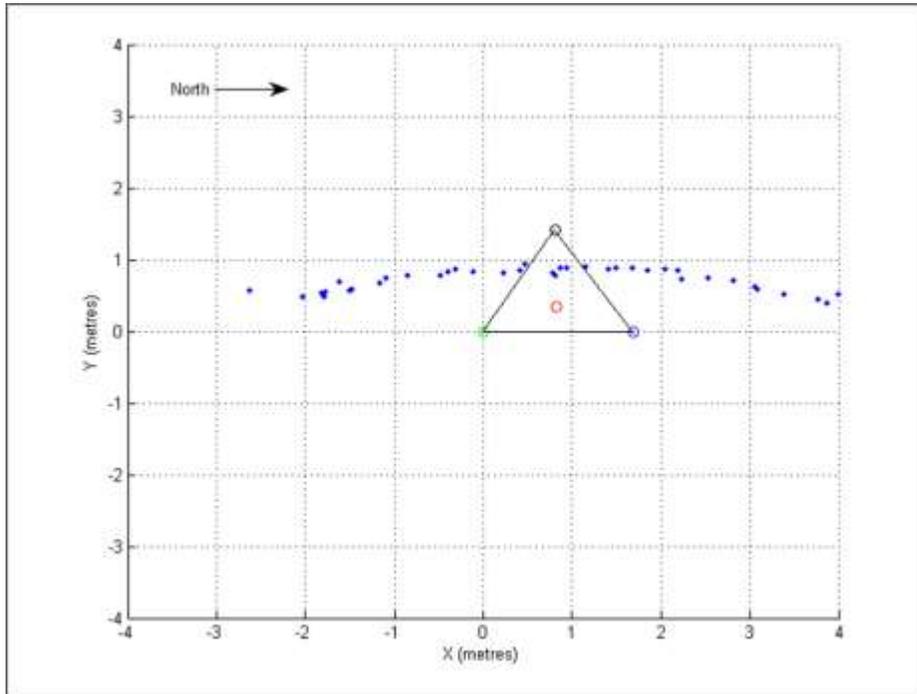
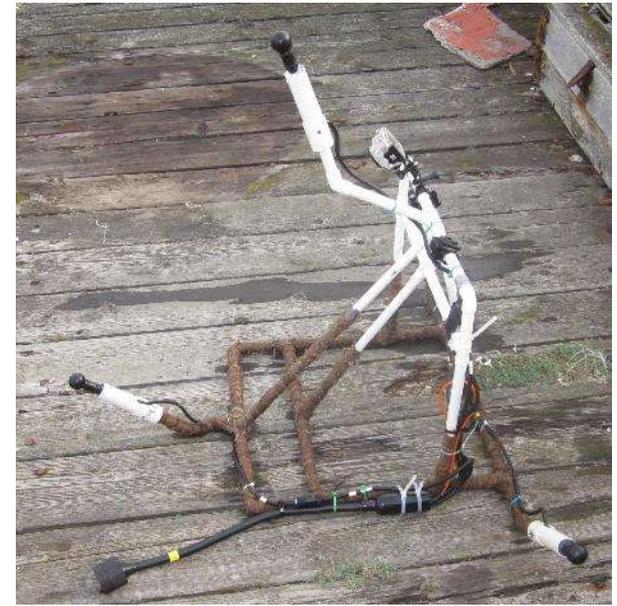
Frame with two GoPro and video cameras and hydrophone

Results:

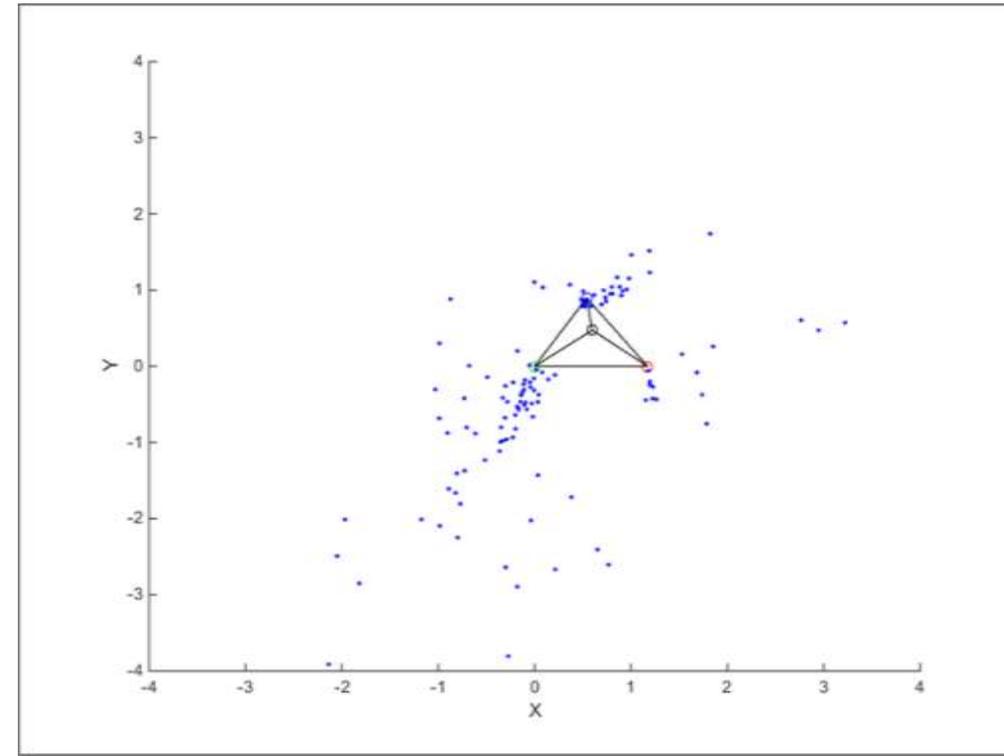
Not a single click was positively identified as coming from an animal 'on camera'!

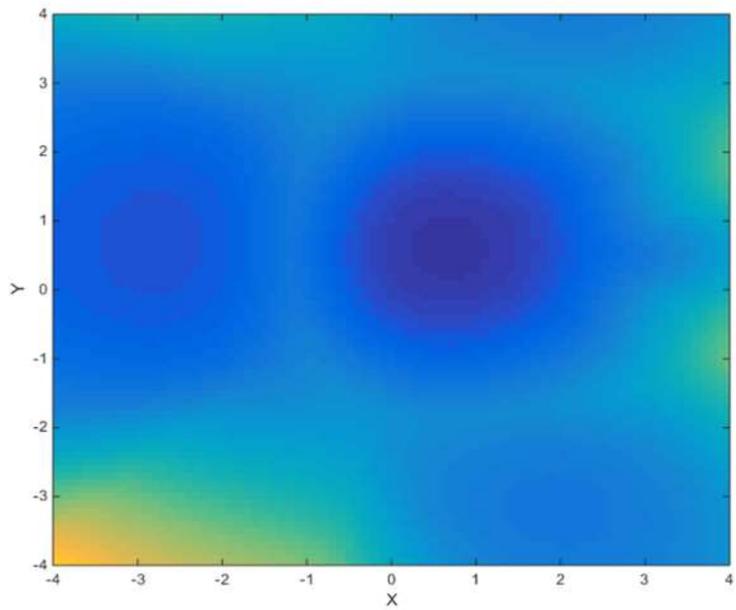
# Acoustic localisation

In addition to the video localisation I also used acoustic localisation to study the click distribution on a very local basis. Four hydrophones were used in a pyramidal array. Theory suggests that 5 are needed for a unique solution while 4 give 2 possible locations. In practice, it was thought that the erroneous location could be eliminated by a set of simple rules.

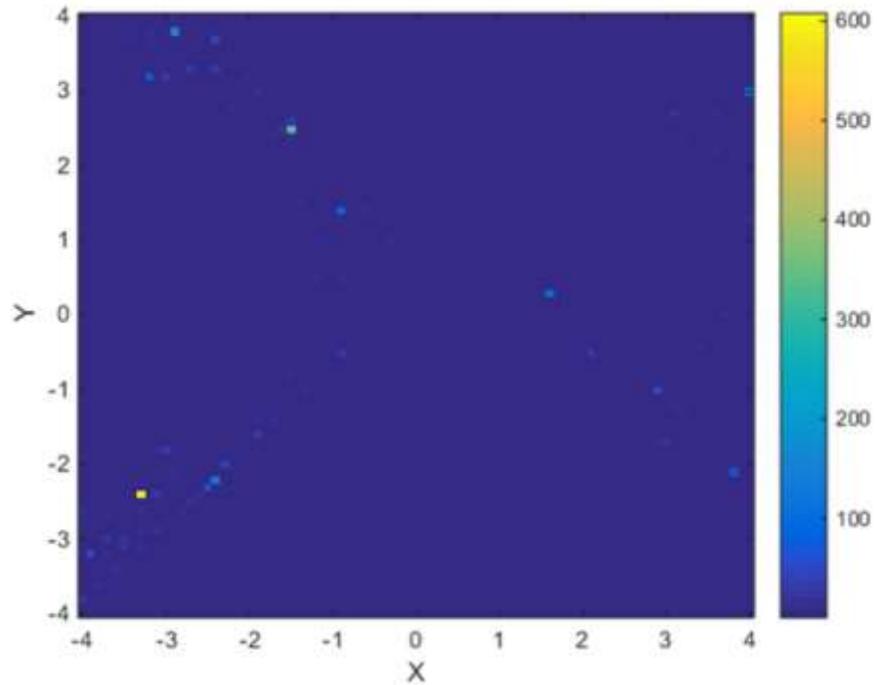
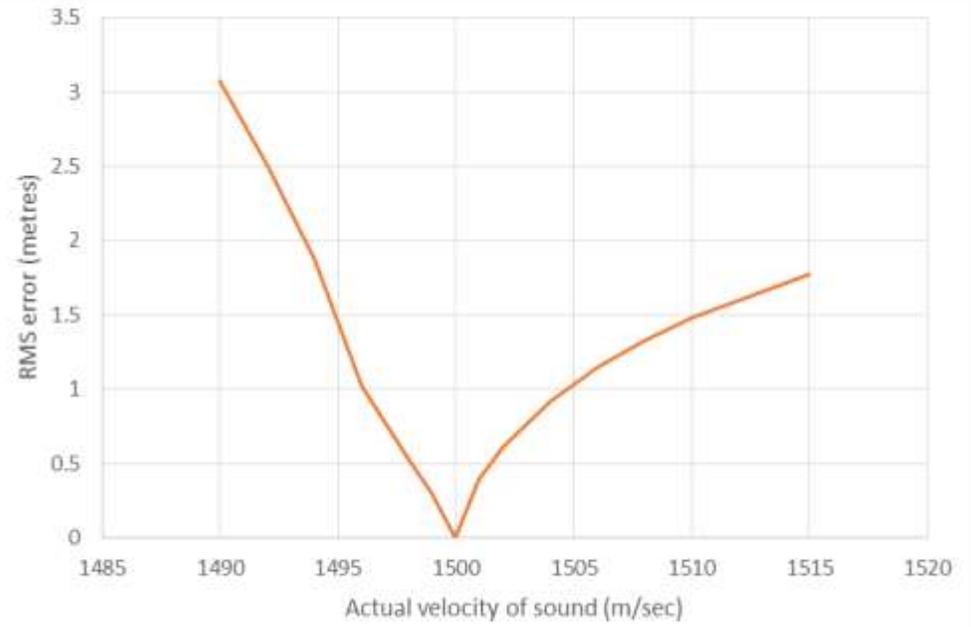


Hydrophone data was processed using the Spiesberger algorithm, but in this application it gave a large number of incorrect complex results. Investigation showed that the algorithm was very sensitive to changes in the velocity of sound.

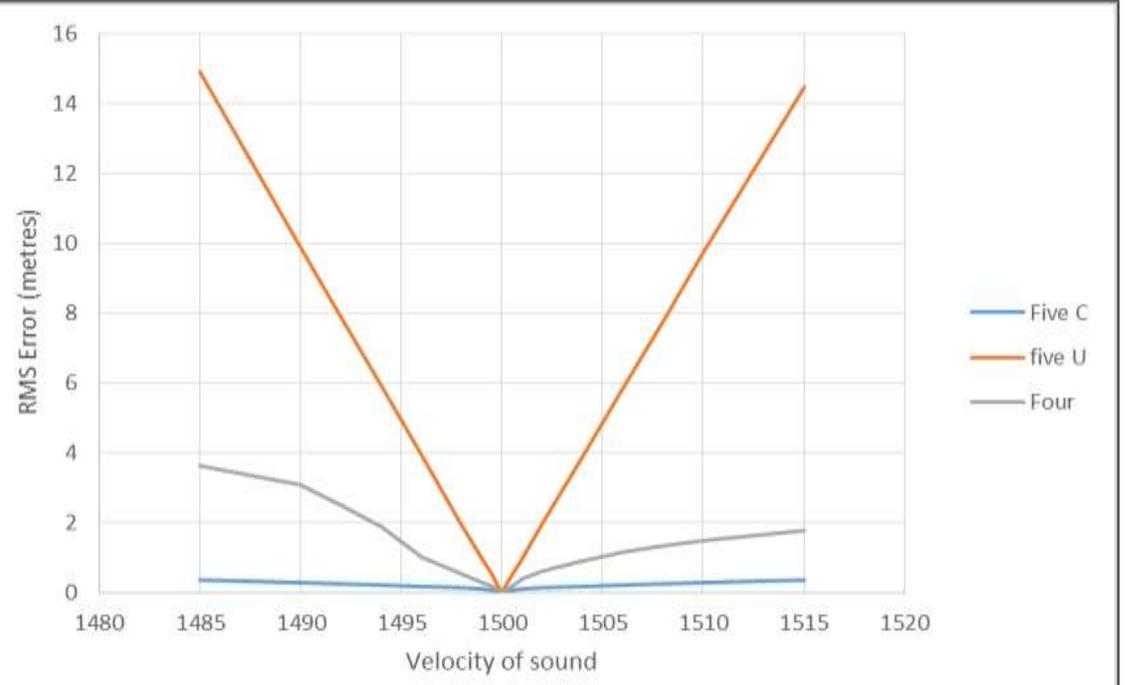




Four hydrophone array



Five hydrophone array



# Conclusions

- The work:
  - Failed to identify the species making the clicks
  - Has extended the knowledge base for the clicking
  - Identified a weakness in the Spiesberger algorithm, which has been widely used for acoustic localisation
- The lack of a visible species making the clicks suggests that the click source is not visible
  - Buried in the seabed: snapping shrimp?
  - Too small to be seen: Amphipoda?



# The PhD experience

- I chose to be an external student as it suited the way I wanted to work
- Southampton University is not 'switched on' to the needs of external students
- However, for an external student, real life gets in the way but the University were very sympathetic to the non-scientific problems that I encountered
- The project was overall a good experience which I would commend to anyone in a similar situation to do

**But it still leaves a major unanswered question...**

**What is producing the clicks?**

# Acknowledgements

- Ilchester Estates for allowing me to use their Chesil Beach hut and for access to their water
- Paul White at ISVR for his guidance and many helpful suggestions
- Don Moxom, the Fleet Warden, for his assistance throughout the project
- Yvonne Miles, for allowing me to use her boat time to collect distribution data
- Chickerell BioAcoustics for part funding this work

