

# Sound and Sharks, Investigating Detection from Different Directions: Detecting sharks – Detecting humans

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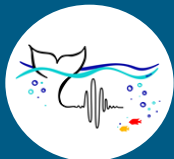


Government of **Western Australia**  
Department of the **Premier and Cabinet**  
**Office of Science**

**WA Dept. Premier & Cabinet: Applied Research Program**

**SHARC I: Sonar detection and classification of sharks**

**SHARC II: Acoustic signatures of beach goers**



# Background to this work

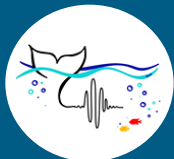


Curtin University

CENTRE FOR MARINE  
SCIENCE AND TECHNOLOGY

- 2012 – Several encounters and fatalities prompted WA Government (Applied Research Program) funding “SHARC”
- 2013 – CMST with Mullaloo (MSLSC) members awarded research grant: Feasibility of shallow water sonar shark detection.  
If a suitable system existed, develop algorithms to detect sharks  
Estimate potential environmental impact.
- 2014 – MSLSC acoustic tag receiver array to detect tagged sharks
  - Curtin/MSLSC initiate MOU “BeachLAB” as a platform to scientifically test Beach Safety Management Technologies (Initially shark orientated)
  - CMST with Mullaloo (MSLSC) members awarded SHARC II grant: Characterise acoustic signatures of water-based activities as a potential cue for sharks
- 2016 – “SHARC” project outcomes
  - Current systems limited range in shallow water
  - Laid out specifications for ‘optimum’ shark detection sonar
  - Laid out experimental procedures to test performance and impact
- 2017 – Seeking funding to progress this (discussions Shark Mitigation Systems)





# Overview: Two Projects



- **Acoustic signatures of beach goers as a potential cue for sharks:** Characterise sounds produced by humans during different water-based activities and assess if they may be detected by sharks.
  - Background (sound pressure, particle motion and fauna hearing )
  - Typical coastal underwater sounds (mechanical)
  - Human-powered activities (swimming, kayaking, diving)
  - Playback tests
- **Sonar detection and identification of sharks:** Assess feasibility of using sonar to detect sharks using off-the-shelf systems. If so, develop detection algorithms and assess the likely environmental impact
  - Brief history of sonar and sharks
  - Initial studies in 2013, short range detection
  - Shark Bay tests
  - Environmental impact



# Take home message: Sound cues



- Quantifying human signals and contribution to the local soundscape is relatively simple.
- Human-powered signals are audible, considerably quieter than mechanical noise, likely audible over tens of metres.
  - Useful for evaluating swimmers performance
- Signals are complex, as would be masking them.
  - Highly variable (35-40 dB variation between 5<sup>th</sup> and 95<sup>th</sup> %iles)
- Accurately quantifying sound pressure and particle velocity in confined spaces is complex and varies considerably with frequency – Requires significant knowledge of acoustics (physics).
- Potential error for quantifying hearing thresholds, need to understand the properties of the sound field.
- CMST making progress. <https://www.youtube.com/watch?v=aQx3QWbf5aI>
  - [https://www.youtube.com/watch?v=EO4q\\_ua0Gbw](https://www.youtube.com/watch?v=EO4q_ua0Gbw)



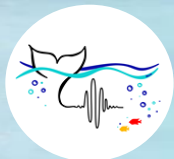
# Take home messages: SONAR



- Short range – Easy bit!
- Longer range (>60 m – Not so easy >100 m the next challenge)
- Several detections at various ranges (in near perfect conditions)

## RANGES USEFUL FOR BEACH MANAGEMENT

- Tested a number of sonar systems – No single one is ideal
- Proposed set of specifications!!!! Additional mechanisms to test
- Classifiers: We have series of descriptors to integrate into previous size, speed classifiers.
- Test version (funding)
  - Long-term performance – BEHAVIOURAL IMPACTS
- Future issues to tackle: Automation – probabilistic detection....
  - What is the safe percentage?



Thank you for listening.  
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Support gratefully received



Department of  
Parks and Wildlife

