November 2012

CMST News

The Newsletter of the Centre for Marine Science & Technology

#19

Research on Endangered Australian Sea Lions in the Perth Metropolitan Area

Male endangered Australian sea lions use islands along the Perth coastline to haul-out, primarily to rest and recuperate from long foraging trips. Sylvia Osterrieder is conducting her PhD through a collaboration between CMST, Victoria University and the Department of Environment and Conservation, to improve survey design, and to better understand how and when sea lions use the Perth metro islands. The project aims to investigate their temporal and spatial habitat use of various islands and their interaction with human use. The effectiveness of long-term photo-identification, using whisker spot patterns for individual animal recognition is also being tested. If this is effective it will allow for colony sizes to be estimated and the level of site fidelity to be identified. Photographs of known individual sea lions in captivity are being used to test the methodology. This has been possible through the extensive support of UnderWater World in Qld, Pet Porpoise Pool in Coffs Harbour, the Adelaide Zoo, and Taronga Zoo in Sydney. In-kind contributions of daily count data from Rockingham Wild Encounters and Francis Marchant have resulted in preliminary findings showing high daily variability in sea lion numbers using Seal Island, and a consistent increase of numbers using Seal Island to haul-out throughout the day. The project is in its first year, with plenty of invaluable information to be collected in the next couple of years.

PHOTO: SYLVIA OSTERRIEDER

Tussling male sea lions

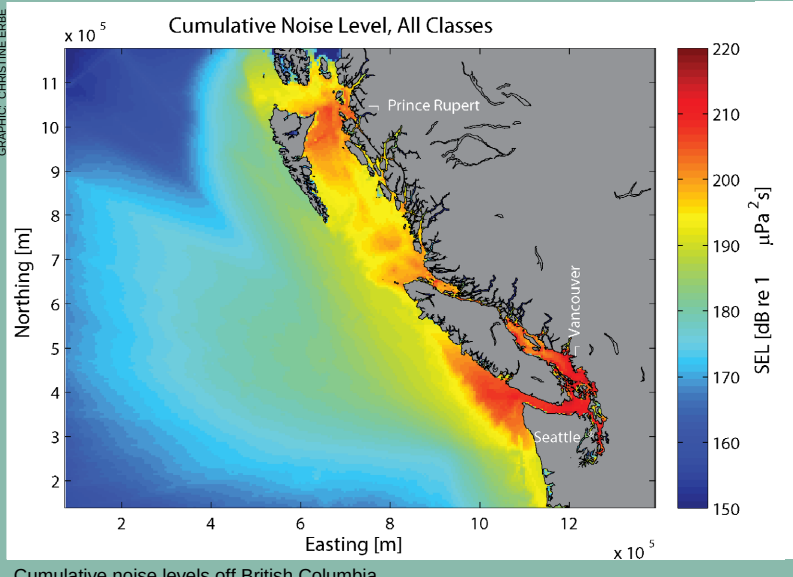
Recent Study puts Ship Noise on the Map

The Canadian British Columbia coast is very similar to Australia's Queensland and Western Australian coasts in terms of rapid port development for coal, mineral and petroleum export. The resource boom has attracted an increasing number of ships, and these inevitably cross potentially critical habitats of marine animals. In British Columbia, the southern resident killer whale population is listed as endangered. Its habitat includes major shipping lanes.

Christine Erbe, CMST's new Director, used Automatic Identification System (AIS) ship track data for one entire year (2008) and modelled the underwater noise from 200,000 individual ship tracks. Near the busy ports of Vancouver and Seattle, on average three ships per hour (for every hour of the year) were counted.

The cumulative sound exposure level from all of these ships over the entire year was mapped (see image). In the absence of underwater noise thresholds in Canada, target noise levels recommended in the European Union for the achievement of "good environmental status" of marine waters were applied. Most of southern British Columbia forming habitat for endangered killer whales exceeded European water quality (noise) thresholds—based on shipping alone, i.e. excluding other (additional) man-made and natural noise sources. The study has recently been published in the Journal of the Acoustical Society of America: www.tinyurl.com/9vktzph

GRAPHIC: CHRISTINE ERBE



Cumulative noise levels off British Columbia

Underwater A-Capella

Humpback whale song is one of the most complex, non-human, acoustic displays performed in the animal kingdom. Only males sing, which is thought to be primarily for courtship or sexual selection. A group of CMST researchers have been investigating humpback whale song and the underwater soundscape in Australia's southwest (Geographe Bay) since 2008, as part of the SouWEST program (Southwest Whale Ecology Study; www.souwest.org). SouWEST is run in collaboration with Western Whale Research and Dunsborough and Coast Land Care. The team heads out to the field again this November, this time with the sponsorship of the Australian Geographic Society. Recent results from previous years' acoustic recordings will be presented at the Acoustical Society of Australia conference and will showcase emerging trends in Geographe Bay humpback song structure and its inter-annual evolution. While songs usually comprise the same units or "words" to form phrases, unique units have been introduced in some years. CMST's Angela Recalde-Salas is currently examining the dominance of certain units in the song structure, whether dominant units remain within the same frequency range and how anthropogenic noise levels may affect how the whales communicate with each other within these frequencies. The research addresses key management priorities for cetaceans around Australia.

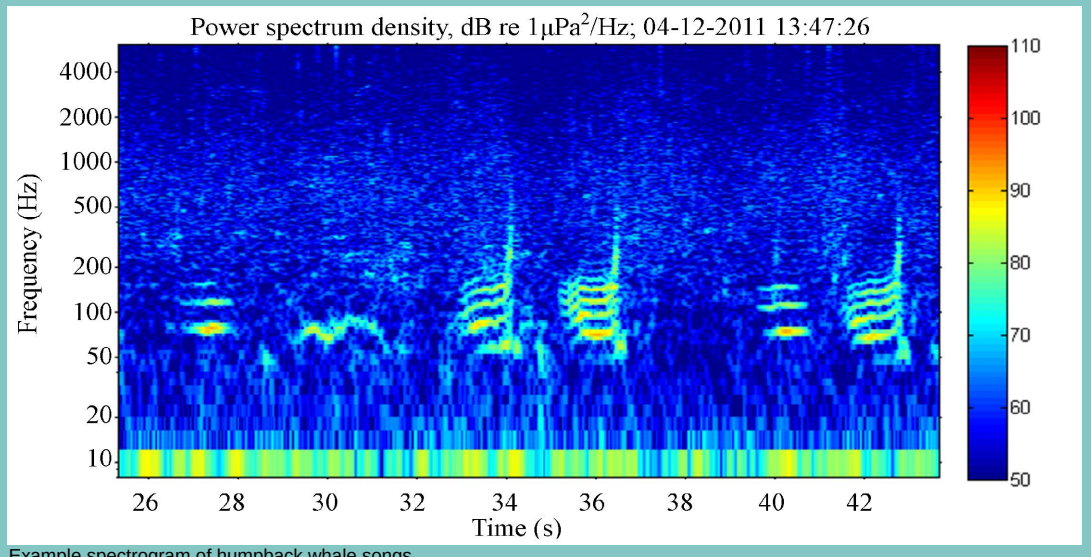


IMAGE: ANGELA RECALDE-SALAS

Example spectrogram of humpback whale songs

Student activities

➤ **Matthew Koessler** is a new CMST PhD student; his research (funded by Chevron Energy Technology Company) will be focused on sound propagation modelling in marine, acoustic-elastic range-dependent environments. The aim is to develop a numerical method to model sound propagation over limestone seafloors that are characteristic of Southern and Western Australia. In 2011, Matthew was awarded a BSc with honours (Physics and Earth-Ocean Sciences) from the University of Victoria in British Columbia, Canada. Prior to joining CMST, Matthew spent a year working at the Geological Survey of Canada locating earthquakes along the Canadian west coast and modelling fault mechanics. Matthew will be supervised by Dr. Alec Duncan, Ass. Prof. Sasha Gavrilov, and Dr. Christine Erbe.

PHOTO: MARTA GALINDO ROMERO

CMST's new crop (clockwise from top left): Shyam Madhusudhana, Matthew Koessler, Sarah Marley, Angela Recalde-Salas, Sylvia Osterrieder, Michael Bittle

➤ **Shyam Madhusudhana** began his PhD in March 2012, and focuses on developing tools for automating the analysis of underwater soundscape measurements. His research interests are in the field of pattern recognition as applied to acoustic signals. After obtaining his Bachelor of Engineering degree in Computer Science & Engineering from Visveswaraya Technological University, Belgaum, India, he moved to San Diego in 2005 to pursue higher education with emphasis on research. He completed his Master's degree in Computer Science at San Diego State University (SDSU) in May 2009. His Master's thesis involved development of an automatic classifier for recognising blue whale B and D calls in long-term underwater acoustic recordings. Shyam worked with researchers at Scripps Institution of Oceanography (SIO), for over three years. He has also worked as a researcher/engineer for about 6 years at LumenVox LLC, an Automatic Speech Recognition solutions provider in San Diego. At CMST, his PhD is funded by Chevron Energy Technology Company and he is being supervised by Dr. Christine Erbe and Dr. Sasha Gavrilov.

➤ **Michael Bittle** started his PhD studies with CMST in July. His project involves the detection and classification of marine mammal vocalisations using a mixture of embedded and reconfigurable computing. He completed his undergraduate studies in 2010 and was awarded a double degree with honours in Computer Systems Engineering and Physics. His undergraduate engineering thesis focussed on detecting snapping shrimp clicks using programmable logic, which followed on from work experience with the Defence Science and Technology Organisation (DSTO). Michael is being supervised by Dr. Alec Duncan in collaboration with DSTO.

Bottlenose dolphins in noise-rich environments

Sarah Marley is leading the first stage of a multi-year project at CMST which aims to incorporate a comprehensive combination of acoustic and visual monitoring techniques to identify the responses of bottlenose dolphins to noise-rich environments. Over successive years, observations are to be conducted, focussing on the busy areas of the Swan Riverpark where a core community of approximately 25 dolphins is resident. Future field seasons will see the deployment of an underwater noise logger to obtain further information about the underwater noise environment in which the dolphins live. This data will help to determine the significance of key areas in the Swan Riverpark, and how dolphins respond to any disturbances in these areas. Such information is invaluable for creating a healthy environment for dolphins and recreational river users. The project links directly to the "Coastal and Estuarine Dolphin Project", run jointly with Murdoch University and Dolphin Watch, which is a community based program managed by the Swan River Trust. This project is also linked to Estenio Paiva's Master's project being undertaken at Curtin University on dolphins in the Fremantle Inner Harbour, which has been made possible through significant support from Fremantle Ports.

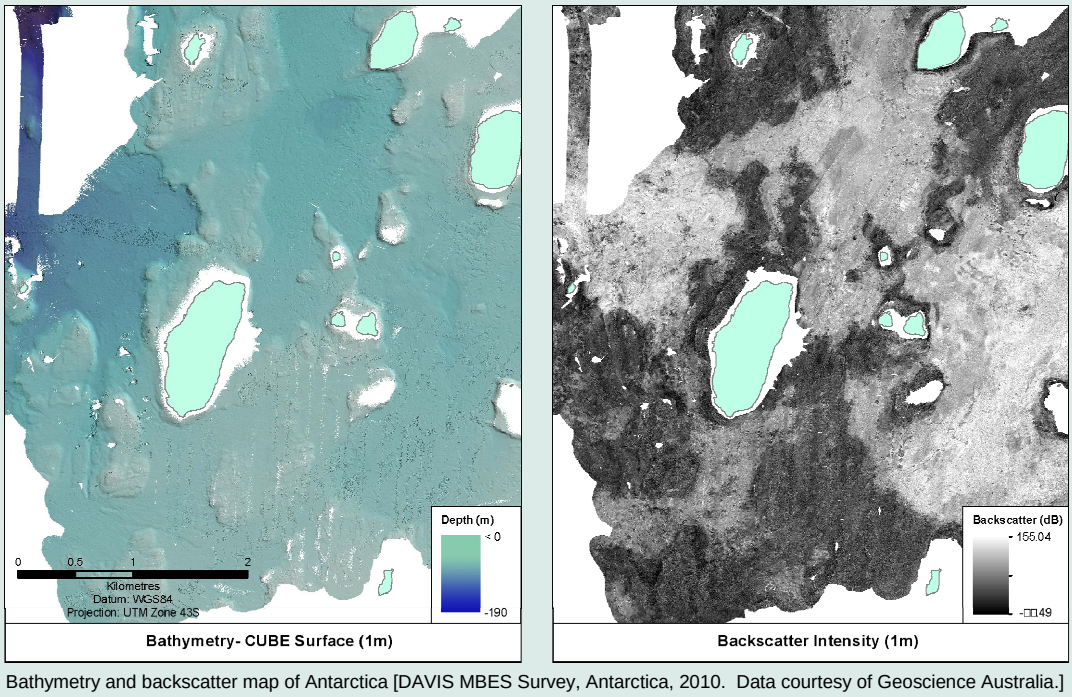
PHOTO: PHIL BOUCHET

Sarah Marley at Fremantle Harbour

Mapping the Antarctic Sea Floor

Elizabeth Mair, a student at Curtin University's Spatial Science Department, has just completed a 3rd year project entitled: "Mapping the sea-floor and characterising the marine environment near the Davis Antarctica Research Station." Supervised by CMST's Dr. Iain Parnum, the study used a Kongsberg EM3002 dual head multibeam echo-sounder dataset collected by Geoscience Australia. Different seafloor classes were identified in the Davis Harbour region through the production and analysis of high resolution bathymetry and backscatter maps (using CARIS, HIPS and SIPS software). Prediction of sediment properties was carried out using an implementation of 'Angular Range Analysis' (ARA) and compared with historic sediment grab sample information. Results of this study will feed directly into other work being conducted in the Antarctic by CMST.

IMAGE: ELIZABETH MAIR



Bathymetry and backscatter map of Antarctica [DAVIS MBES Survey, Antarctica, 2010. Data courtesy of Geoscience Australia.]

CMST Lunchbox Seminars

CMST holds weekly seminars, with speakers from interstate and overseas, as well as CMST staff.

The schedule of seminars is listed on our website:
www.cmst.curtin.edu.au/seminars

If you would like to receive email updates regarding CMST seminars, simply send an email to the following address:
seminars@cmst.curtin.edu.au

The Centre for Marine Science & Technology (CMST) conducts world-class consulting, research, development and education for the marine industry and for government agencies.

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Curtin University

Acoustics 2012: Fremantle, Western Australia

The 2012 conference of the Australian Acoustical Society will be held in Fremantle, Western Australia from 21 to 23 November, 2012. ACOUSTICS 2012 Fremantle will be another great opportunity for Australian and International guests to get together to discuss all aspects of acoustics. The theme for the 2012 conference is **"Acoustics, Development, and the Environment"**, which is very relevant in the Western Australian context given the significant urban, mining, and infrastructure development being undertaken at present.

ACOUSTICS 2012 Fremantle will include sessions addressing the acoustical and vibration aspects of major developments, and disseminate up-to-date methodologies and practices. There will also be sessions on acoustical topics that fall outside of the main theme.

General Themes:

Vibration;
General Acoustics;
Musical Acoustics;
Engineering Noise Control;
Architectural Acoustics;
Environmental Noise;
Underwater Acoustics – Other;
Occupational Noise and Vibration;
Underwater Communications and Sonar Signal Processing;
Marine Environmental and Bioacoustics;
Underwater Acoustic Modelling And Measurement;
Air Acoustic Measurement/Metrology;
Physiological and Psychological Acoustics;

The Australian Acoustical Society and the Centre for Marine Science and Technology, Curtin University, present:

Acoustics 2012 Fremantle. Pre-Conference Workshop on:

Underwater Passive Acoustic Monitoring and the Impacts of Underwater Noise on Marine Fauna

Date: Wednesday, 21st November 2012.
Venue: Esplanade Hotel Fremantle, Western Australia.
Welcome tea, morning & afternoon tea and lunch included.

Cost: $220 per person for the day
Space is limited to 60 people; we encourage you to register early.

The workshop will comprise three tutorial sessions covering ambient noise, underwater acoustics, terminology, metrics, the marine soundscape, sound propagation, anthropogenic noise, biological sources, measurement technology and methods, noise modelling and prediction, noise impacts on marine fauna, mitigation, and environmental management and policy. The tutorials will be followed by a selection of rapid-fire presentations of 10-minute duration each. We invite you to submit an abstract for this presentation session by email.

Tutorial 1: Introduction to Underwater Acoustics

Dr. Alec Duncan, CMST

➤ This tutorial will explain terminology and metrics (quantities and units) commonly used in underwater acoustics and bioacoustic impact assessments: pressure, energy, intensity, power, sound exposure, 1/3 octave band, decibel etc. Principles of sound generation and propagation will be described. Tools and methods for underwater sound measurement will be presented. Aspects of noise modelling and prediction will be explored.

Tutorial 2: Passive Acoustic Monitoring

Dr. Rob McCauley, CMST

➤ This tutorial will take you on a dive into the marine soundscape. Listen to the sounds of whales, dolphins, fish and invertebrates. Ever wondered what rain sounds like underwater? Discover man-made sounds in the ocean. How can soundscapes be quantified and characterised? How do soundscapes change with location and time? Find out what we can learn from passive acoustic monitoring about the marine ecosystem and potential anthropogenic effects.

Tutorial 3: Potential Impacts of Noise on Marine Animals

Dr. Christine Erbe, CMST

➤ As ocean water conducts light very poorly but sound very well, marine animals have evolved a sophisticated acoustic sense for communication, social interaction, navigation and foraging. Humpback whales sing songs for hours on end. Killer whale families have different dialects, and we can tell them apart just by listening to them. Dolphins use active sonar to find fish. Fish sing evening choruses. Larvae tune in to reef sounds for homing purposes. Underwater noise can interfere with these functions on an individual yet ultimately population level.

Online registration is now open:
www.acoustics.asn.au/joomla/acoustics-2012.html
Registrations close: On the day