Active Acoustic Detection of Marine Mammals Using Seismic Airguns

Seiche — Marine Acoustic Solutions
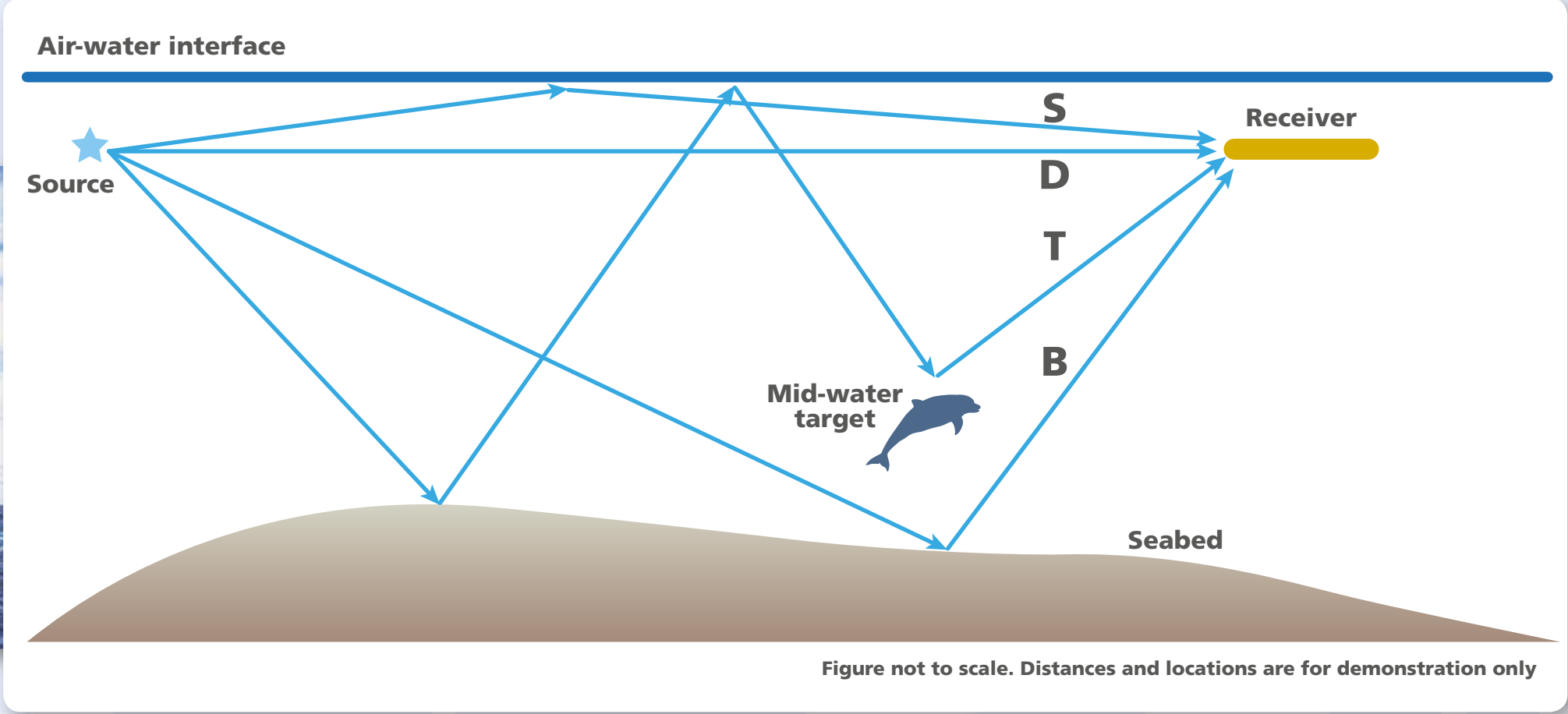
UNIVERSITY OF BATH

IDEA AND CONCEPT

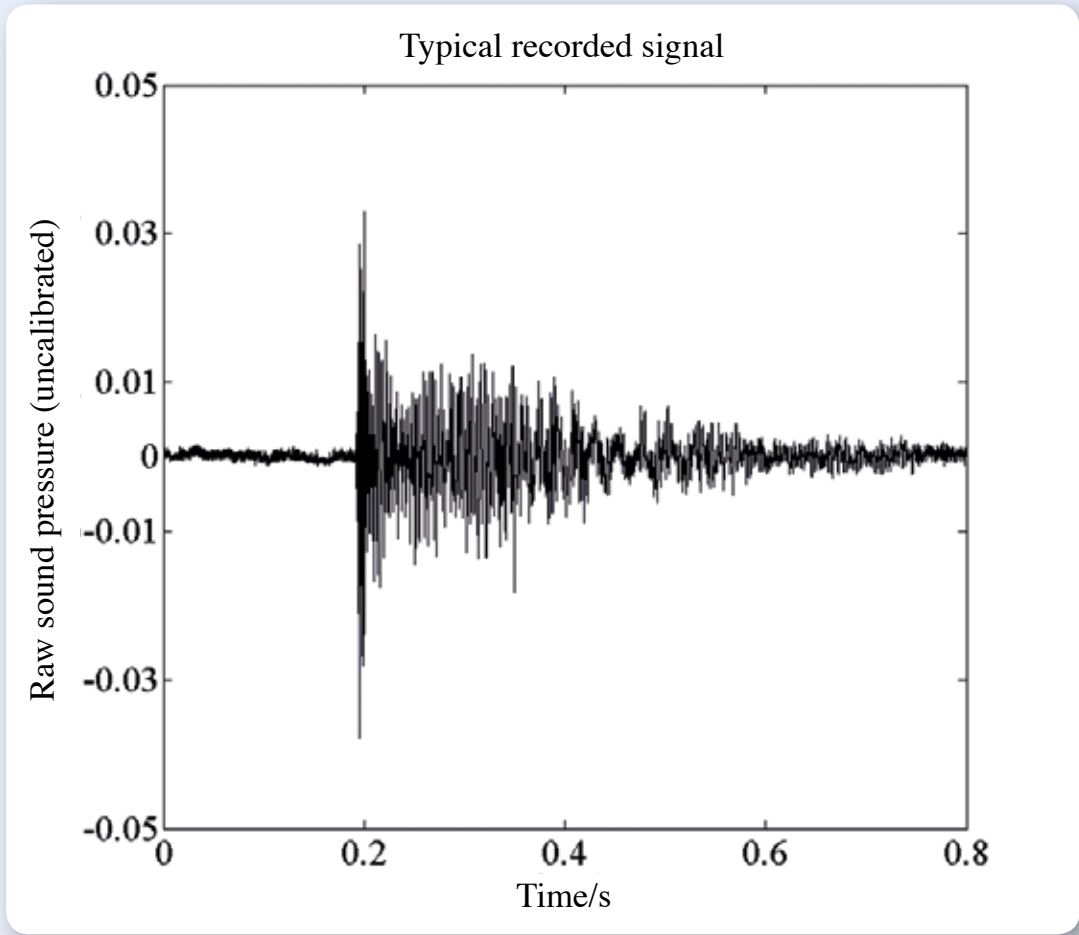Identifying mid-water targets (marine mammals) from the myriad of different surfaces and other targets that airguns could acoustically illuminate:

a) Seabed

b) Sea surface

c) Large rocks

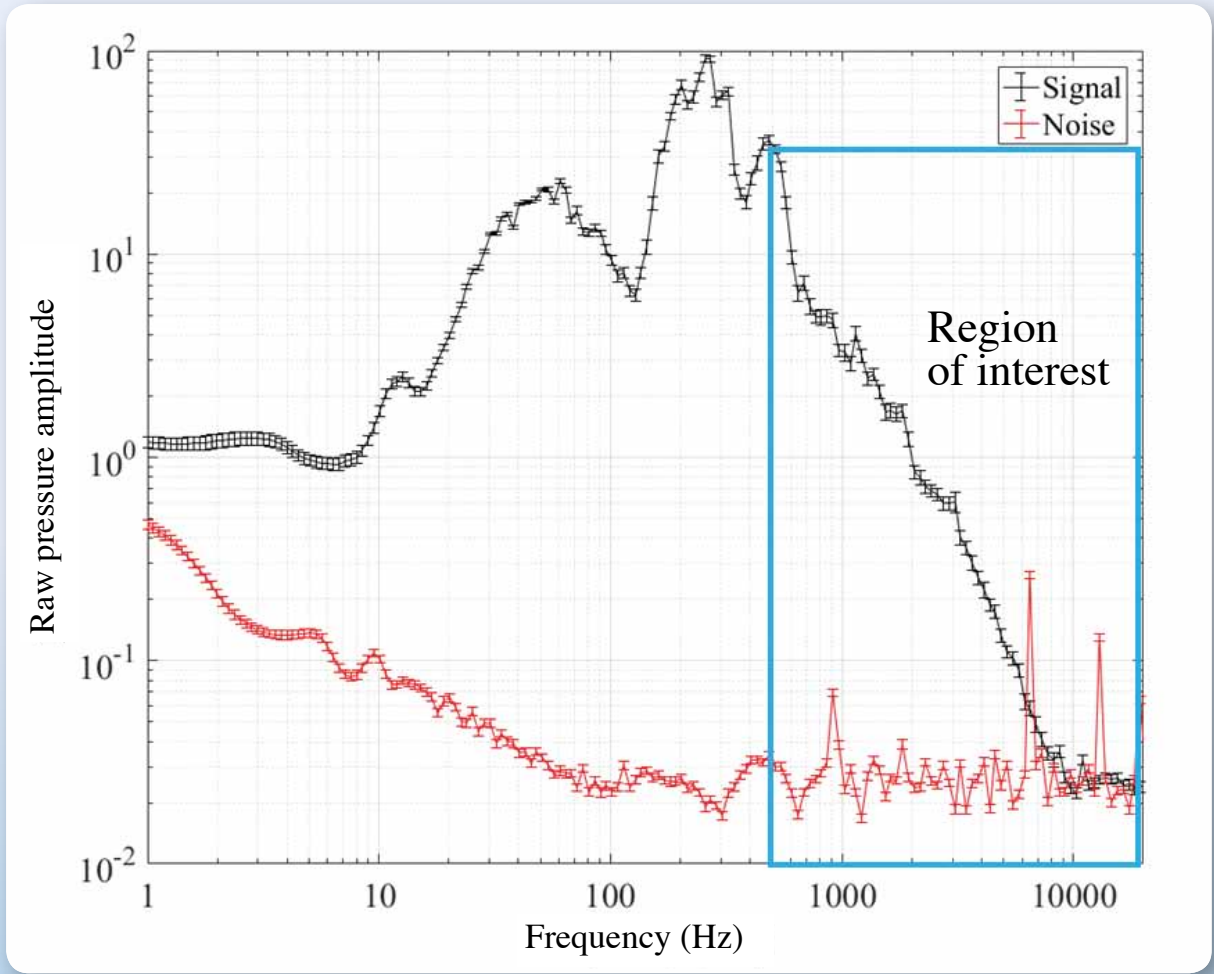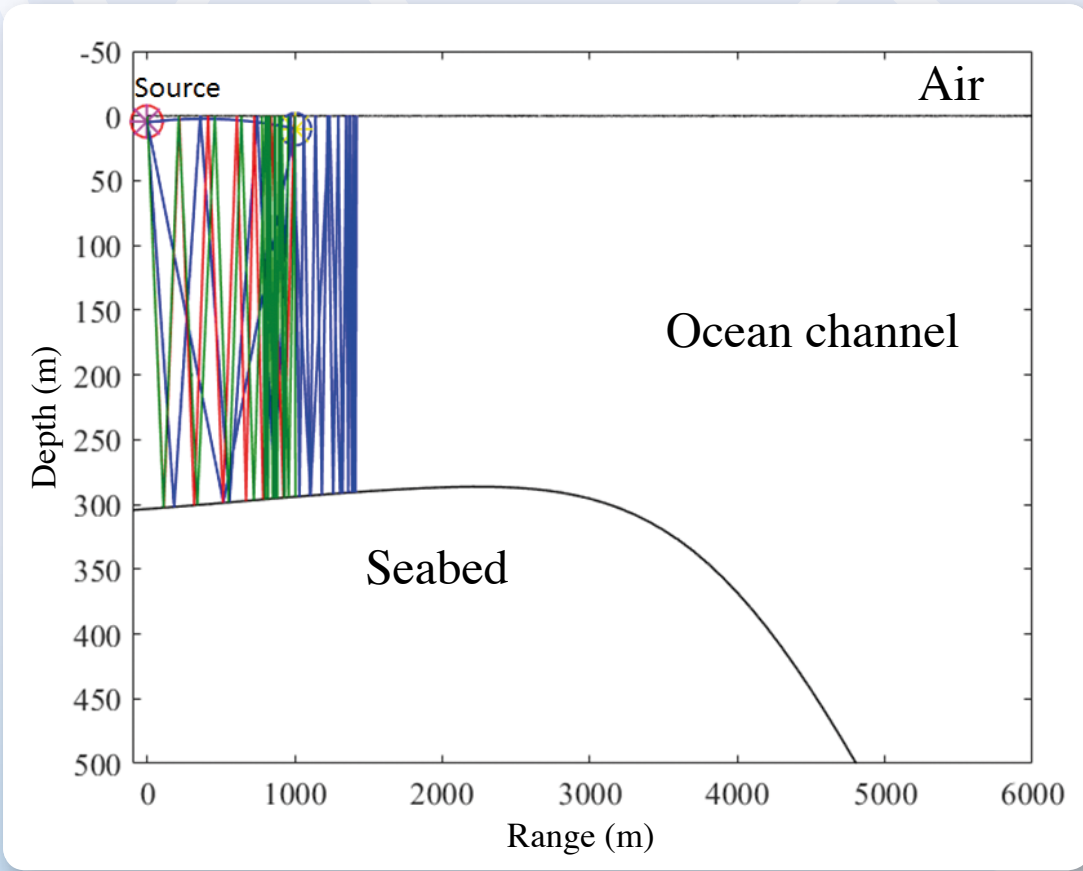Intended to work complementary to PAM observers, cameras and MMOs.

Air-water interface

Source — S — Receiver
D
T
B
Mid-water target
Seabed

Figure not to scale. Distances and locations are for demonstration only

RECORDED ACOUSTIC SIGNAL

Typical recorded signal

Raw sound pressure (uncalibrated) vs Time/s

INPUT AND OUTPUTS TO THE MODEL

INPUT	INPUT/OUTPUT	OUTPUT
Hydrophone	Hydrophone array properties	Cetacean locations
Hydrophone GPS	Cetacean movements	
Airgun timings	Cetacean properties	
Airgun GPS	Cetacean location from PAM and MMO	
Sea surface properties	Airgun properties	
	Seabed properties	
	Water column properties	

FREQUENCY CONTENT

Raw pressure amplitude vs Frequency (Hz)

- Signal
- Noise

Region of interest

RAY TRACING MODELLING

Source — Air
Ocean channel
Seabed

Depth (m) vs Range (m)
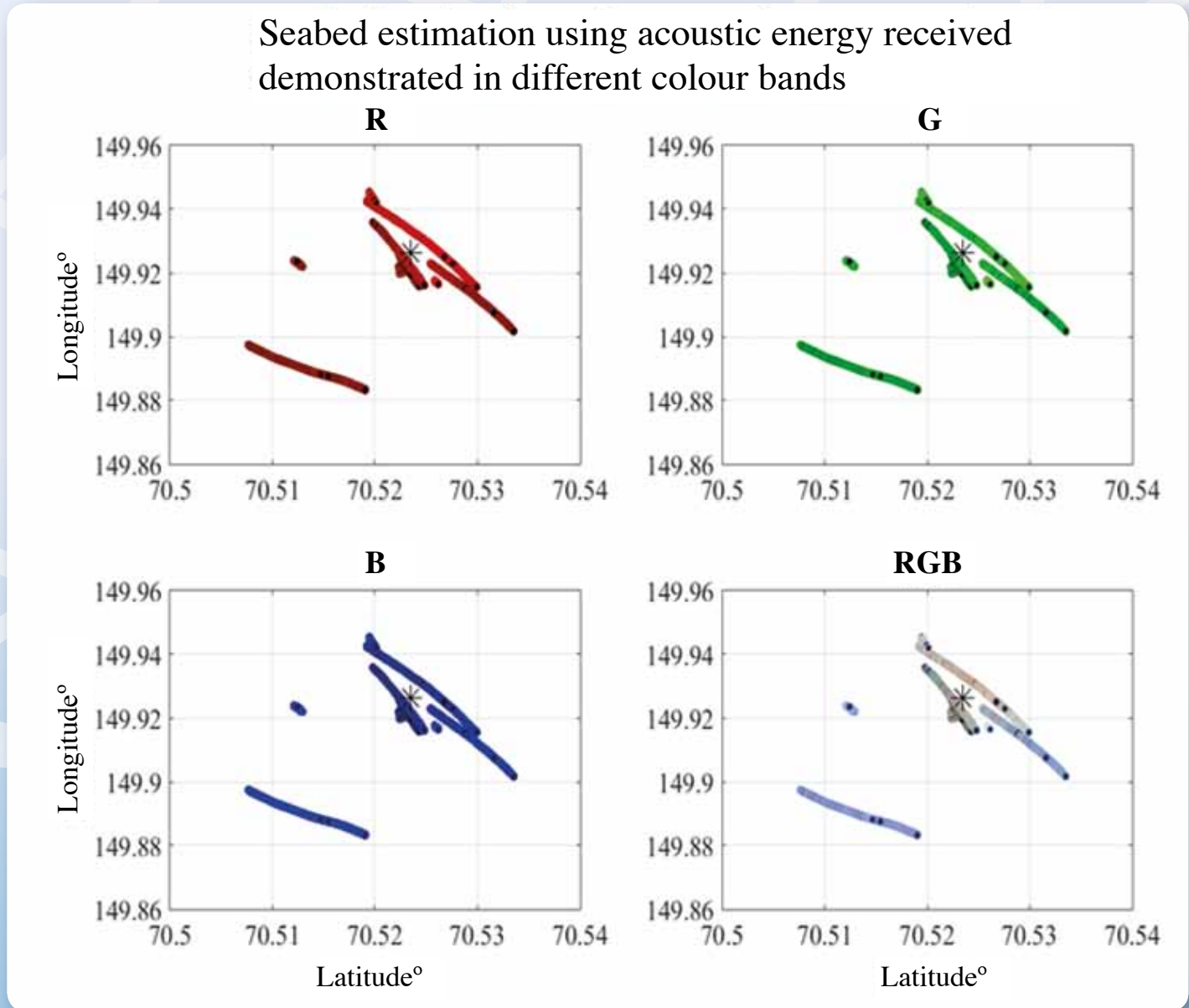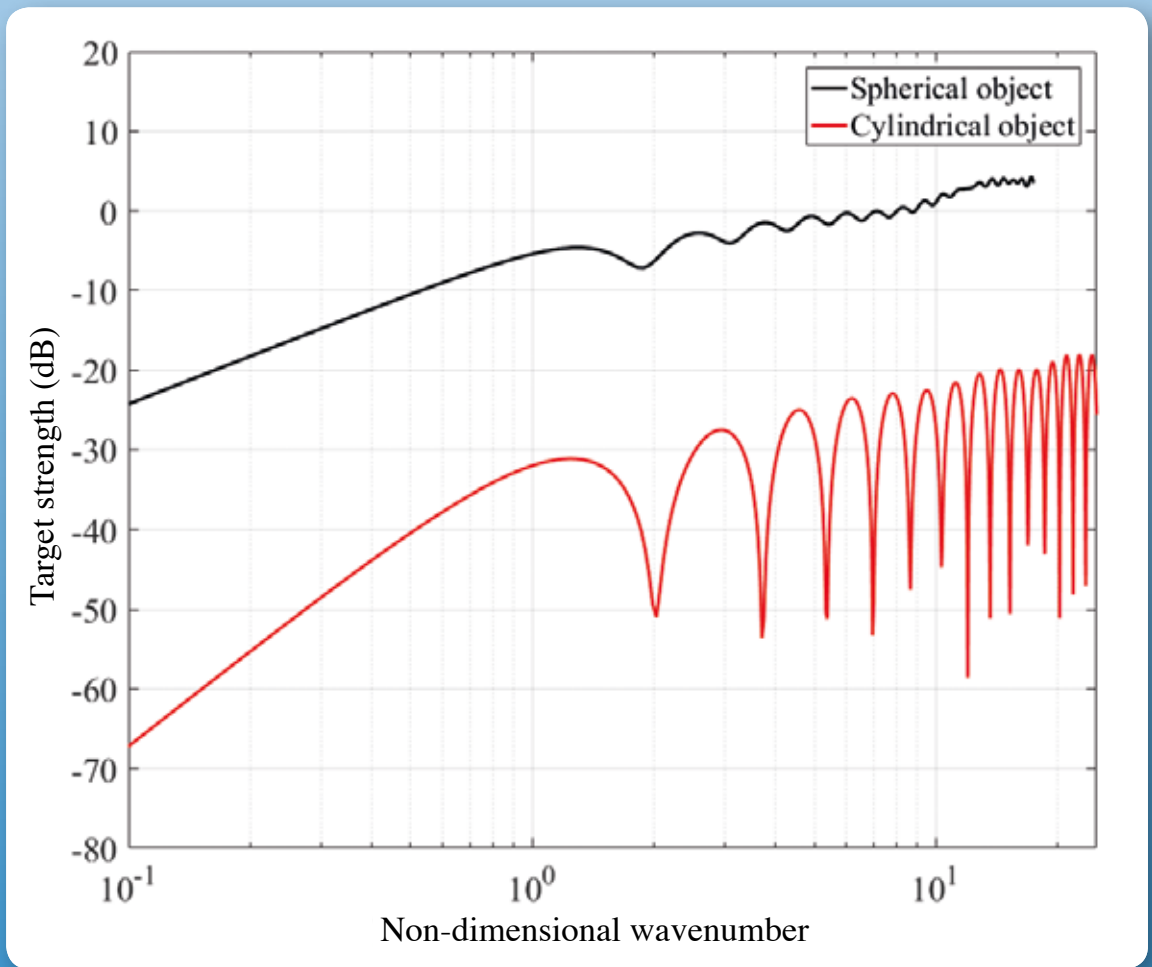
Propagation of acoustic energy from source to receiver location in different ocean channels.

SEABED ESTIMATION

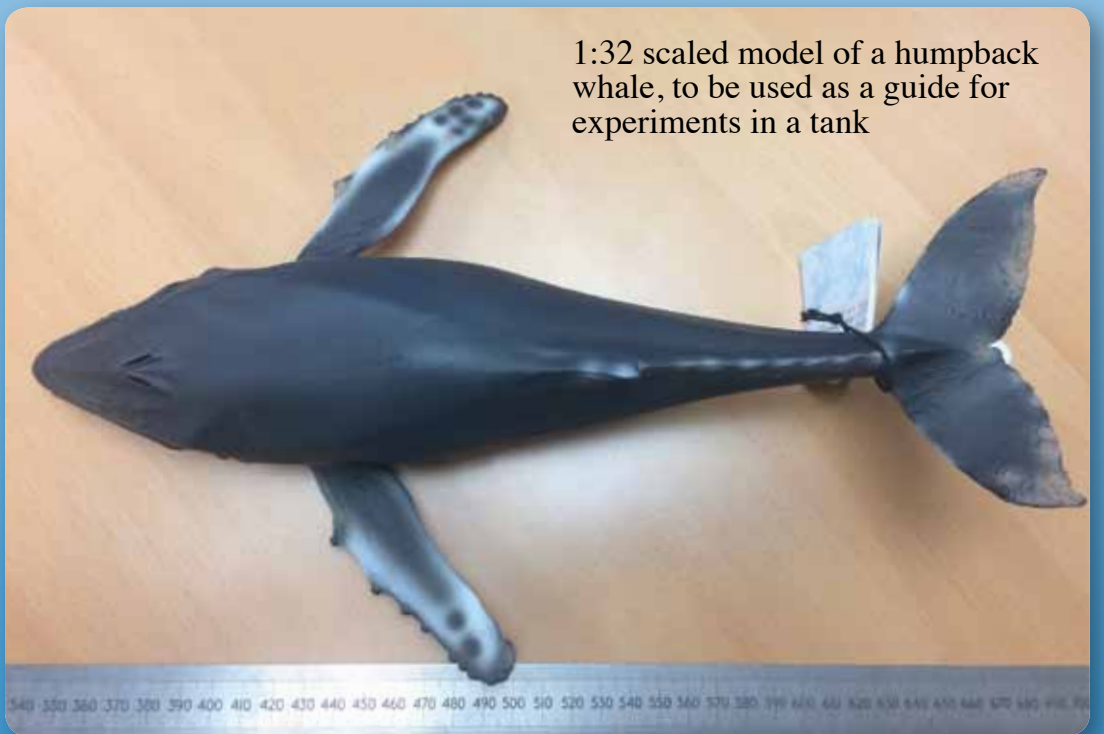Seabed estimation using acoustic energy received demonstrated in different colour bands

R   G
B   RGB

Longitude° vs Latitude°

Using energy from seismic airguns to identify top layers of the seabed below the survey ship. * is the fixed source location. Lines are the estimates from different buoys.

TARGET ACOUSTIC STRENGTH OF DIFFERENT MARINE MAMMALS

Target strength (dB) vs Non-dimensional wavenumber

- Spherical object
- Cylindrical object

Probably from lungs or other large internal organs (see orca figure). Can use approximate mathematical models to estimate their frequency response.

Internal anatomy of an orca

1:32 scaled model of a humpback whale, to be used as a guide for experiments in a tank

FUTURE WORK

(a) Development of acoustic inverse problem to identify possible location of marine mammals.

(b) Applications to shallow and deep water.

(c) Probable estimation of type of mammals in the survey, their motion in the sea and estimates of psychological behaviour in response to airgun sounds.

(d) Estimation of target strength using scaled experiments in a laboratory tank.