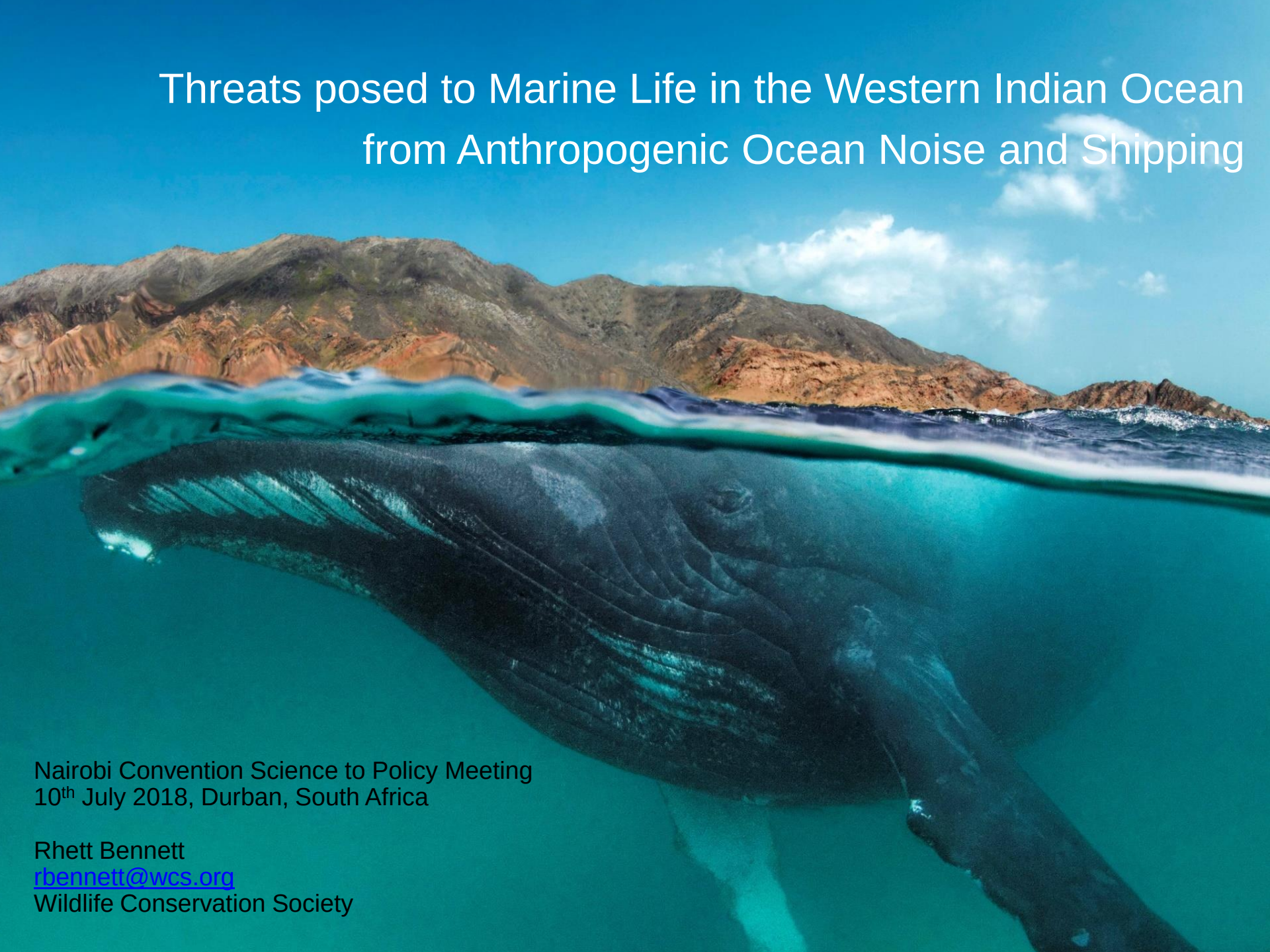
Threats posed to Marine Life in the Western Indian Ocean from Anthropogenic Ocean Noise and Shipping



Nairobi Convention Science to Policy Meeting
10th July 2018, Durban, South Africa

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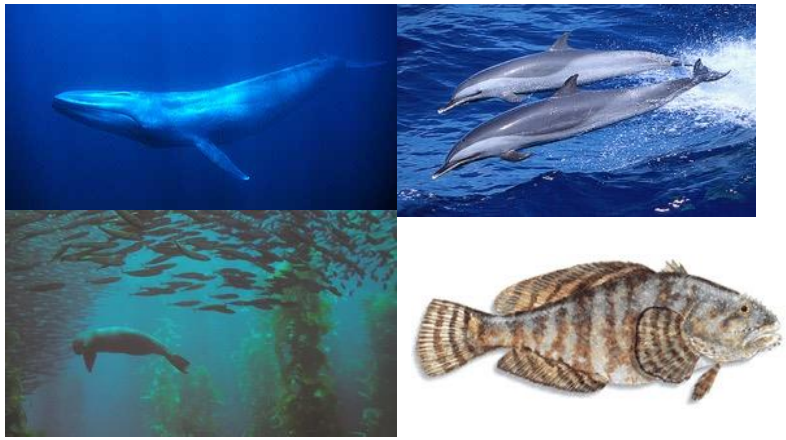
Wildlife Conservation Society

Marine Animal Acoustics and Ocean Noise

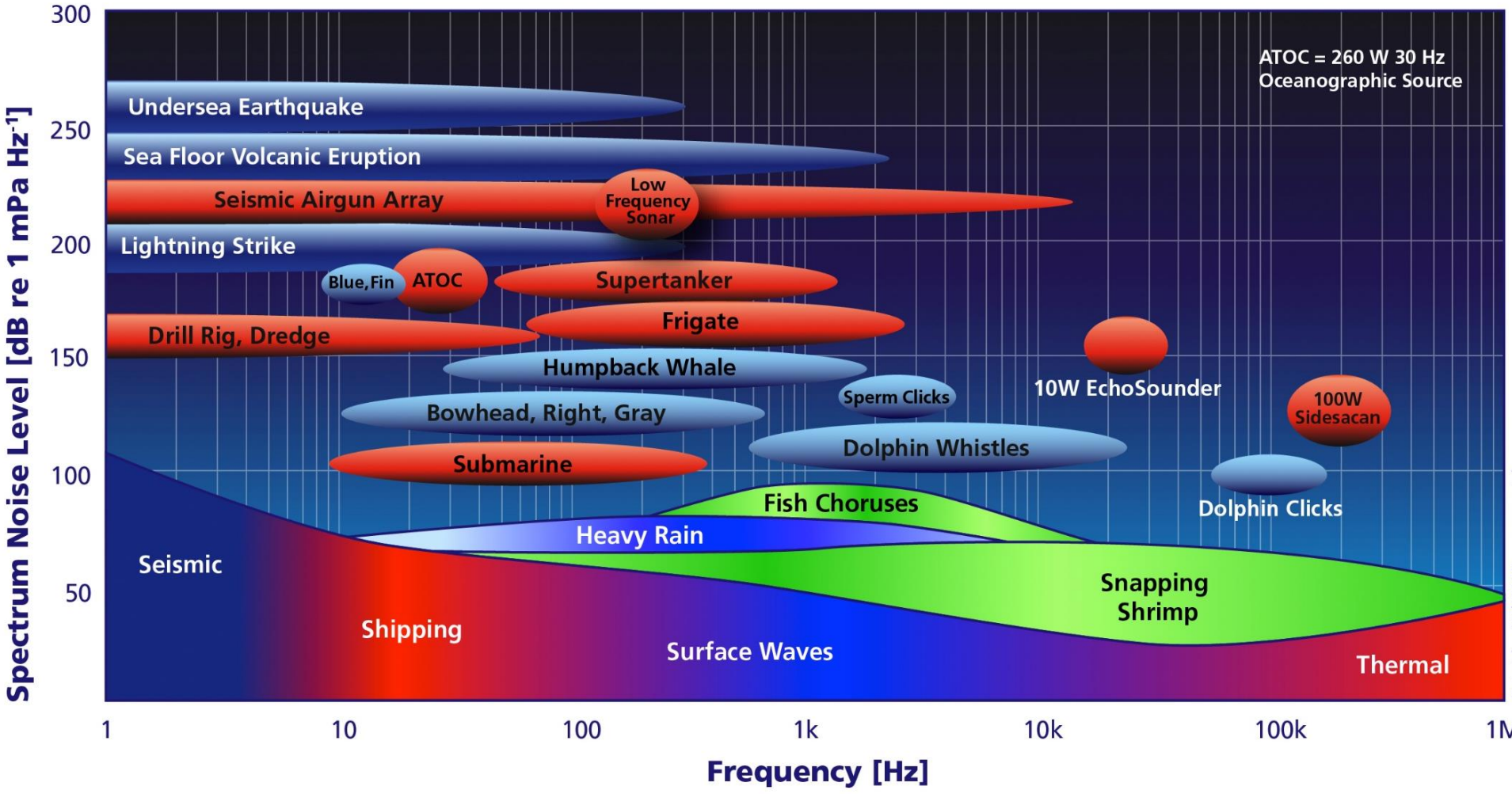


- Underwater sound is critical in life history
- Marine animals produce sounds to communicate, to find food & to listen for environmental acoustic cues.

- For many of the same physical reasons, humans produce underwater sounds either *intentionally* or *incidentally*

See: www.dosits.org
https://dosits.org/decision-makers/webinar-series/webinars-2018/potential-effects-mammals2018/

Ambient and Localised Noise Sources



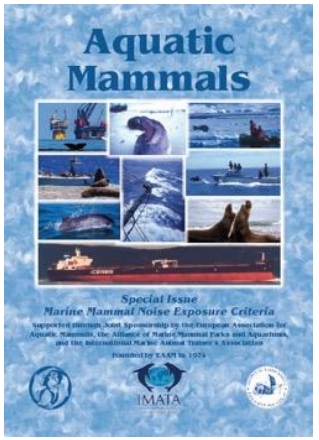
The effects of noise on marine life

Generally Increasing Severity

But

Generally Decreasing Occurrence

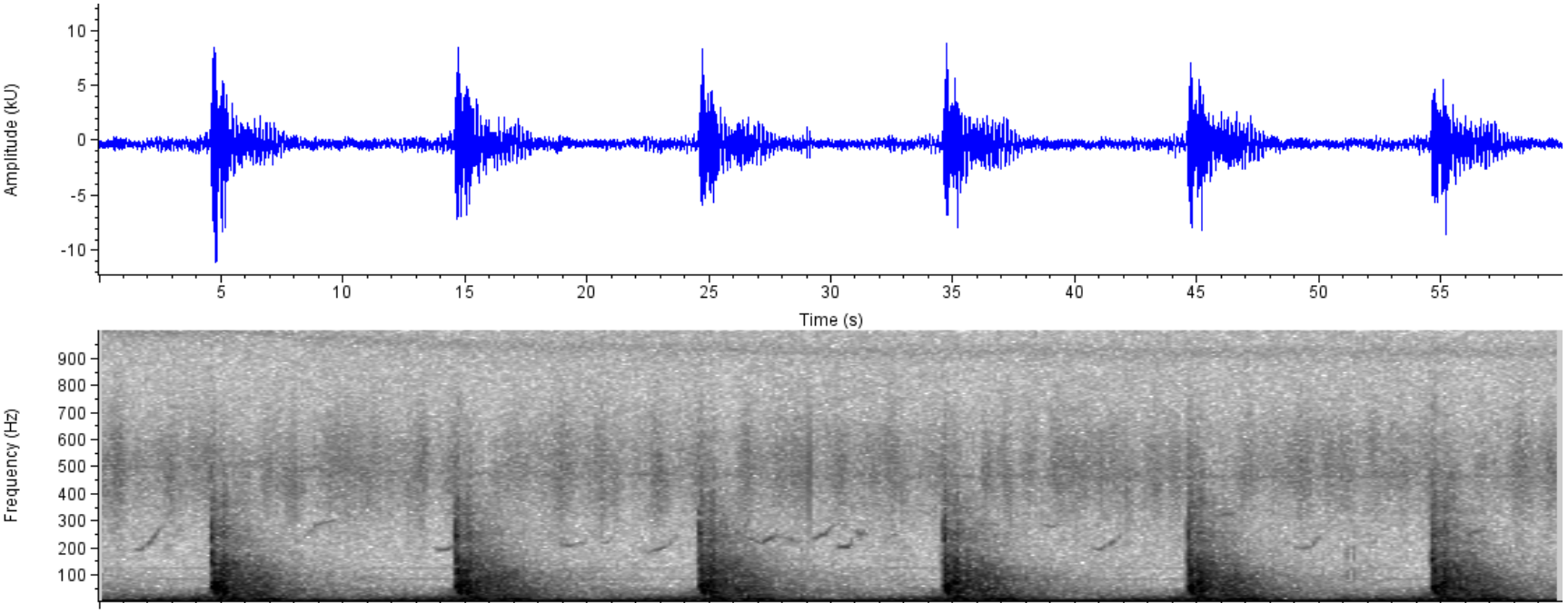
- No observable effects
- Interference with Communication
  - Auditory masking (loss of acoustic "habitat")
  - Temporary or permanent hearing damage
- Behavioral Responses
  - Orientation, increased alertness, vocal changes
  - Effects on feeding, breeding, social activity, risk of predation
  - Habitat abandonment: temporary or permanent
- Physiological Effects (stress, DCS)
- Injury and/or death (e.g. strandings)



Ocean Noise

- Vital functions and normal behavior disrupted by "masking" of communication signals between sender and receiver
- Loss of acoustic habitat for foraging, socializing, and breeding (e.g., relevance to UN Sustainable Development Goal 14)
- Emerging technologies are being used to assess levels of threat and impact

Ocean Noise



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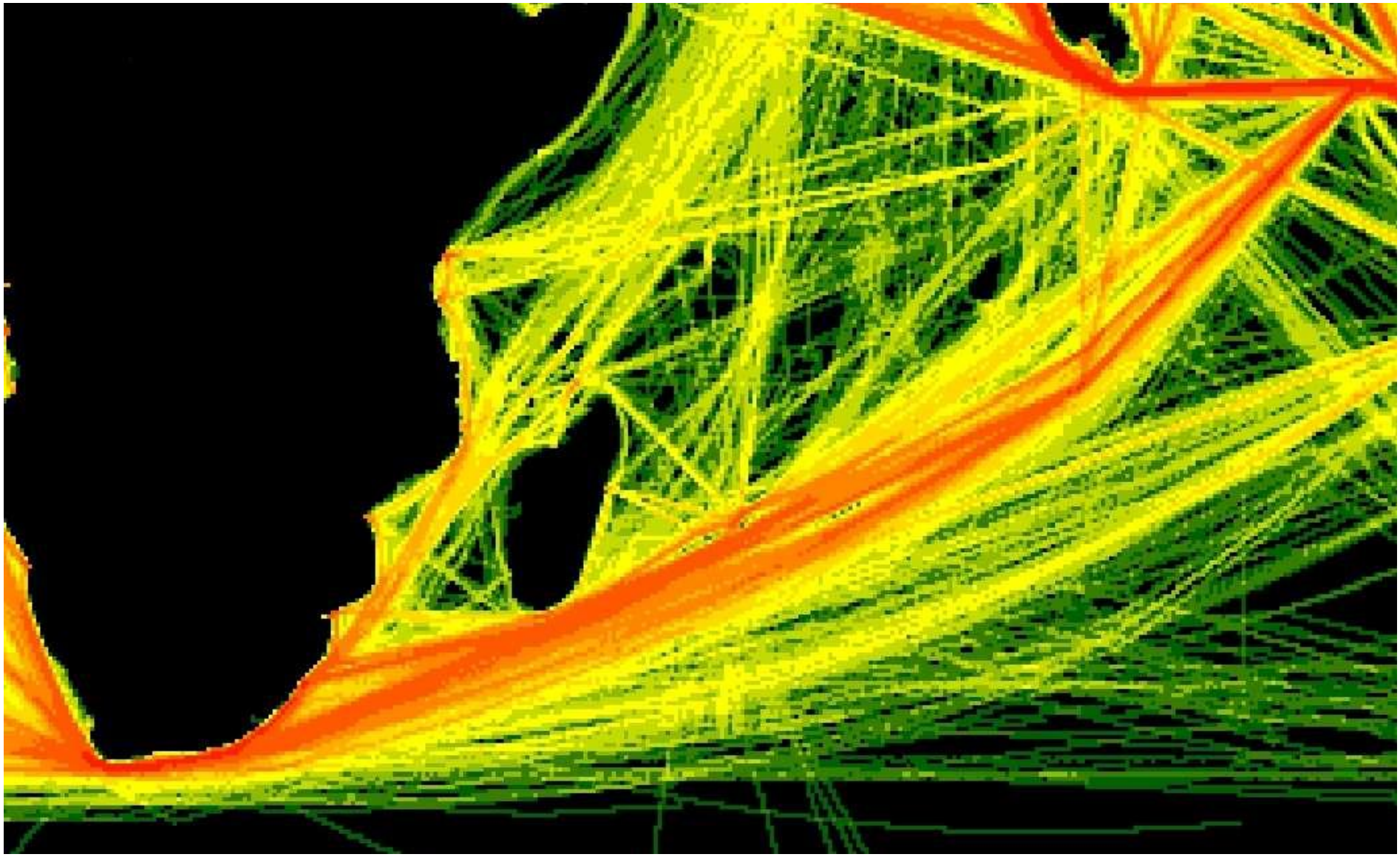
PLOS ONE

Seismic Surveys Negatively Affect Humpback Whale Singing Activity off Northern Angola

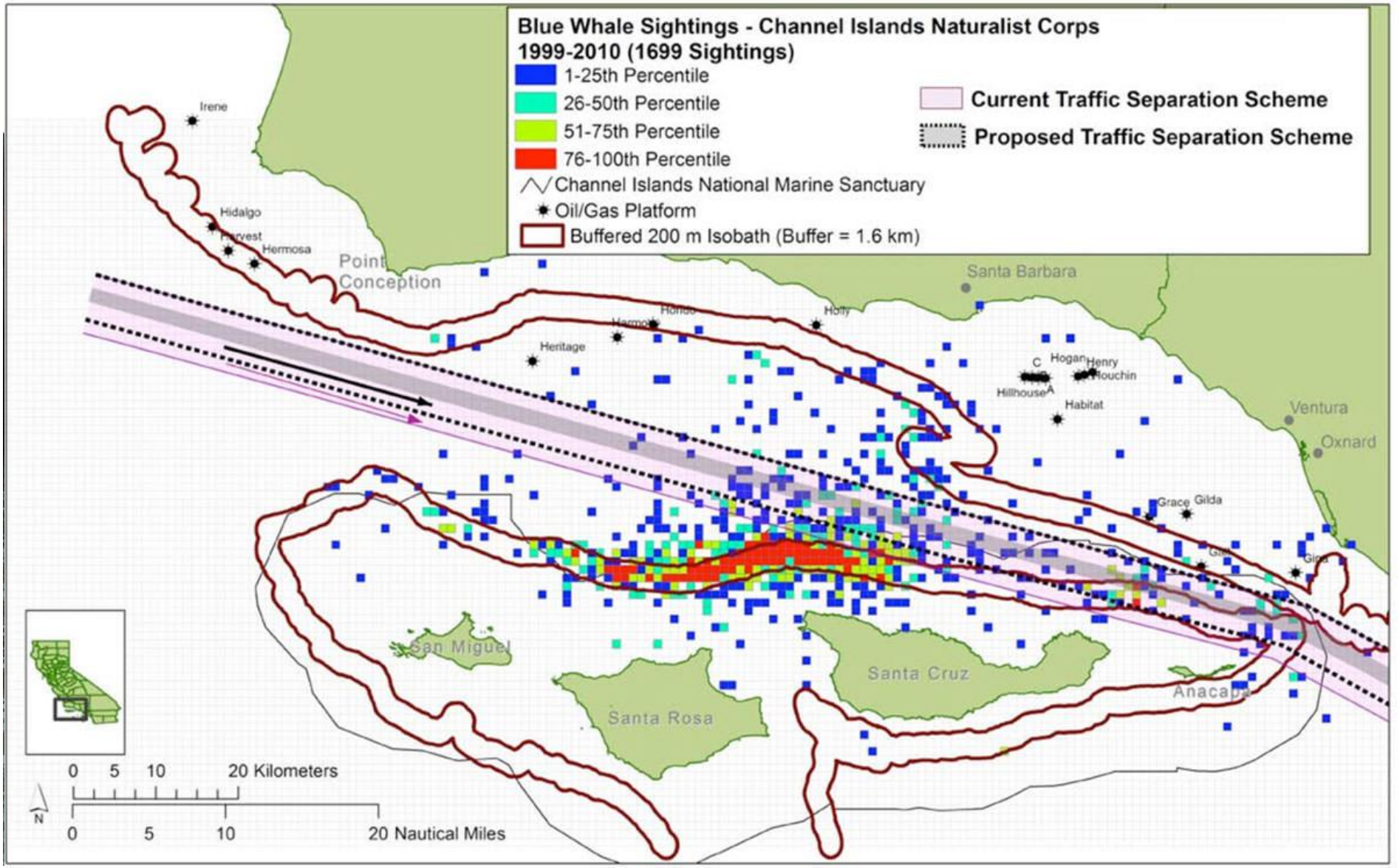
Salvatore Cerchio[1,2*], Samantha Strindberg[1], Tim Collins[1], Chanda Bennett[1,2,3], Howard Rosenbaum[1,2]

1 Wildlife Conservation Society, Global Conservation Program, Bronx, New York, United States of America, 2 American Museum of Natural History, Sackler Institute for Comparative Genomics, New York, New York, United States of America, 3 New York Aquarium, Brooklyn, New York, United States of America

Ocean Noise and the Nairobi Convention Area

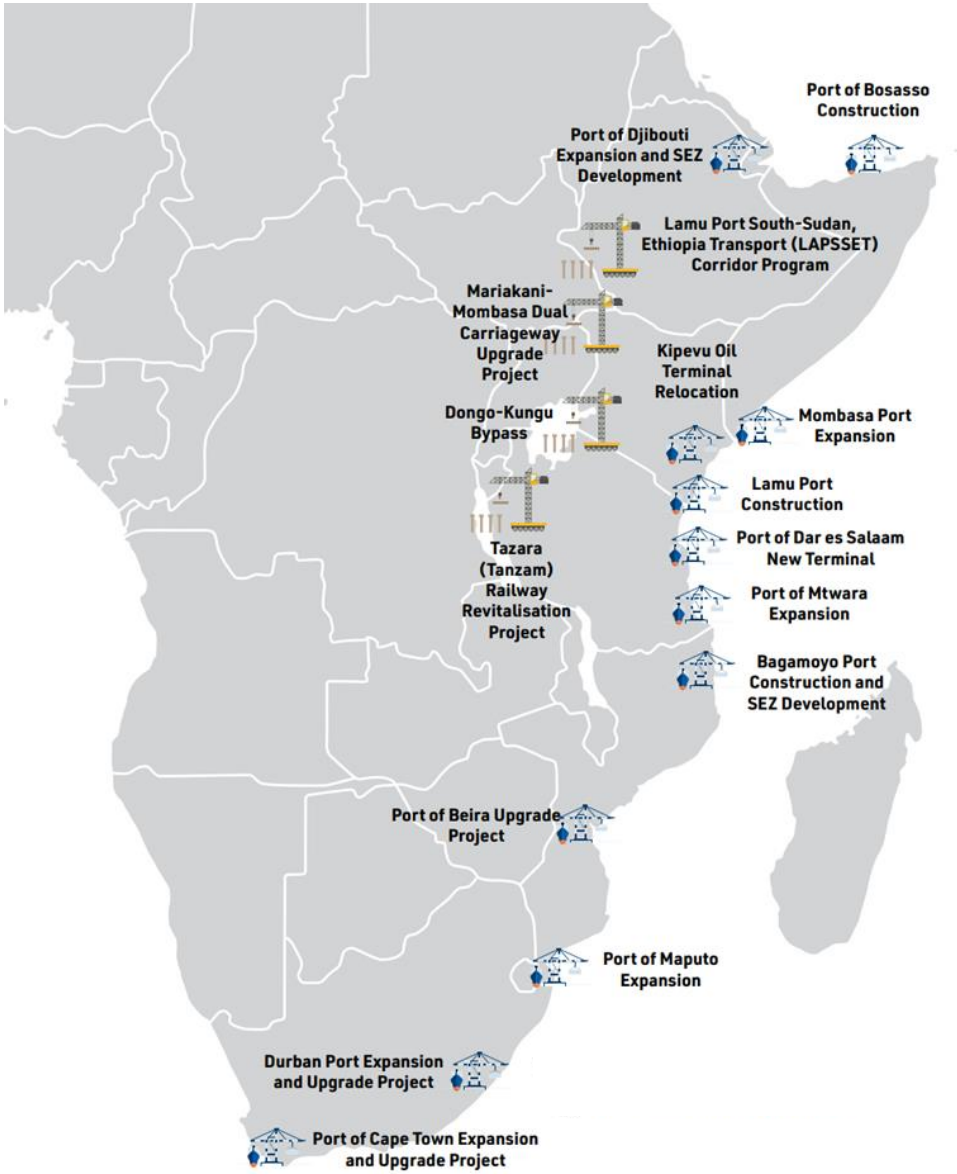


Shipping and Ship Strikes



Ocean Noise and the Nairobi Convention Area

- WIO states are accelerating plans to diversify maritime trade in keeping with the "Blue Economy".
- 13 large ports, expansion planned.
- Threats from noise/shipping poorly understood & rarely considered in development plans/EIAs
- Cumulative effects of multiple noise and ship/industry related stressors.
- 30% of global tanker traffic passes through the Mozambique Channel & shipping is projected to increase (Kaplan, 2009; Halpern et al. 2015).
- WIO ambient noise levels are increasing (Miksis-Olds et al. 2013).



Selected international measures to address noise

- UN/IMO Vessel Quieting Guidelines
- International Quiet Ocean Experiment (IQOE)
- Acoustic monitoring integration in Ocean Observatories (e.g. Chagos)
- Industry-supported Joint Partnerships for Passive Acoustic Monitoring (North Slope AK, GoMex)
- U.S. NOAA's 'Ocean Noise Strategy'
- Port of Vancouver (BC) ECHO program
- UN Ocean Noise Voluntary Commitment
- IUCN Marine Mammal Protected Areas Task Force - IMMAs

The challenges and taking action

- Pursue a multi-disciplinary international collaborative effort with governments, industry, academic/research community and IGOs/NGOs.

- Application of modern research and technology for better monitoring, understanding, reducing, and mitigating ocean noise impacts.

- Translation of science and associated efforts into more concrete actions and activities by member states and other stakeholders

The challenges and taking action

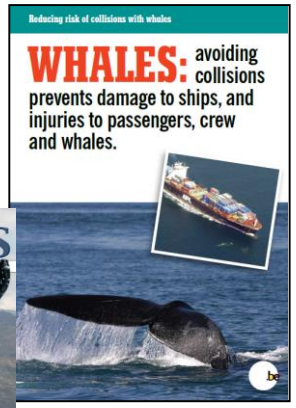
- Regulate and incentivize ‘change’ and ‘innovation’
- Mainstream Ocean Noise in national development plans as part of Country efforts to achieve Sustainable Development
- Build Capacity to undertake needed research, science and monitoring
- Continue Research and Science to understand impacts

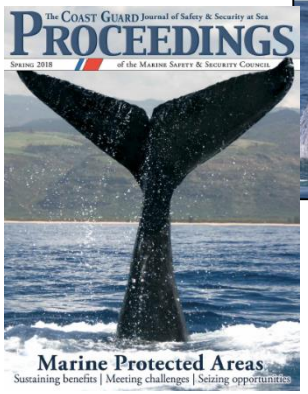
The challenges and taking action

International Collaboration

- UN Sustainable Development Goals (Goal 14)
- Convention on Biological Diversity (CBD)
- International Maritime Organization (IMO)
- Convention on Migratory Species (CMS)
- IUCN Joint Species Survival/World Commissions
- EU Marine Strategy & OSPAR
- International Whaling Commission (IWC)
- Nairobi Convention (interest)
- Arctic Council (interest)
- UNCLOS, 19th ICP

International Whaling Commission & International Maritime Organization joint publication for mariners





Links to Nairobi Convention Themes

Management:

"The main objective of activities under this theme is the effective management and protection of the marine and coastal environment of the Western Indian Ocean region".
"This includes development and implementation of ecosystem-based management programmes and activities that seek to reduce or prevent degradation of the coastal and marine environment."

This relates to not destroying the acoustic habitat in which animals may undertake essential ecological processes, such as communication, finding mates, feeding or navigating (or survival).

"The approach will address interactive and cumulative human impacts on ecosystems including a blue economy pathway using natural blue capital."

This is particularly important as the blue economy seeks to increase development, which will like increase ship traffic, thereby increasing ocean noise – management will need to assess the impacts that developments such as new ports will have on the level of ocean noise and mitigate against those problems.

Links to Nairobi Convention Themes

Assessments and Capacity Building:

"The main objective of the activities under this theme is to create better understanding and knowledge of the coastal and marine environment for informed planning and decision-making processes."

Here, we need more information in the levels of noise in the WIO, and the impacts, so that these can be incorporated into informed decision making processes

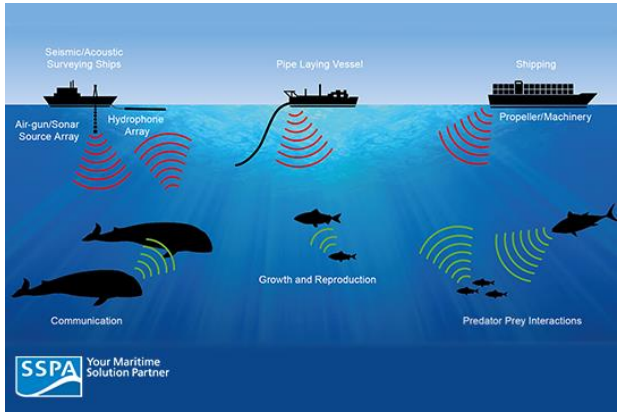
Coordination and legal aspects:

"Coordination activities will support the efforts of governments to negotiate and develop national, regional and international marine related environmental conventions, protocols, policies and legislation for current, new and emerging issues such as climate change, blue economy, oil and gas, ports and harbours, Ecologically or Biologically Significant Areas (EBSA), Vulnerable Marine Ecosystems (VME), and Particularly Sea Sensitive Areas (PSSA)."

Ocean noise is an emerging issue, and an important issue particularly in the face of Blue Economy. Need to develop protocols/follow international guidelines for best practice for assessments for activities such as harbor development, and shipping lane identification. We will need to incorporate the Mitigation Hierarchy approach.

Ocean Noise, Ships and the Nairobi Convention

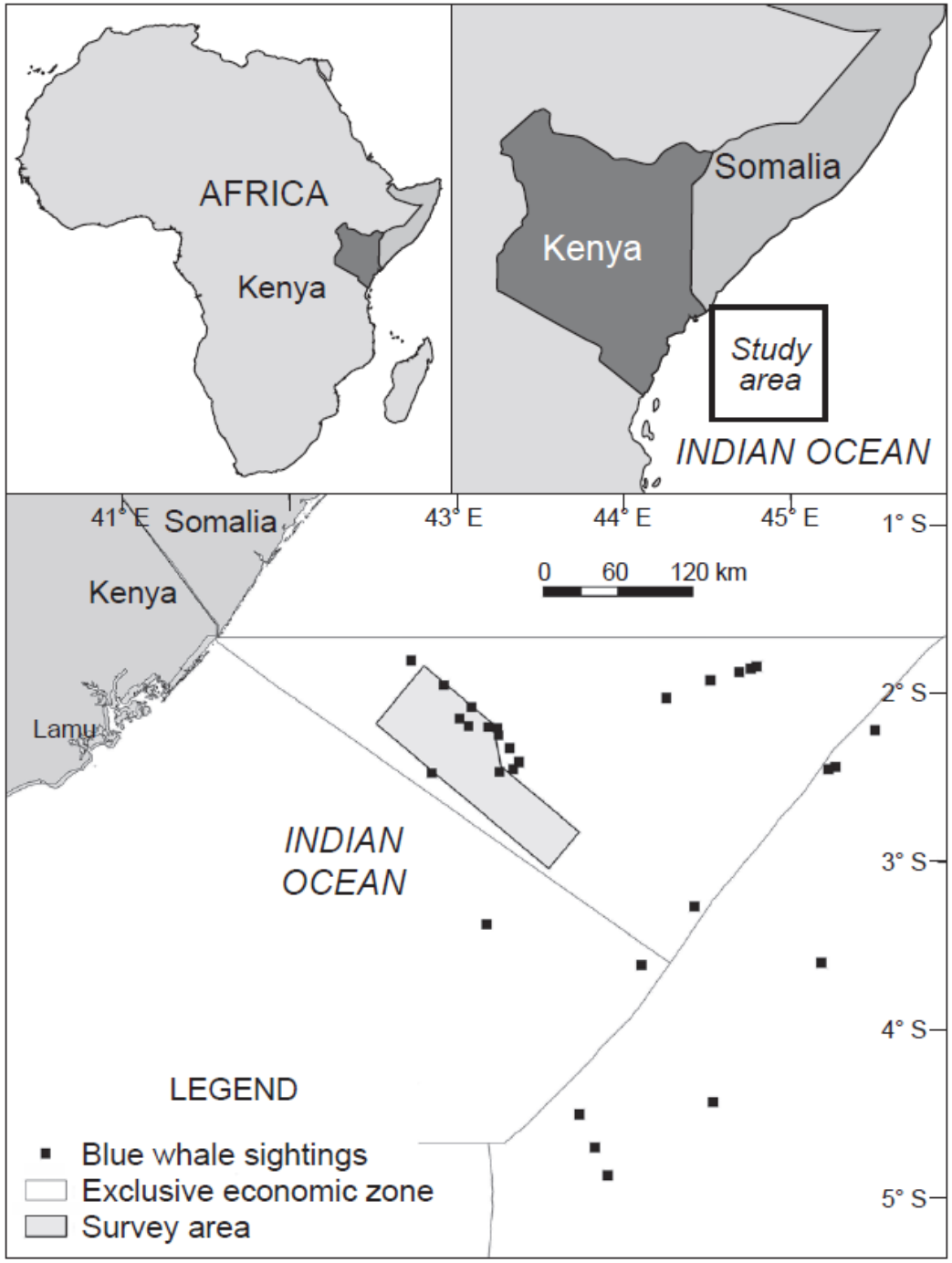
- Ocean noise matters to wildlife, but also affects people (fishing, tourism) and communities supported by the sea
- Ship strikes can be mitigated and should be considered as part of port development plans and EIA assessments
- Ocean noise should be recognized as a form of pollution and its management considered when promoting the Blue Economy.
- There are tractable, workable solutions for addressing both ocean noise and ship strikes



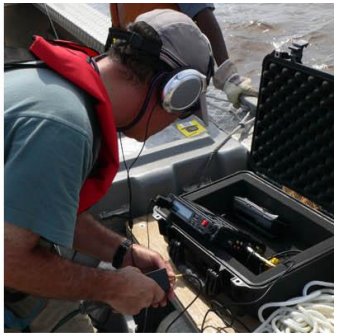

WCS

Western Indian Ocean

New Discoveries – Blue whales in Kenya


AFRICA
Kenya
Somalia
Kenya
Study area
INDIAN OCEAN
41° E
Somalia
43° E
44° E
45° E
1° S
0 60 120 km
Kenya
Lamu
2° S
INDIAN OCEAN
3° S
4° S
LEGEND
Blue whale sightings
Exclusive economic zone
Survey area
5° S

The effects of seismic surveys



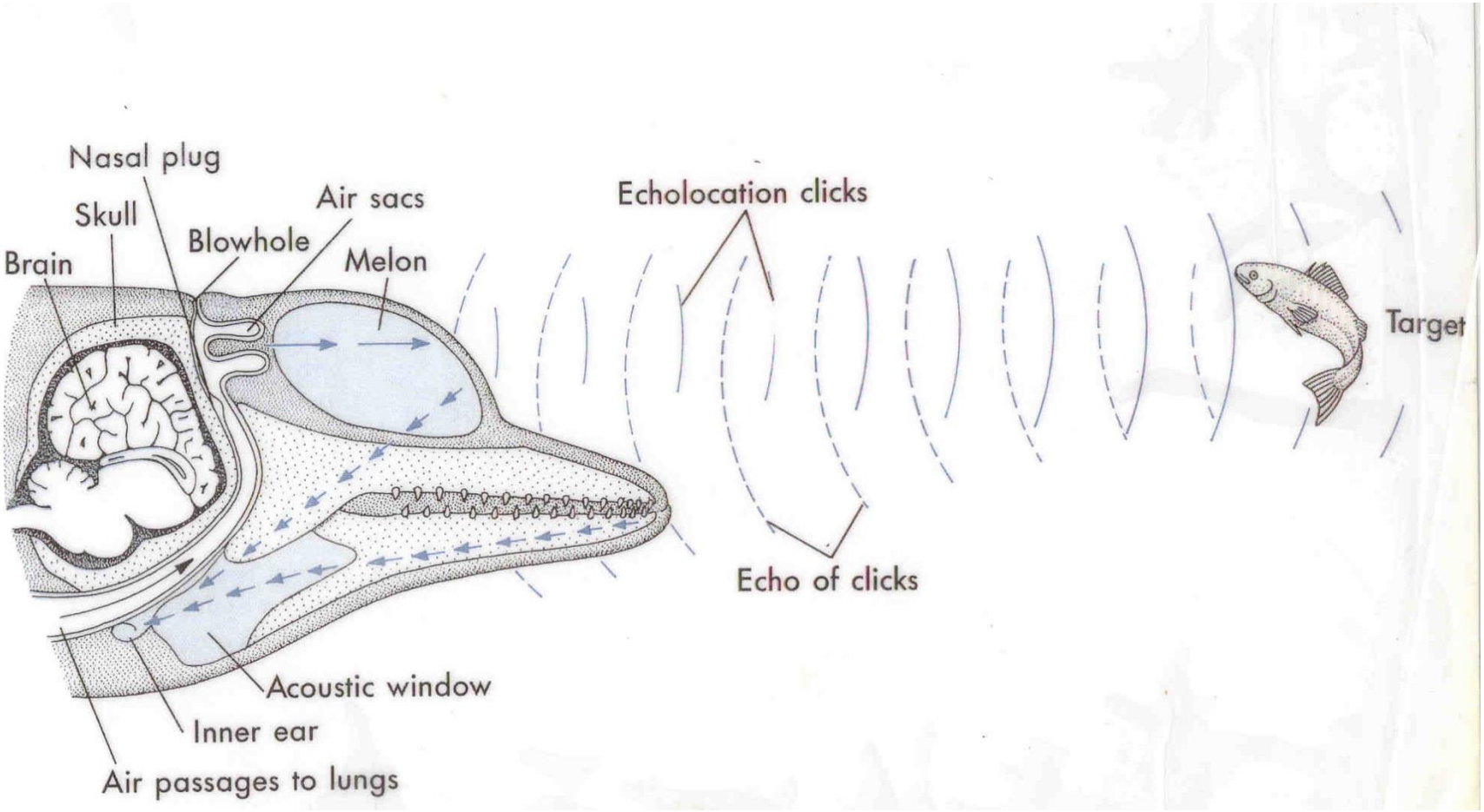
The effects of seismic surveys

Species	Location	Response/ Effect	Received Level	Reference
Bowhead whale	Arctic	Change surface-respiration; Avoidance	120-130 dB re 1 µPa RMS	Richardson et al. 1999; Robertson et al. 2013
Sperm whale	Gulf of Mexico	Buzz (feeding) rate decline	135-147 dB re 1 µPa RMS	Miller et al. 2009
Harbor porpoise	North Sea	Temporary displacement	145–151 dB re 1 $\mu Pa^2\ s^{-1}$	Thompson et al. 2013
Humpback whale	Angola	Singing and singers declined	120-150 dB re 1 µPa peak	Cerchio et al. 2014
Fin whale	Mediterranean	Altered singing and abandon habitat	ca. 15 dB 1 µPa above background	Castellote et al. 2012
Fish (herring, blue whiting)	Norway	Displacement, horizontal and vertical	Unknown	Slotte et al. 2004
Fish (Cod, Pollock)	Scotland	Short-term startle, no long term effects	variable	Wardle et al. 2001
Fish (Pink snapper)	Captive	Hearing system damage	Variable 150-180 dB re 1 µPa RMS	McCauley et al. 2003

Seismic survey management options

Nowacek et al. 2015

- Empirically-based restrictions on time, duration and/or area of activities in biologically important habitats
- Require sustained monitoring of acoustic habitat indicators, including establishing limits and targets
- Promote development and requiring use of methods and technologies that reduce acoustic footprints
- Creation of intergovernmental science organization to coordinate, promote and advance efforts to improve assessment of impacts
- Requirements for preparation of EISs and ‘strategic’ or ‘programmatic’ EAs that meaningfully analyze cumulative effects


Nasal plug
Skull
Brain
Blowhole
Air sacs
Melon
Echolocation clicks
Target
Echo of clicks
Acoustic window
Inner ear
Air passages to lungs