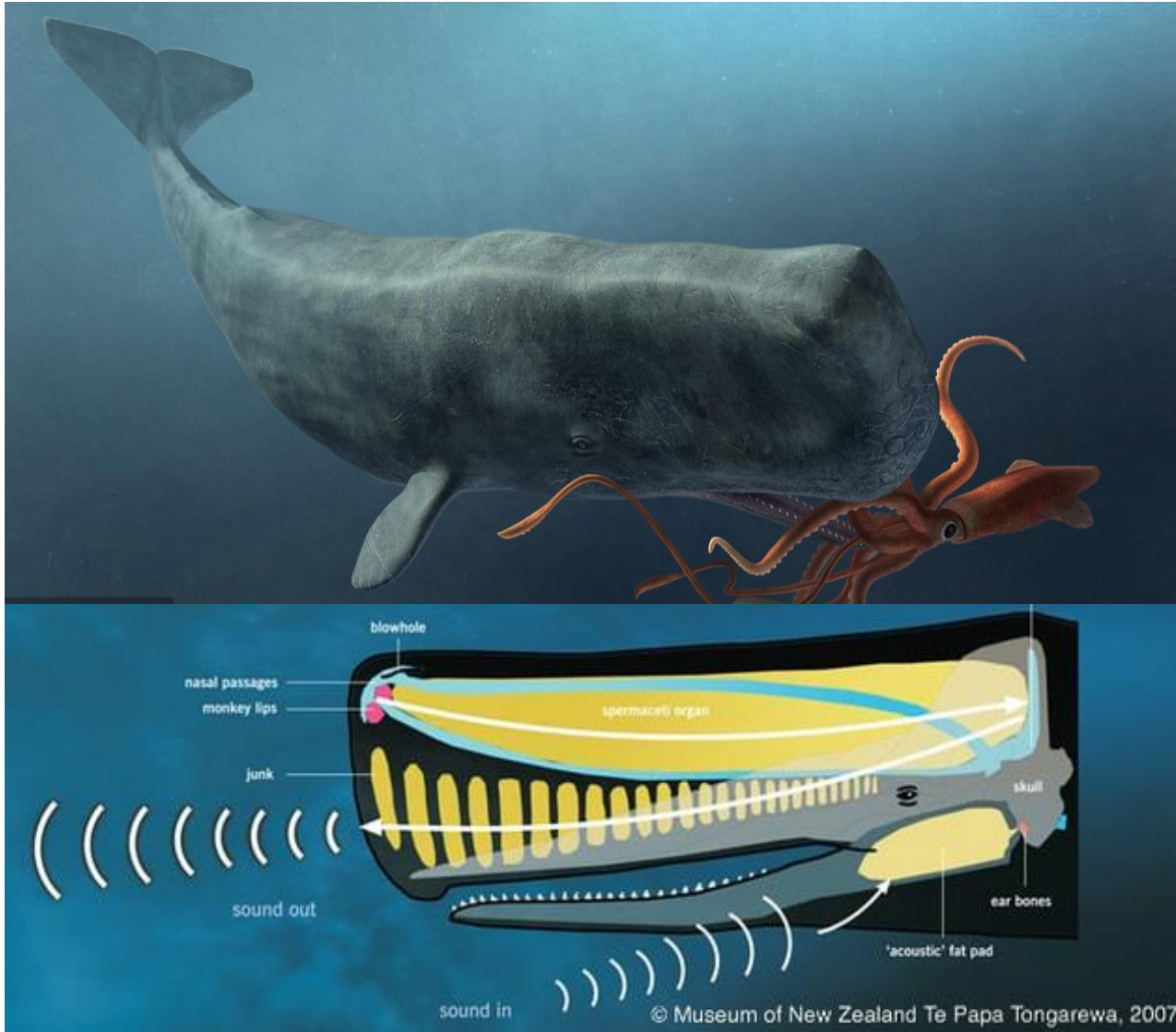


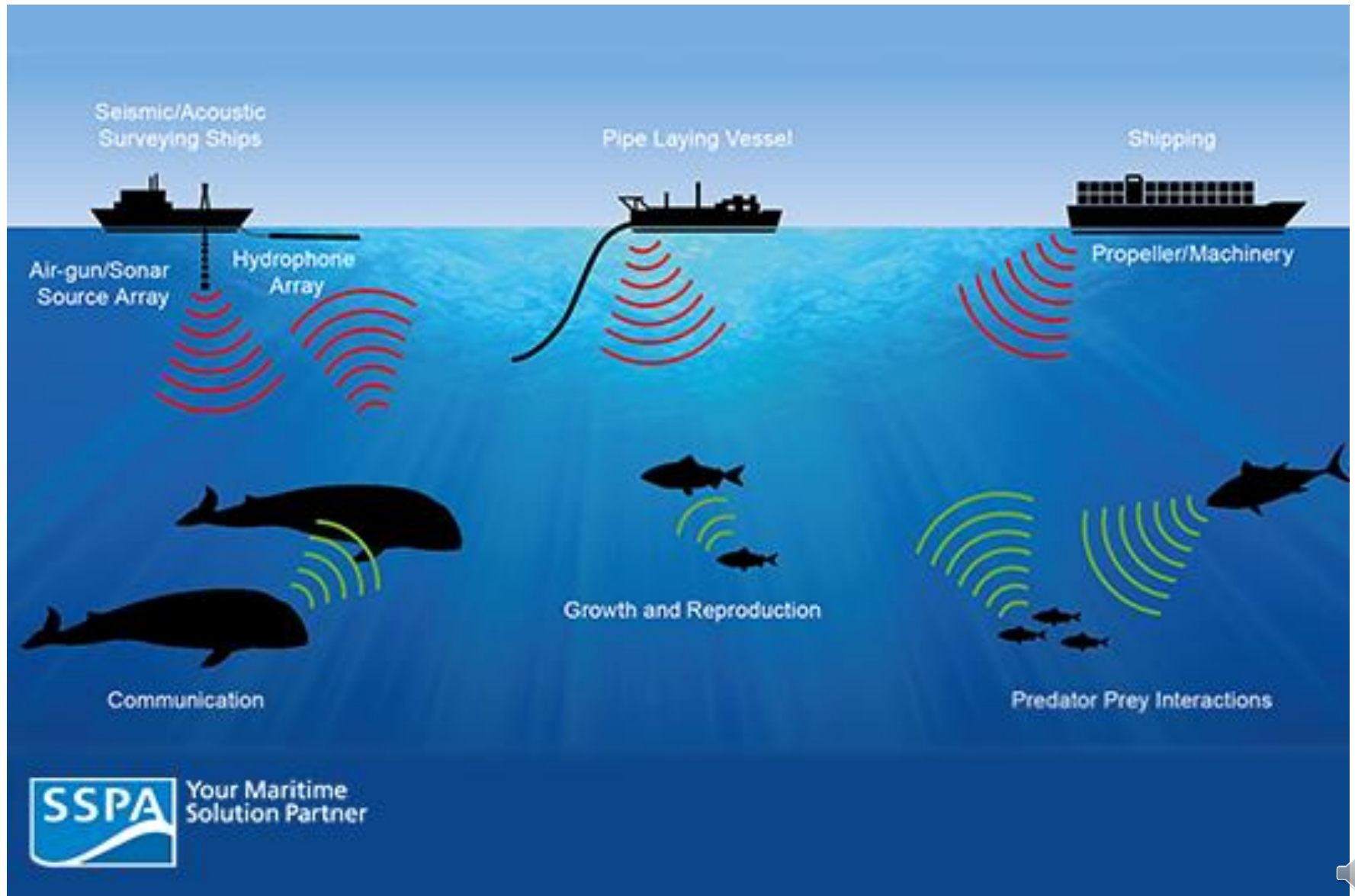
Threats posed to marine species in the Western Indian Ocean from underwater noise and shipping



The general problem - the effects of noise on marine life



The general problem - the effects of noise on marine life



Changes in Humpback Whale Song Occurrence in Response to an Acoustic Source 200 km Away

Denise Risch^{1*}, Peter J. Corkeron², William T. Ellison³, Sofie M. Van Parijs²

1 Integrated Statistics, Woods Hole, Massachusetts, United States of America, **2** Northeast Fisheries Science Center, Woods Hole, Massachusetts, United States, **3** Marine Acoustics, Inc., Middletown, Rhode Island, United States of America

biology
letters

Exposure to seismic survey alters blue whale acoustic communication

Lucia Di Iorio and Christopher W. Clark

Biol. Lett. 2010 **6**, 51–54 first published online 23 September 2009
doi: 10.1098/rsbl.2009.0651

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OF
THE ROYAL
SOCIETY

Proc. R. Soc. B (2012) **279**, 2363–2368
doi:10.1098/rspb.2011.2429
Published online 8 February 2012

Evidence that ship noise increases stress in right whales

Rosalind M. Rolland^{1,*}, Susan E. Parks^{2,†}, Kathleen E. Hunt¹,
Manuel Castellote³, Peter J. Corkeron^{4,‡}, Douglas P. Nowacek⁵,
Samuel K. Wasser⁶ and Scott D. Kraus¹

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Animal behaviour

Evidence for ship noise impacts on humpback whale foraging behaviour

Hannah B. Blair¹, Nathan D. Merchant², Ari S. Friedlaender³, David N. Wiley⁴ and Susan E. Parks¹

¹Duke University, Durham, NC, USA
²Center for Environmental and Estuarine Science, University of North Carolina, USA
³Marine Mammal Institute, Oregon State University, Newport, OR, USA
⁴Stetson Bank National Marine Sanctuary, National Oceanic and Atmospheric Administration, Seabrook, VA, USA

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Noise from shipping activity in North Atlantic coastal waters has been steadily

Research



Cite this article: Blair HB, Merchant ND, Friedlaender AS, Wiley DN, Parks SE (2012) Evidence for ship noise impacts on humpback whale foraging behaviour. *Biol. Lett.* **12**: 20120005
http://dx.doi.org/10.1098/rsbl.2012.0005

Marine Mammal Science



DOES INTENSE SHIP NOISE DISRUPT FORAGING IN DEEP-DIVING CUVIER'S BEAKED WHALES (*ZIPHIUS CAVIROSTRIS*)?

Natasha Aguilar Souza, Marc Johnson, Peter J. Madson, Peter L. Tyack, Alessandro Rocconcelli, J. Lebrício Borsari

First published: 10 February 2015 | <https://doi.org/10.1111/1749-7682.12044.x> | Cited by 93

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Ocean & Coastal Management

Volume 115, October 2015, Pages 17–24



Impacts of anthropogenic noise on marine life: Publication patterns, new discoveries, and future directions in research and management

R. Williams^{a,b,c,d,e}, A.J. Wright^{c,d}, E. Ashe^{a,b}, L.K. Blight^d, R. Bruinijes^e, R. Canessa^f, C.W. Clark^g, S. Cullis-Suzuki^h, D.T. Dakinⁱ, C. Erbe^j, P.S. Hammond^g, N.D. Merchant^k, P.D. O'Hara^{l,j}, Purser^m, A.N. Radford^m, S.D. Simpsonⁿ, L. Thomasⁿ, M.A. Waleⁿ

Vol. 39: 247–254, 2019 https://doi.org/10.1016/j.csi.2019.08.001	ENDANGERED SPECIES RESEARCH Endang Species Res	Published July 25
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Contribution to the Theme Section 'Marine pollution and endangered species'



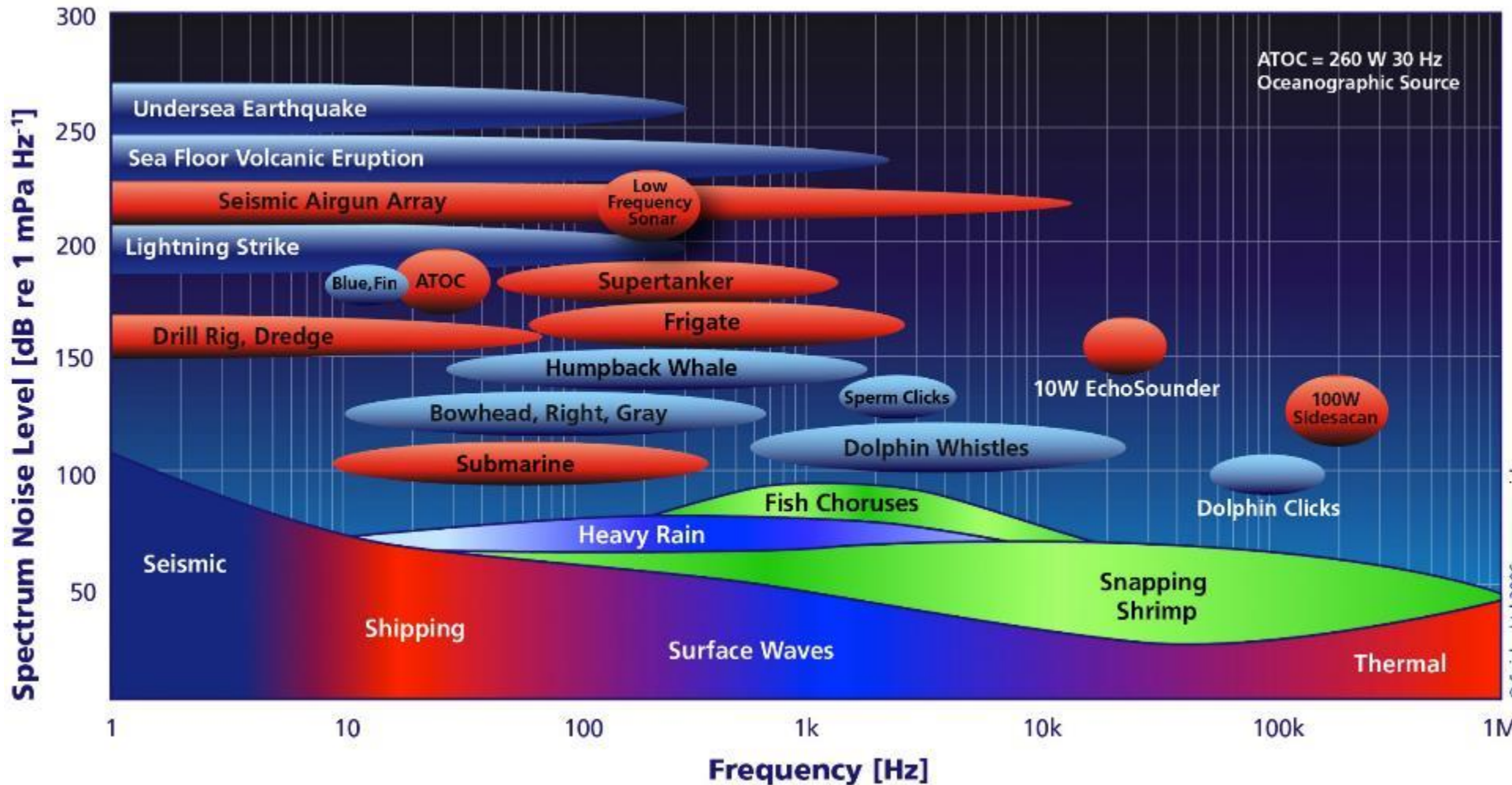
OPINION PIECE

Critical information gaps remain in understanding impacts of industrial seismic surveys on marine vertebrates

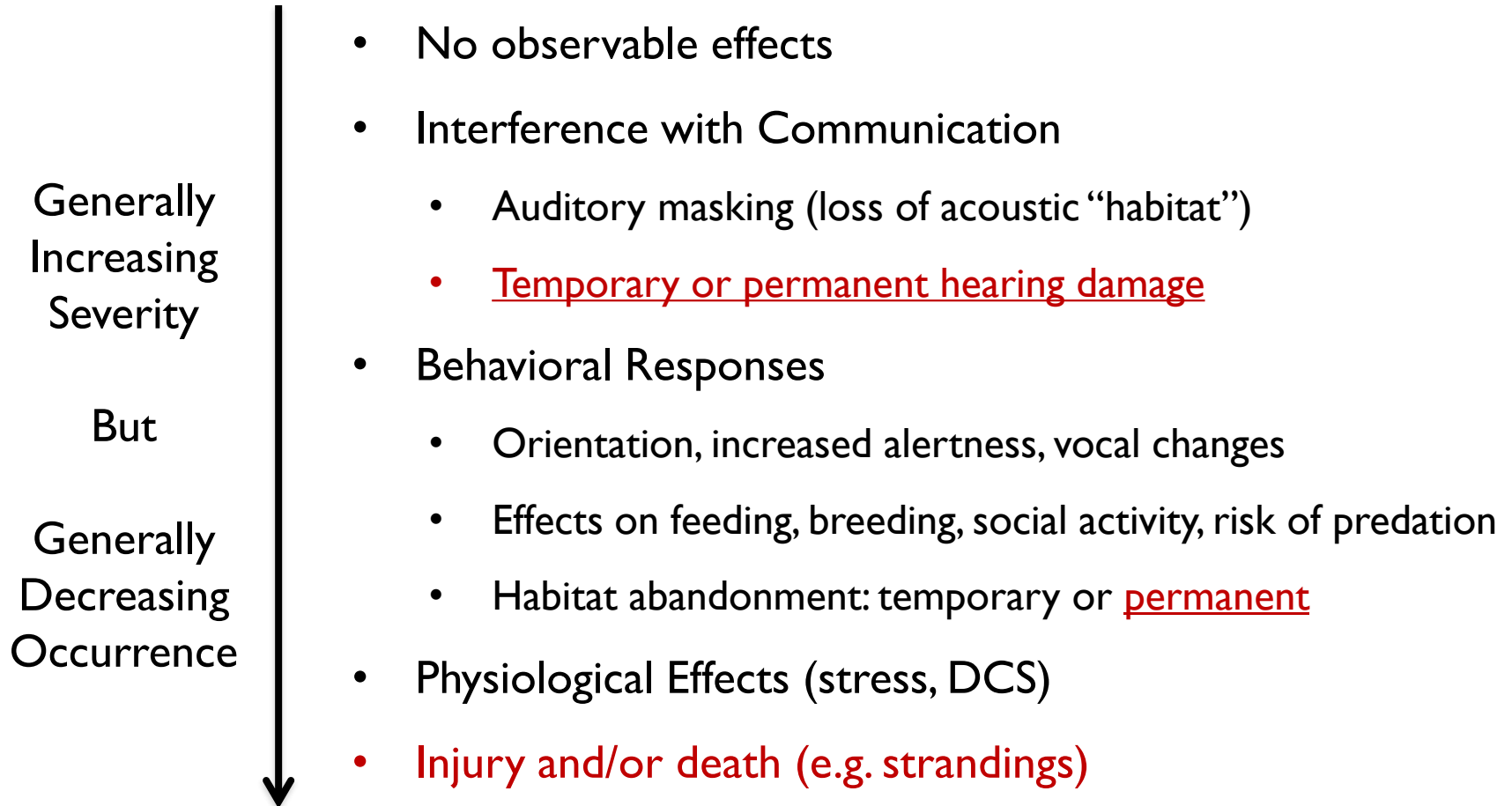
B. W. Elliott^{1,4}, A. J. Read¹, B. J. Godley², S. E. Nelms^{2,3}, D. P. Nowacek^{1,4}

¹Duke University Marine Laboratory, Nicholas School of the Environment, 135 Duke Marine Lab Rd, Beaufort, NC 28516, USA
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³Plymouth Marine Laboratory, Prospect Place, Plymouth PL1 3DJ, UK
⁴Duke University Pratt School of Engineering, 305 Teer Building Box 90271, Durham, NC 27708, USA

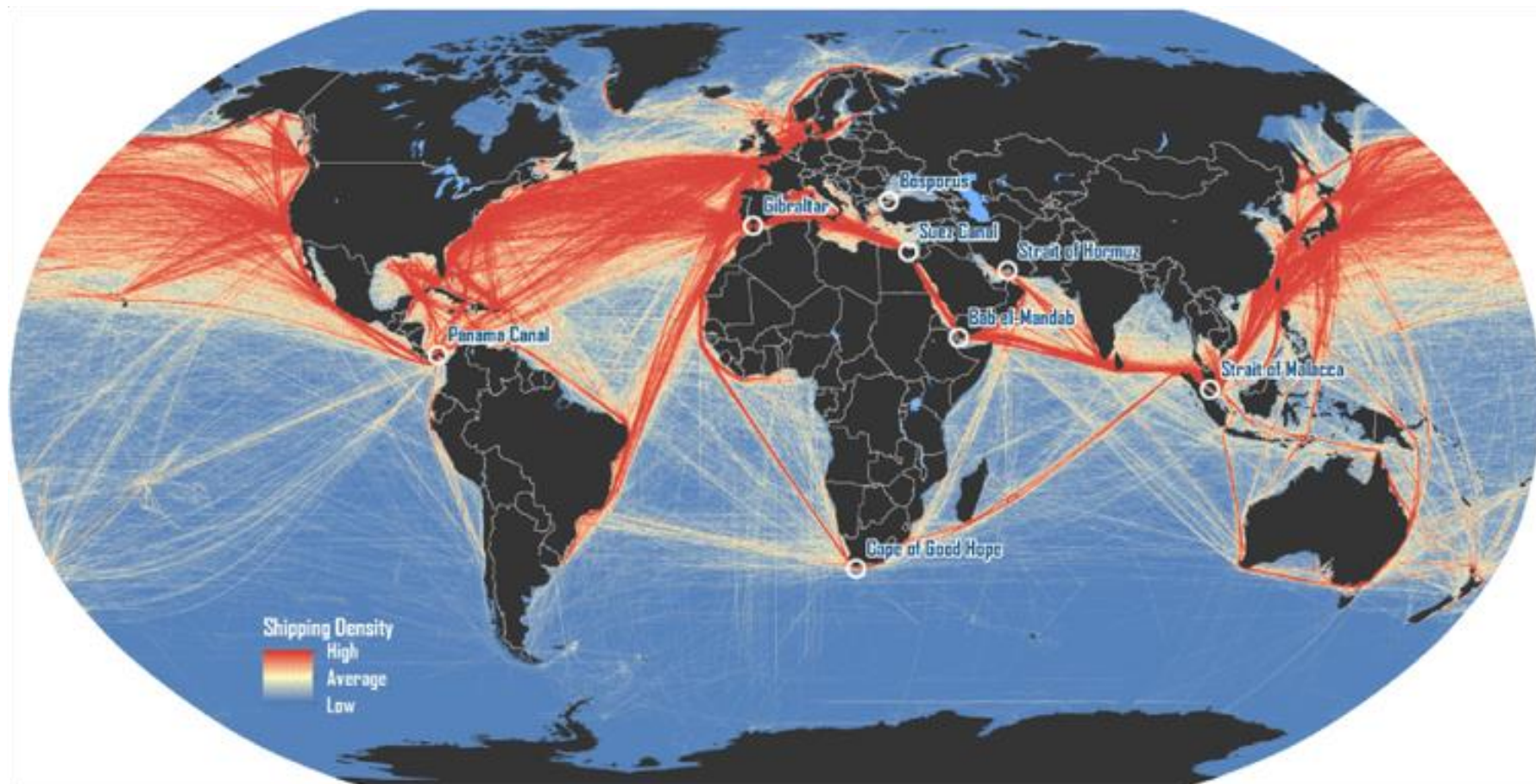
The general problem - the effects of noise on marine life



The general problem - the effects of noise on marine life



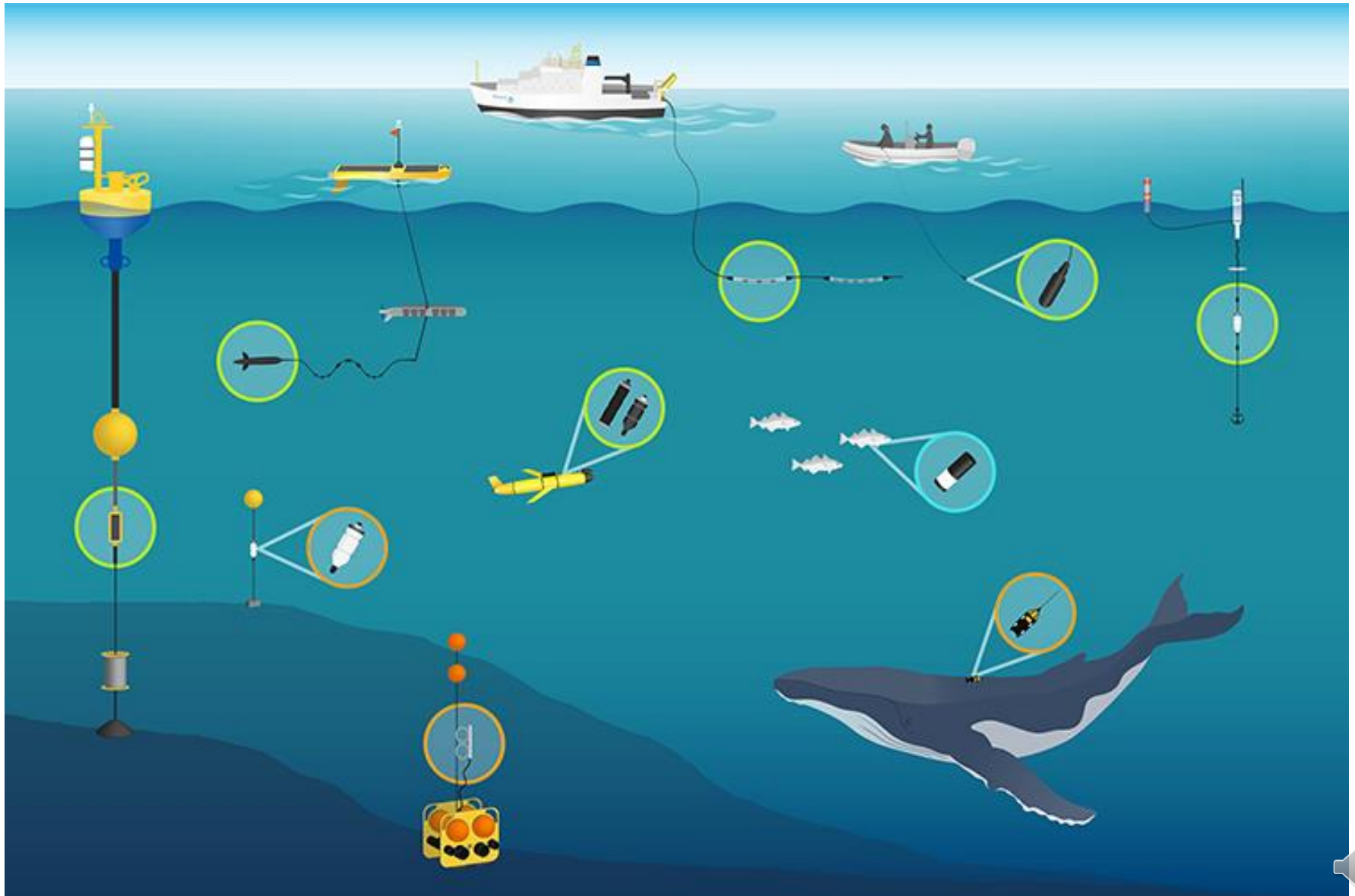
Shipping in the WIO



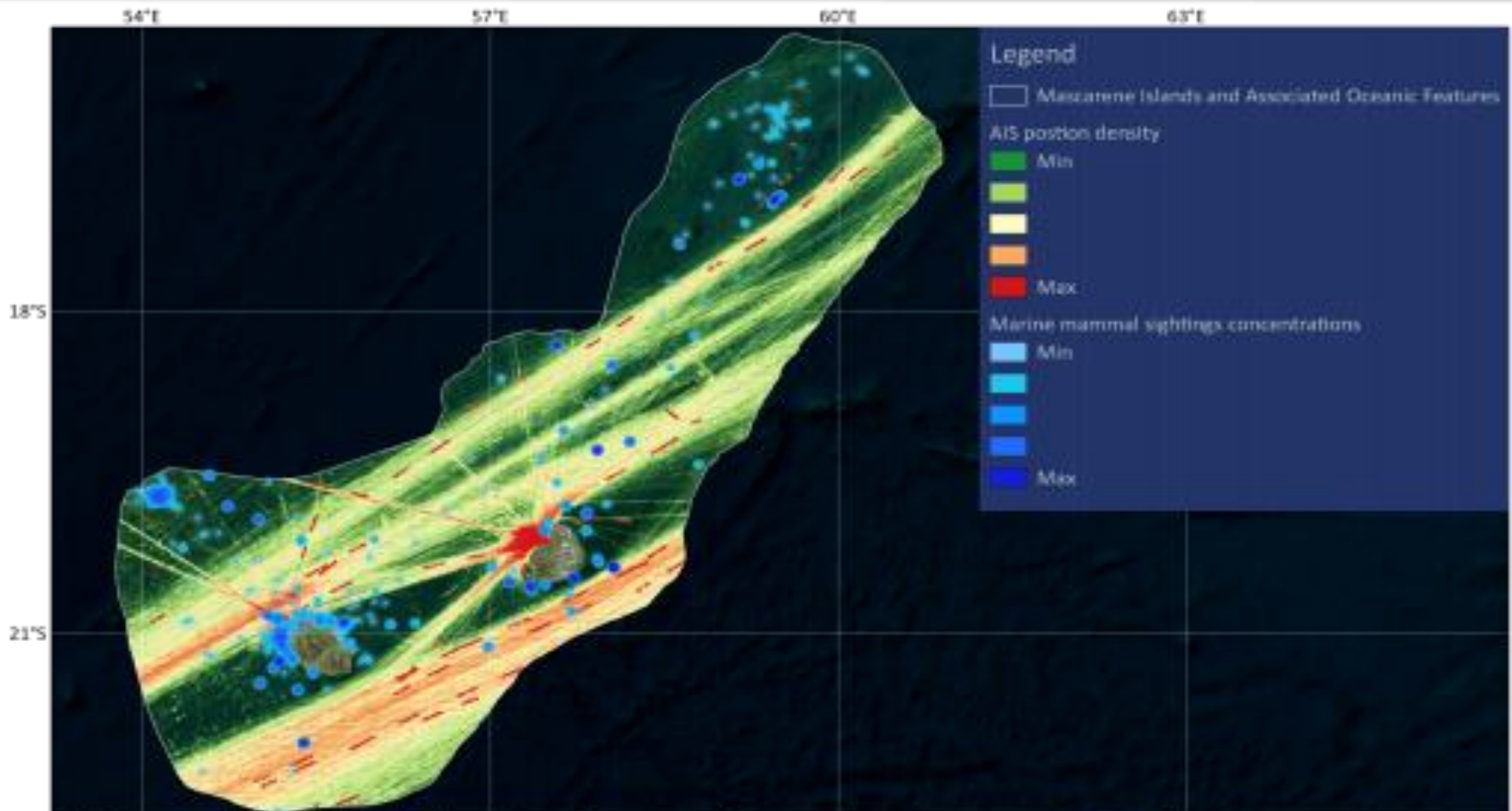
The general problem – ship strikes



Potential conservation and management solutions.



Potential conservation and management solutions.



Heatmaps of AIS position density and marine mammal sightings concentrations

AIS position density (kernel-radius: 1 nm) between 01Sep2018 - 31Aug2019 and available data on marine mammal sightings concentrations (kernel-radius: 5 nm) between 2010 - 2019.

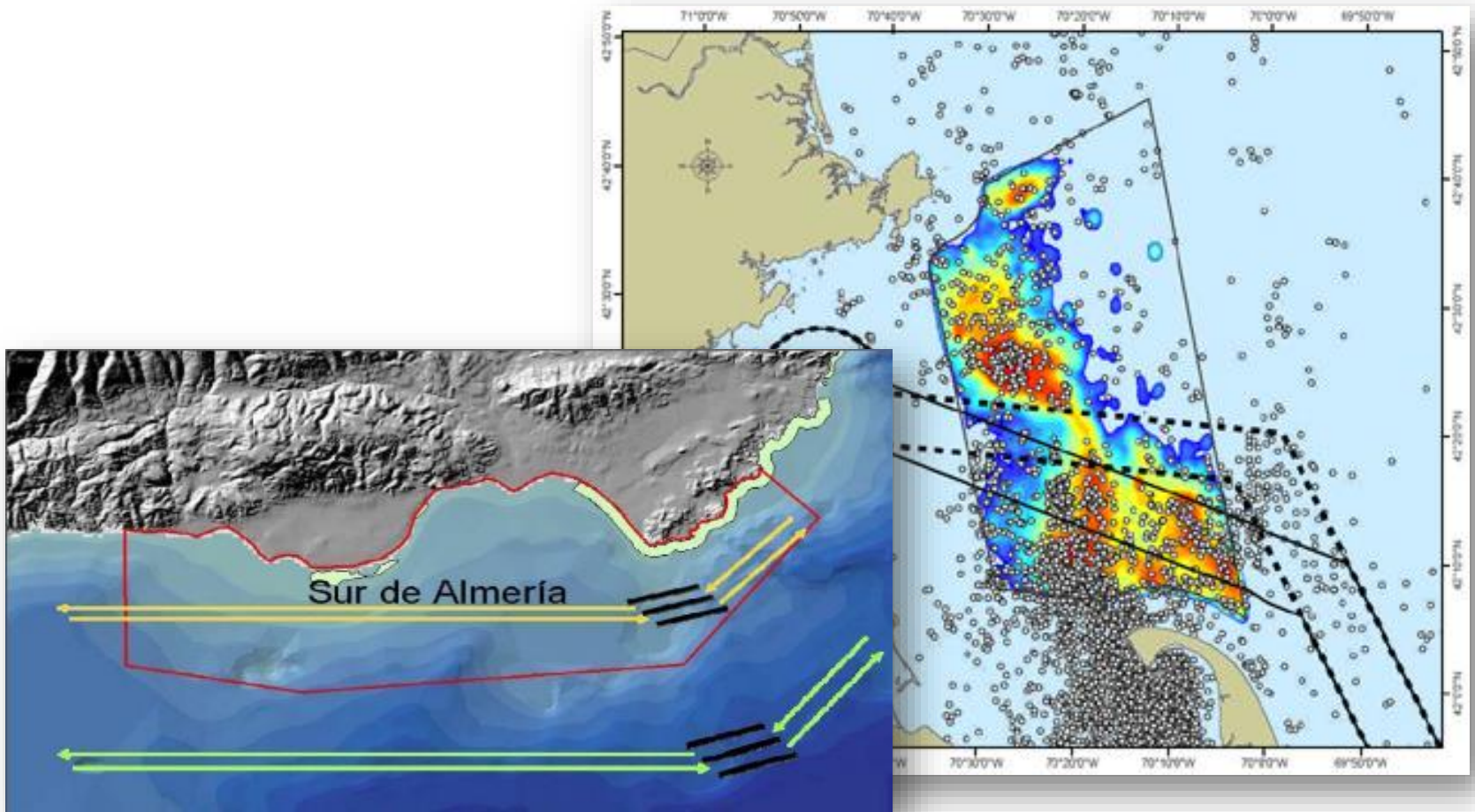
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181 - WCS



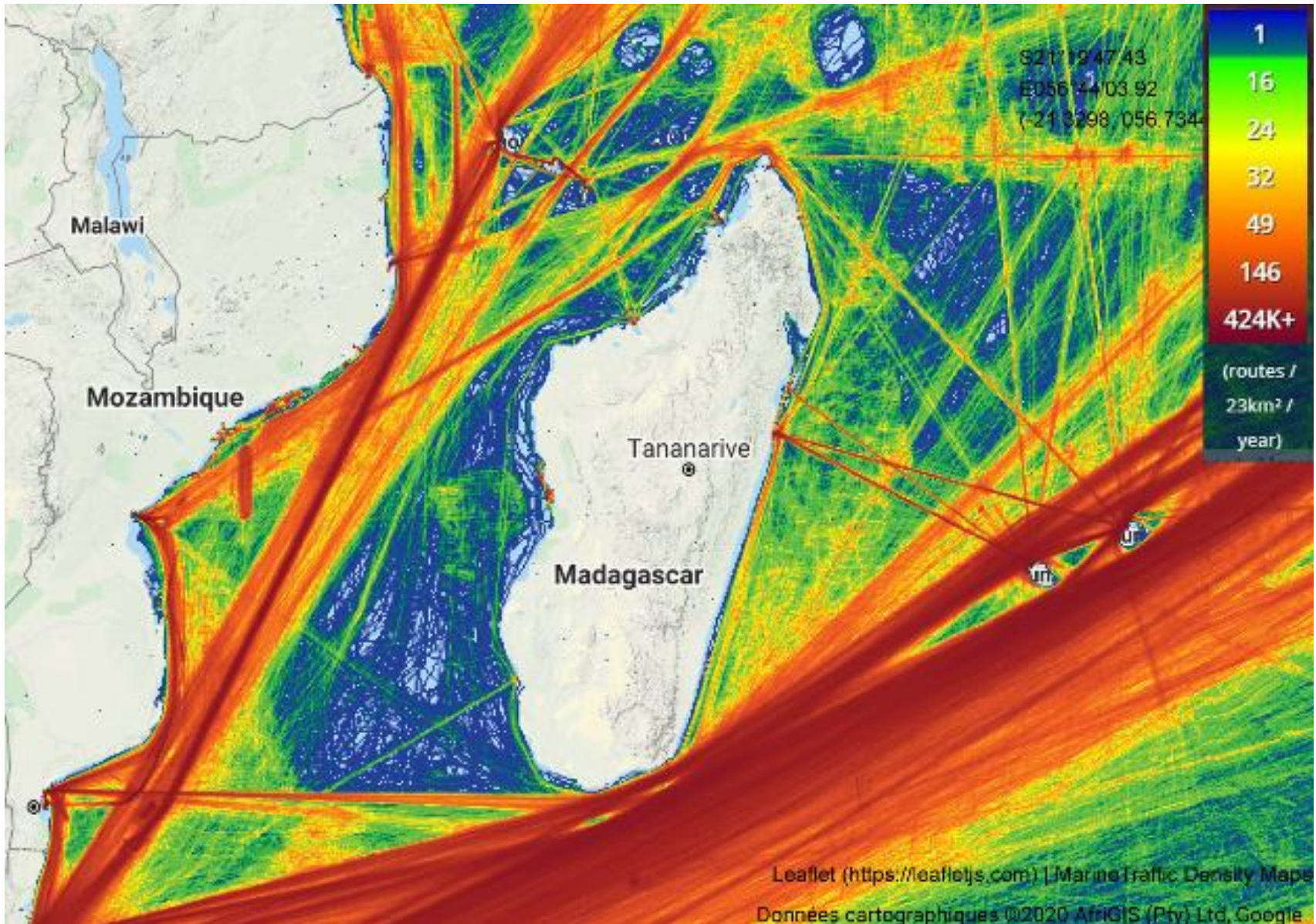
Potential conservation and management solutions.



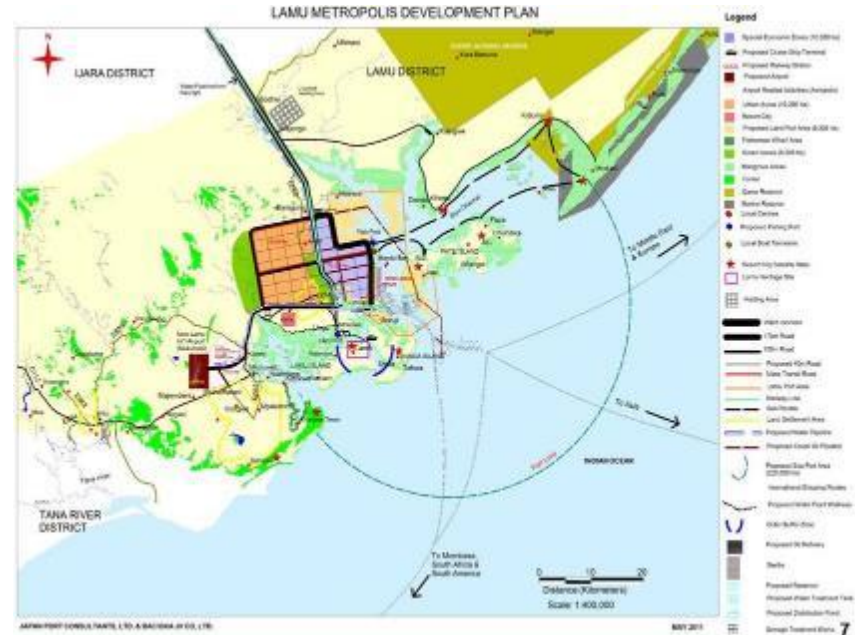
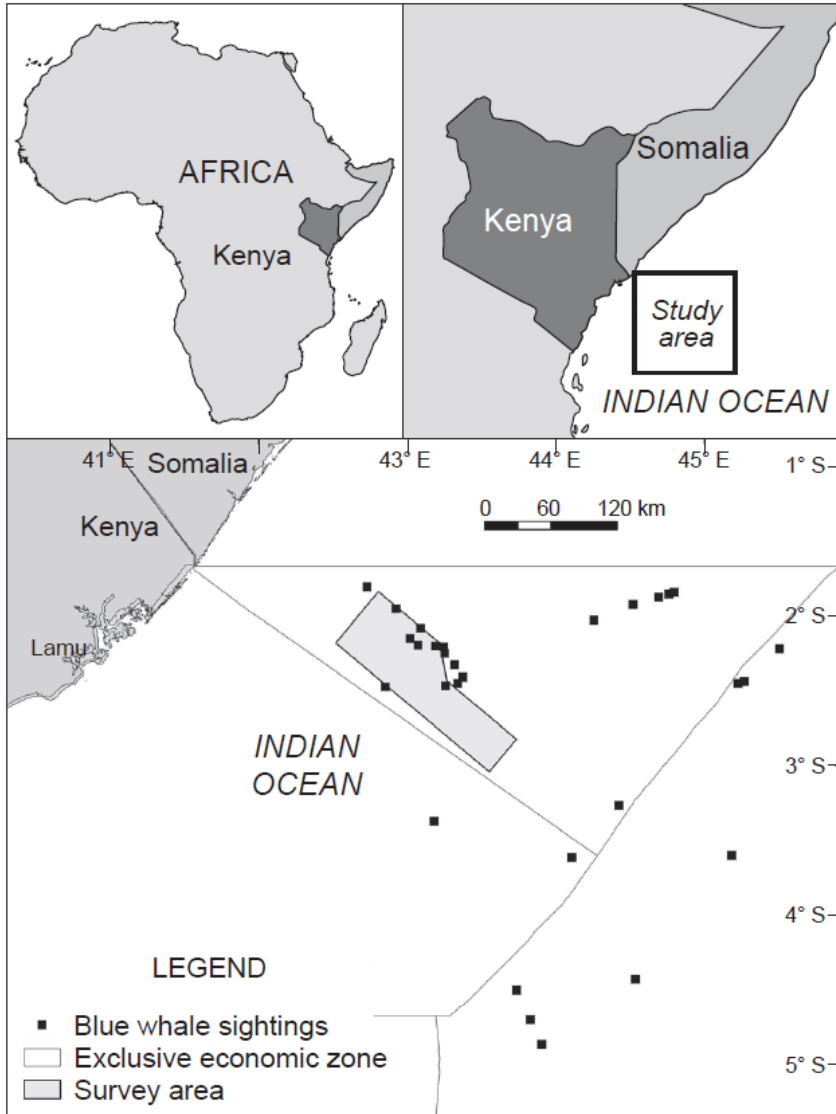
- WIO states are accelerating plans to diversify maritime trade in keeping with the “Blue Economy”.
- Over 50 ports across the Nairobi Convention area, of which at least 15 are considered large, and their expansion is either planned or underway.
- Threats from noise/shipping poorly understood & rarely considered in development plans/EIAs
- 30% of global tanker traffic passes through the Mozambique Channel & shipping is projected to increase (Kaplan, 2009; Halpern et al. 2015, World Bank 2019).
- WIO ambient noise levels are increasing (Miksis-Olds et al. 2013).



Ocean noise, ships in the WIO – Gaps and Needs



Ocean noise, ships in the WIO – Gaps and Needs



Impact and Risk Assessment

Many port developments either fail to mention or understate the scale of threat associated with ports, shipping and noise.

Barber, R., Sikora, I. and Nimak-Wood, M., 2016. Blue whales *Balaenoptera musculus* in offshore waters of Kenya. *African Journal of Marine Science*, 38(2), pp.279-284.



Potential conservation and management solutions.



- Identify practical, reasonable and timely conservation measures during project time span.
- Pursue a multi-disciplinary international collaborative effort with governments, industry, academic/research community and IGOs/NGOs.
- Targeted application of modern research methods to improve monitoring, predicting, reducing and mitigating ocean noise and ship strikes
- Translation of science and associated efforts into concrete conservation actions and activities by regional countries and other stakeholders – ensure inclusion in sustainable development plans



- A review of current underwater noise mitigation policies within the Nairobi Convention area should be completed as soon as possible. The review would identify:
 - A plan for targeted regional and collaborative research that improves current understanding of regional WIO ocean noise levels.
 - A plan for targeted research that sheds light on the potential impacts to marine habitats and species from underwater noise and shipping and assesses the effects of threats associated with expanding maritime trade.
- The development of regional technical capacity for the study and management of underwater noise should be encouraged by member states.



- Projects that actively investigate noise and its effects on marine life should be encouraged and supported. Decision CP.9/7 addressed these concerns, calling on member states and other partners to support the development of projects that address the impact of underwater noise and shipping activities on marine animals. Very little progress has been made on this Decision
- Member states should be encouraged to routinely review current guidance and regulation on the environmental management of maritime development and to address the following deficits:
 - The mitigation of underwater noise associated with development projects, particularly during project impact and risk assessments.
 - To consider incorporating recommendations identified during a robust technical review into national guidance, as well as any other relevant guidance provided by other appropriate agencies.



Thank you!



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