WWF

Underwater Noise Webinar Series – Session 1

March 27, 2024

WHALES AND BEYOND: UNDERSTANDING GREATER ECOSYSTEM IMPACTS OF UNDERWATER NOISE

Dr. William Halliday

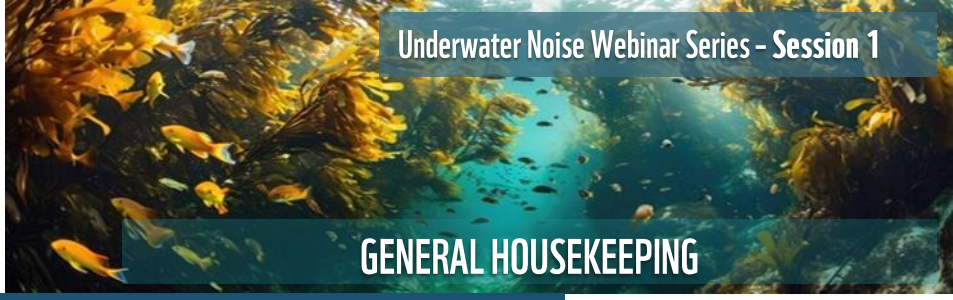
Wildlife Conservation Society

Belugas in a Noisy World: Assessing Impacts of Underwater Noise on Arctic Marine Mammals

Dr. Kieran Cox

Simon Fraser University

Something Sounds Fishy: Bioacoustics, Noise Pollution, and Policy in the Northeast Pacific



- Session will be recorded and transcribed
- Please keep mics muted
- Camera on/off optional
- Q&A after speaker presentations
- Questions welcome in chat
- Please introduce yourselves in the chat!
    - Name, role/organization, location

Underwater Noise Webinar Series – **Session 1**

CONTEXT FOR TODAY

- Knowledge building session
- Learn from underwater noise experts
- Build a foundational knowledge on ecosystem impacts of underwater noise
- Objectives: discuss possibilities, priorities and pathways for ocean noise management in Canada

Underwater Noise Webinar Series – **Session 1**

BELUGAS IN A NOISY WORLD: ASSESSING IMPACTS OF UNDERWATER NOISE ON ARCTIC MARINE MAMMALS

William (Bill) Halliday is the Arctic Acoustics Program Lead with WCS Canada, based in Whitehorse, Yukon, and is an Adjunct Professor at the University of Victoria.
Bill leads a research program that studies marine mammals in the Canadian Arctic using an underwater passive acoustic monitoring network, and also measures underwater noise from human activities and assesses how Arctic marine mammals are impacted by underwater noise.
Bill works with a large group of graduate students and post doctoral fellows at the University of Victoria on various studies within his research program.

Belugas in a Noisy World

Assessing Impacts of Underwater Noise on Arctic Marine Mammals

William D. Halliday, PhD

Conservation Scientist
Wildlife Conservation Society Canada

Adjunct Assistant Professor
School of Earth and Ocean Sciences
University of Victoria

Importance of Sound for Marine Animals

- The ocean is dark.
- Sound travels more efficiently in water than in air.
- Sound produced for communication and echolocation, but also incidentally.
- Not just marine mammals! Fish and invertebrates also produce sounds.

What Causes Underwater Noise?

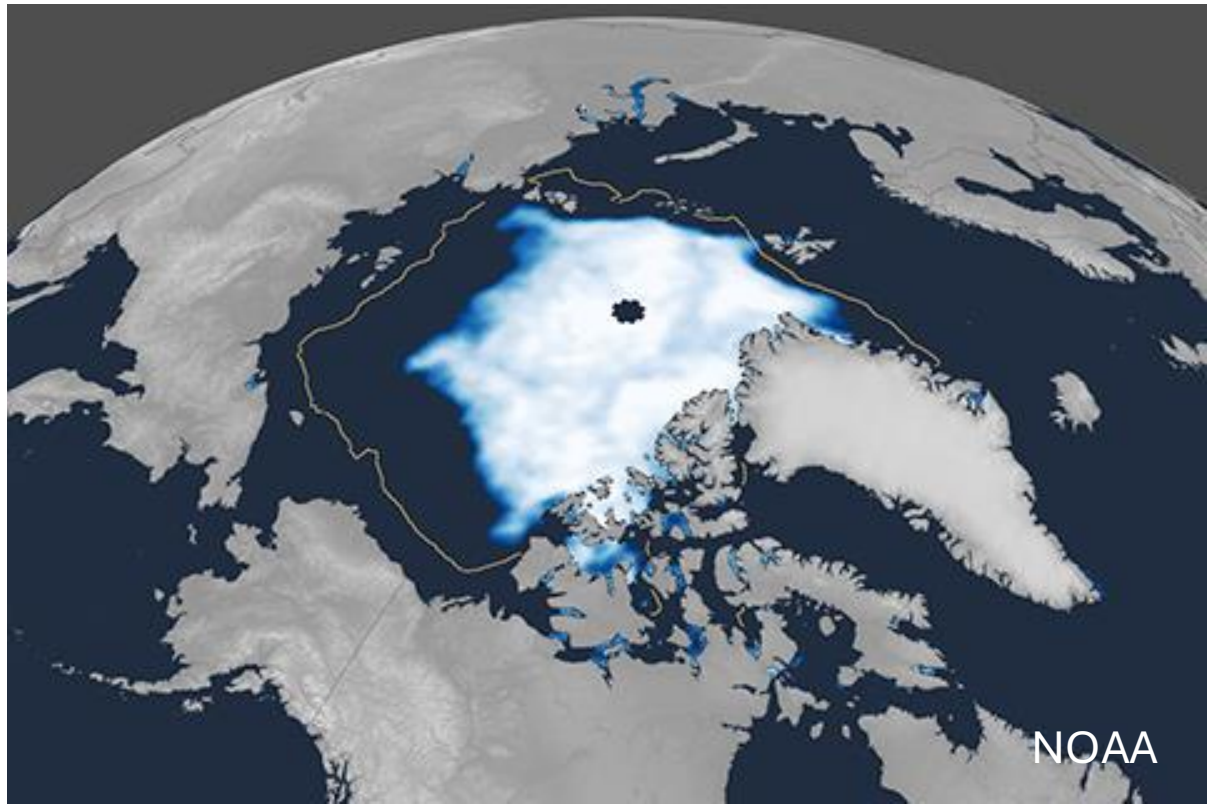
Many human activities generate noise underwater.

Underwater Noise

- Acoustic masking
- Behavioural disturbance
- Temporary or permanent threshold shifts
- Death

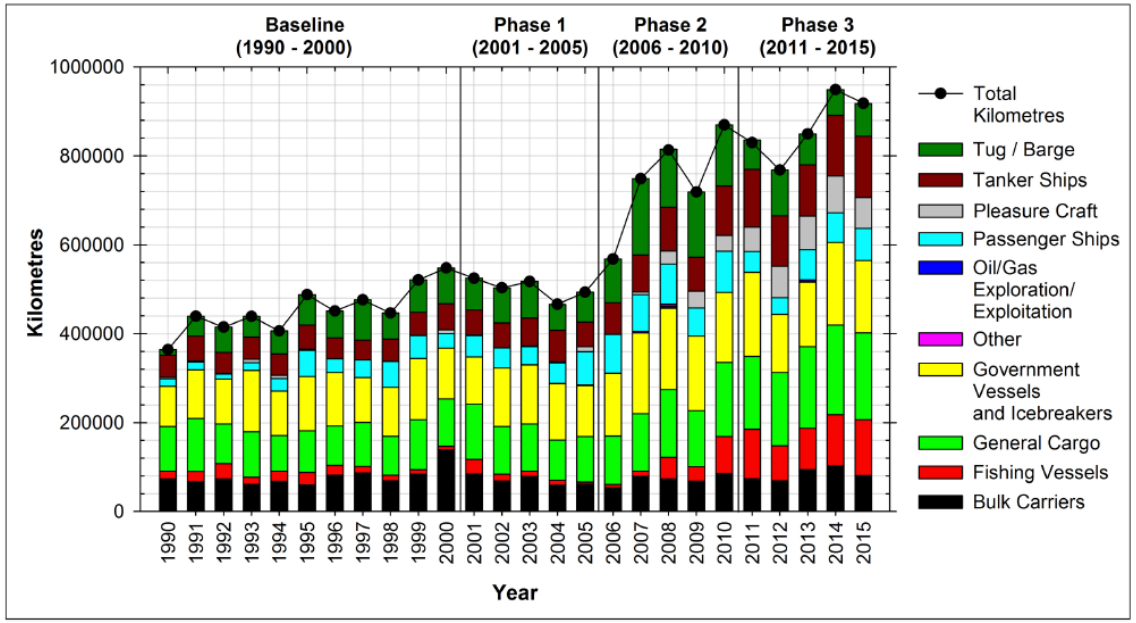
The Arctic

- The Arctic is covered in ice much of the year.
- Quietest and very dynamic underwater acoustic environment.
- Climate change is decreasing sea ice and increasing access for noisy human activities.



Underwater Noise in the Arctic

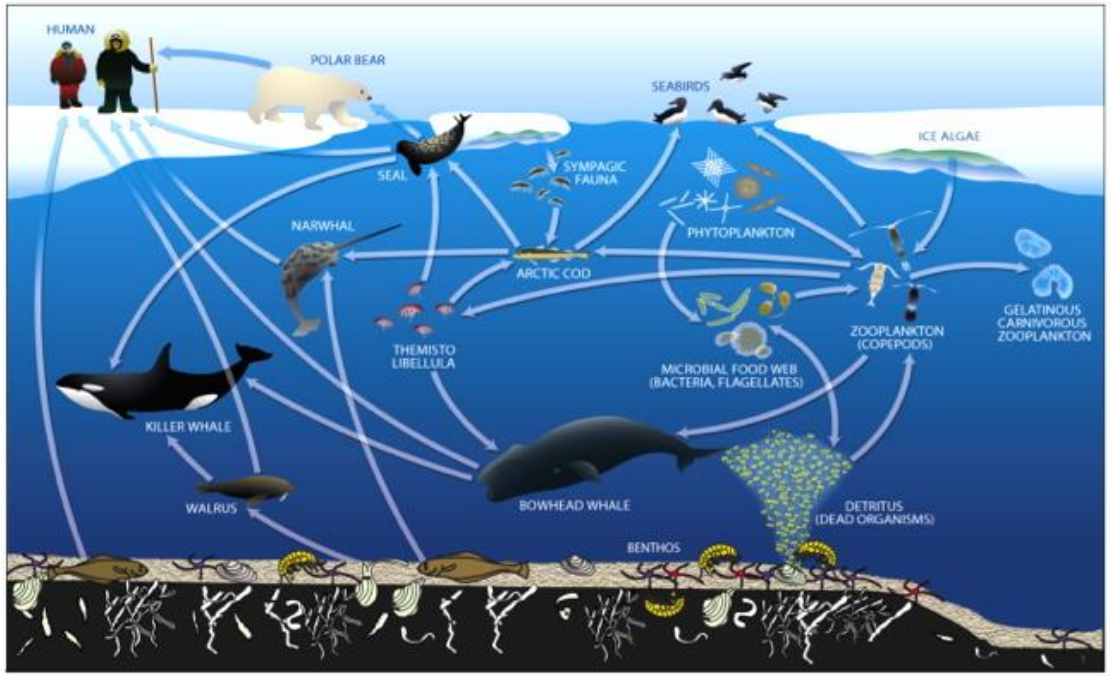
- Vessel traffic was low > 40 years ago but has been increasing rapidly lately.
- Oil and gas exploration also a large source of noise at certain times.
- Projections of future ice conditions suggest that the Arctic will become more accessible, and therefore noisier.



Dawson et al 2018 Arctic 71: 15-26

Inuit Perspectives

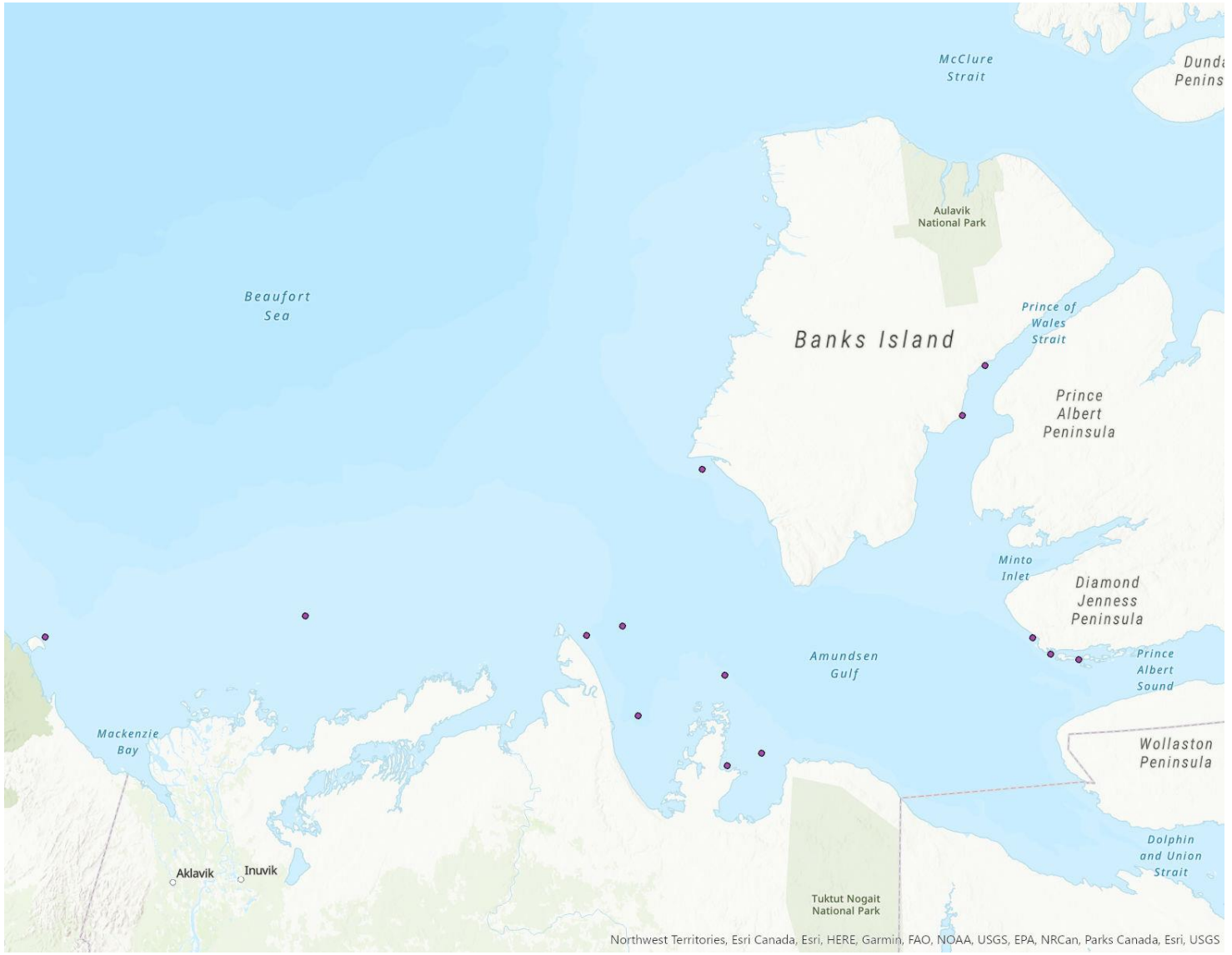
- Inuit have strong ties to the marine environment, relying on marine species for subsistence and culture.
- Underwater noise can indirectly affect Inuit by making marine species inaccessible or by generally disrupting cultural activities.



www.nunatsiaqonline.com

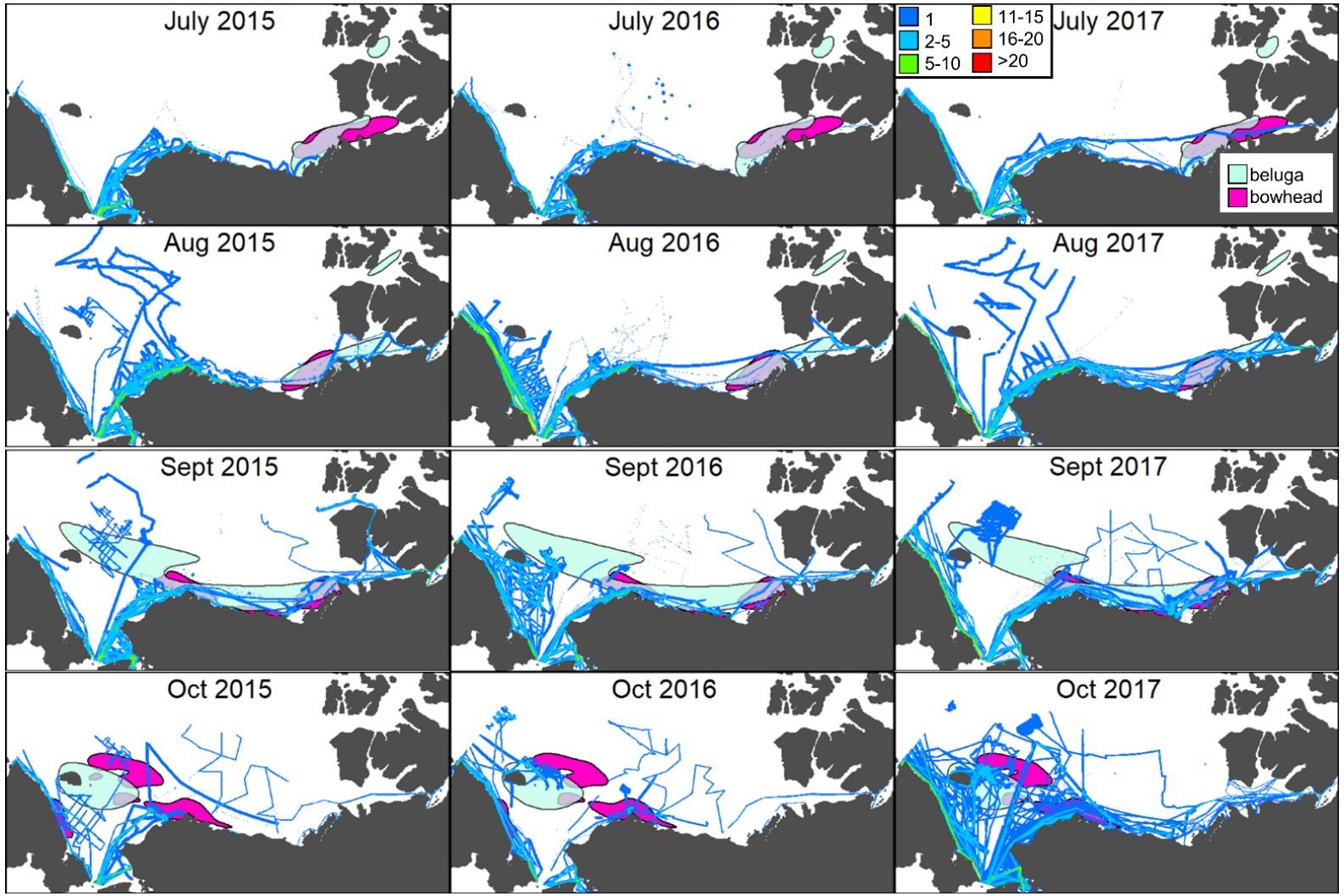
WCS Canada's Arctic Noise Research Program

- Network of passive acoustic recorders (see map).
- Using archived animal and vessel movement data.
- Underwater noise playback experiments.



WCS Canada's long-term passive acoustic monitoring network.

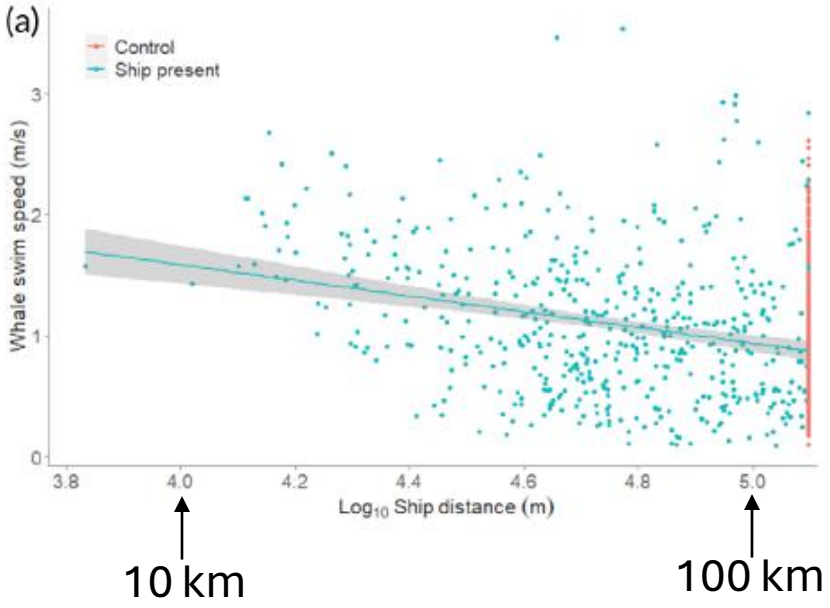
Exposure of Arctic Whales to Underwater Noise



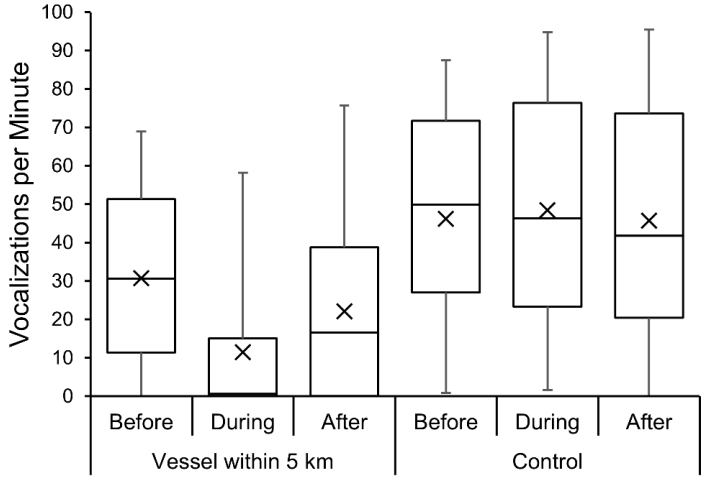
Halliday et al 2021 Ocean and Coastal Management

Beluga Whales

- Beluga whales show a flee response to vessel noise, starting their reaction at > 50 km away.
- Generally leave an area when vessels arrive, but also swim faster and more shallow dives.



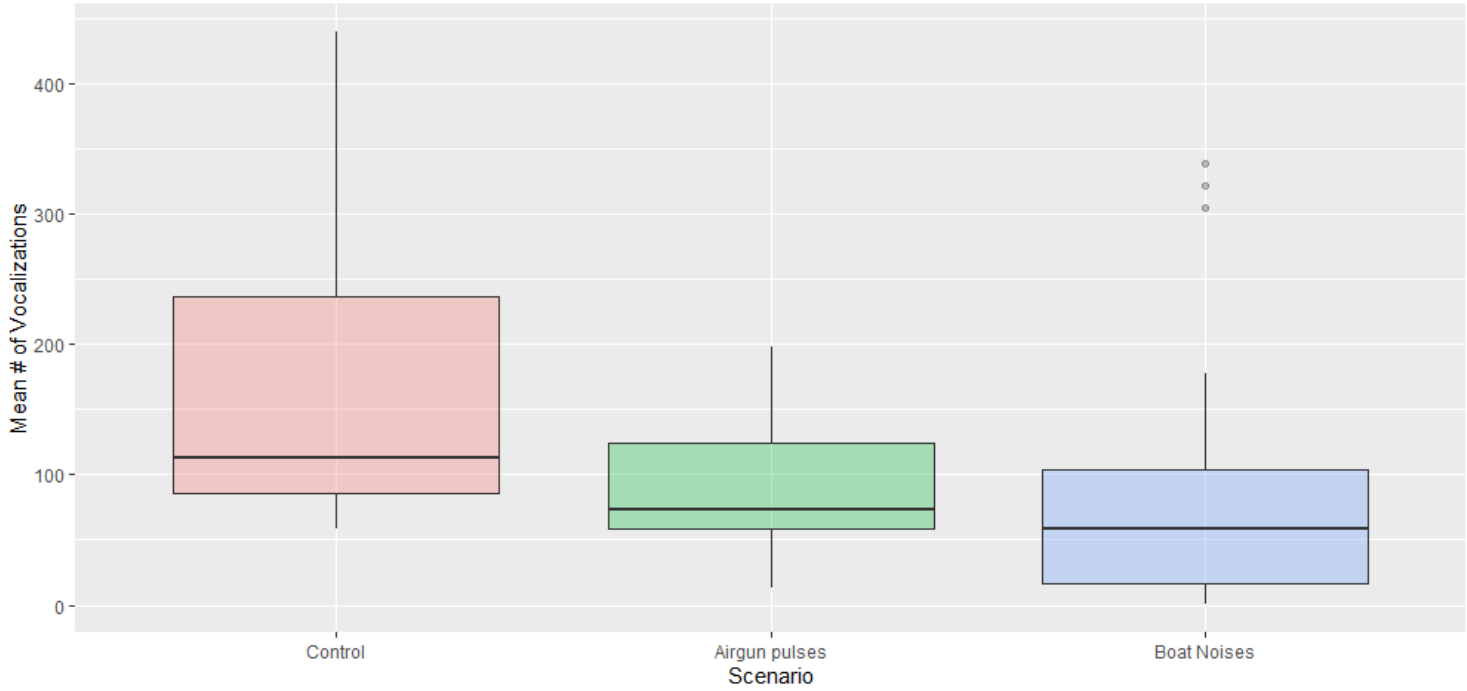
Martin et al 2023 Marine Mammal Science



Halliday et al 2019 Arctic

Bowhead Whales

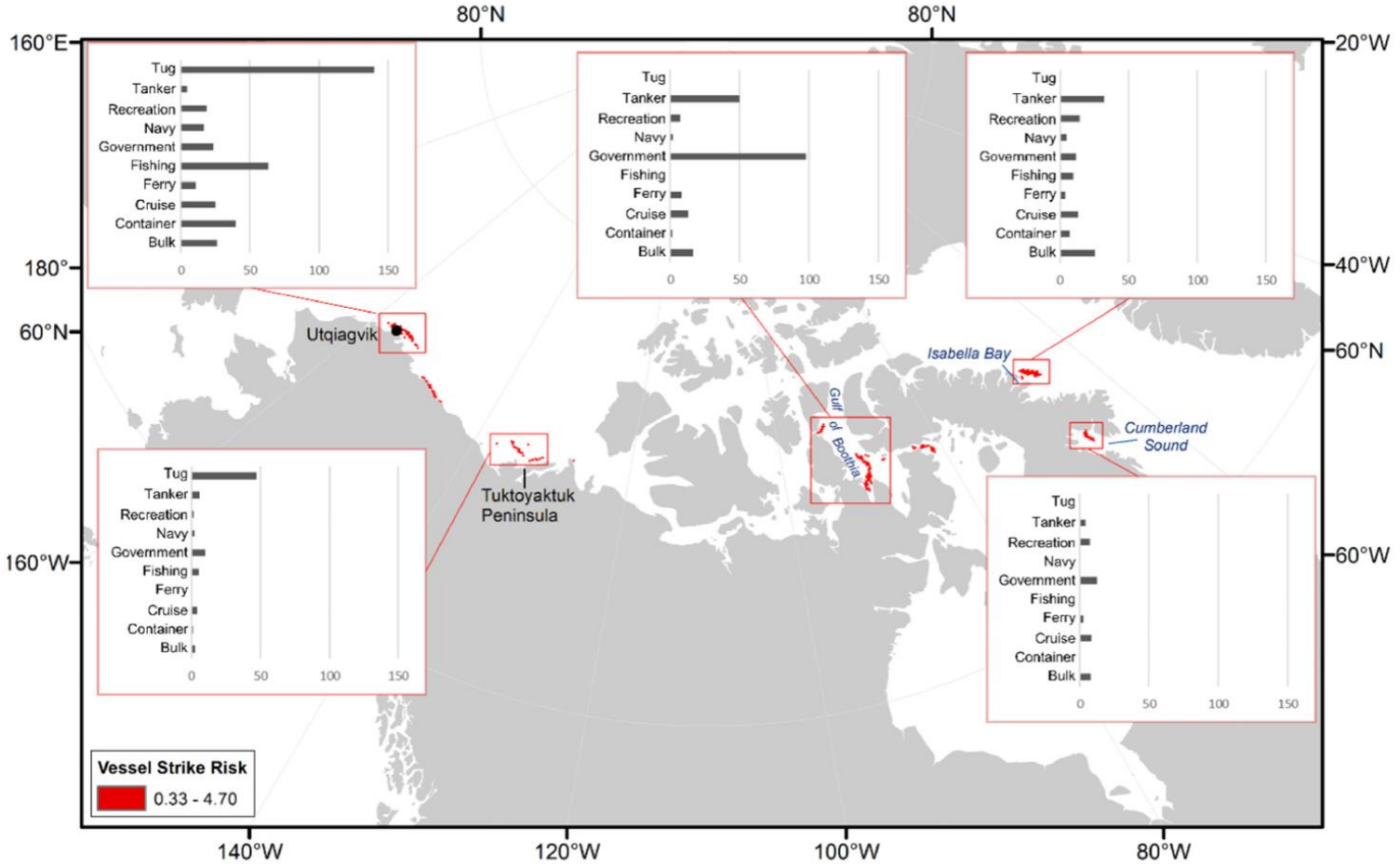
- Bowhead whales also show a response to underwater in the vocal behaviour, but not in their movement at far distances.



Rodriguez 2023 MSc Thesis

Bowheads – Ship Strike Risk

- Bowhead whales not moving away from ships puts them at increased risk of ship strikes.



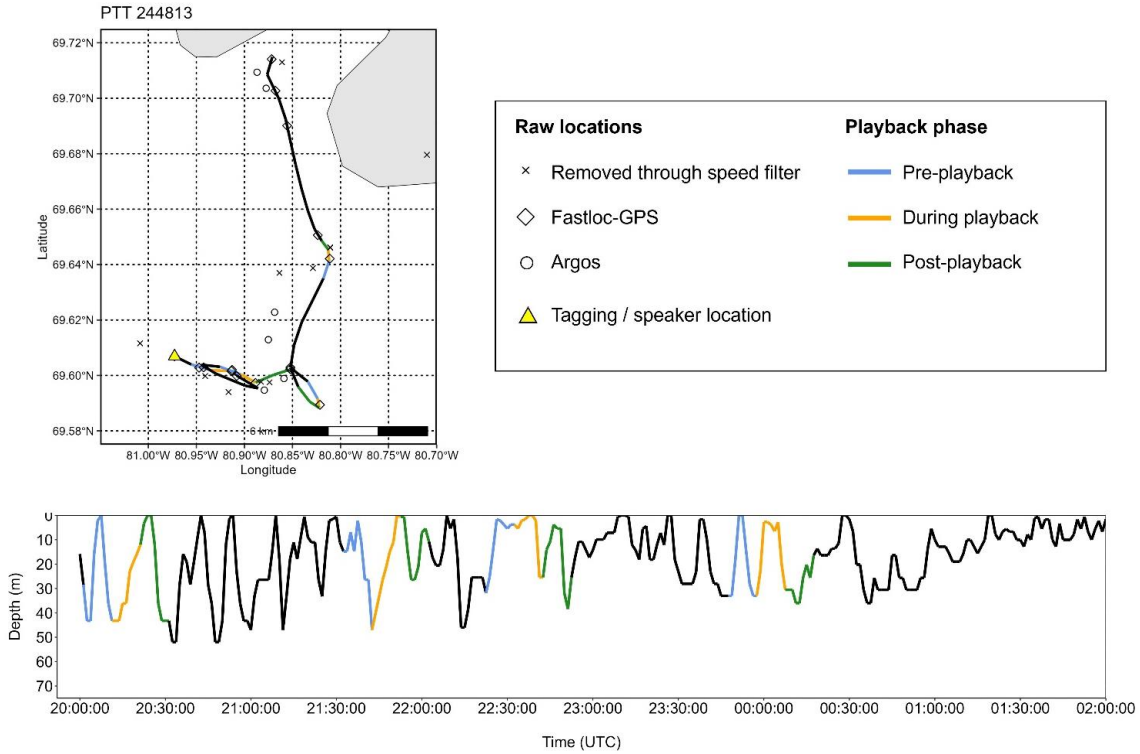
Halliday et al 2022
Biological Conservation

Ongoing and Future Research

- Key knowledge gaps that we are working to fill:
  - Very few studies on the impacts of underwater noise on ringed seals or bearded seals.
  - Little information on how bowhead whales respond to vessel noise at close range.

Current Experimental Work - Bowheads

- Bowhead whales tagged near Igloolik, NU in July 2023.
- Exposed to vessel noise playback experiment.
- Analysis still underway, more data collection happening in 2024.
- Project partially funded by WWF Canada.



What Can We Do About Noise?

- Many ways to reduce the impacts of underwater noise on marine species:
  - Limit noisy activities in sensitive areas or at sensitive times for marine species.
  - Reduce noise levels: technological or operational solutions.

- Vibratory rather than impact pile driving, bubble curtains to reduce noise transmission.
- Vessel routing measures, slowdowns, and quieter designs.

BBC

Underwater Noise Management in the Arctic

- Vessels asked/required to avoid a few protected areas:
  - Anguniaqvia Niqiqyuam and Tarium Niryutait Marine Protected Areas in Inuvialuit Settlement Region.
  - Ninginganiq National Wildlife Area near Clyde River, NU.
- Two vessel slowdowns in effect:
  - Voluntary slowdown in the Inuvialuit Settlement Region in important habitats for beluga and bowhead whales.
  - Slowdown in Eclipse Sound by vessels going to Mary River Iron Ore Mine.
- Many new or future marine protected areas which could also manage vessel traffic and underwater noise.

The Future Arctic?

- Vessel traffic and other noisy activities increasing as sea ice decreases.
- But increased protection through marine protected areas if they include management strategies for underwater noise.
  - Only effective for marine species if the protected area covers important habitat for a species.
- We are still at the early stages of increased noise in the Arctic. There is still time to get management measures in place to reduce impacts on Arctic marine species.

Thank you!

whalliday@wcs.org

www.ArcticNoise.ca

Underwater Noise Webinar Series - **Session 1**

SOMETHING SOUNDS FISHY: BIOACOUSTICS, NOISE POLLUTION, AND POLICY IN THE NORTHEAST PACIFIC

Kieran Cox is a Liber Ero and NSERC Fellow at Simon Fraser University. His research focuses on the nexus of aquatic pollutants, community ecology, and ecosystem management. Kieran and his collaborators are currently mapping vessel noise levels throughout British Columbia's exclusive economic zone, examining how noise pollution interacts with changing coastal conditions, and working to increase national awareness of these important topics. Kieran co-founded the FishSounds project to document sound production in fishes, ensure non-mammalian taxa are included in noise pollution assessments, and facilitate engagement between researchers and the public. FishSounds.net is now the largest global inventory of soniferous fish diversity, cataloguing the hums, grunts, and other sounds made by over one thousand fish species.

Something Sounds Fishy: Bioacoustics, Noise Pollution, and Policy in the Northeast Pacific

Kieran D. Cox
Liber Ero and NSERC Postdoctoral Fellow
Simon Fraser University, Department of Biology
@KieranCx






Isabelle Côté


Francis Juanes


Audrey Looby


Sarah Vela


Claire Attridge


Santiago Bravo


Amalis Riera


Hailey Davies


Bridget Maher


Laura Reynolds


Charles Martin


Natalie Ban


Margot Hessing-Lewis


Em Lim


Kelsie Murchy


Kayla Holloway


Kiara Kattler


Steven Brownlee


Aaron Rice


Rodney Rountree


Sarah Dudas


Hussein Alidina


Brittney Spriel


Xavier Mouy

SFU SIMON FRASER UNIVERSITY

UF UNIVERSITY of FLORIDA

WWF

MERIDIAN

CHOne
CANADIAN HEALTHY OCEANS NETWORK

TheCornellLab
Center for Conservation Bioacoustics

LIBER ERO
FELLOWSHIP PROGRAM

Smithsonian

Hakai
Science on the Coastal Margin

NSERC
CRSNG

earthtoocean

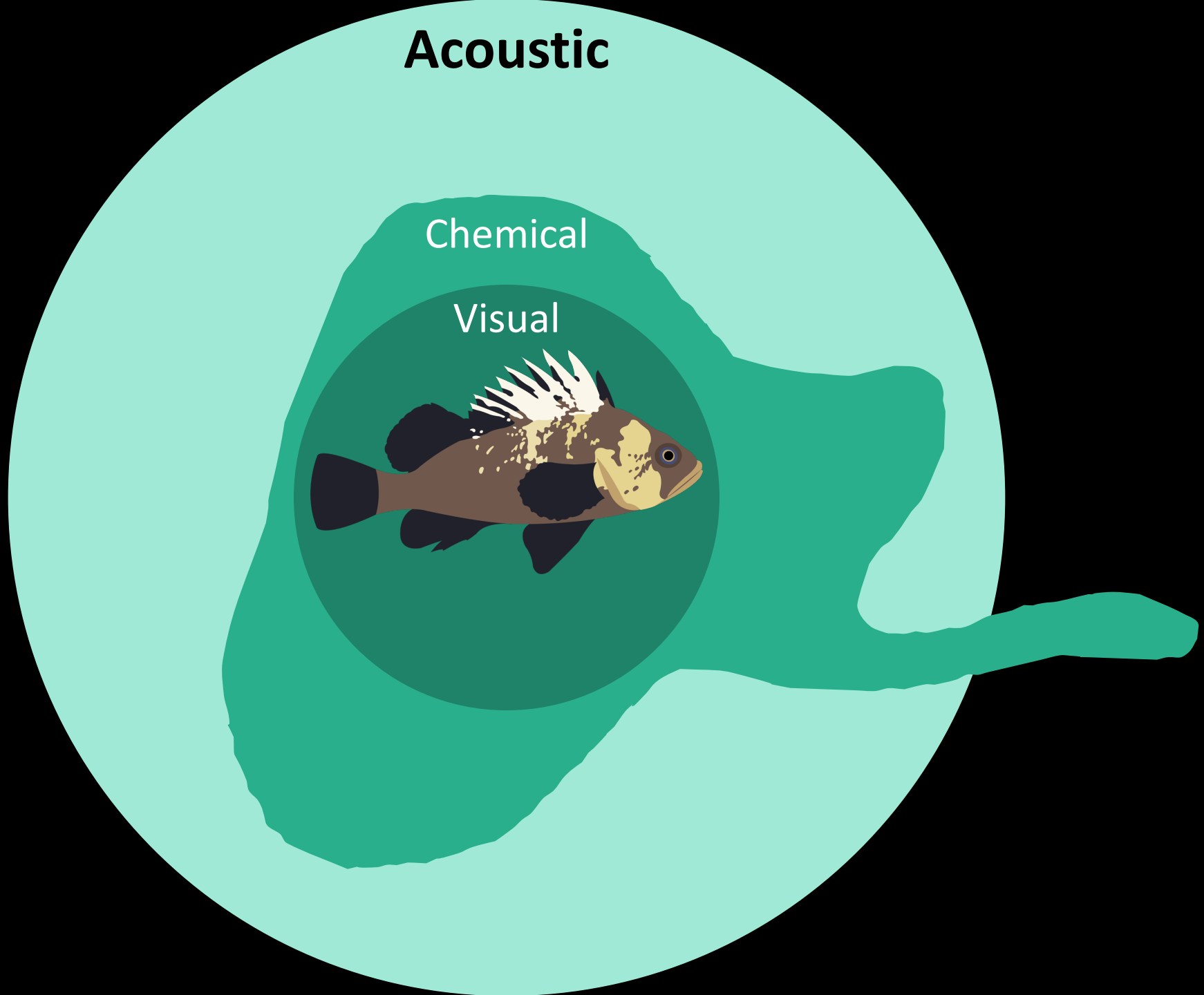
Juanes Lab

University of Victoria

UNIVERSIDADE DE SÃO PAULO
SCIENTIA VINCES

Canada
FISHERIES AND OCEANS

Vanier Canada
Graduate scholarships


Acoustic
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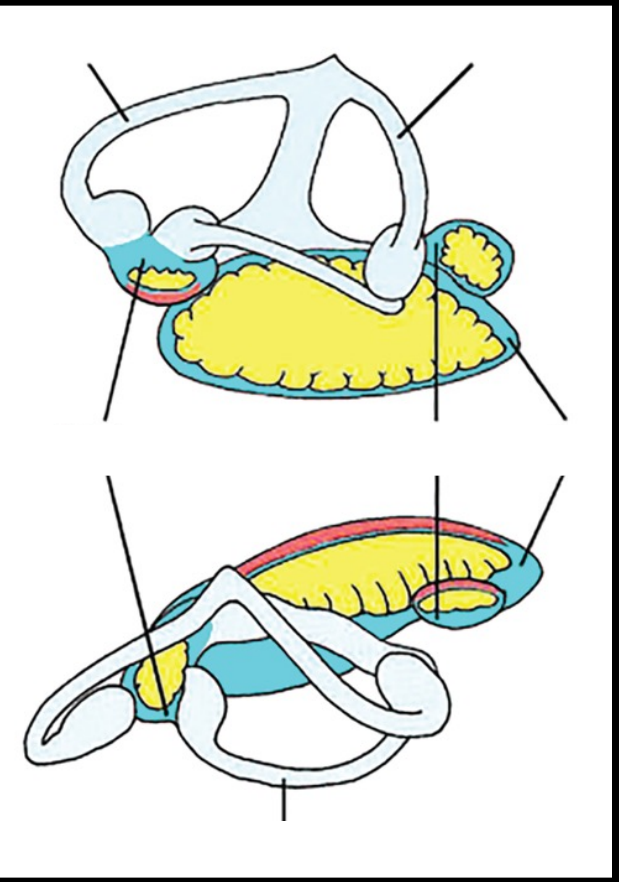
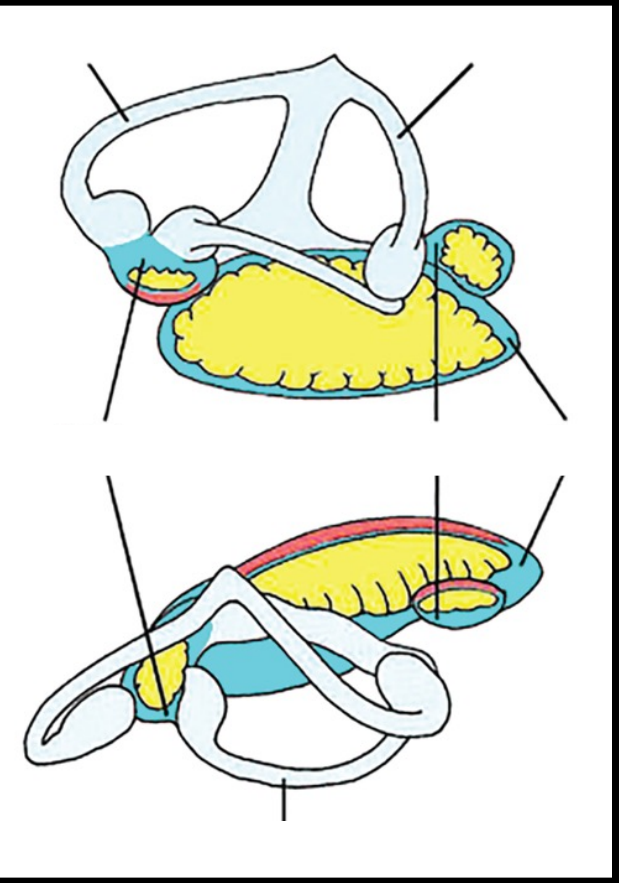
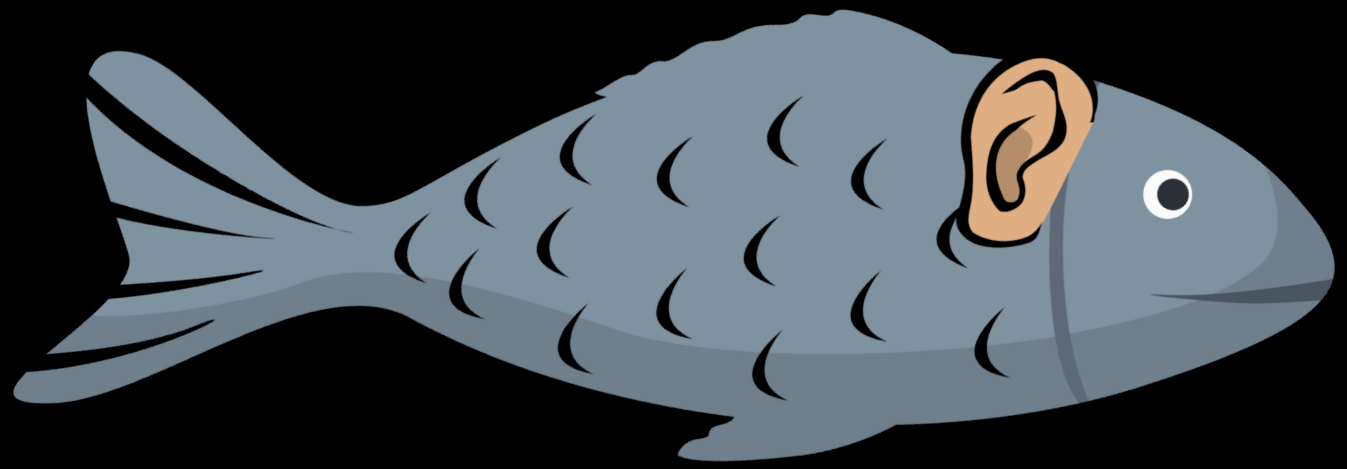
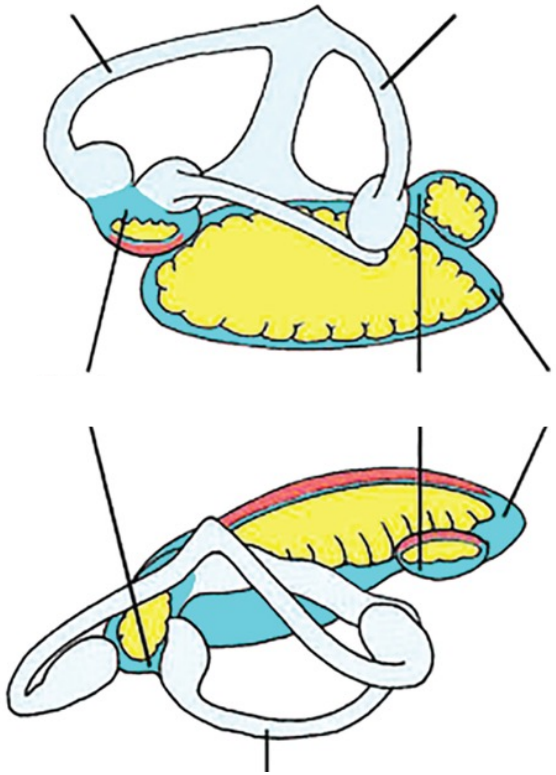


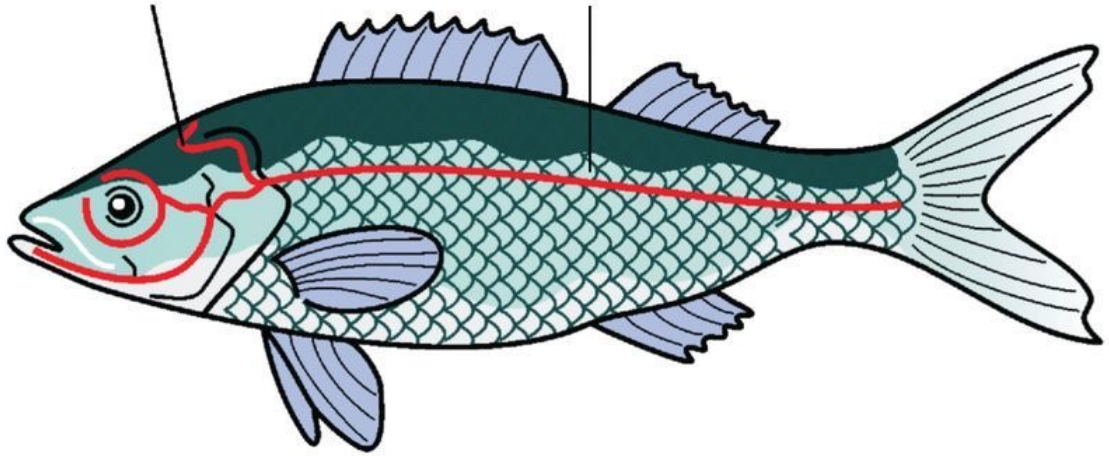
Dagamseh *et al.* 2013; *R Soc Interface*, Popper and Hawkins 2019 *Fish Bio*





Dagamseh *et al.* 2013; *R Soc Interface*, Popper and Hawkins 2019 *Fish Bio*





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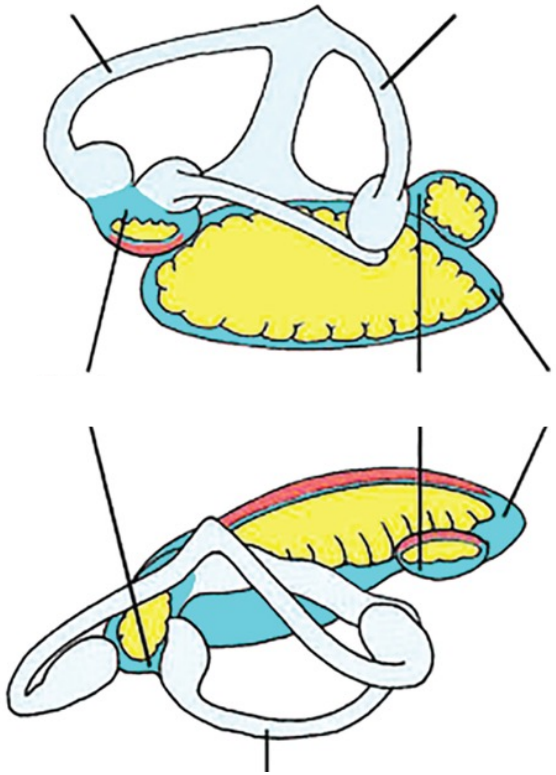
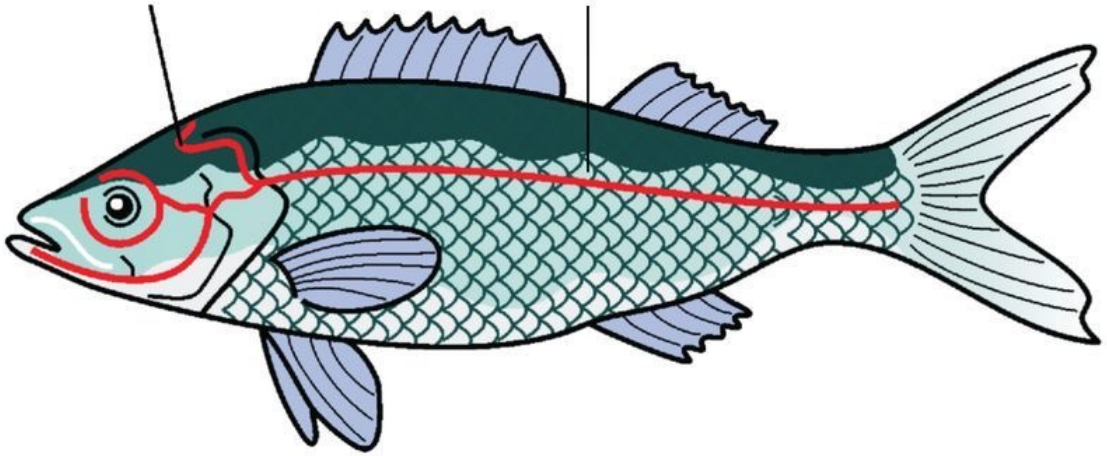
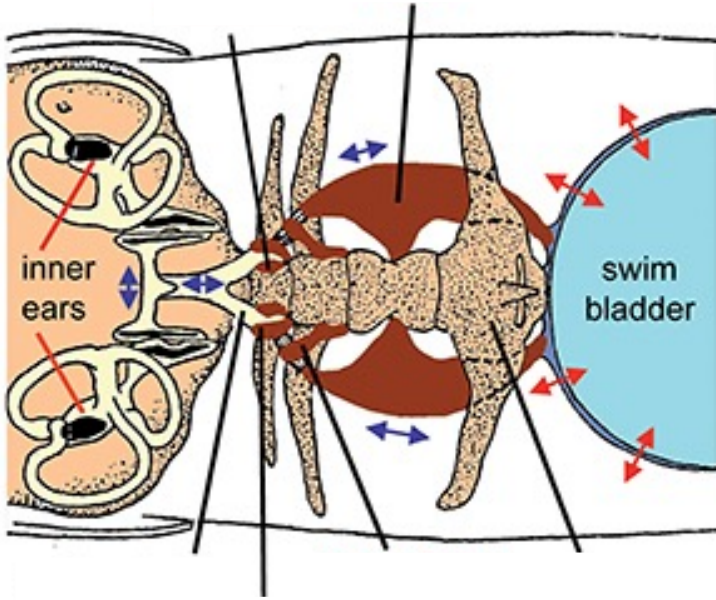
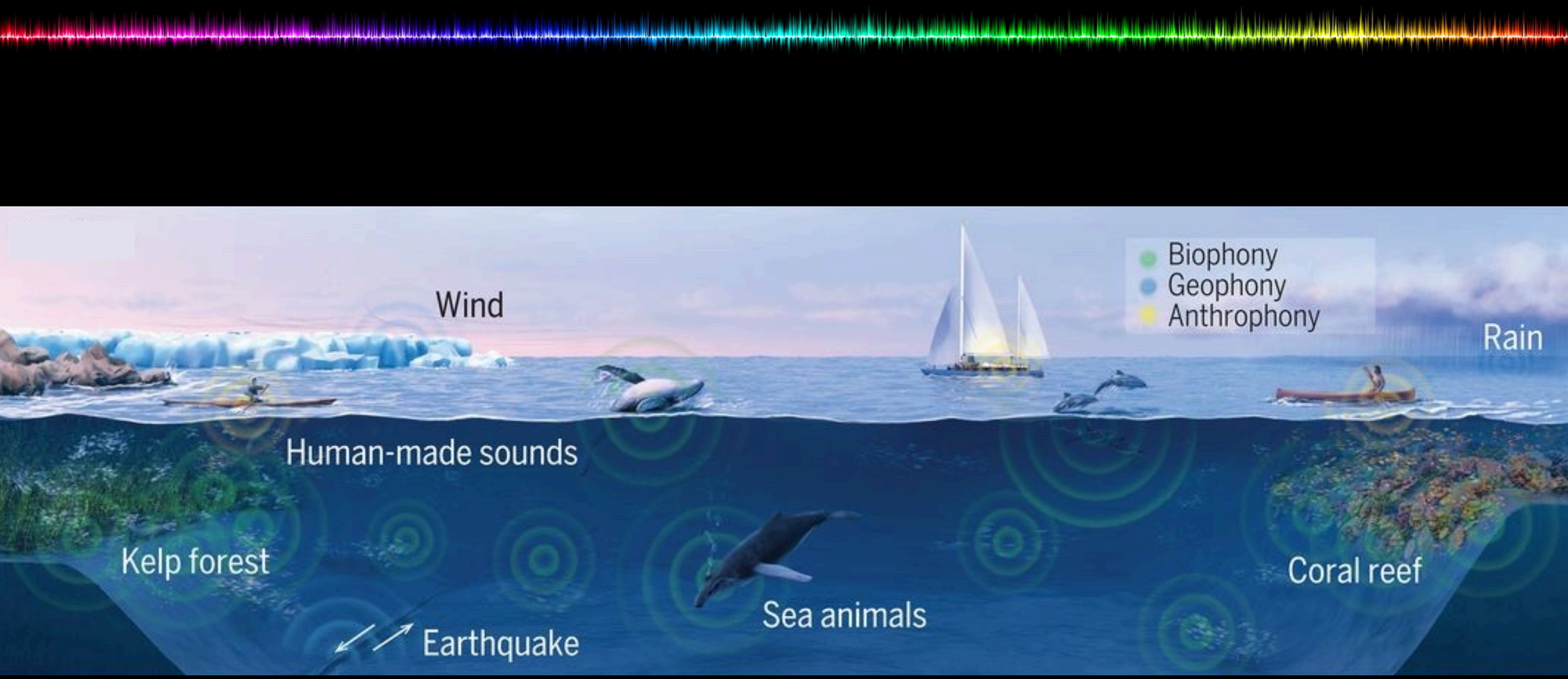




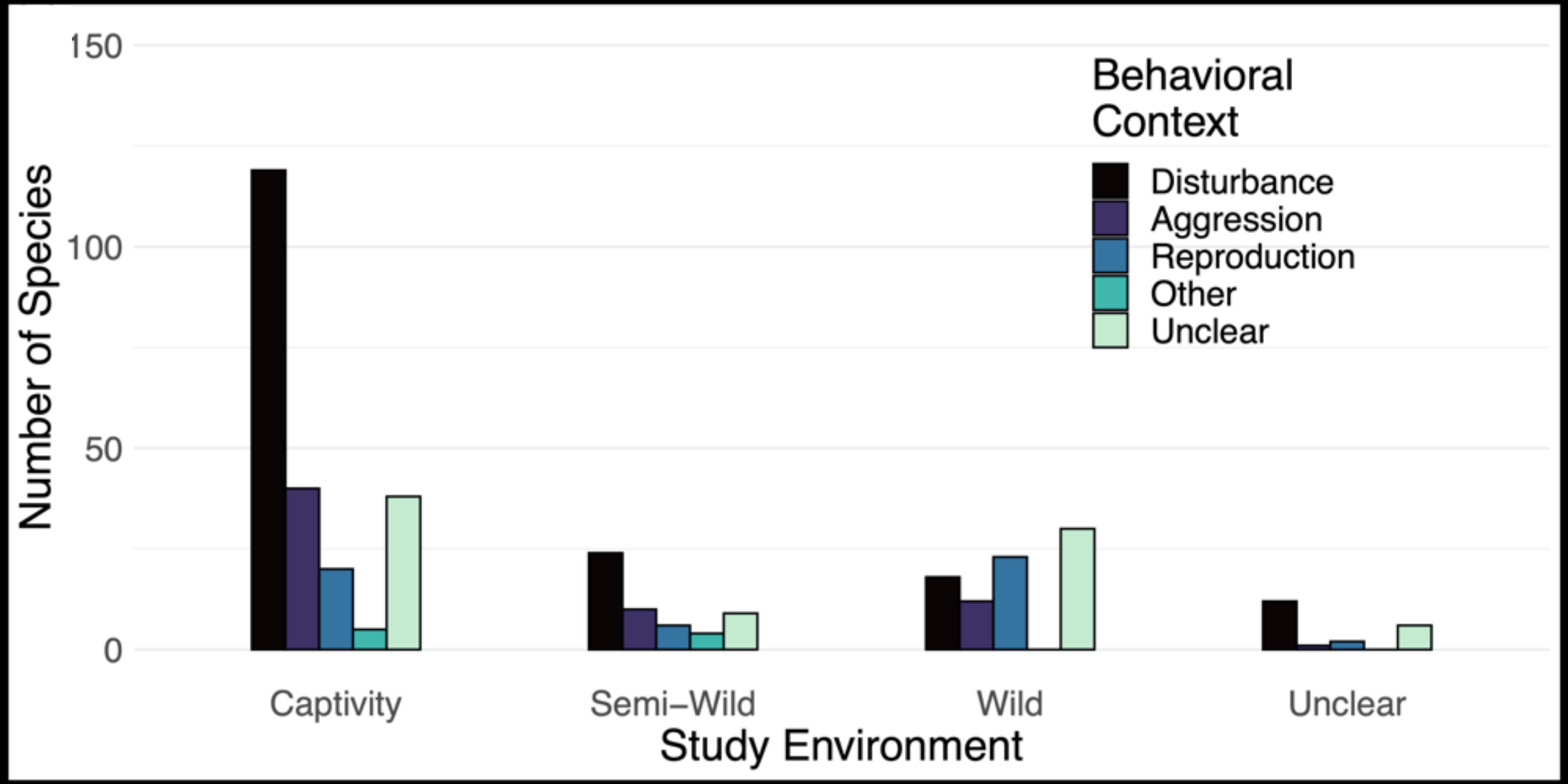


Ladrich and Schulz-Mirbach 2019 *Front Eco Evo*

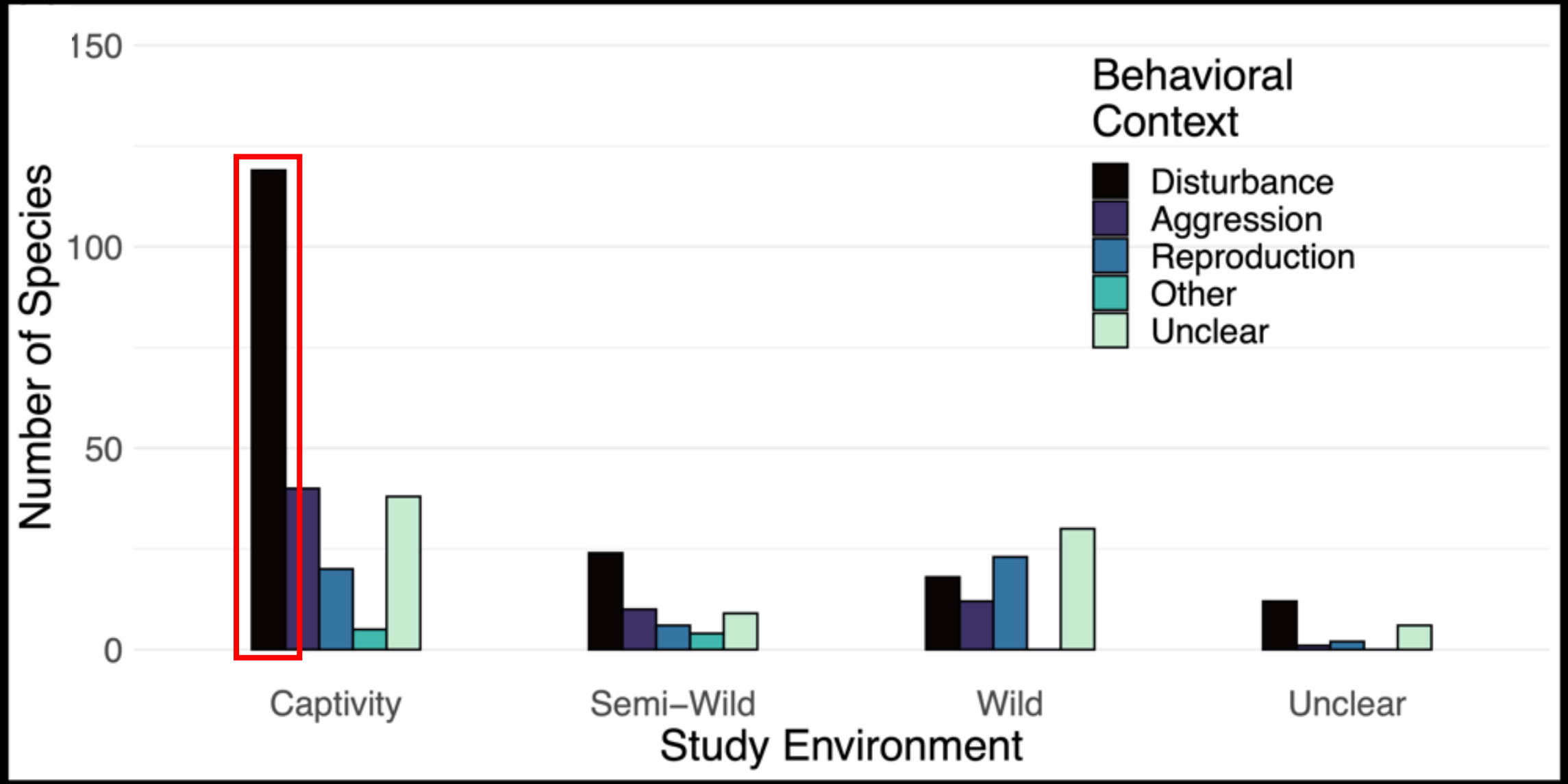


Duarte *et al.* 2021 *Science*

Fine and Parmentier 2015 *Anim Sign and Com*



Looby, … Cox 2022 2023 *JASA*



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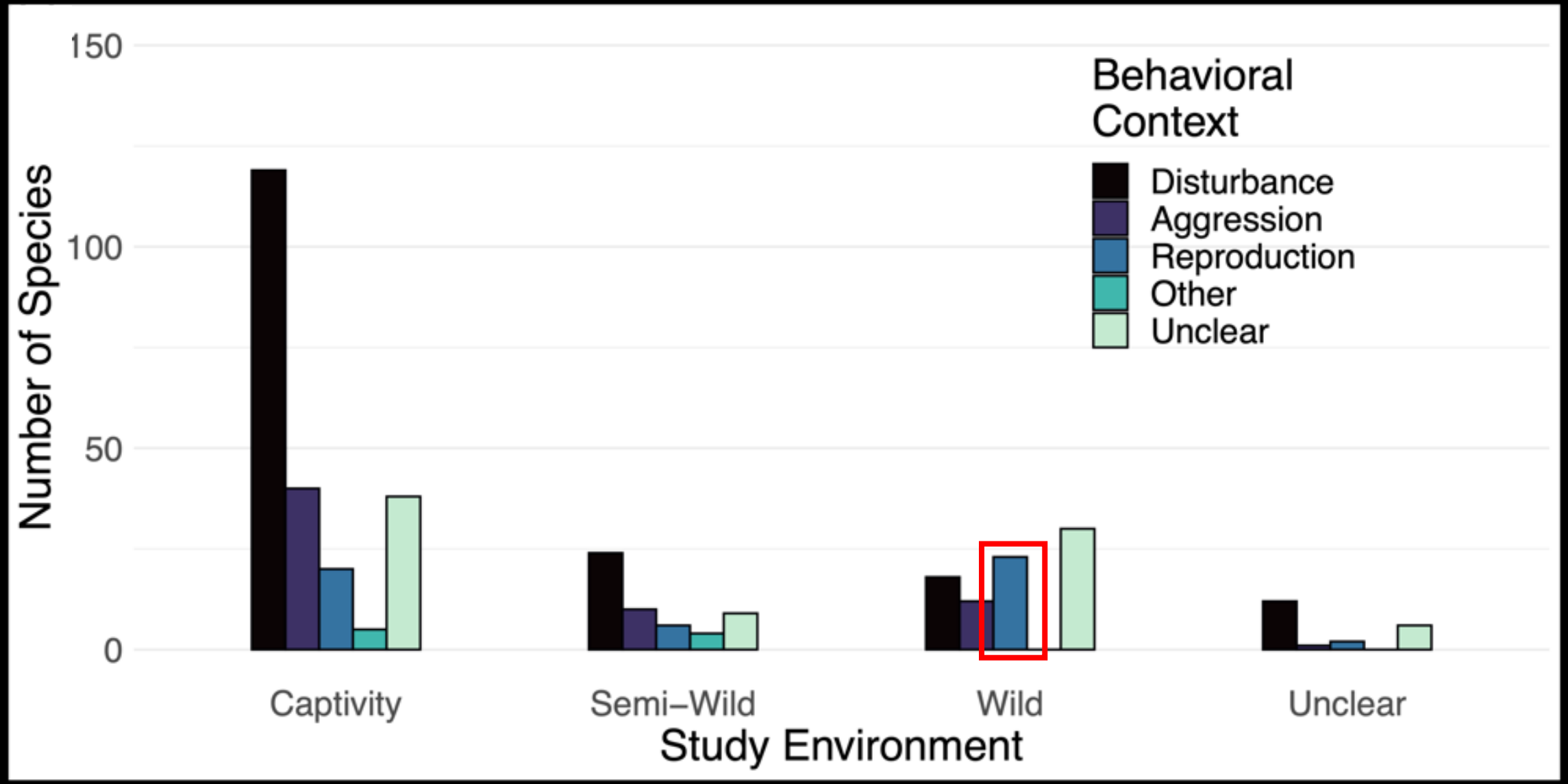
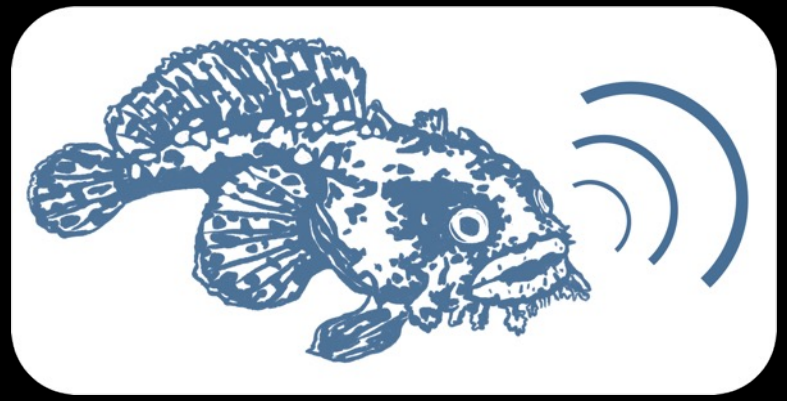


Looby, … Cox 2022 2023 *JASA*

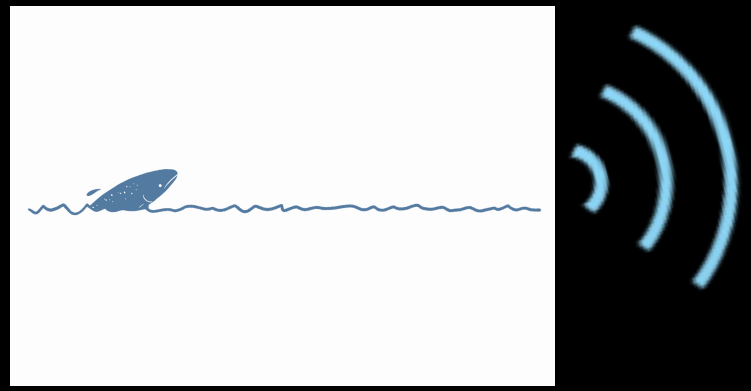
How many species of fish produce sound?

How many species of fish produce sound?

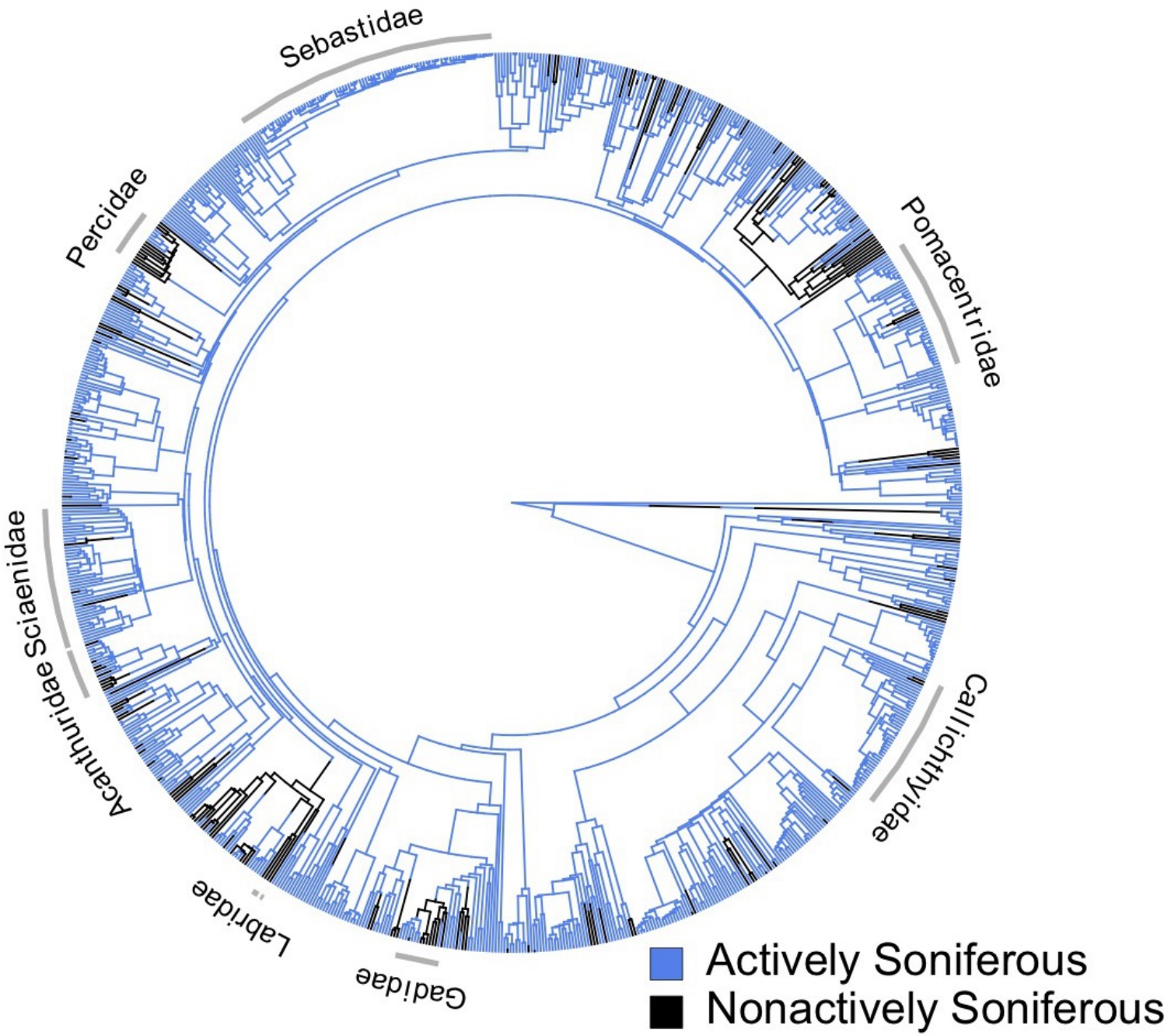
active sounds



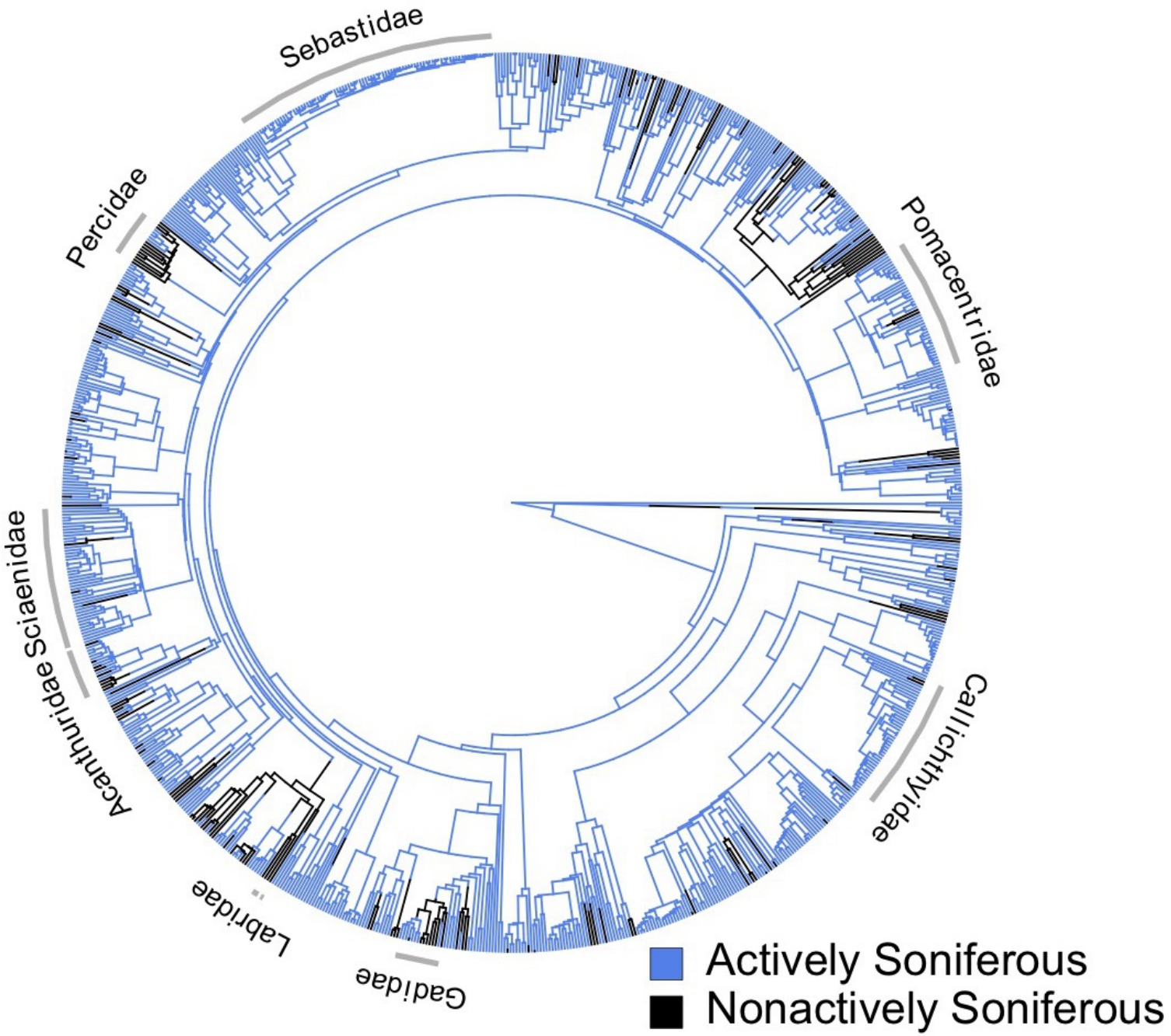
passive sounds



Looby, Cox *et al.* 2022 *Rev Fish Biol Fish*



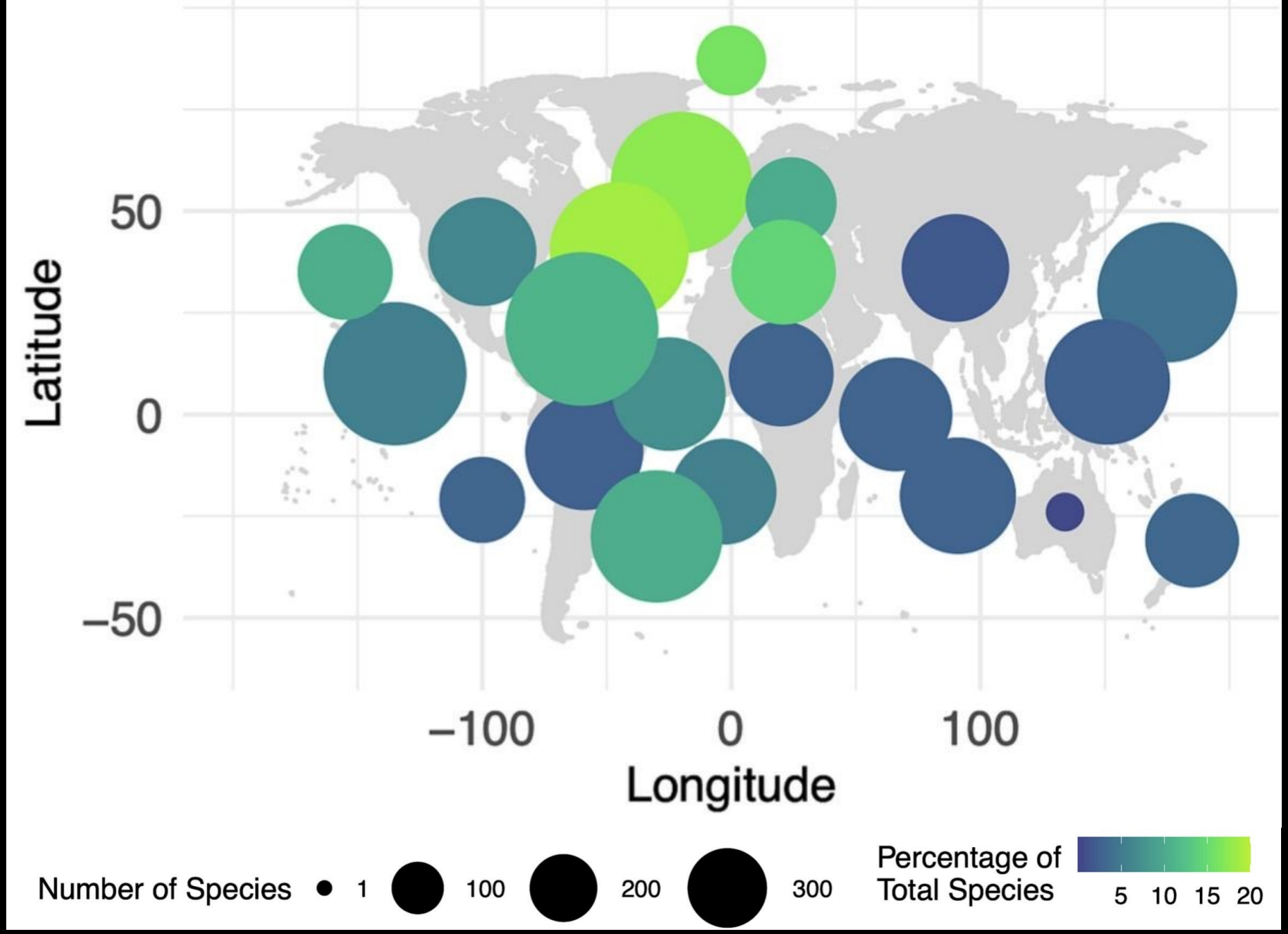
Looby, Cox *et al.* 2022 *Rev Fish Biol Fish*



133 families

989 species

Looby, Cox *et al.* 2022 *Rev Fish Biol Fish*



Looby, Vela, Cox *et al.* 2022 *Eco Info*

FishSounds

Learn More | Search | Profile

Welcome!

Welcome to the FishSounds website! We offer a comprehensive, global inventory of fish sound production research. Information can be searched by fish taxa, by sound characteristics, or by reference. Learn more about us and our data in the About Us section!

We are still growing! If you would like to suggest an edit or contribute a reference or associated fish sound recording, please contact us.

Check out our Additional Resources page for other places to learn about fish, underwater sounds, passive acoustic monitoring, and more!

Video Tour

Download PDF version of tour

Need some help?

Visit the About Our Data section for an explanation of where the data comes from and definitions of terms used throughout the site.

We encourage users to cite our website in your work! Please review our instructions on how to cite for information on referencing the website in general, as well as specific recordings and research. Also review the license information accompanying images and recordings for clarification on their reuse.

Highlighted Species

Aplodinotus grunniens

(Freshwater drum)

Ohio Sea Grant, license: CC BY-NC 4.0, source: iNaturalist

Visit Our Friends!

Rodney Rountree's Studies on Soniferous Fishes

Dr. Rountree has contributed to public education on underwater soundscapes for more than 2 decades. His website features fish sound clips (from over 60 species), fish song ringtones, the "Listening to Fish" blog, and children's stories.

List of Additional Resources

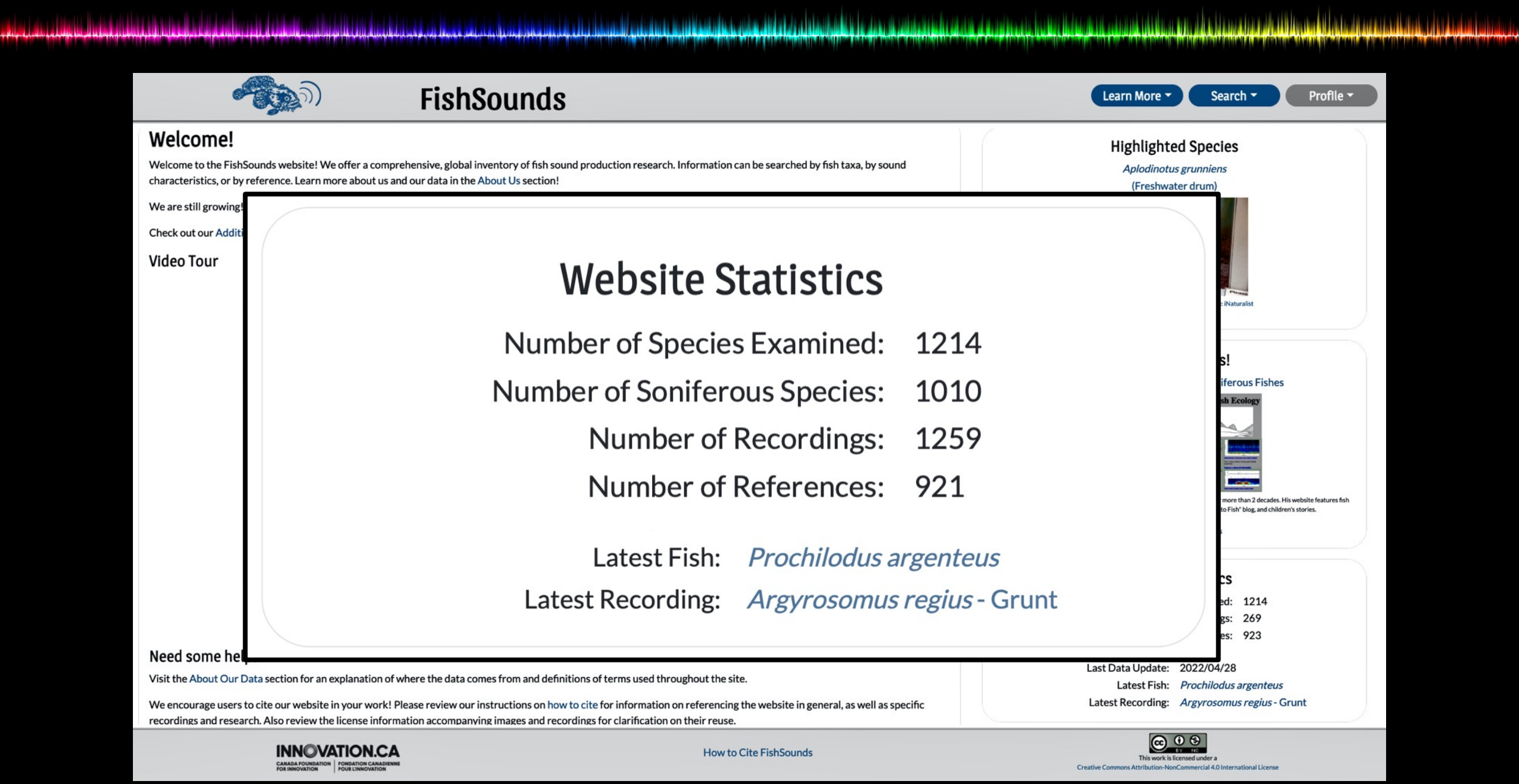
Website Statistics

Number of Species Examined:	1214
Number of Sound Recordings:	269
Number of References:	923
Last Data Update:	2022/04/28
Latest Fish:	*Prochilodus argenteus*
Latest Recording:	*Argyrosomus regius* - Grunt

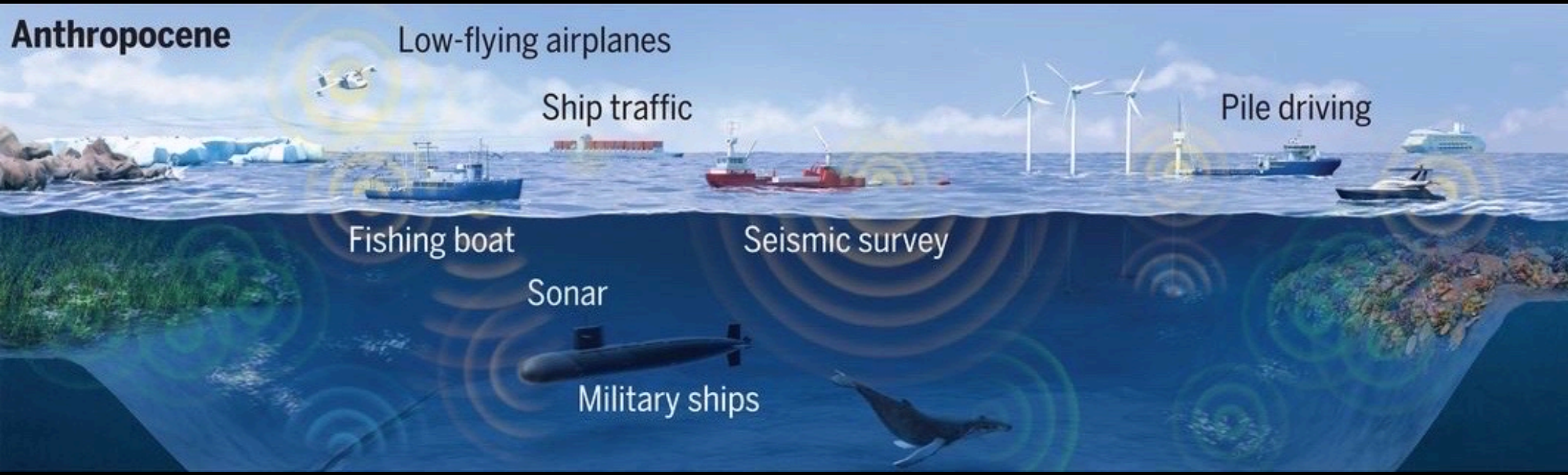
INNOVATION.CA
CANADA FOUNDATION FOR INNOVATION | FONDATION CANADIENNE POUR L'INNOVATION

How to Cite FishSounds

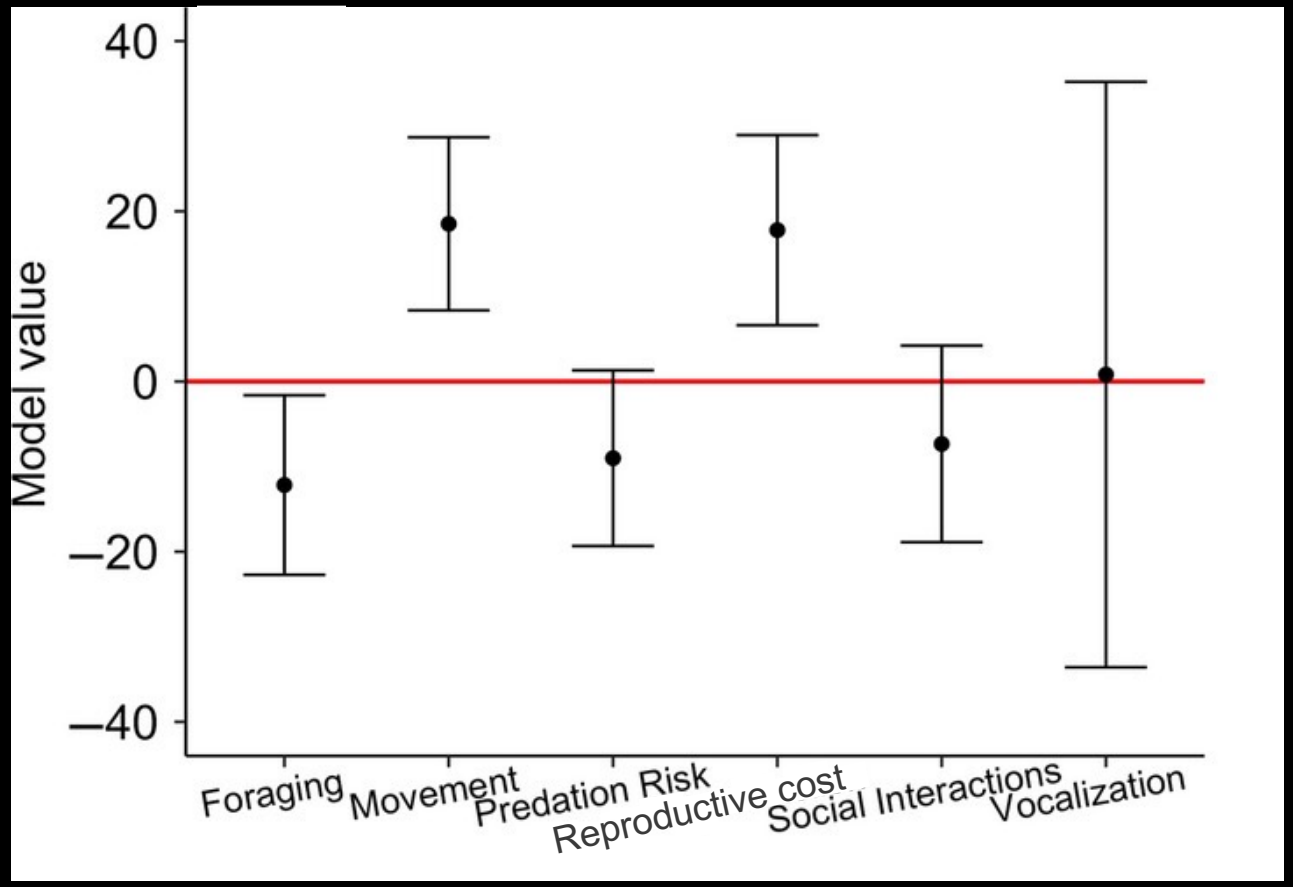
Looby, Vela, Cox *et al.* 2022 *Eco Info*; Cox *et al.* 2023



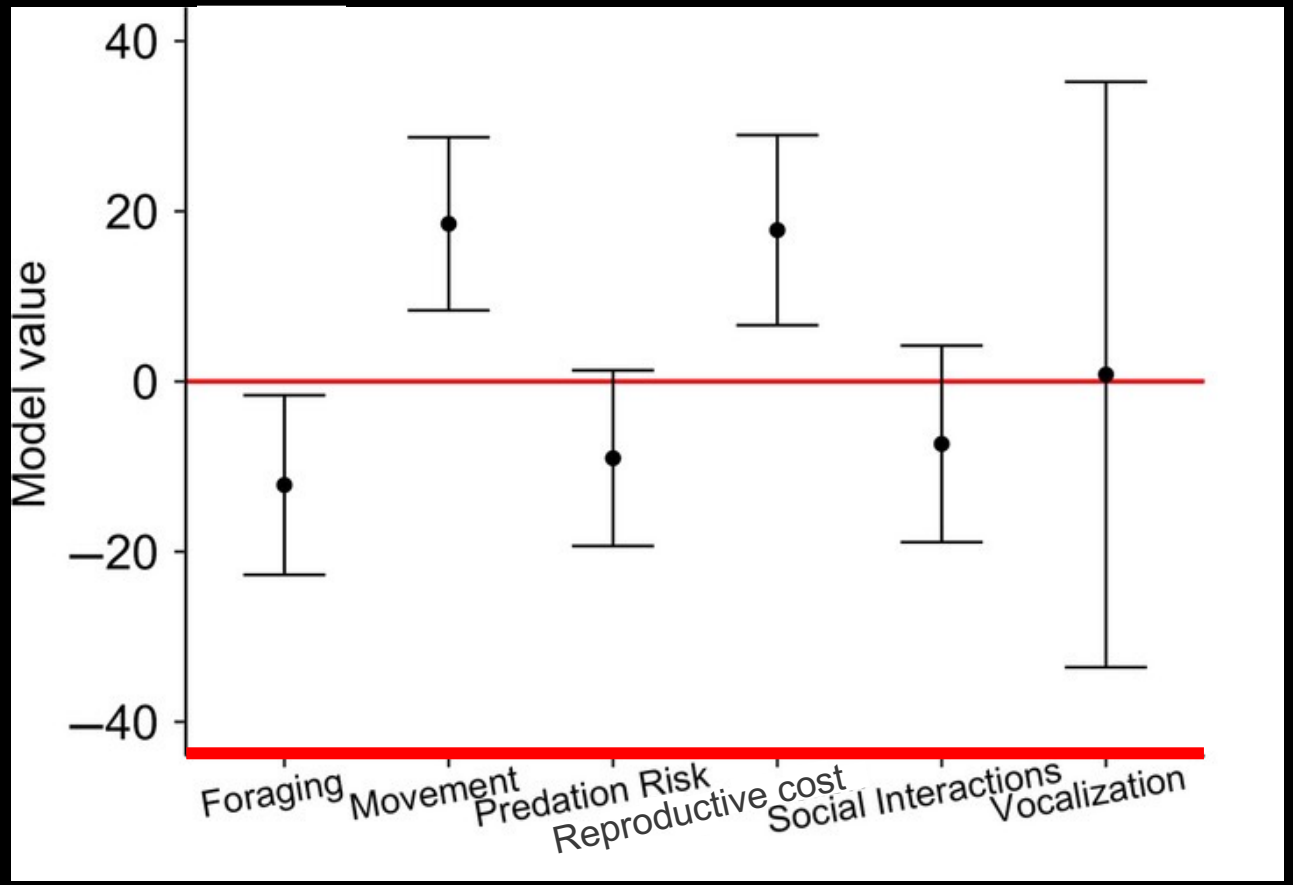
Looby, Vela, Cox *et al.* 2022 *Eco Info*; Cox *et al.* 2023



Duarte et al. 2021 *Science*



Cox et al. 2018 *Glob Chang Biol*



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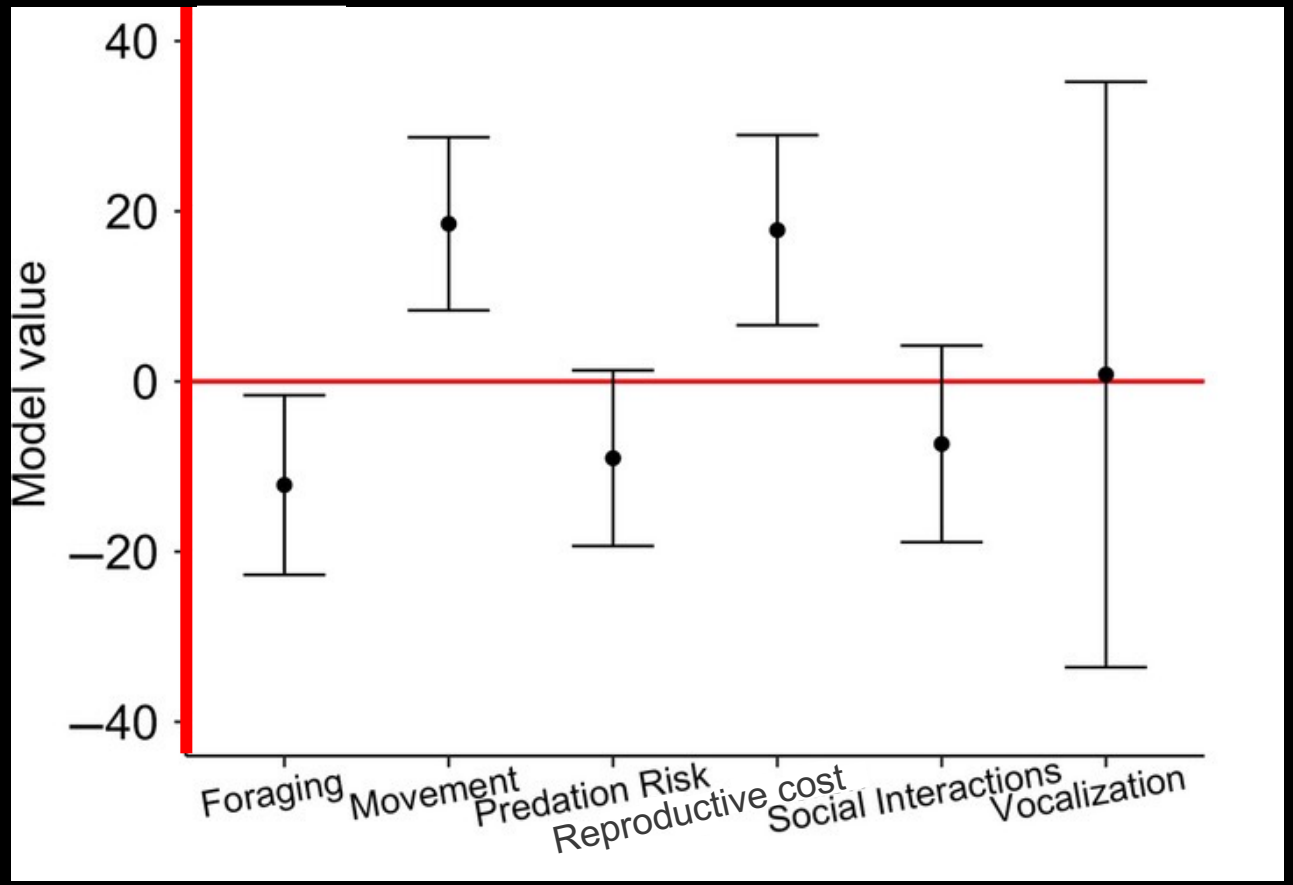

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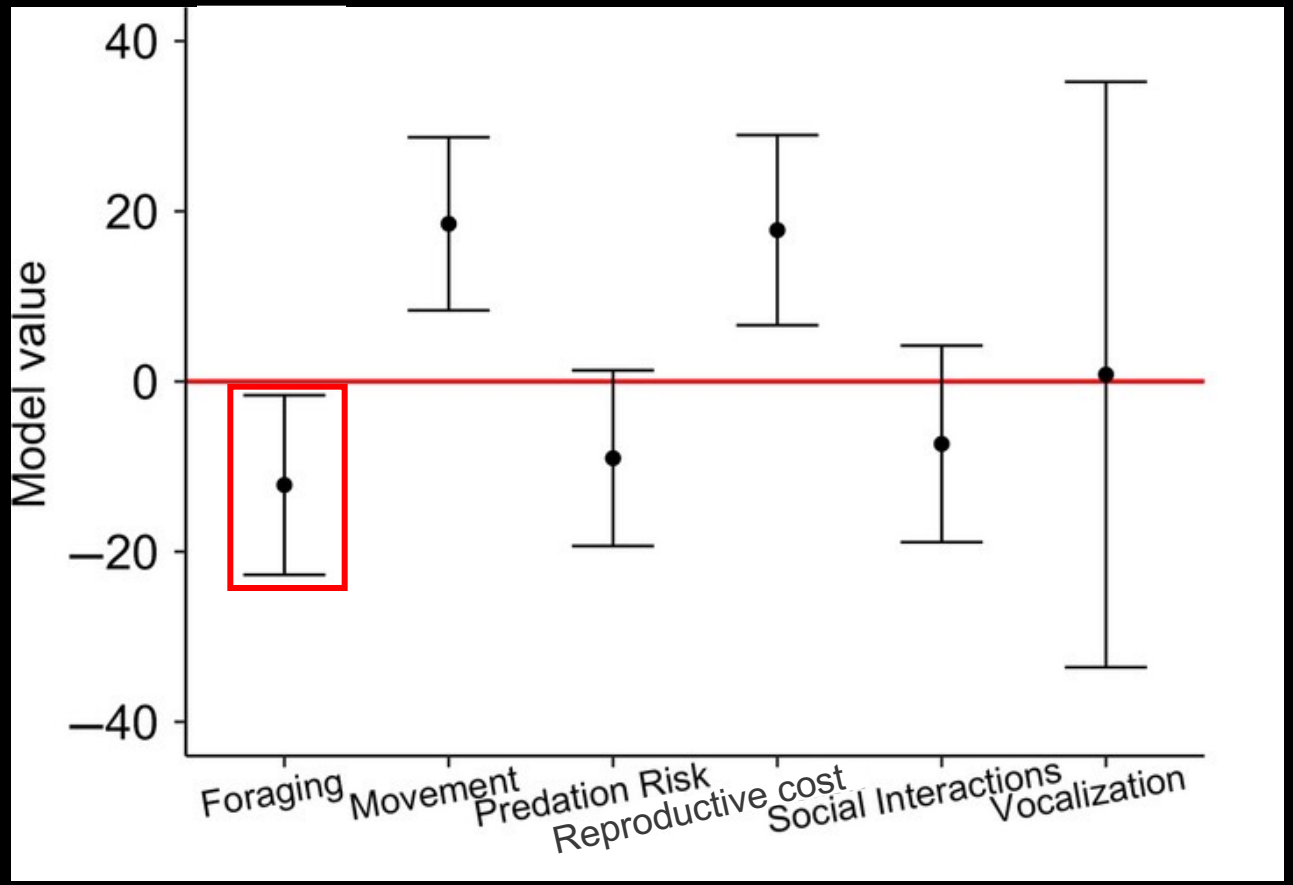

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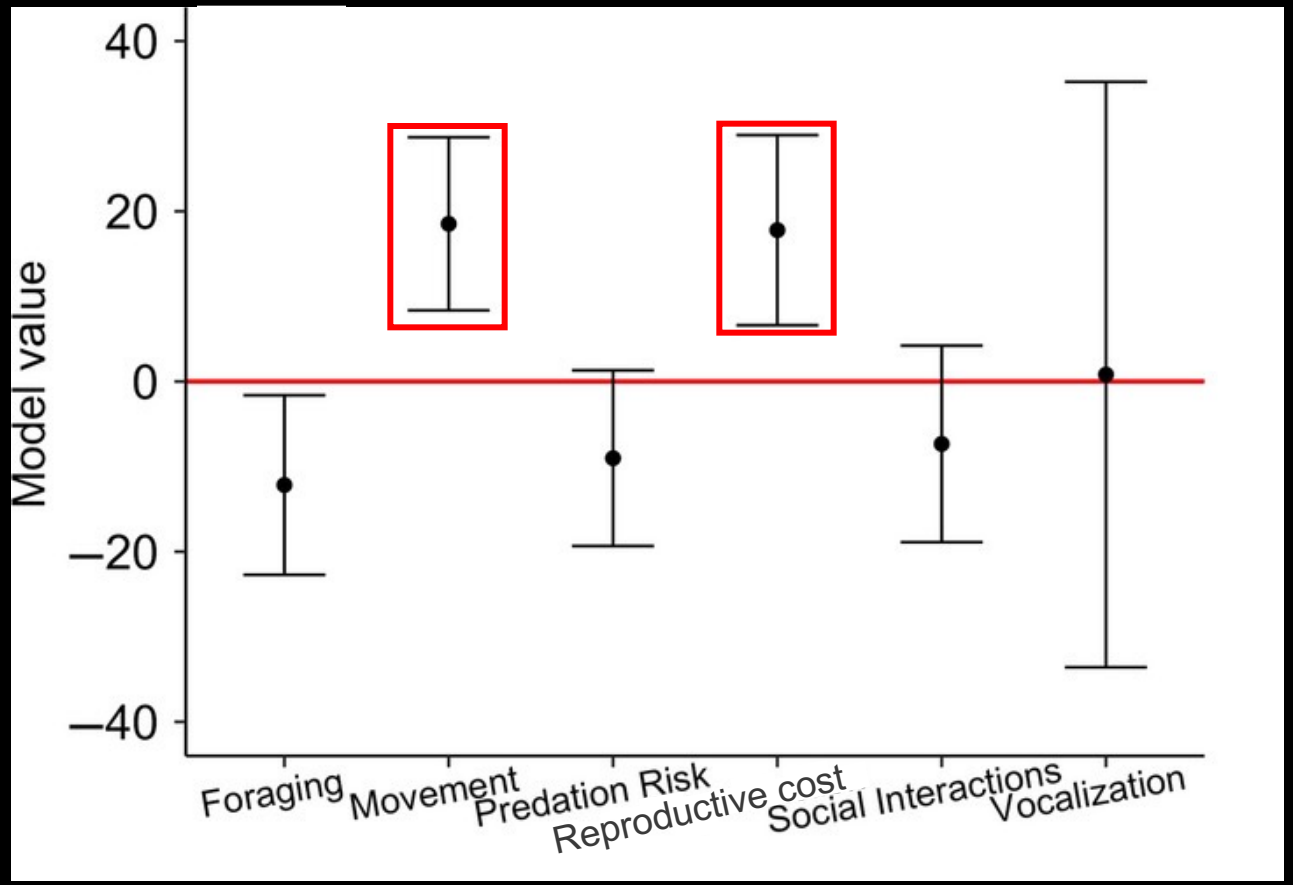

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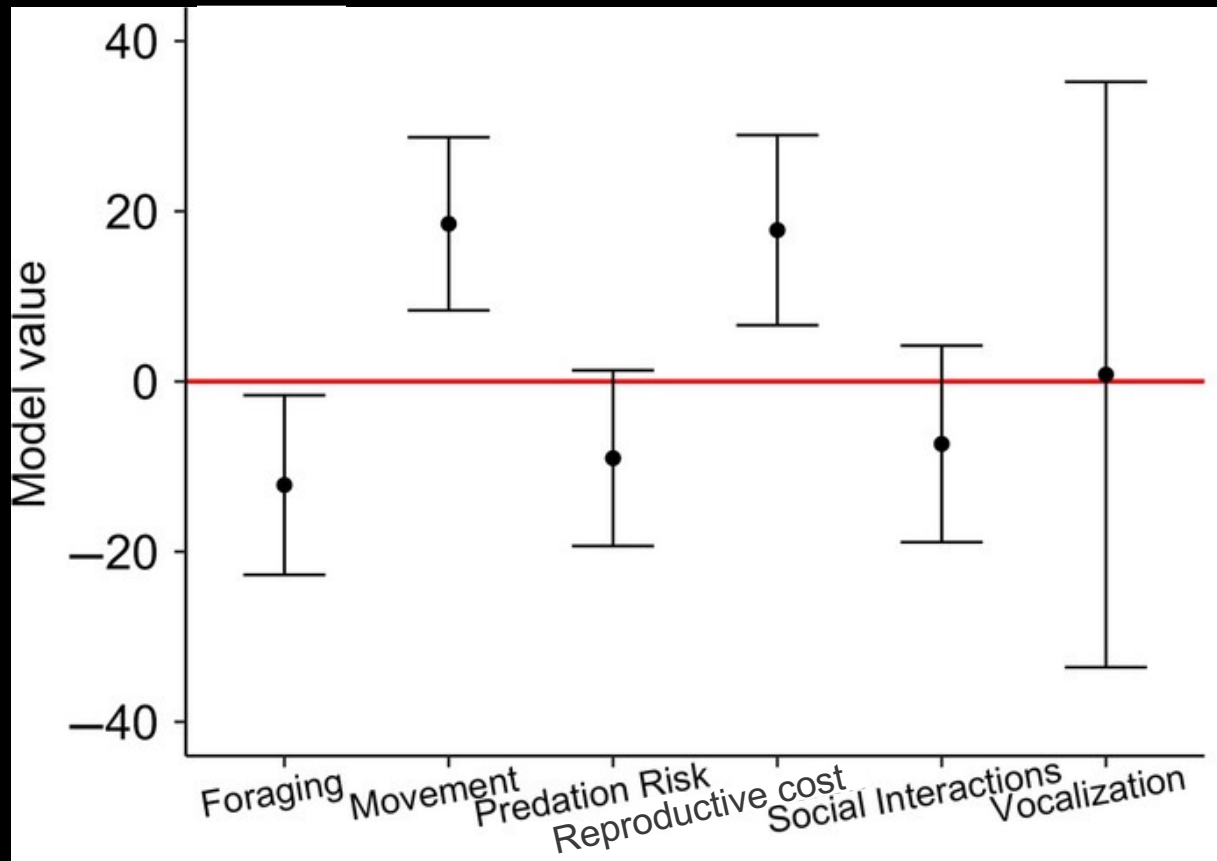

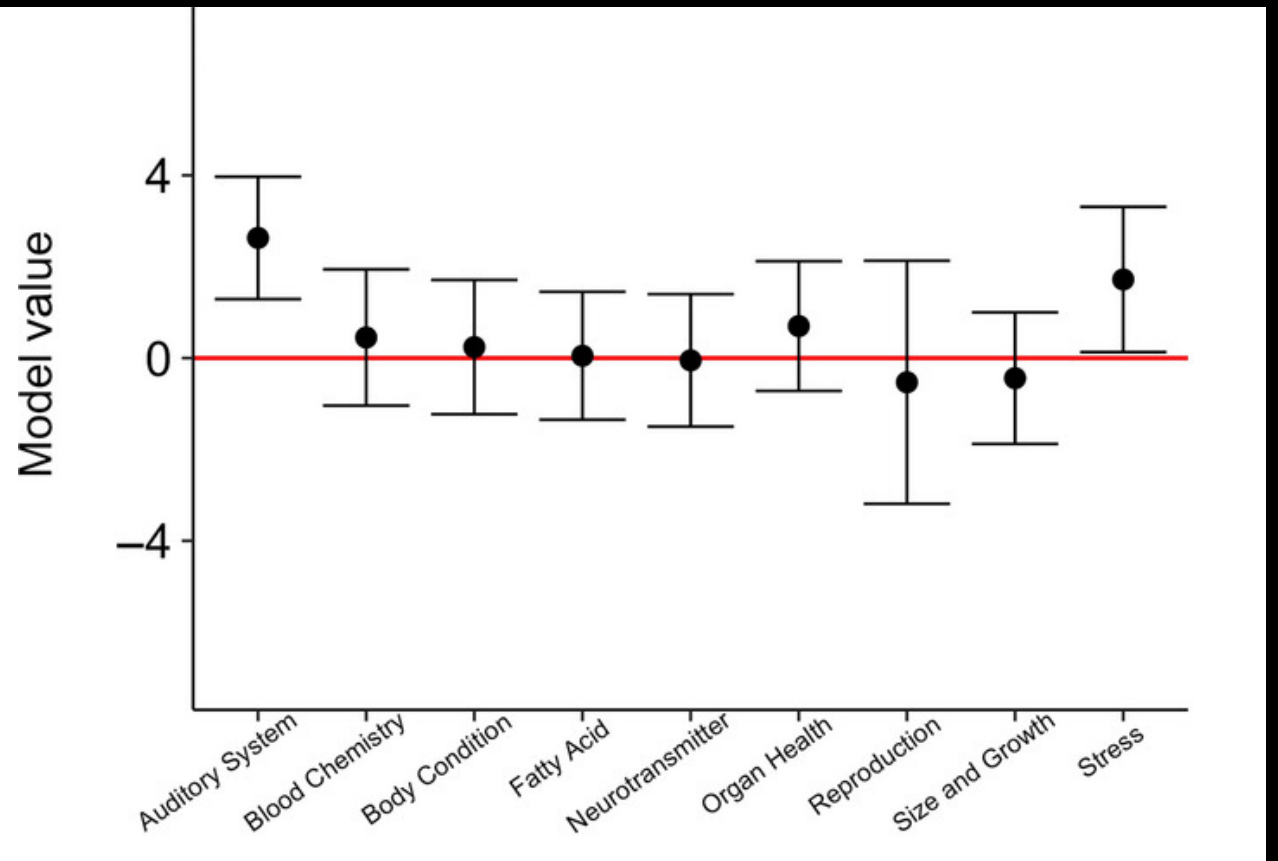

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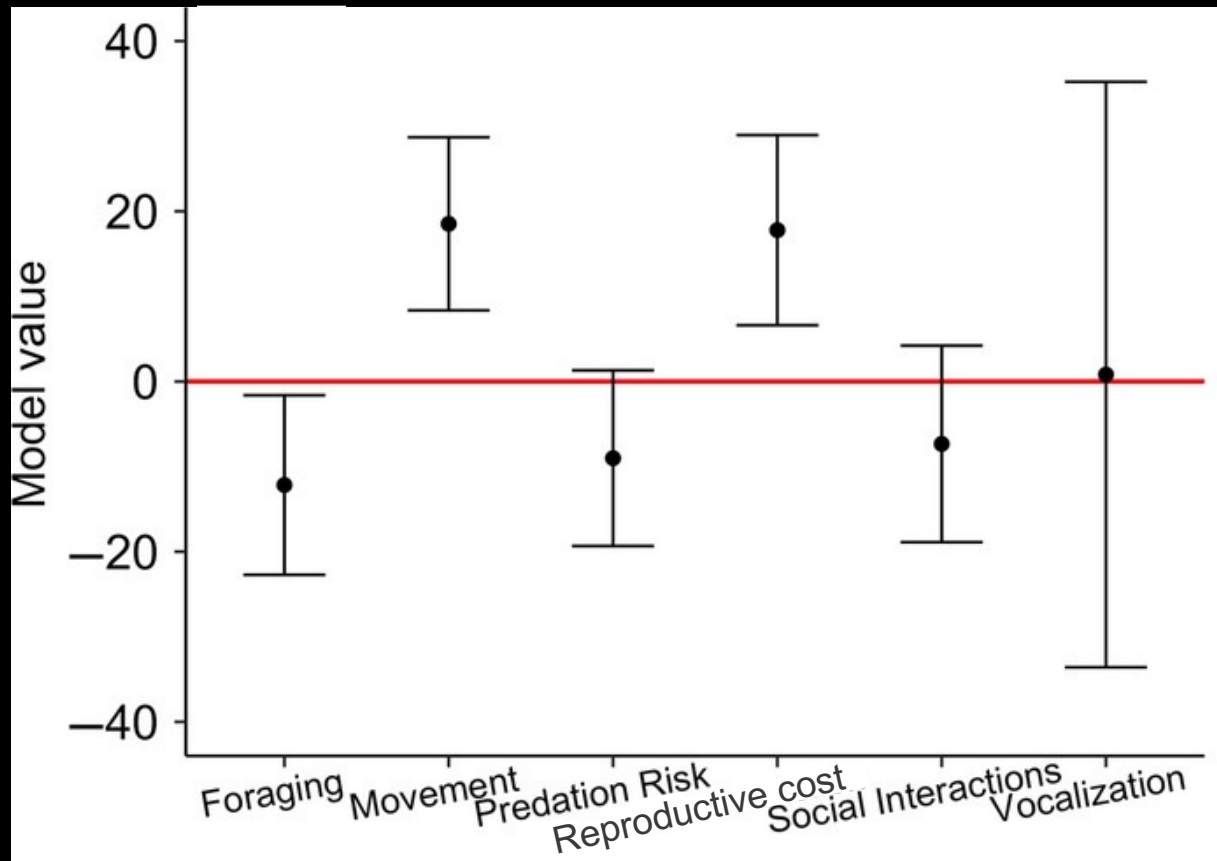
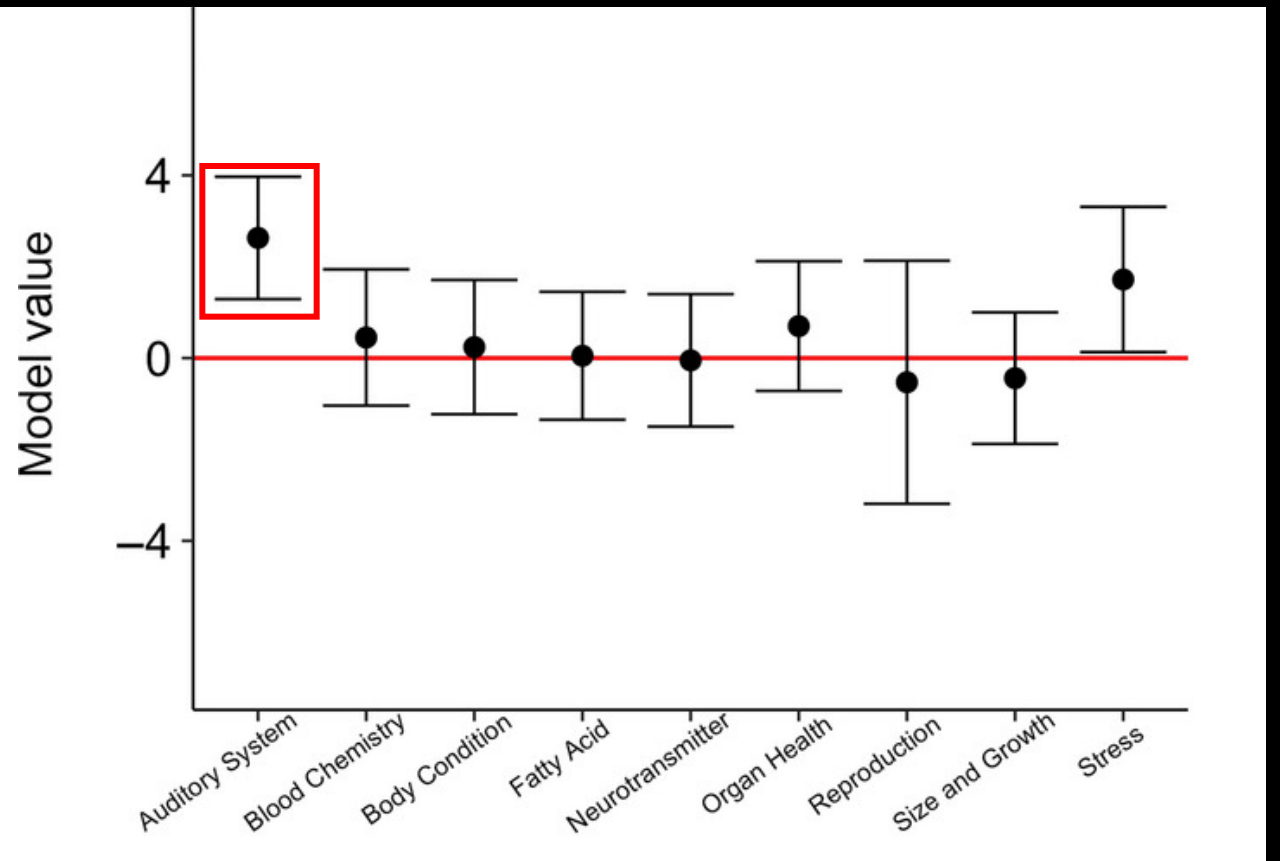
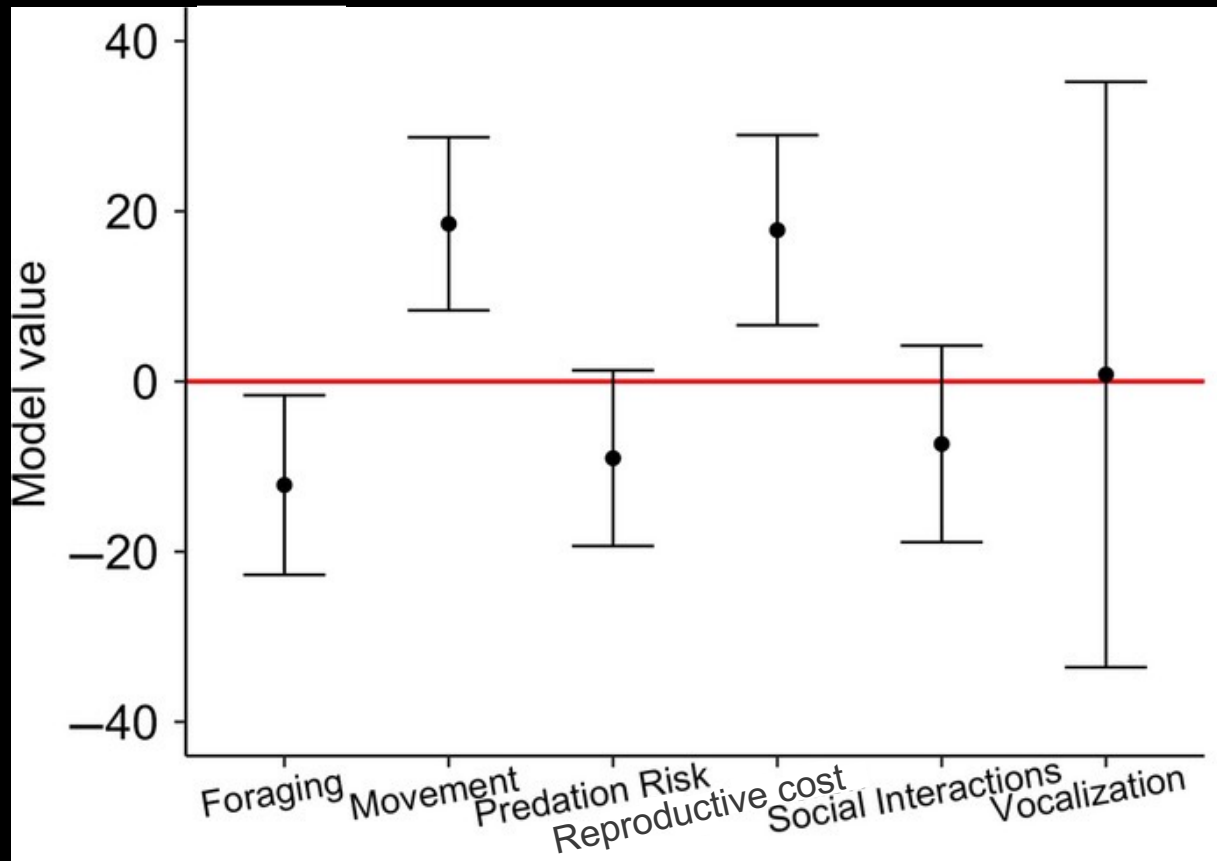
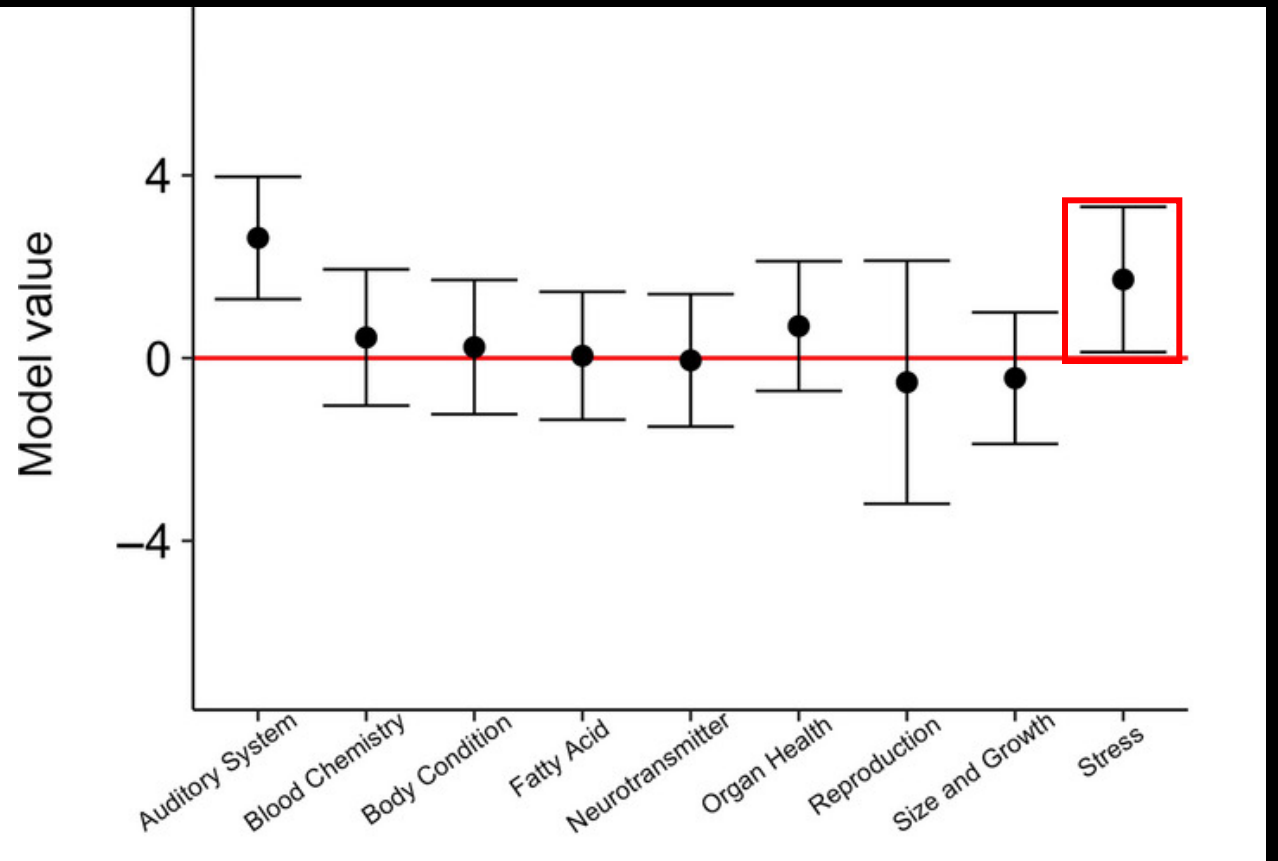




Cox et al. 2018 *Glob Chang Biol*





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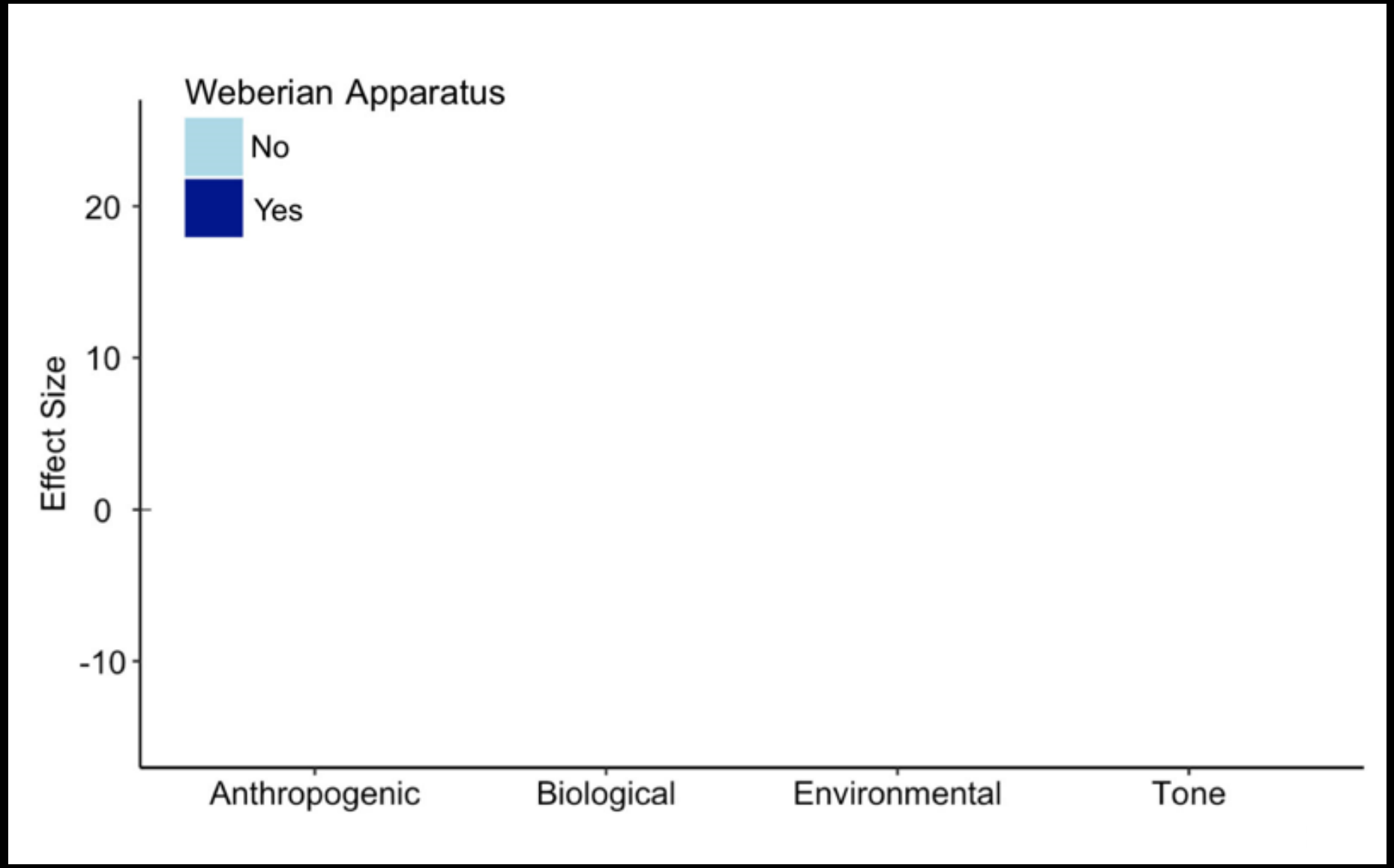

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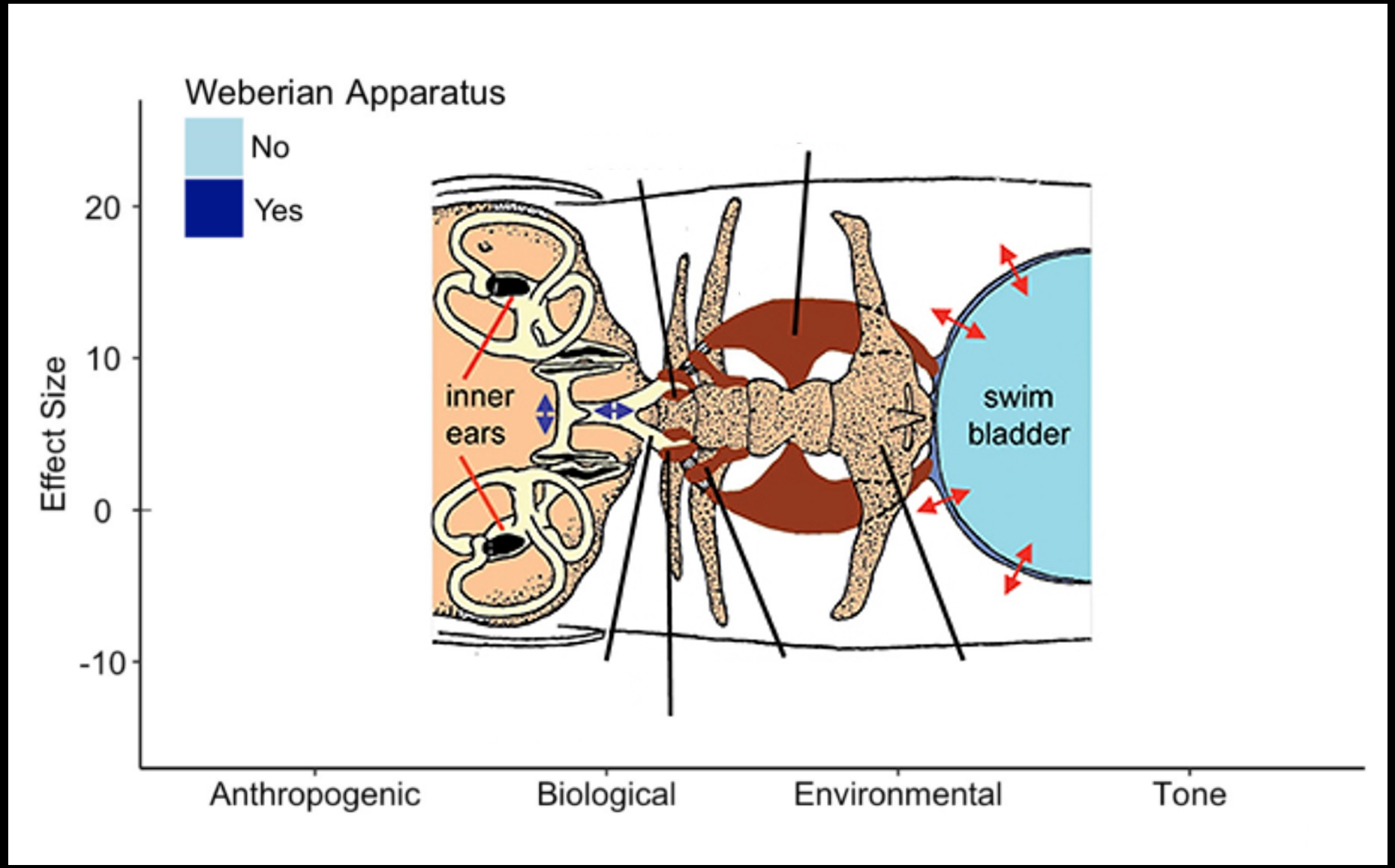

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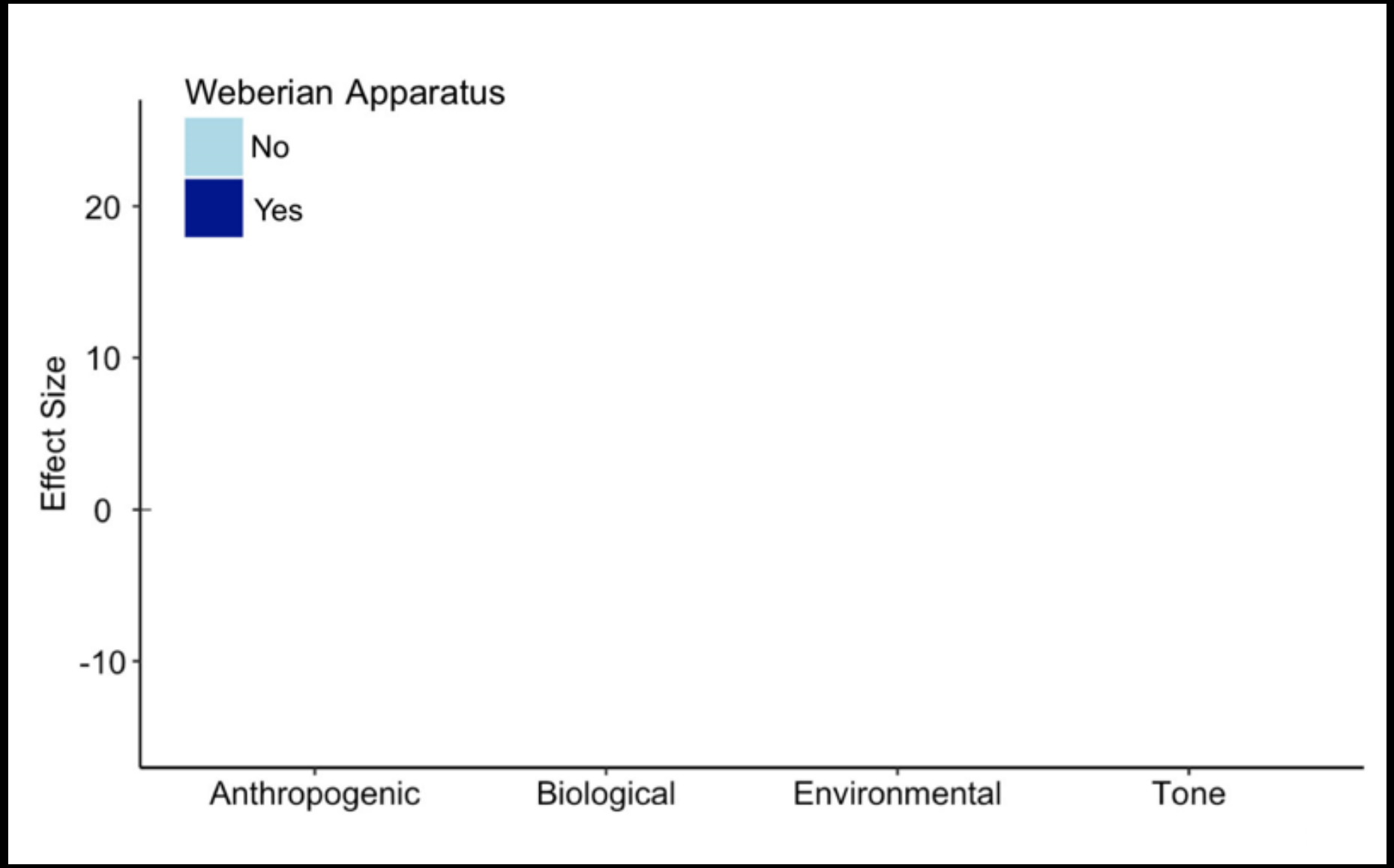

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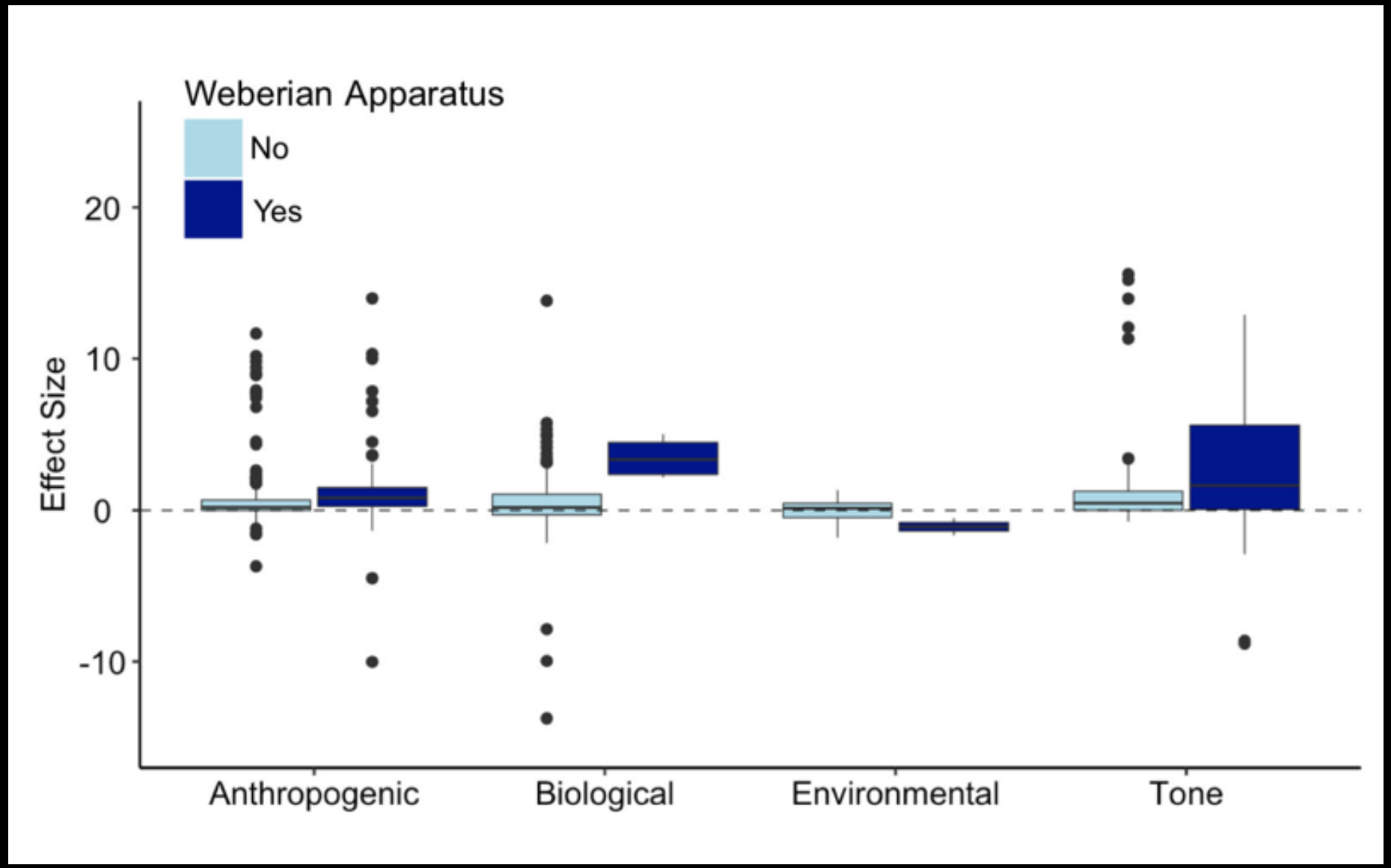

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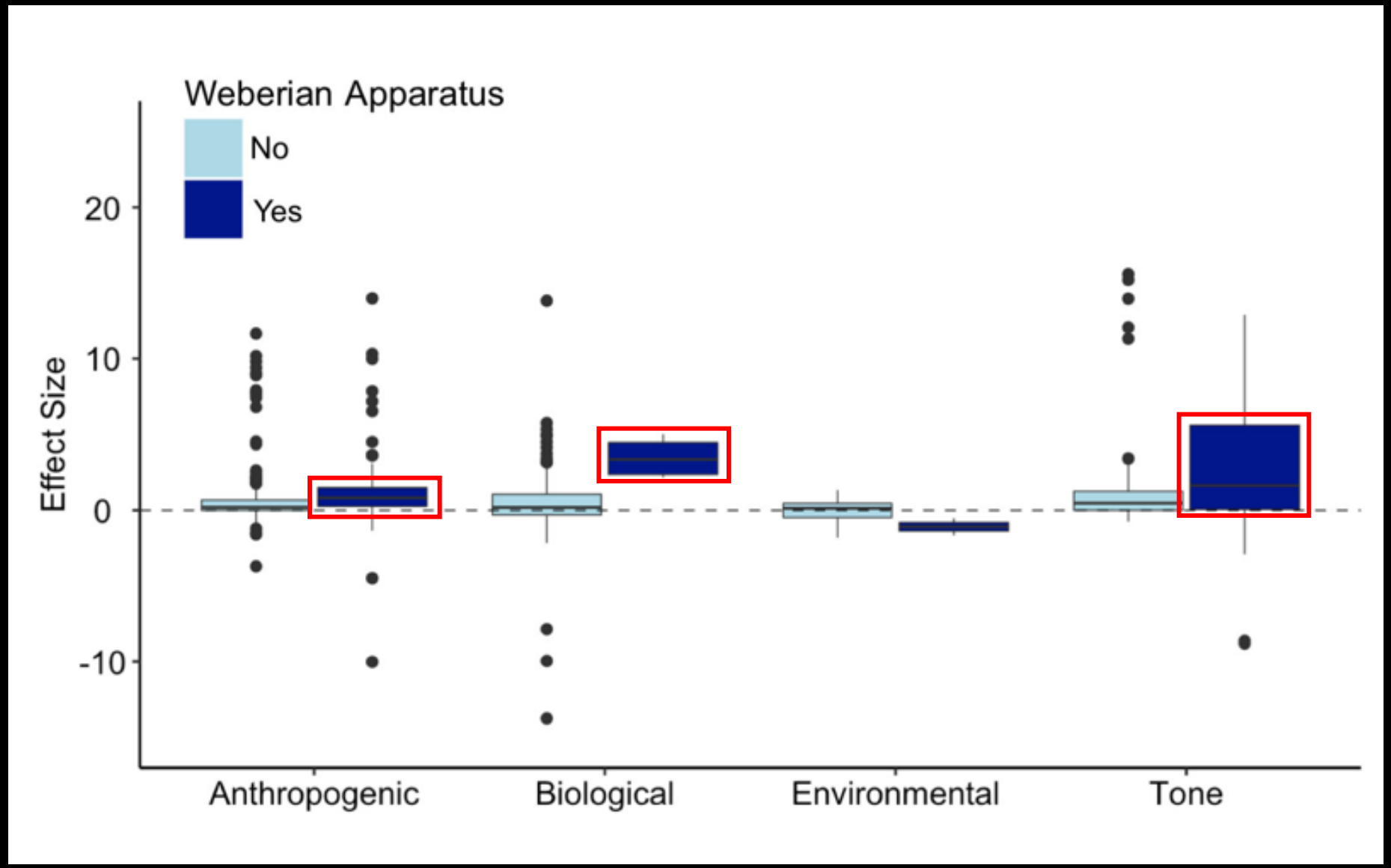

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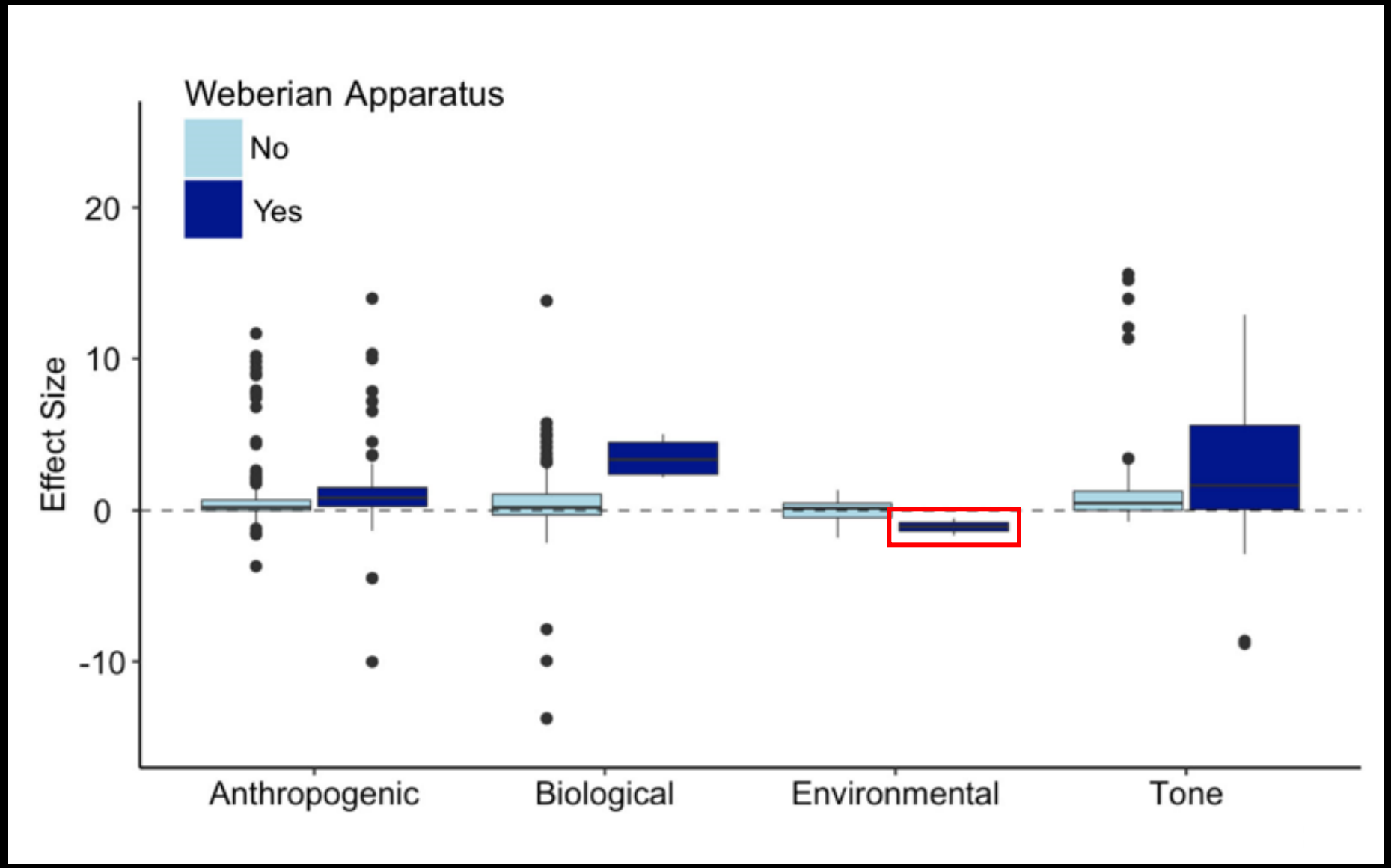

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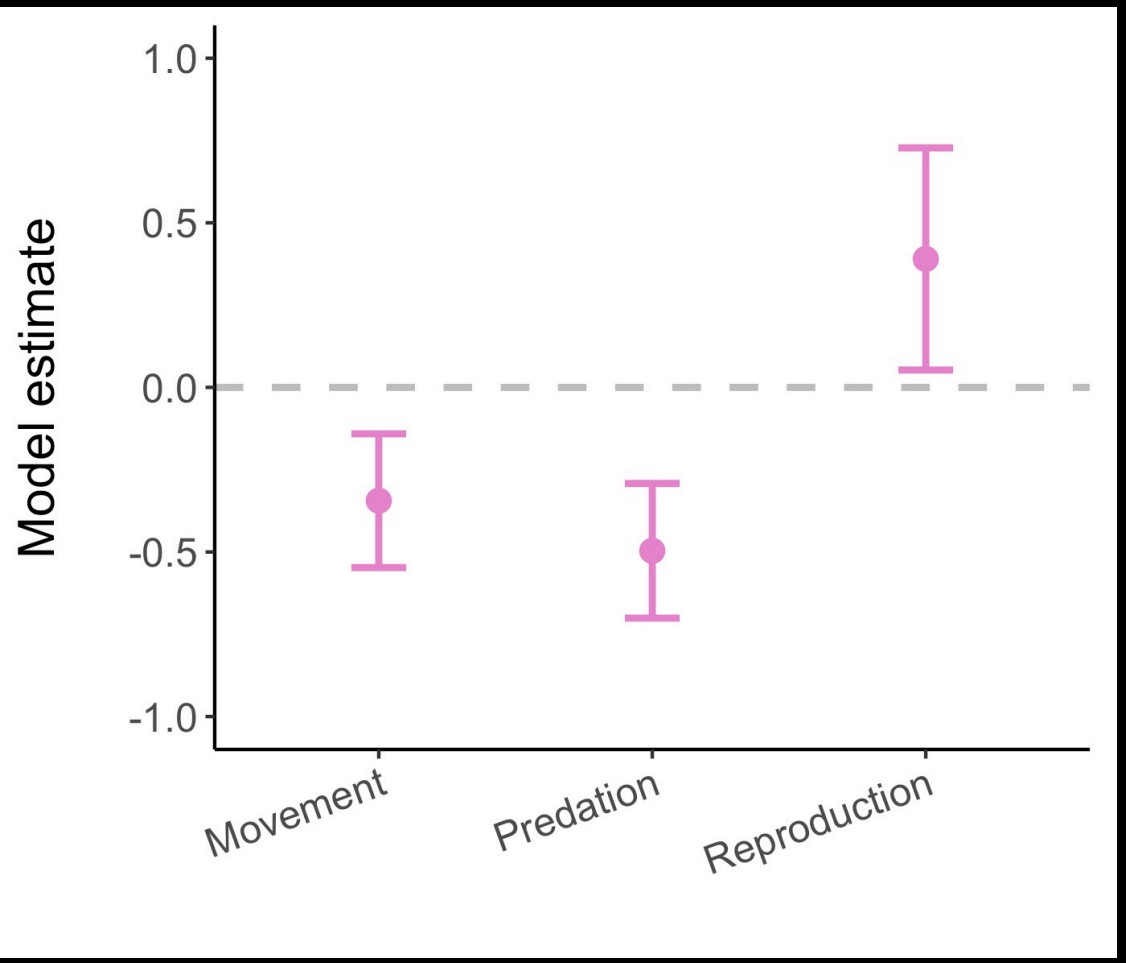
Cox 2017; Cox et. 2017; Attridge, Cox et al. 2024 *Fisheries*



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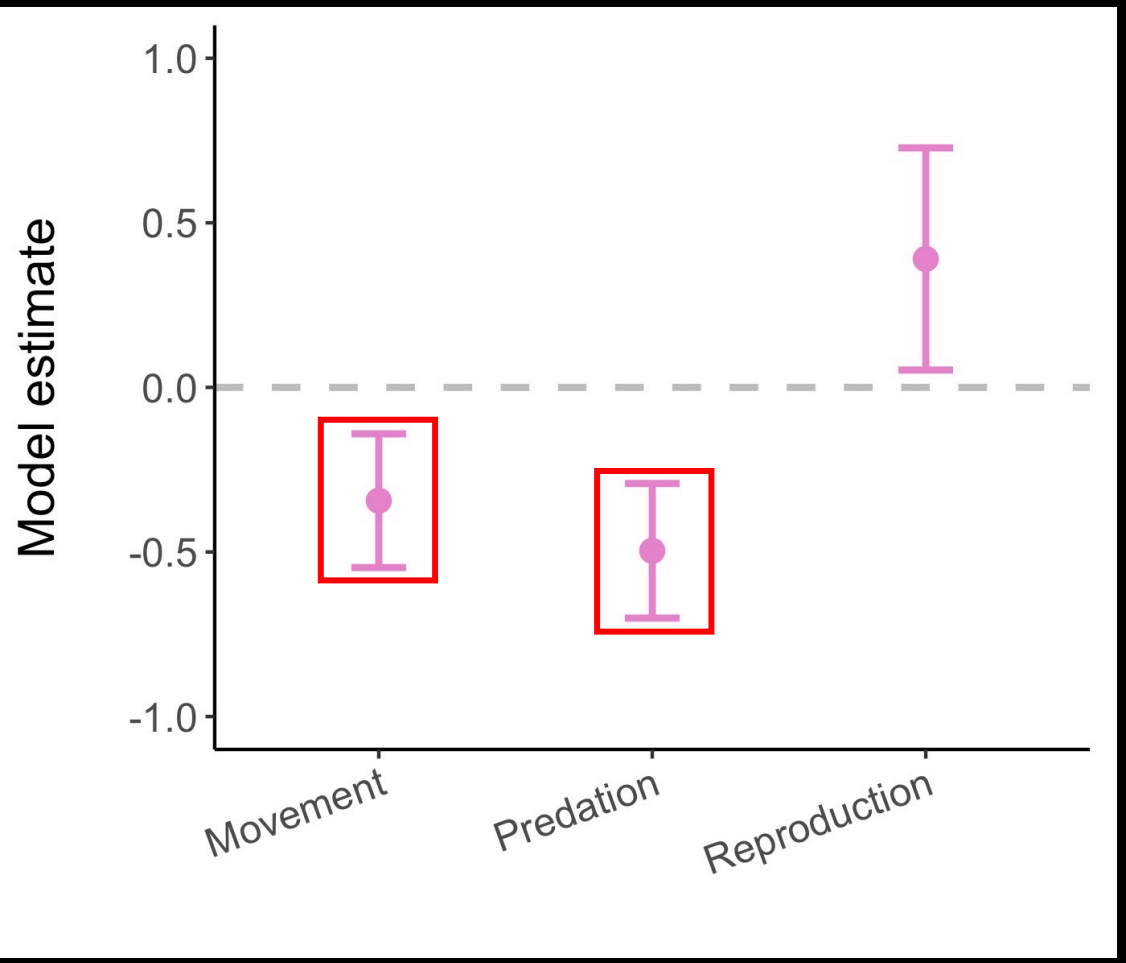

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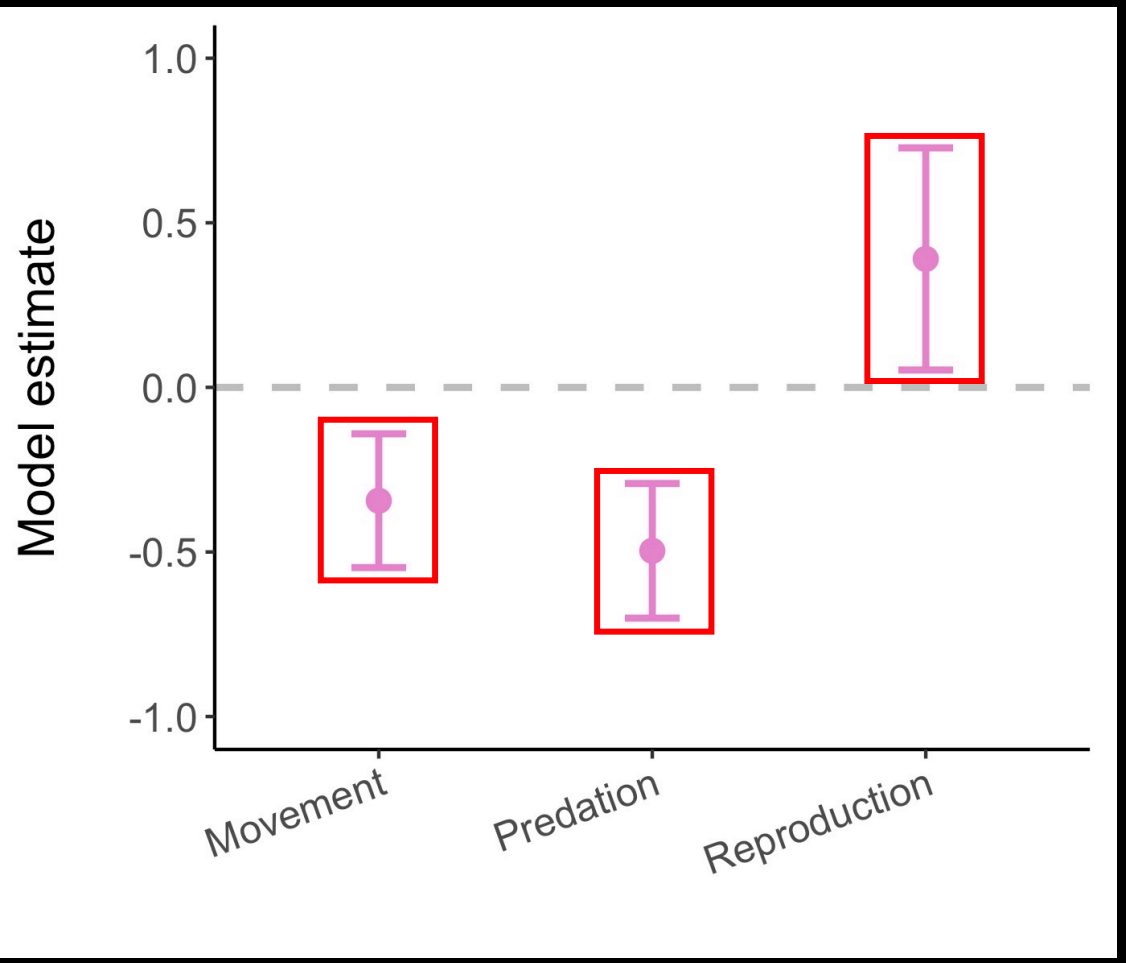

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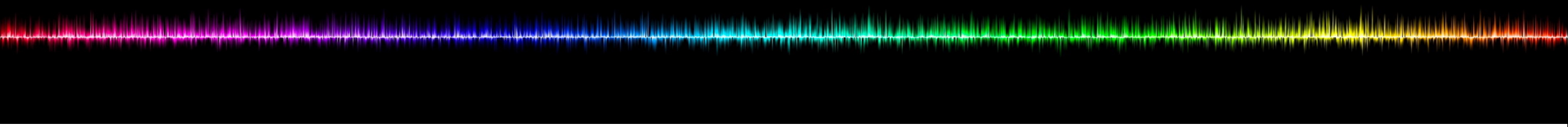

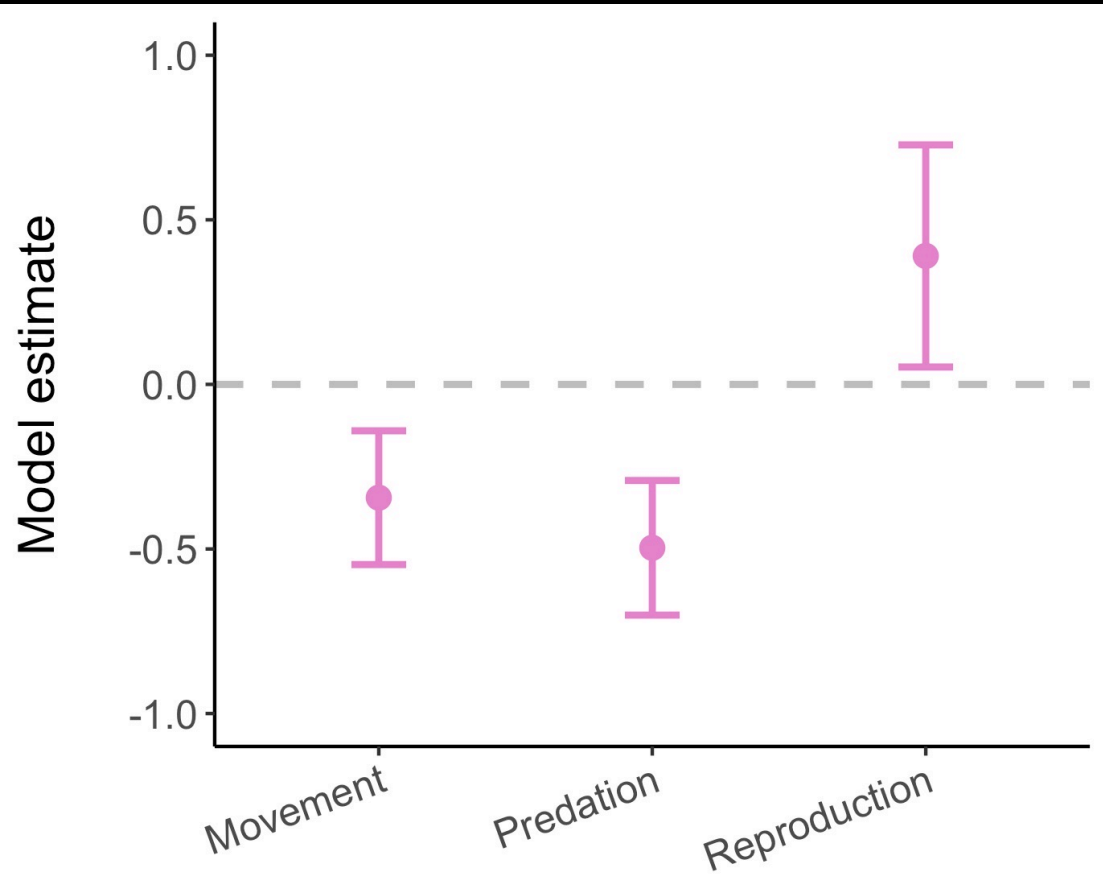

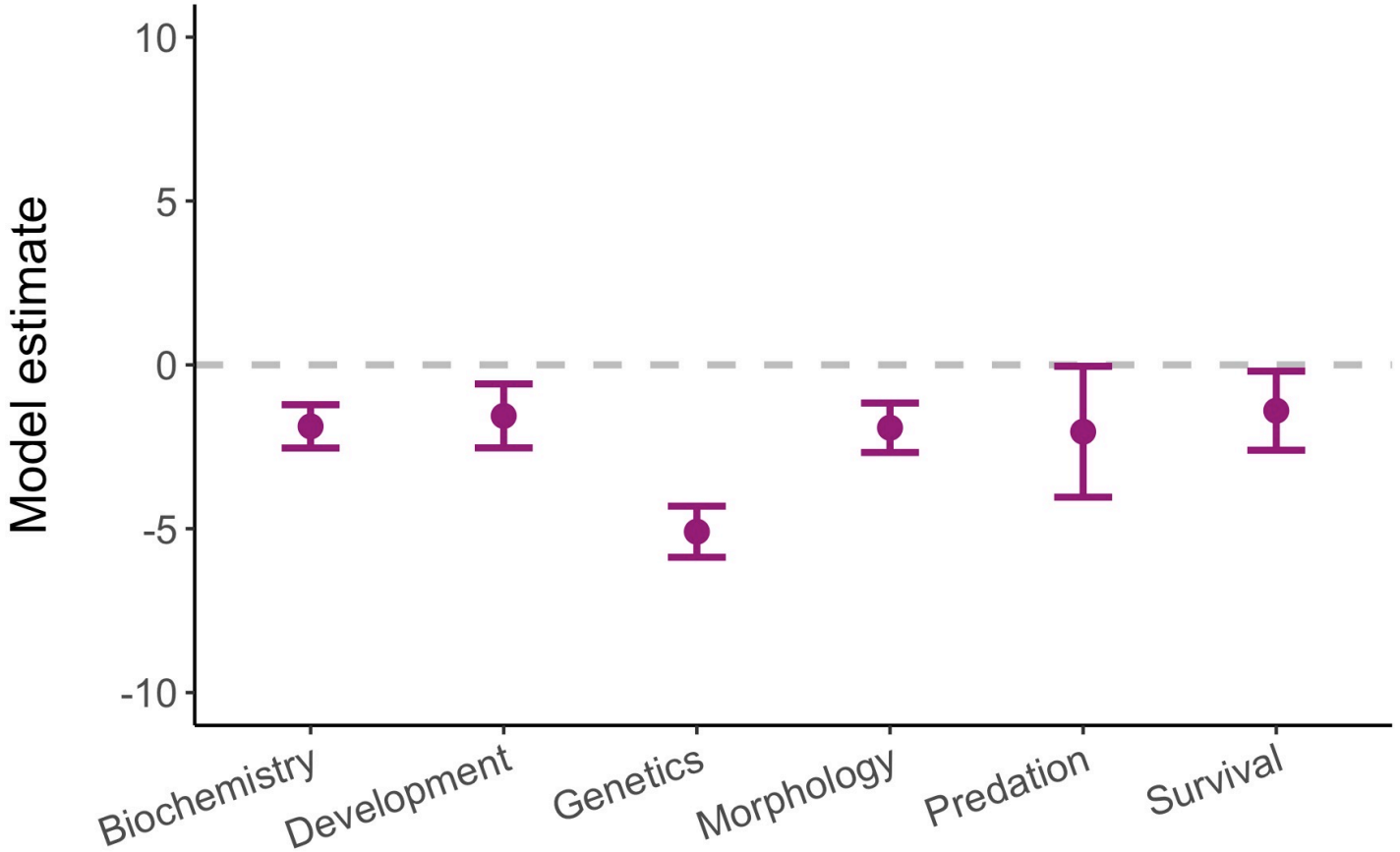

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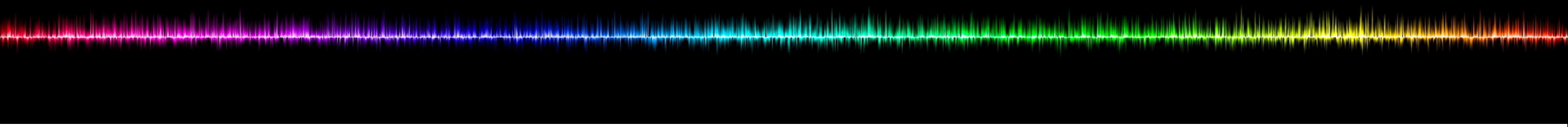

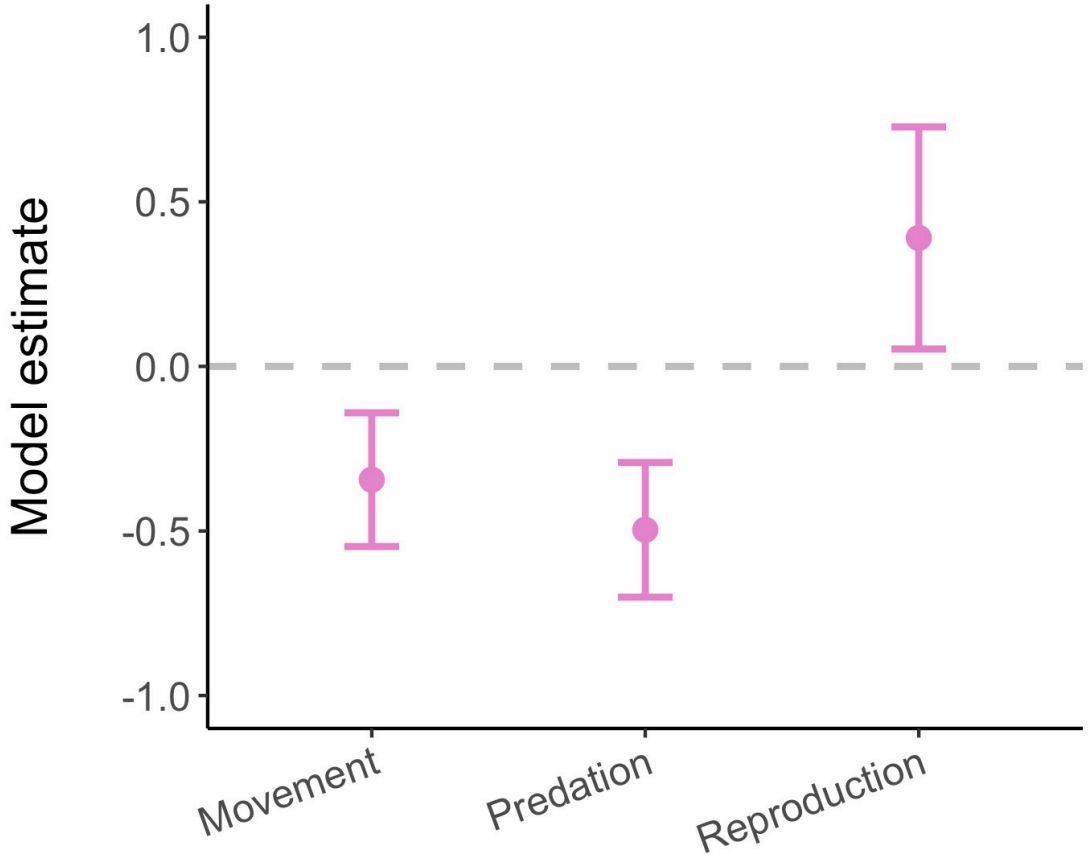

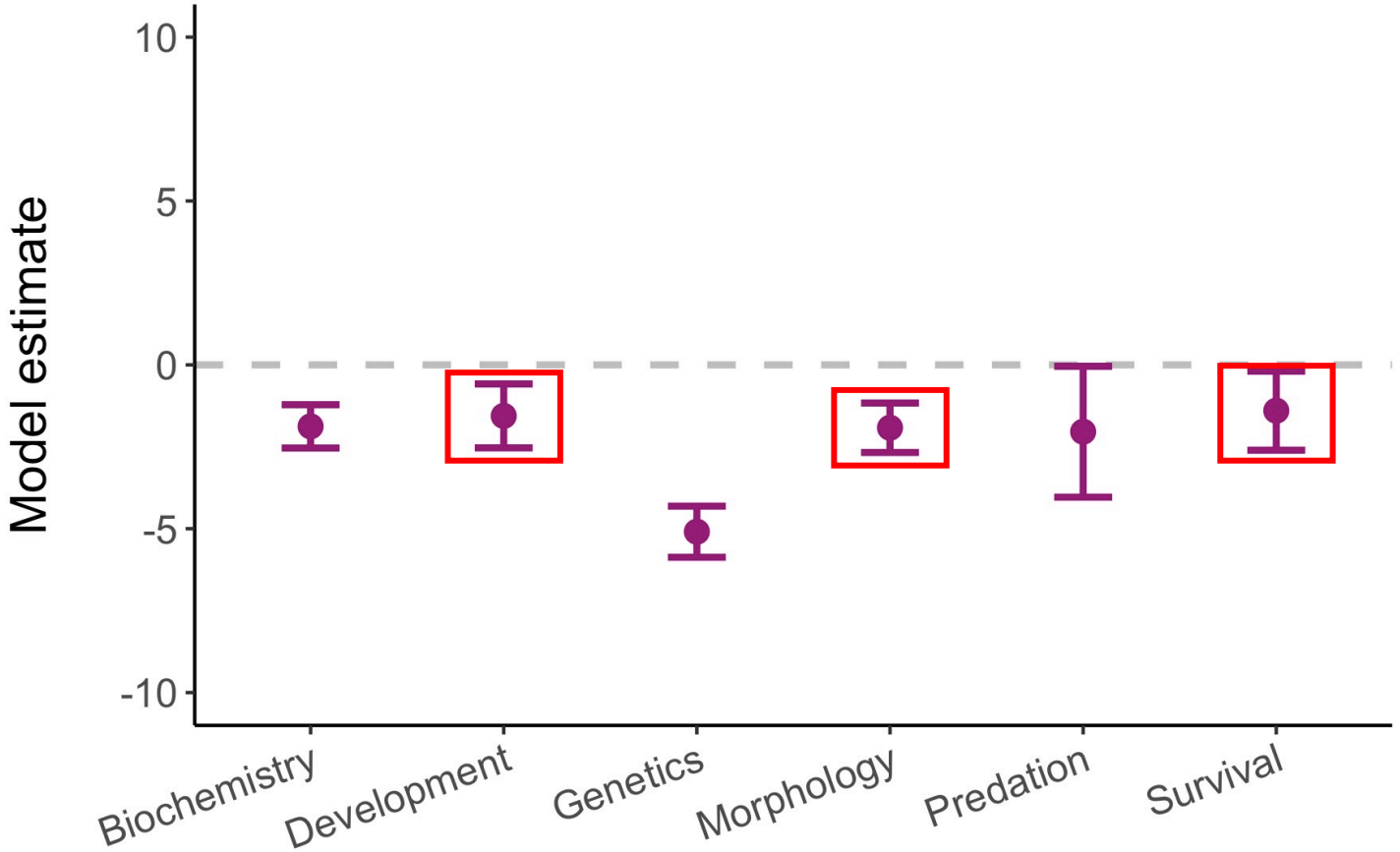

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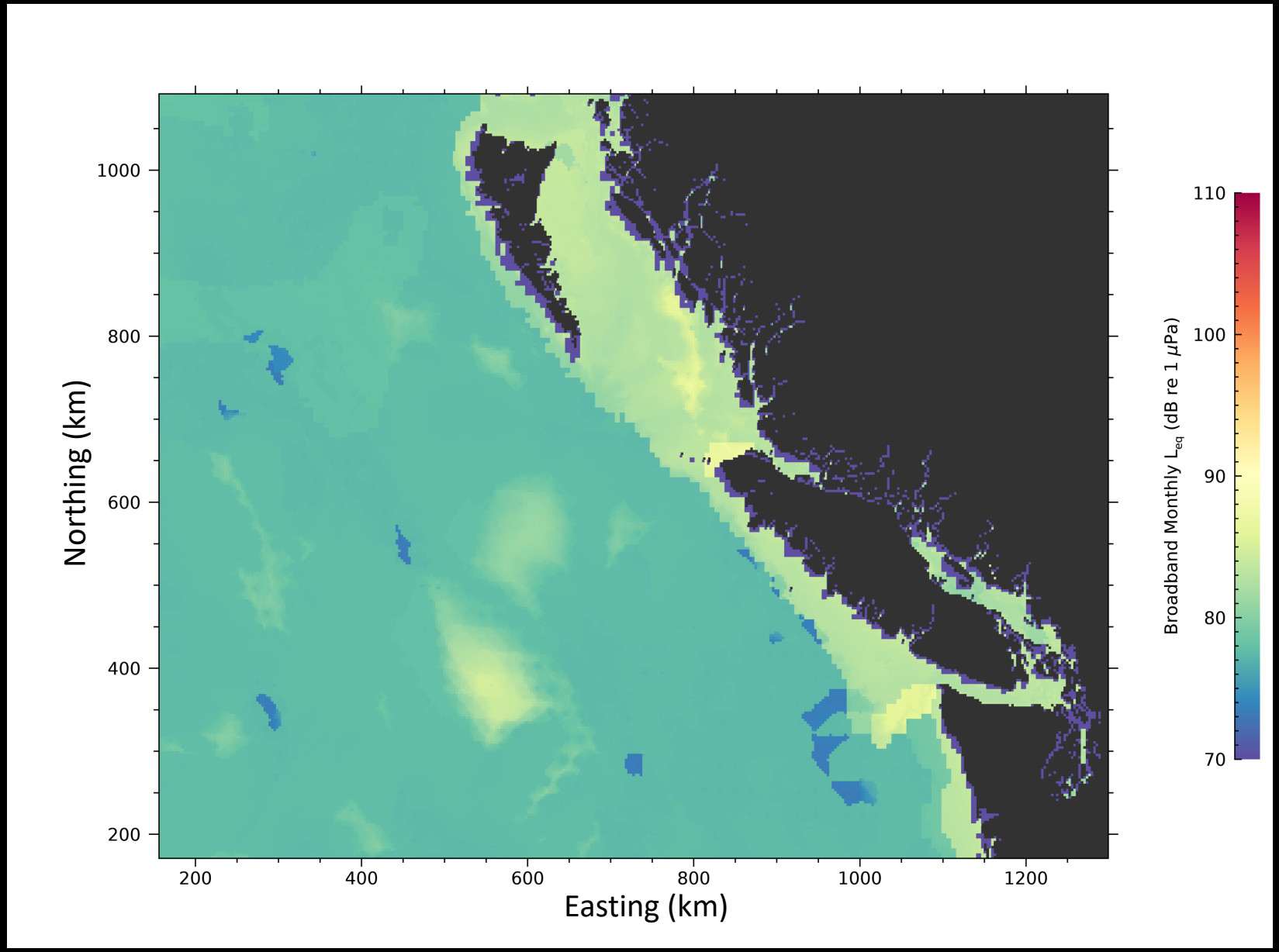

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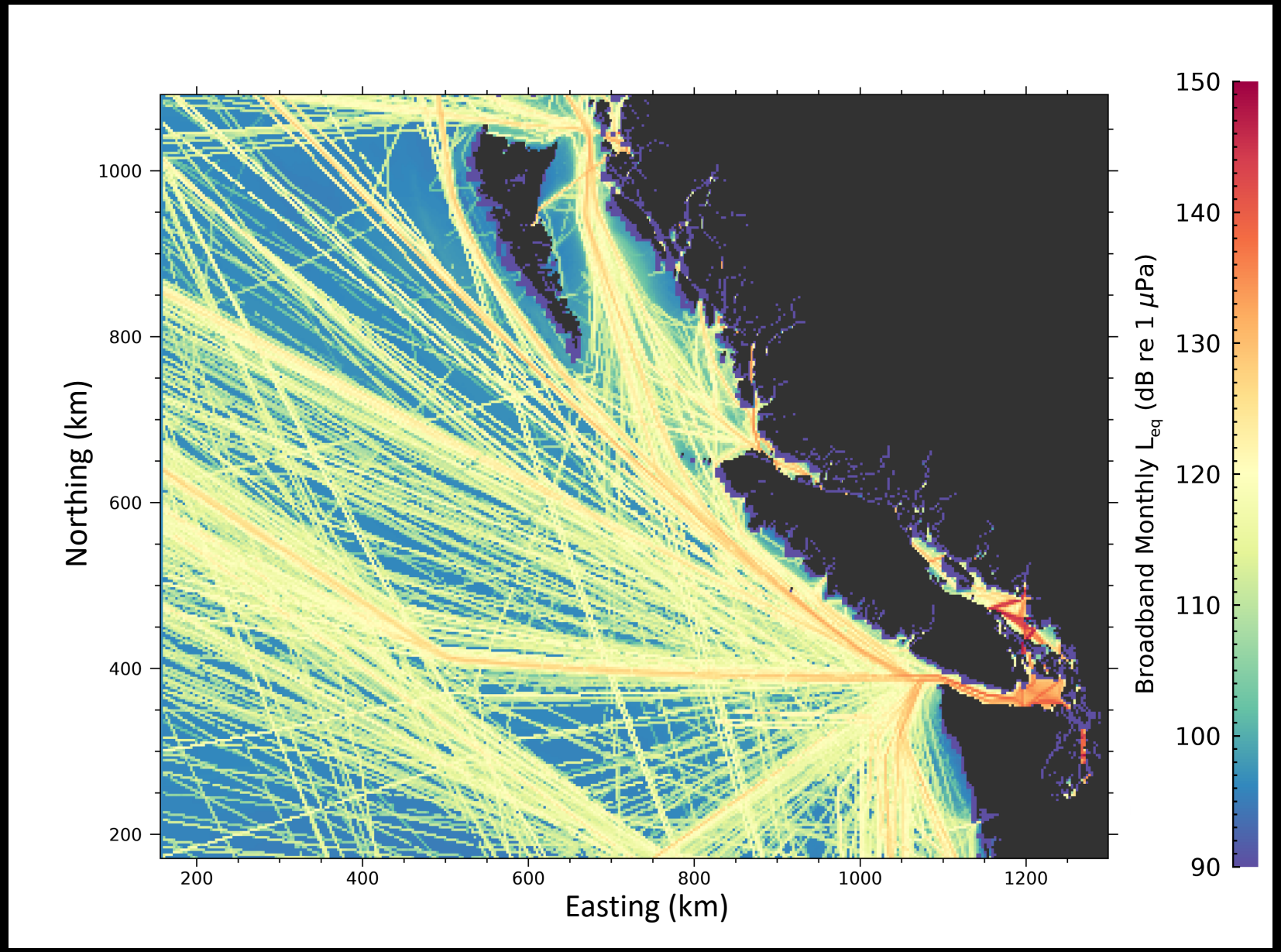

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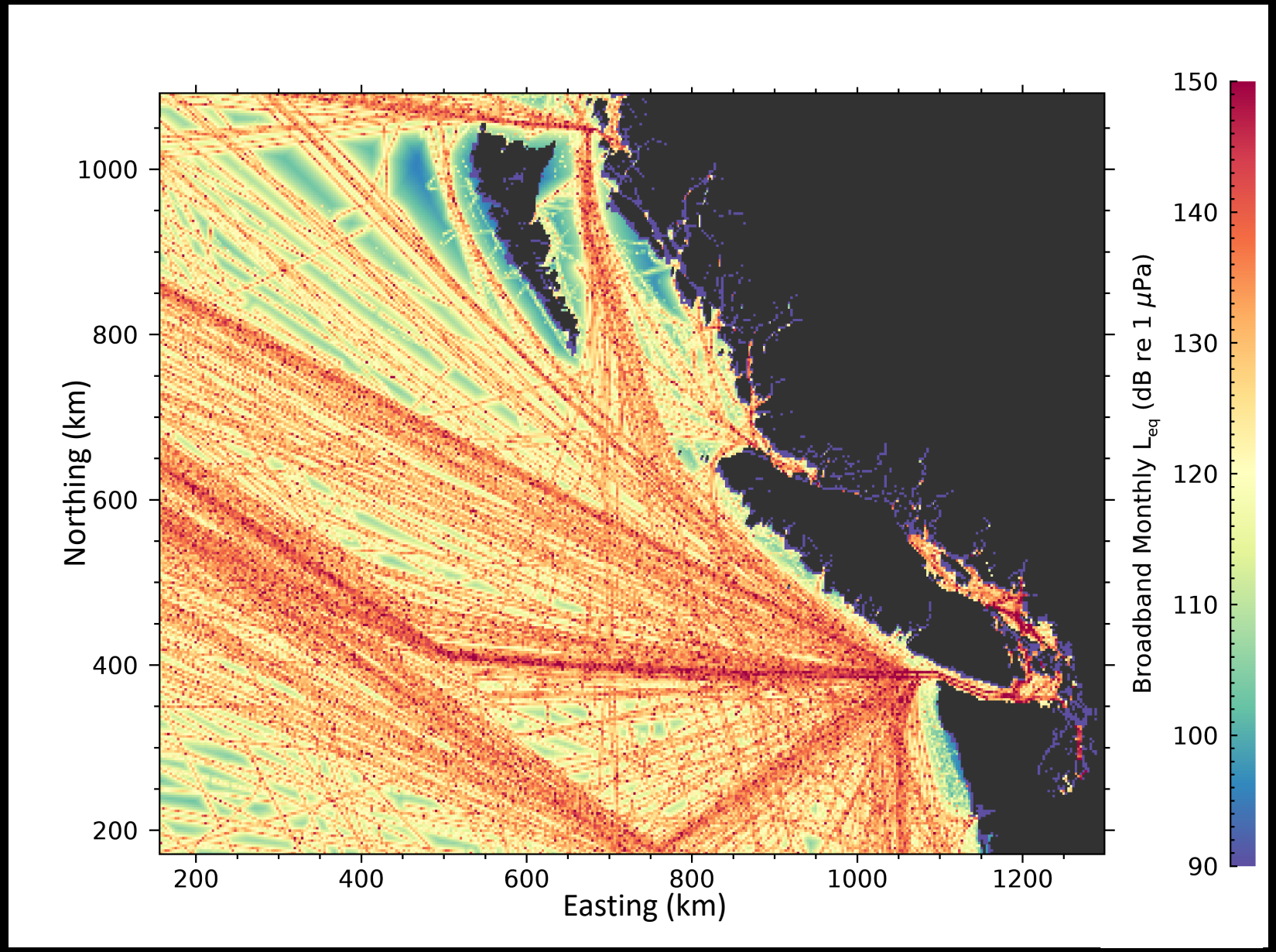

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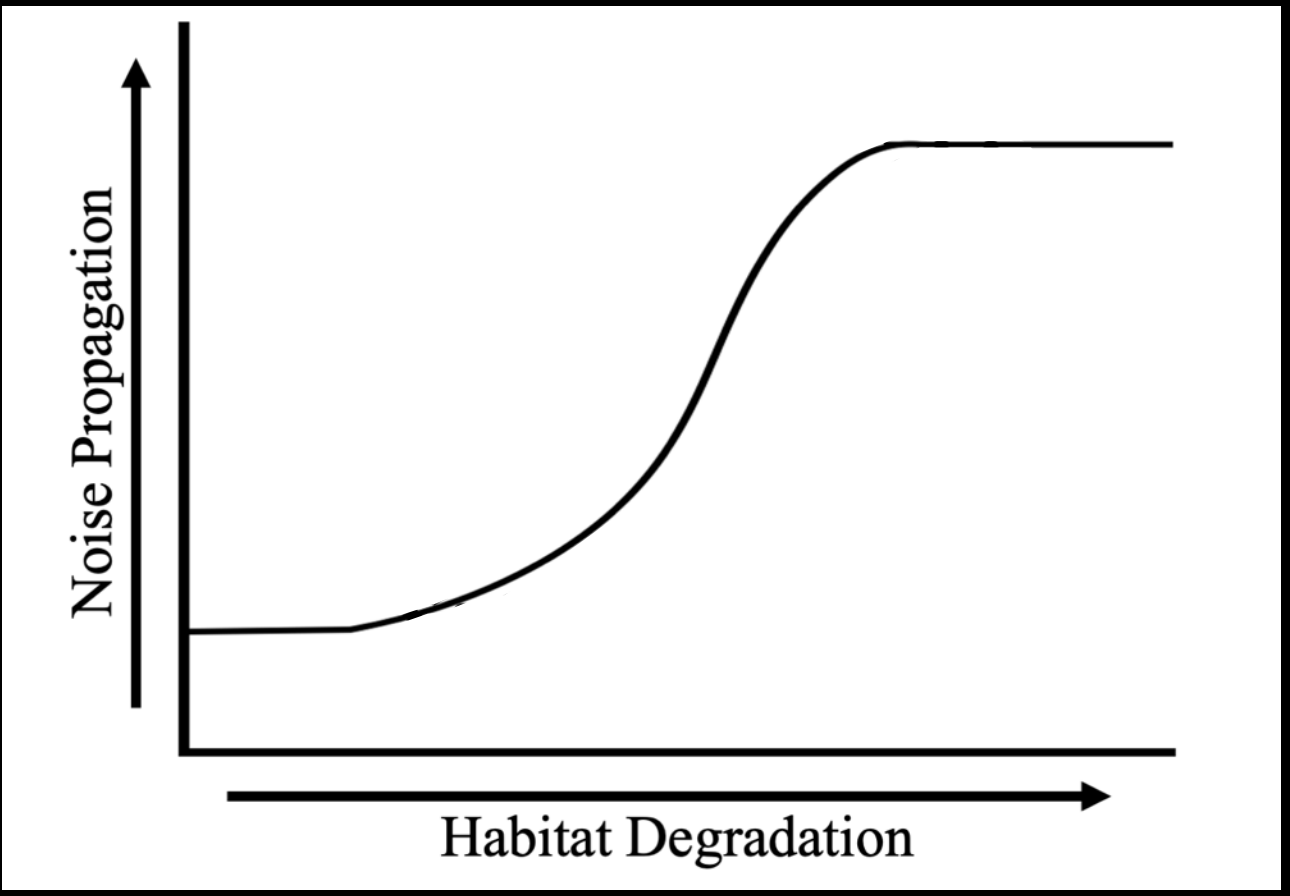
Shane Gross, Narwhal 2023

Patrick Webster



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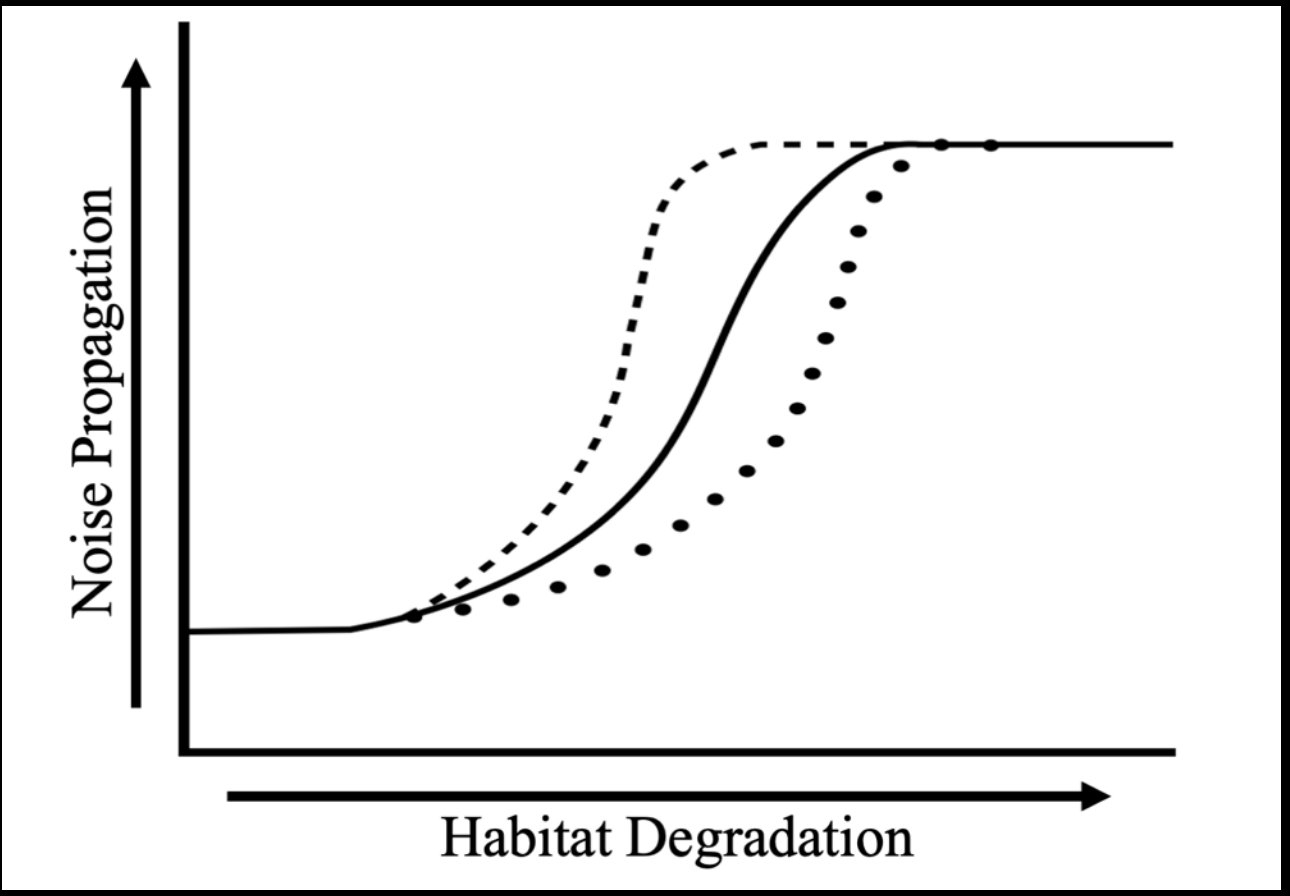

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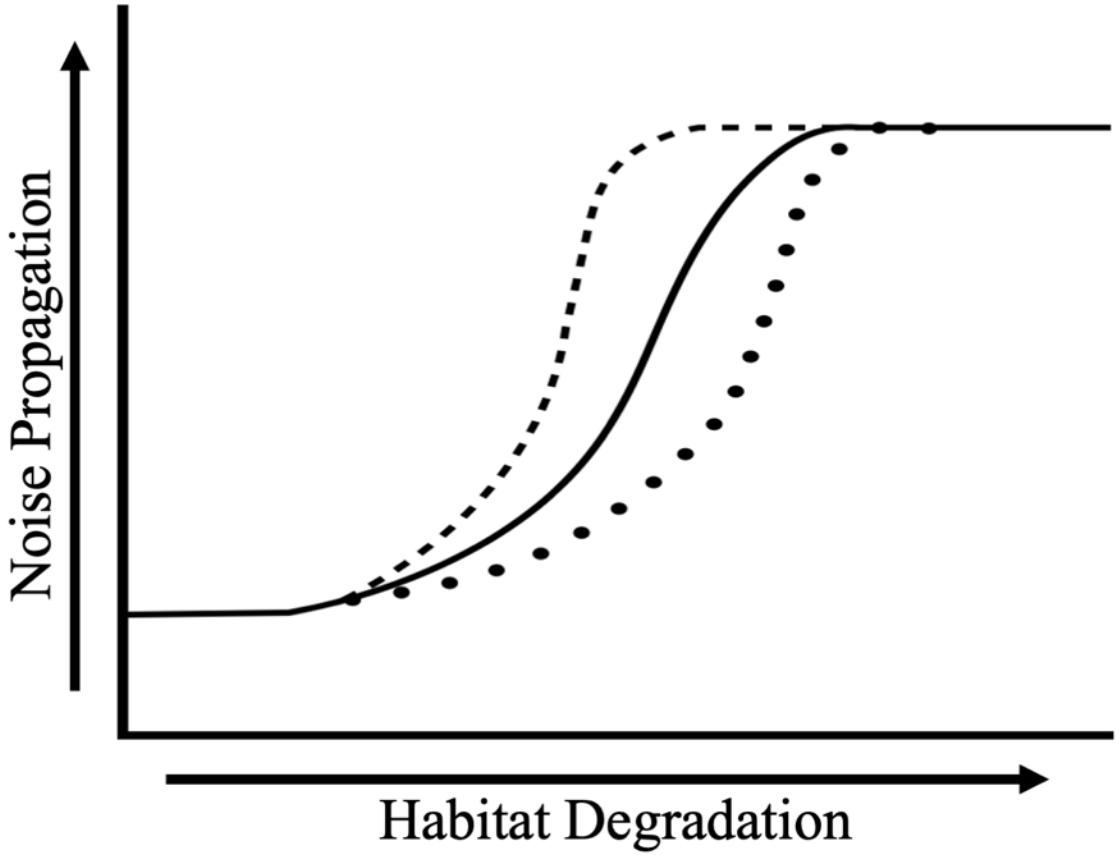

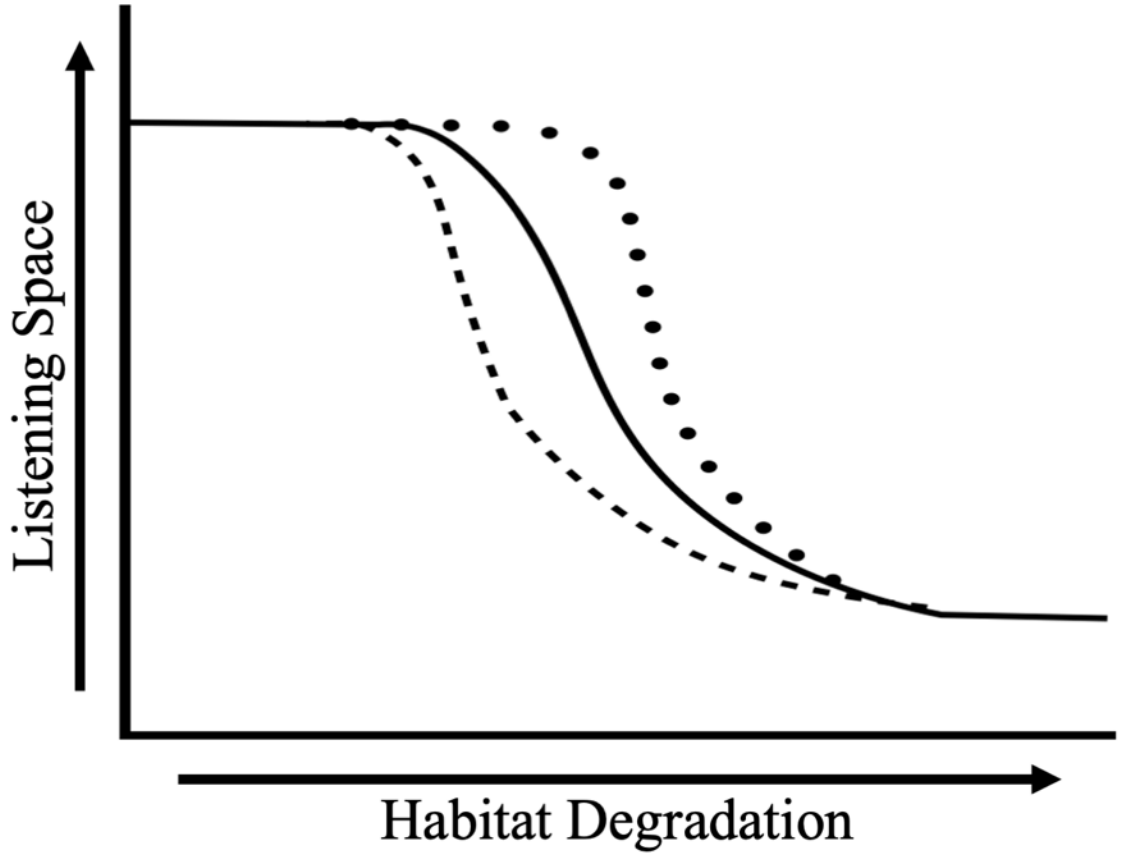

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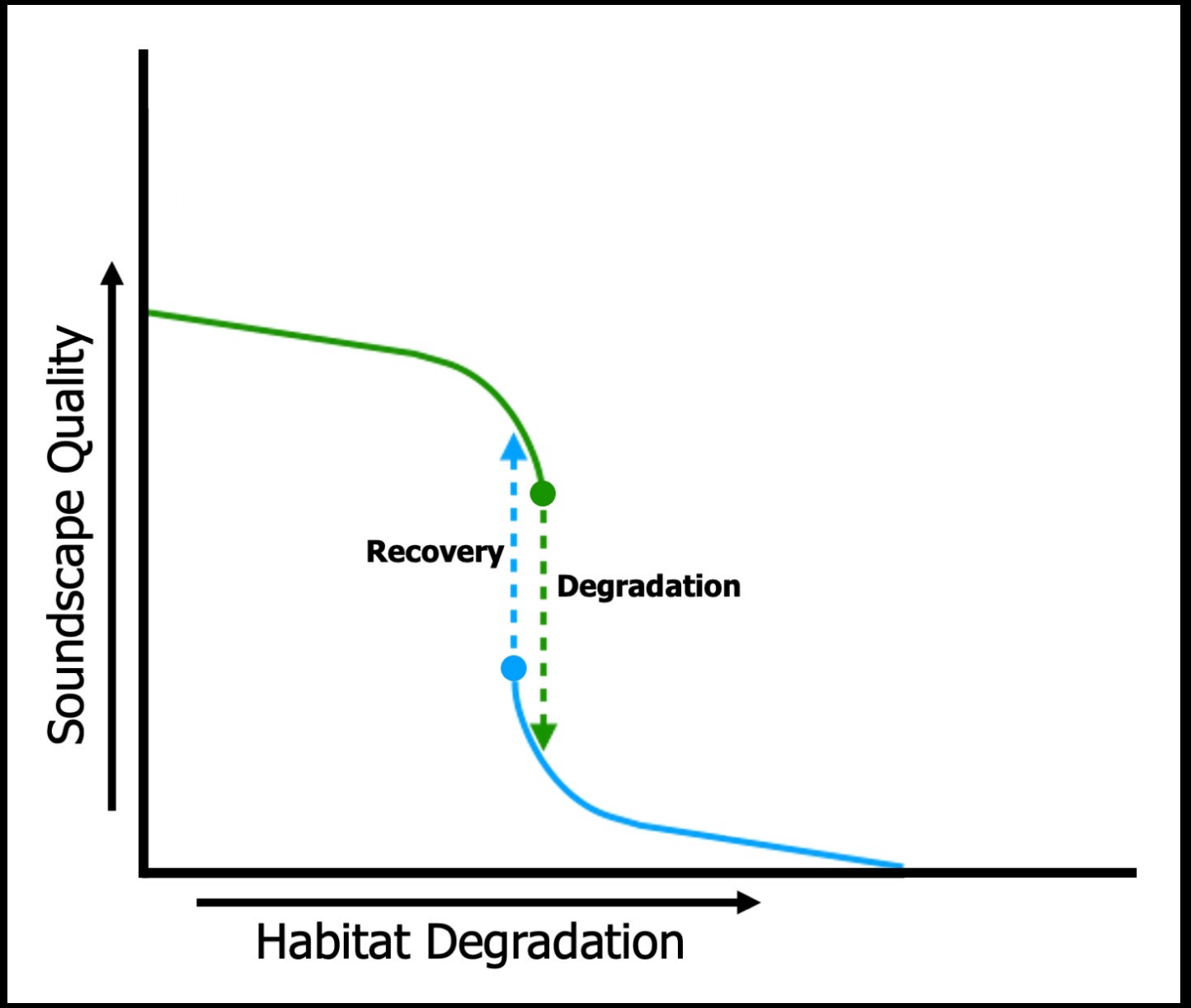

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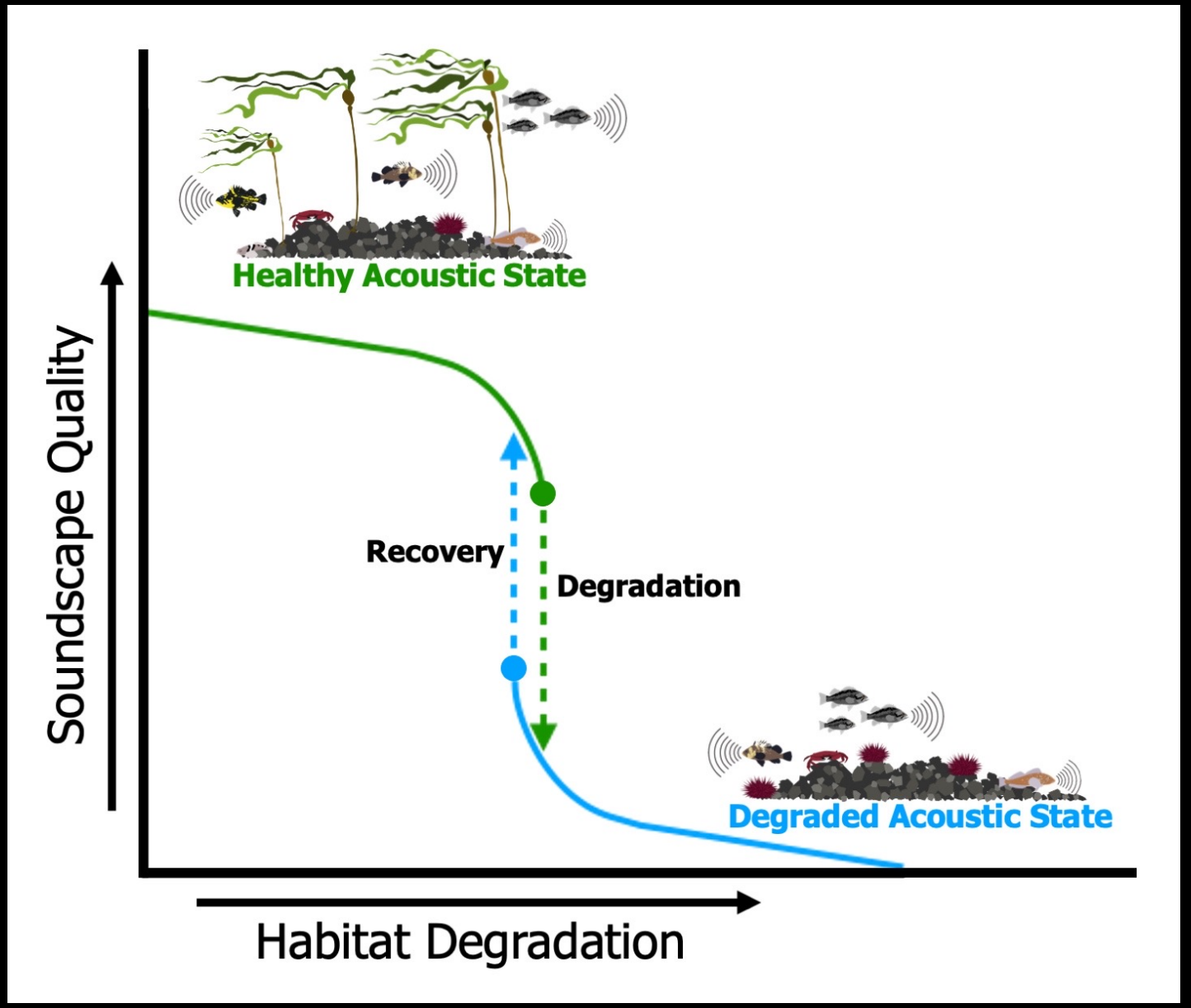

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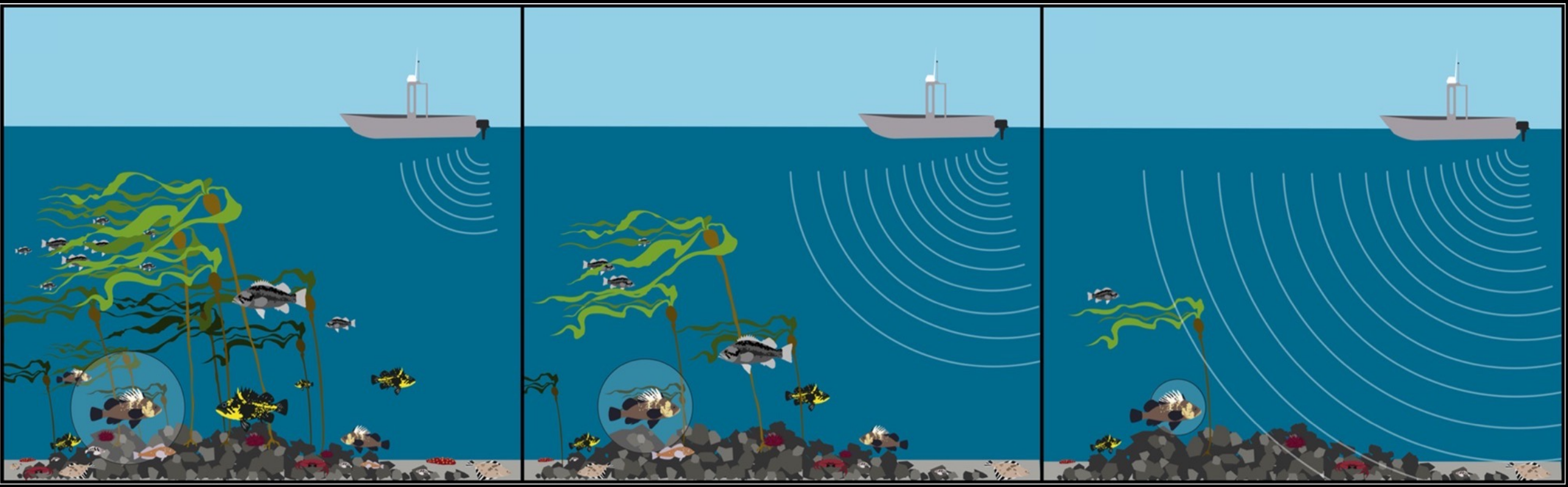

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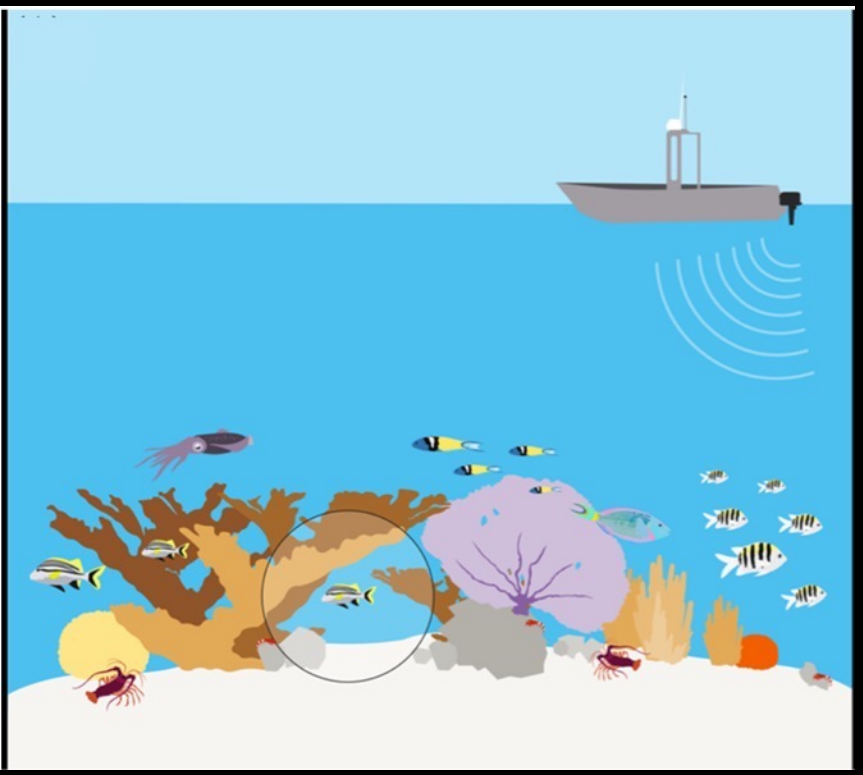

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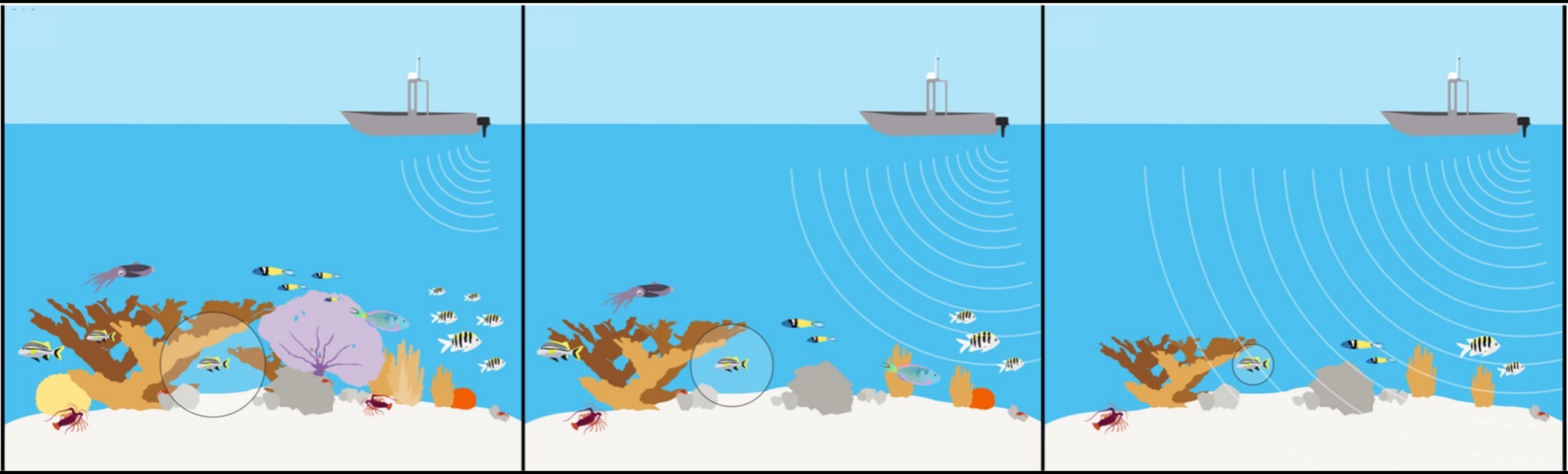

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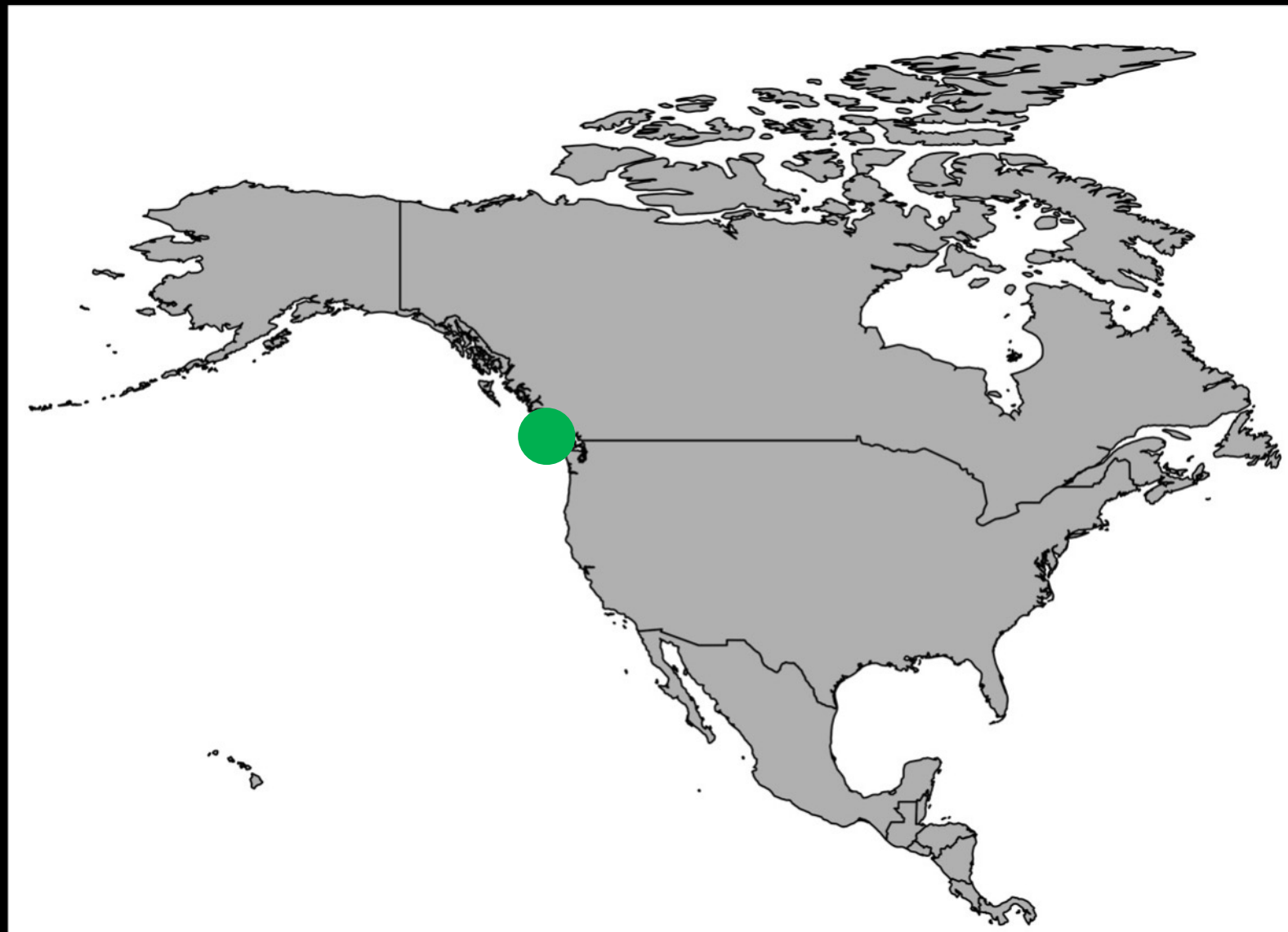

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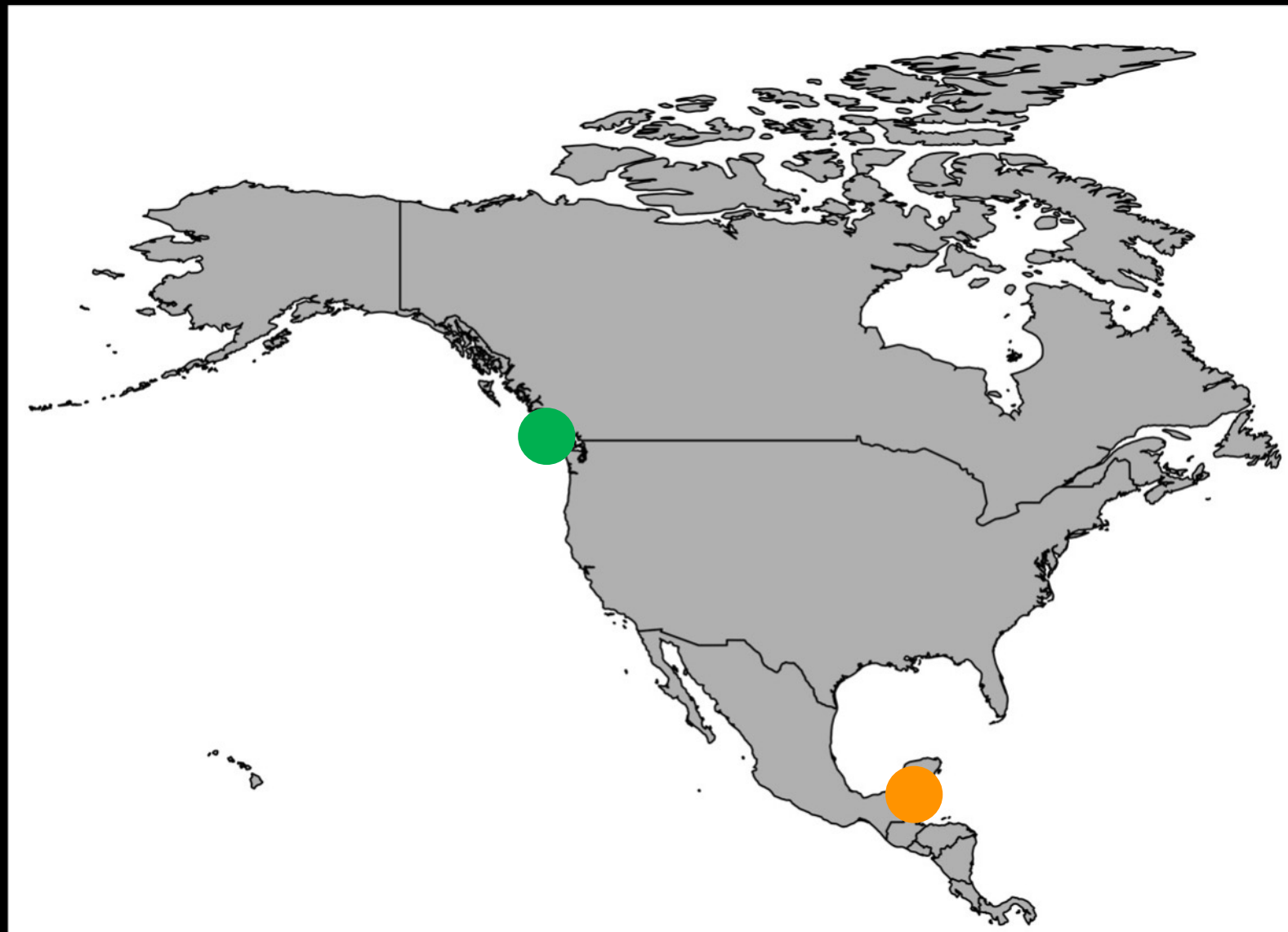

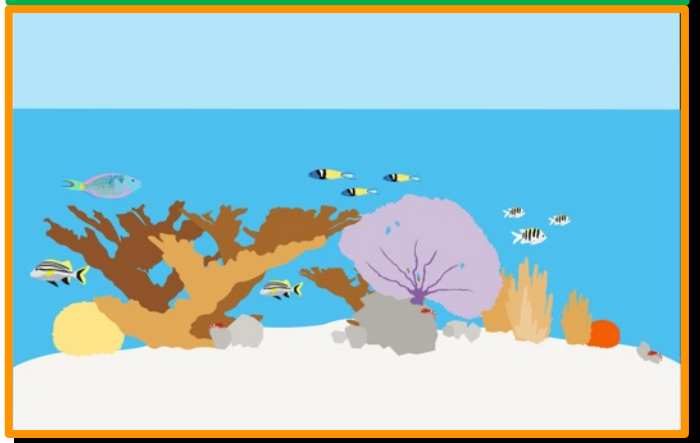

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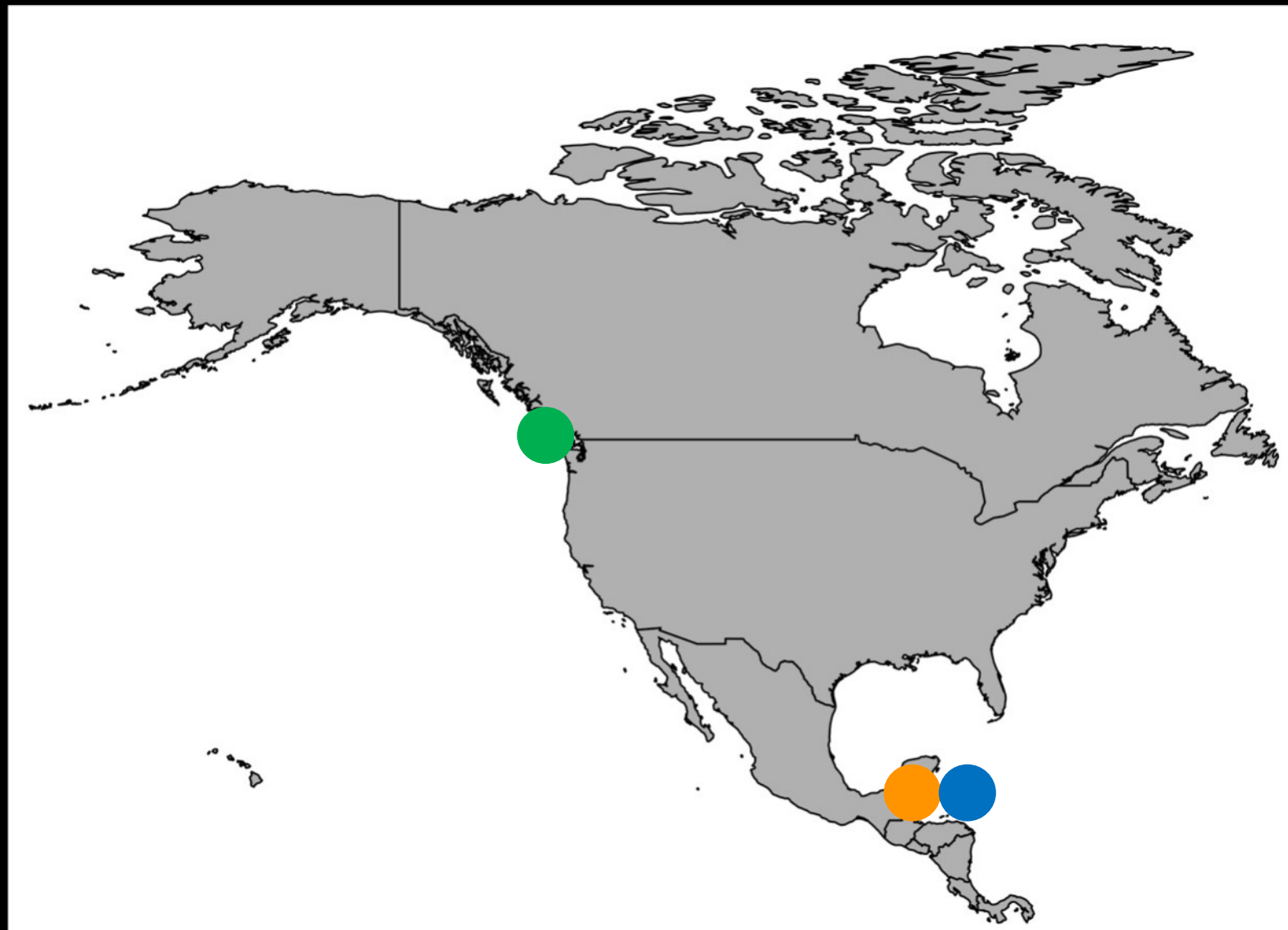

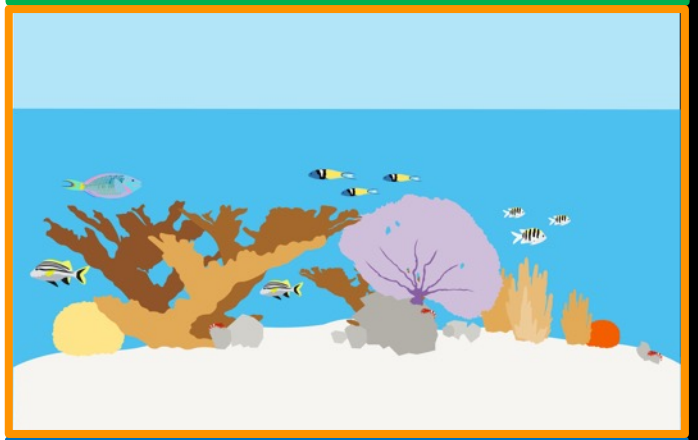

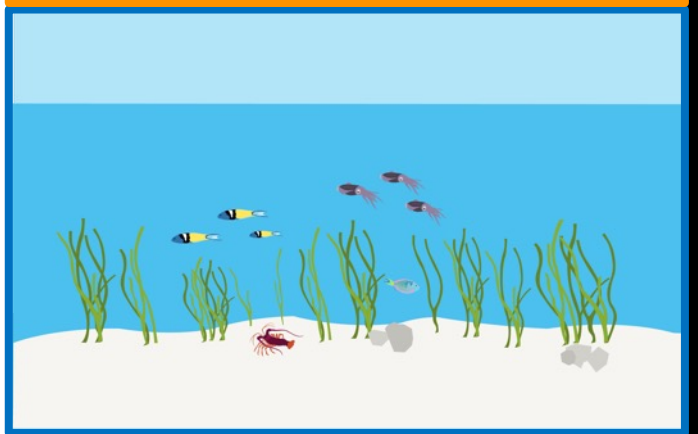

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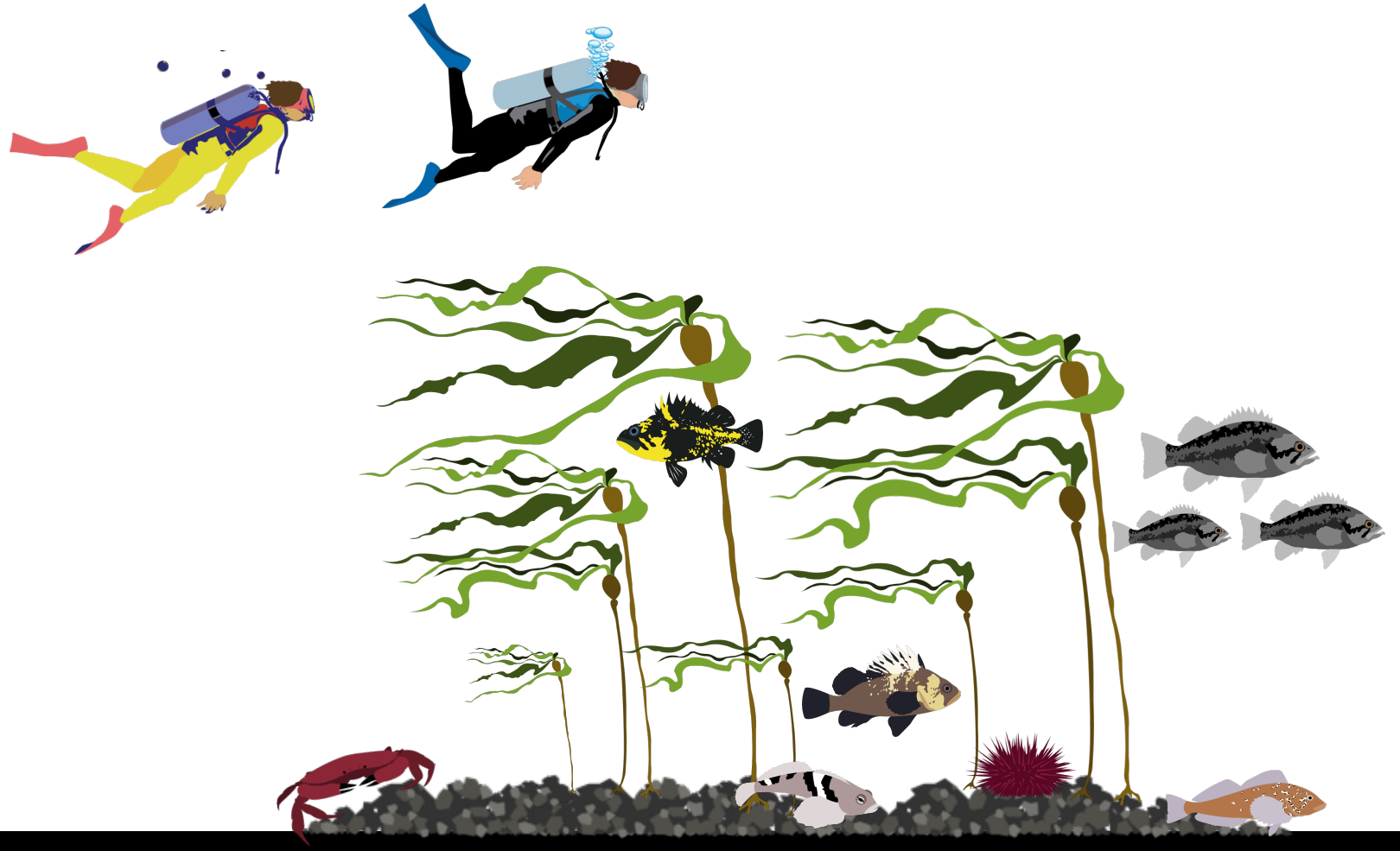

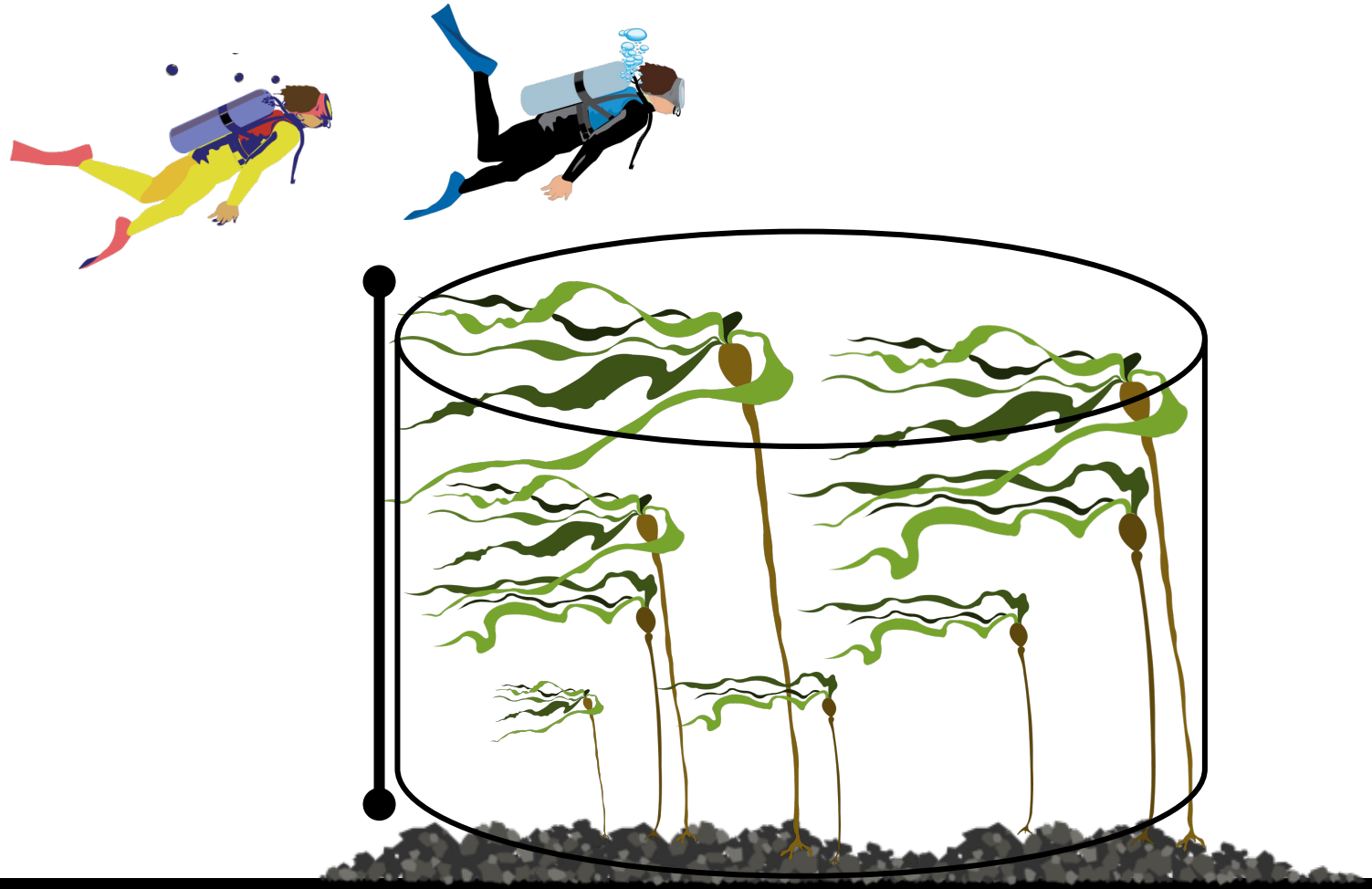

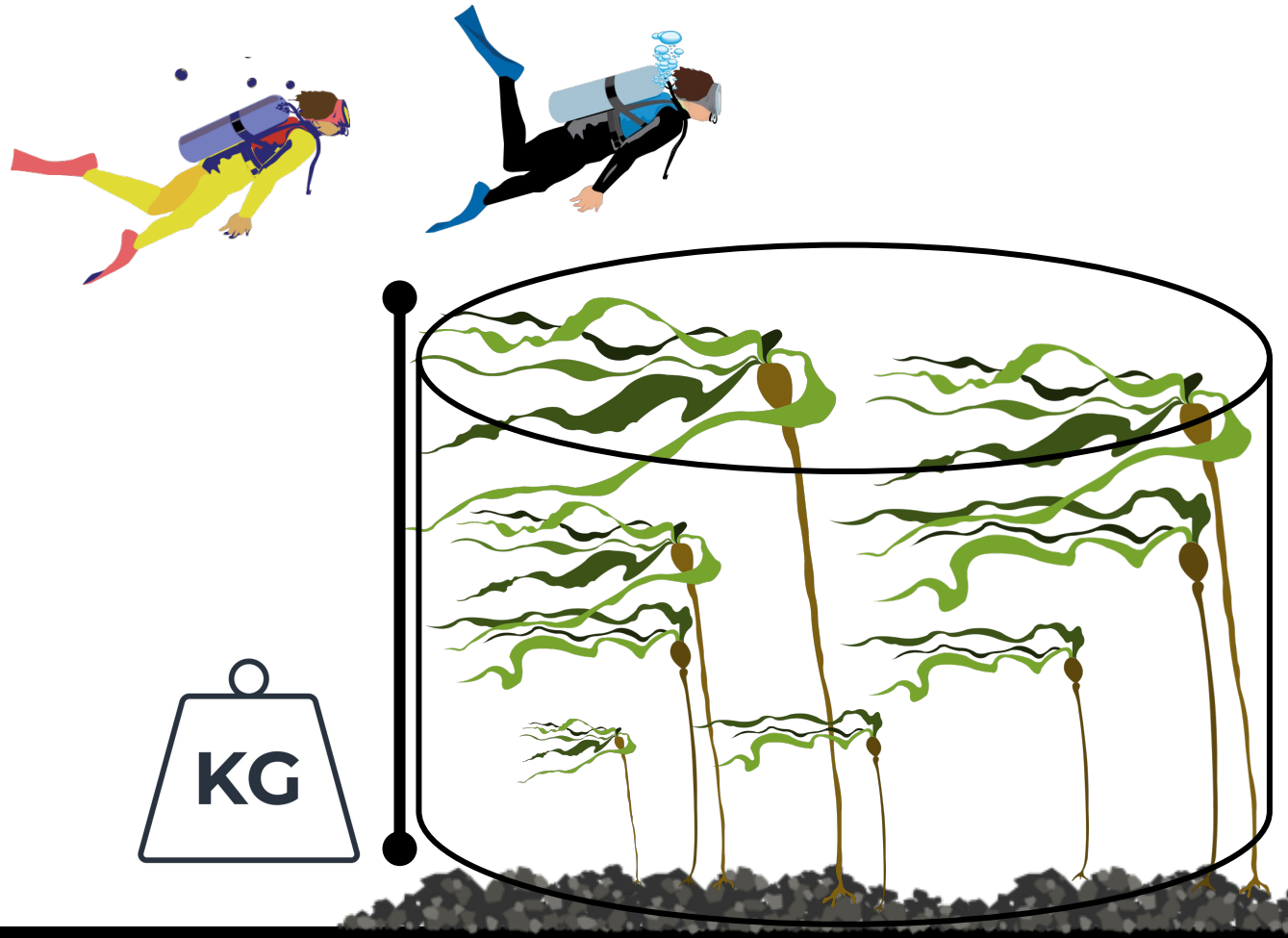
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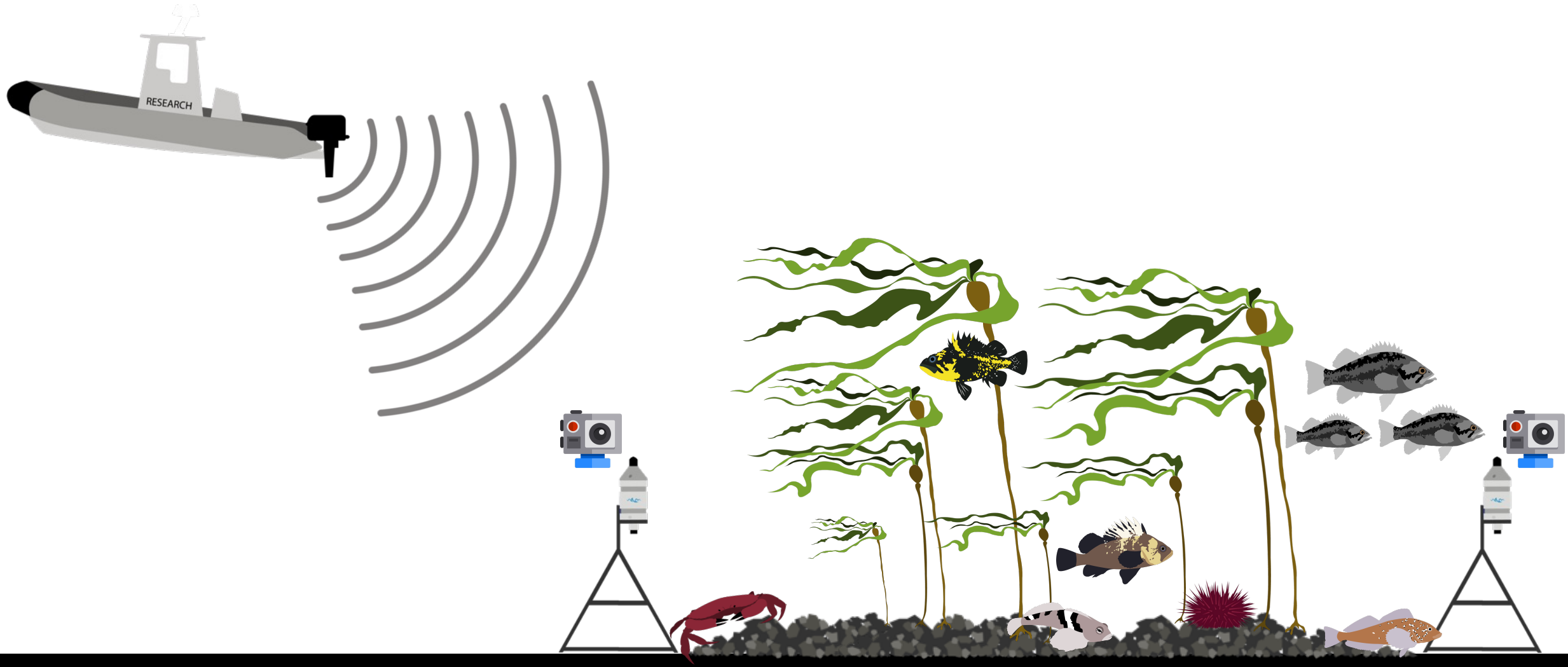
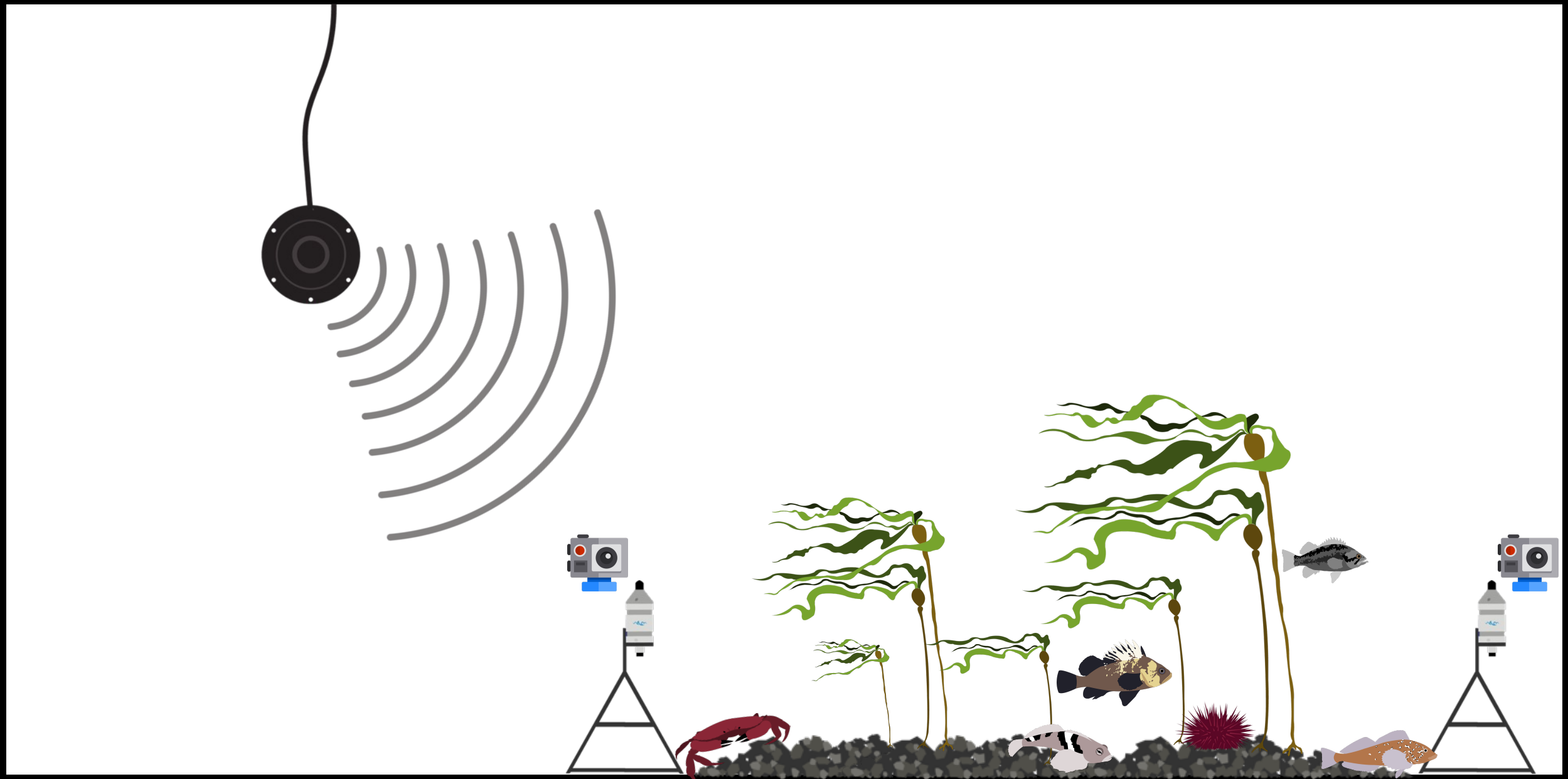
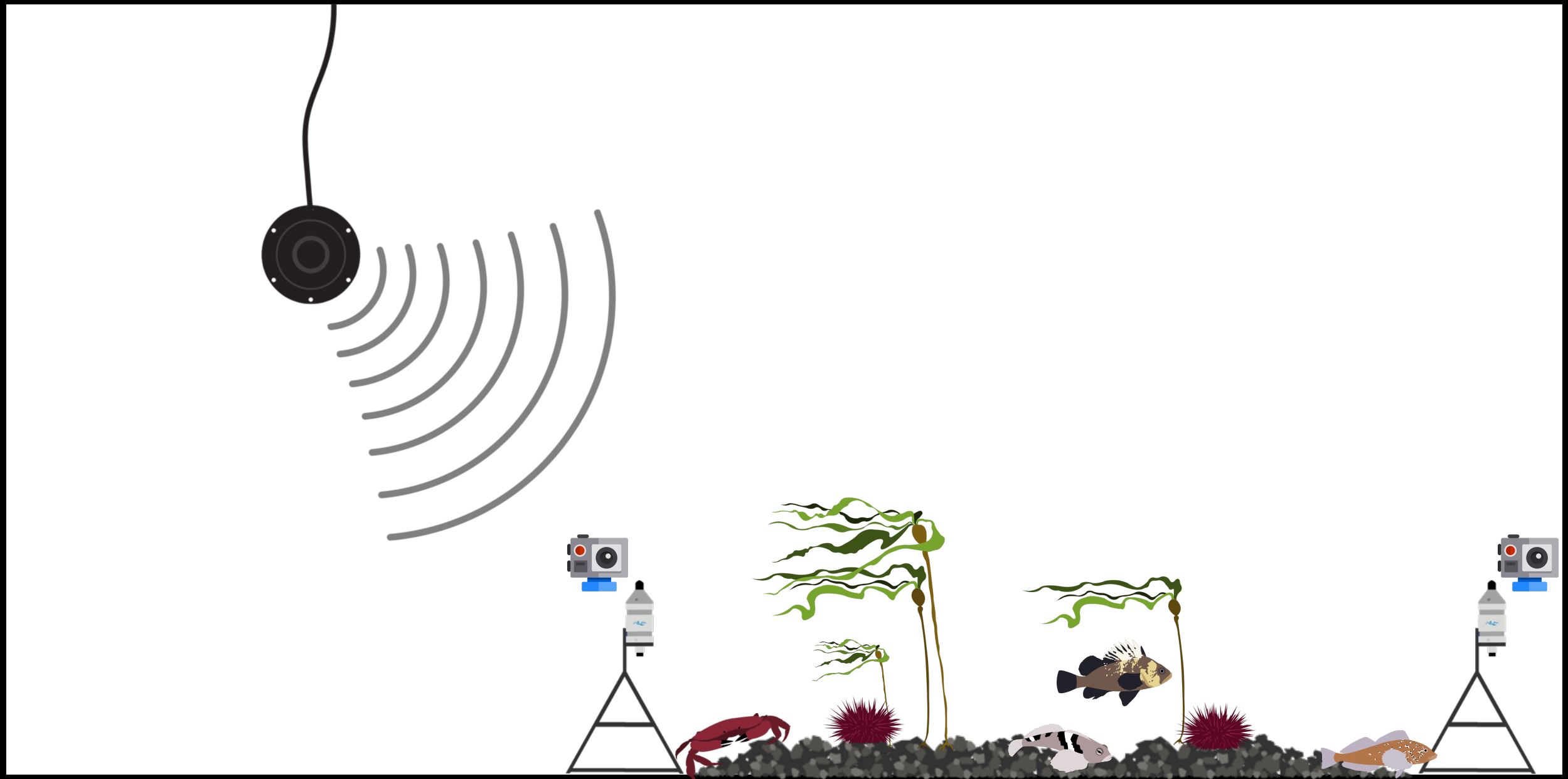
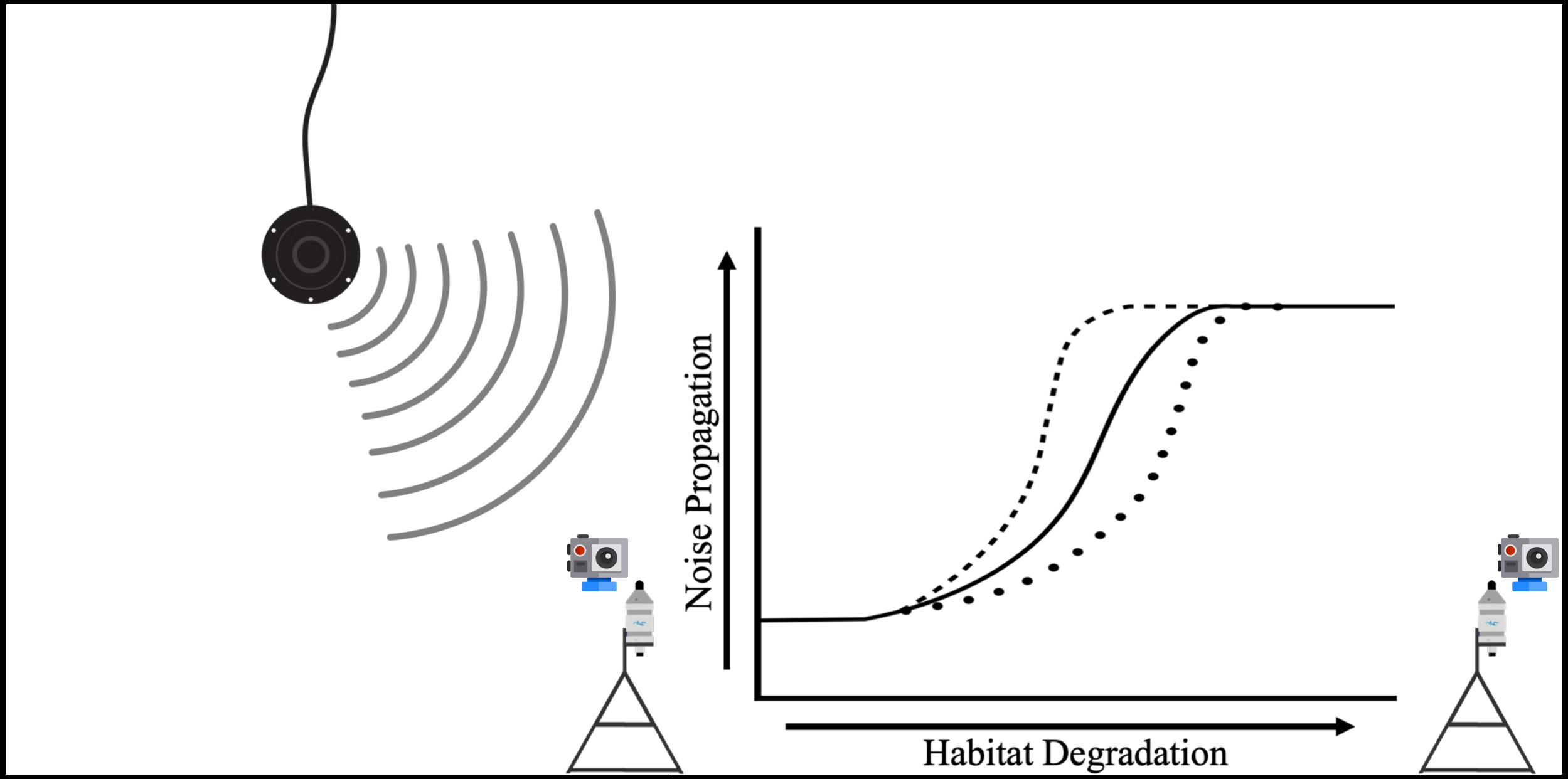

RESEARCH



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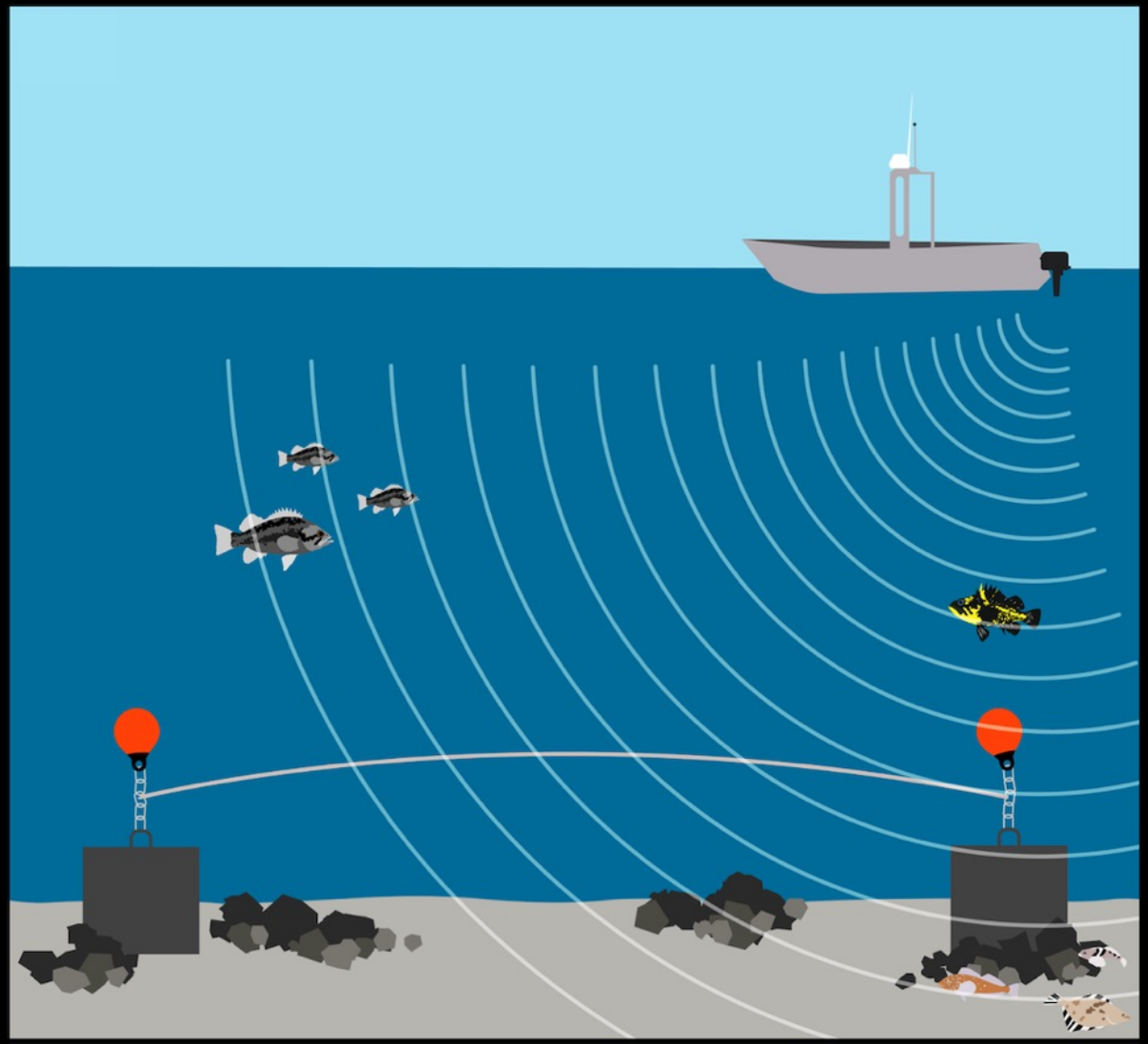
Habitat Degradation



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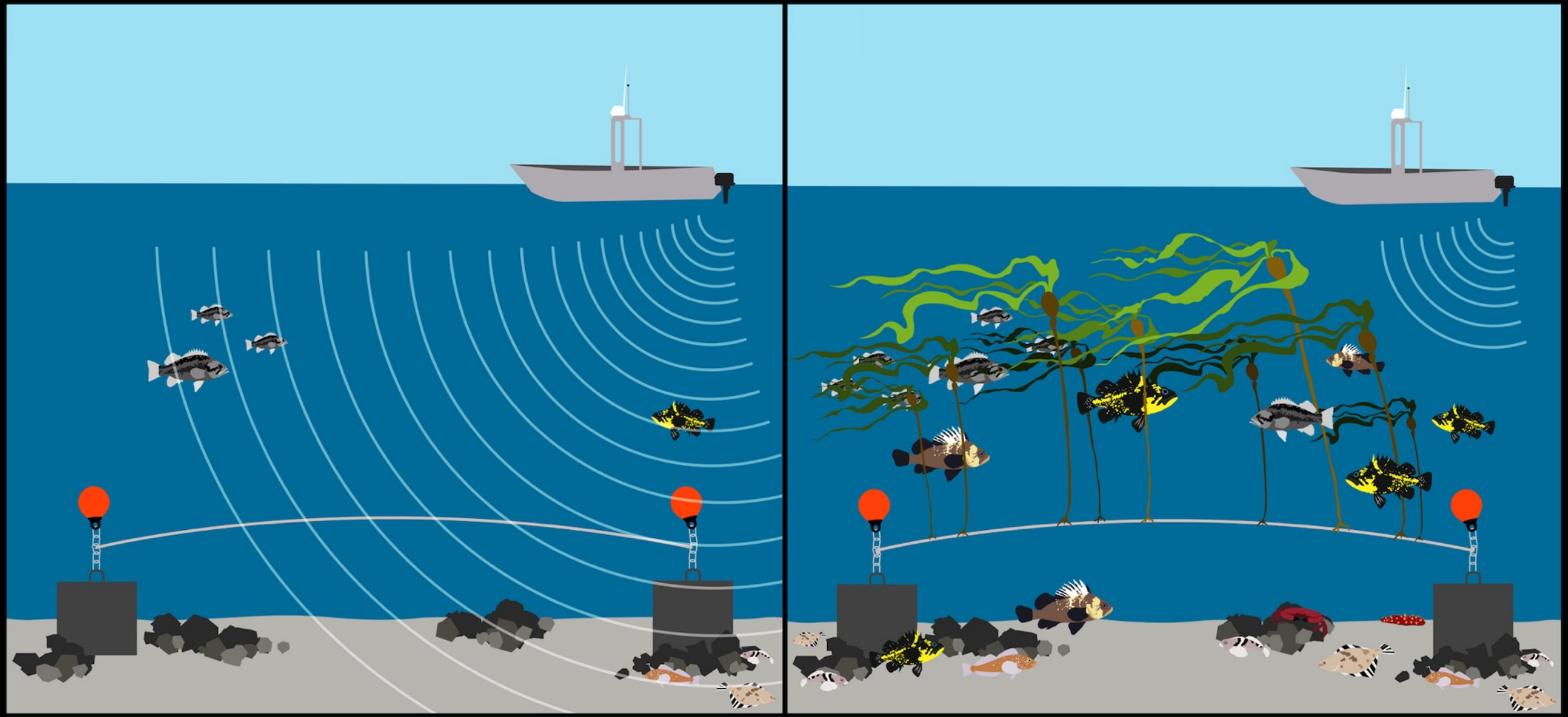

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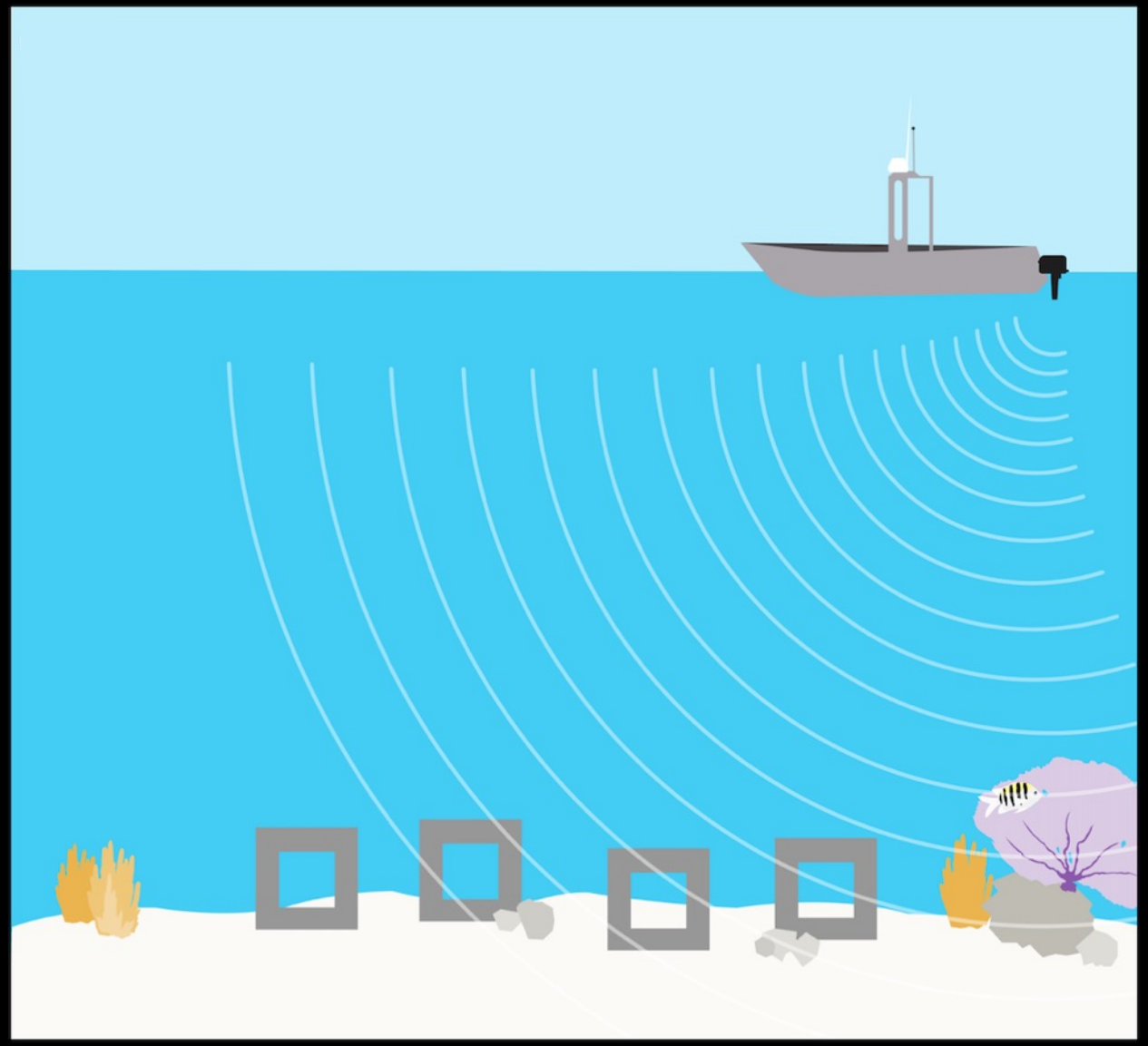

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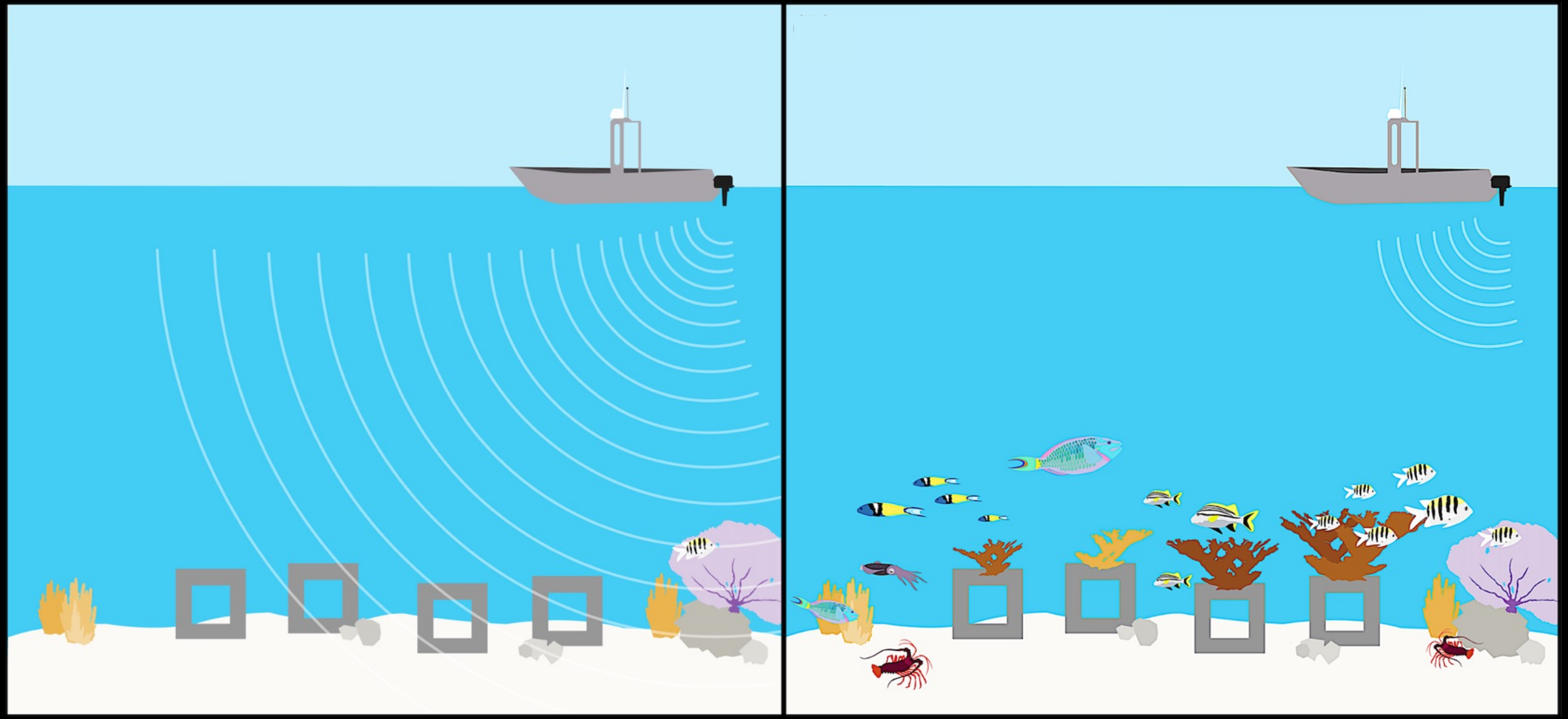

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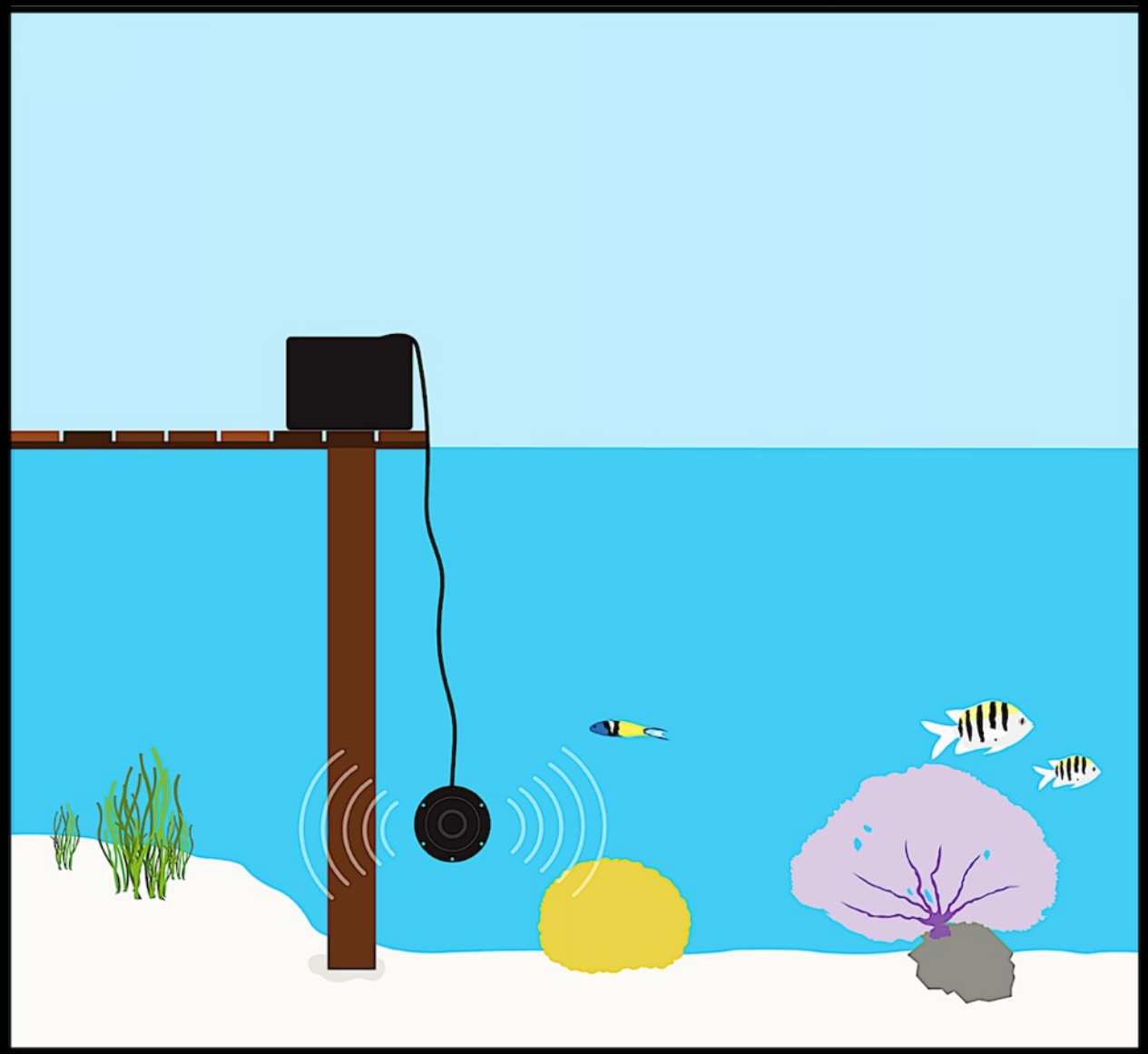

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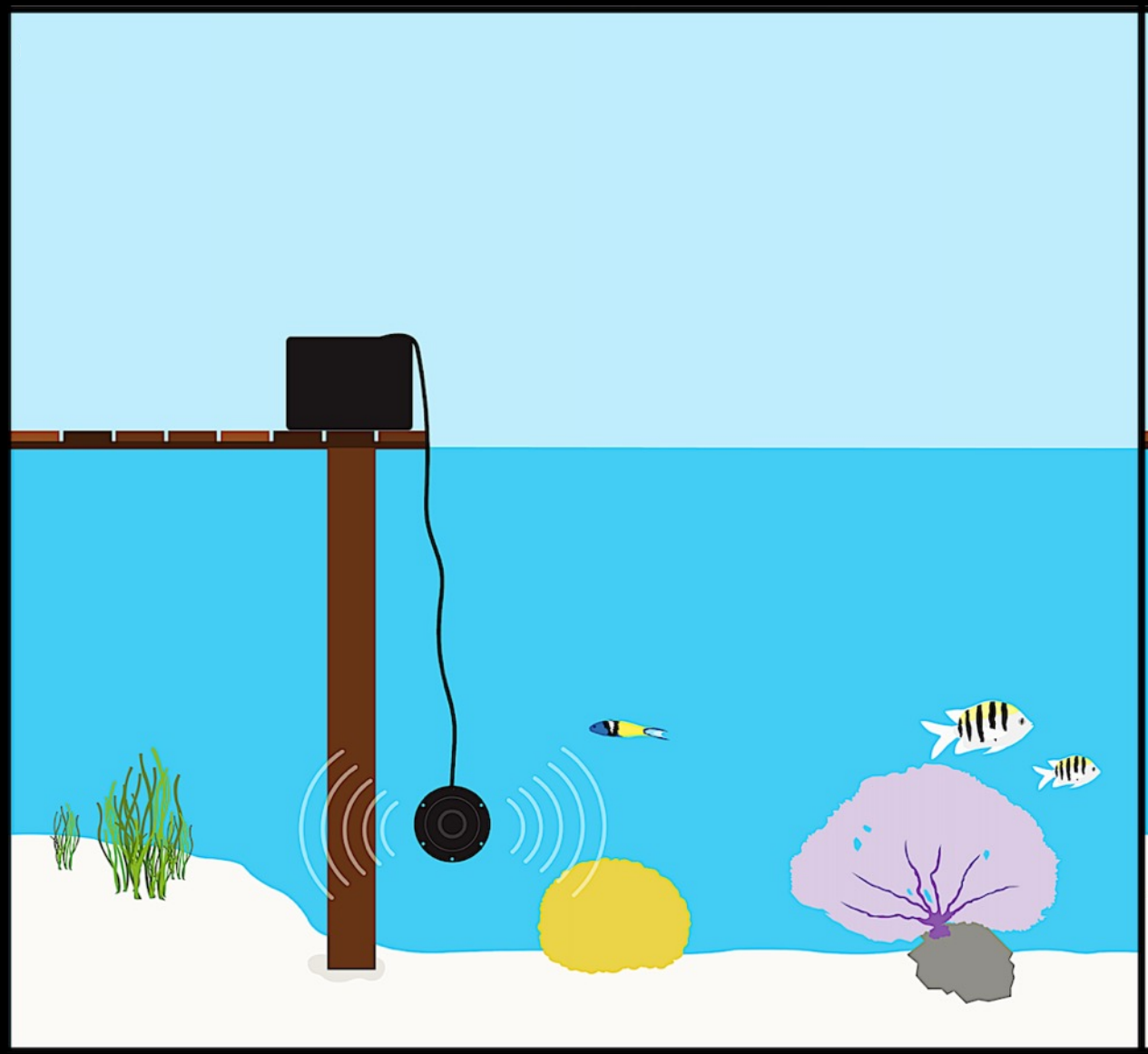

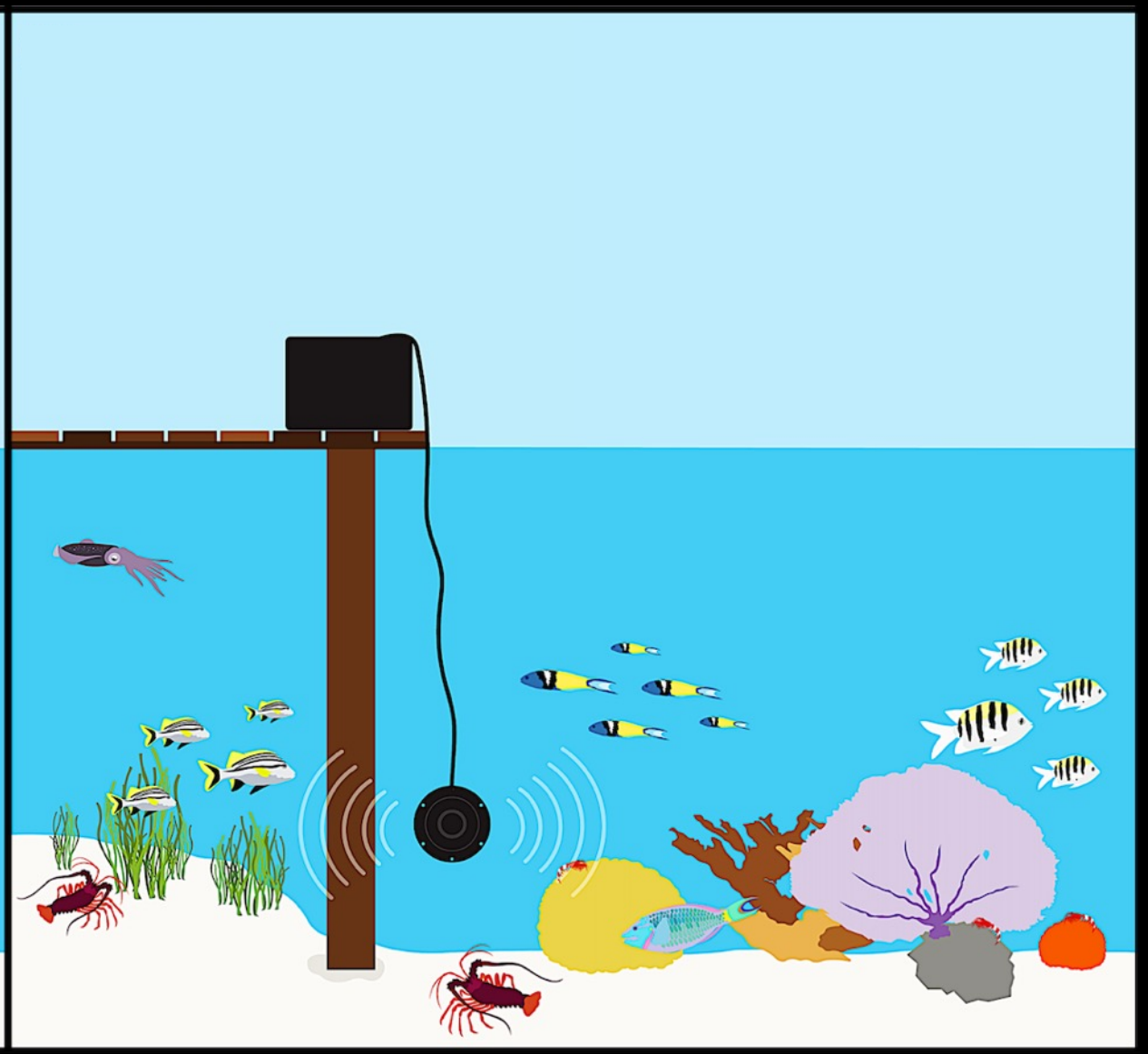

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Francis Juanes


Audrey Looby


Sarah Vela


Claire Attridge


Santiago Bravo


Amalis Riera


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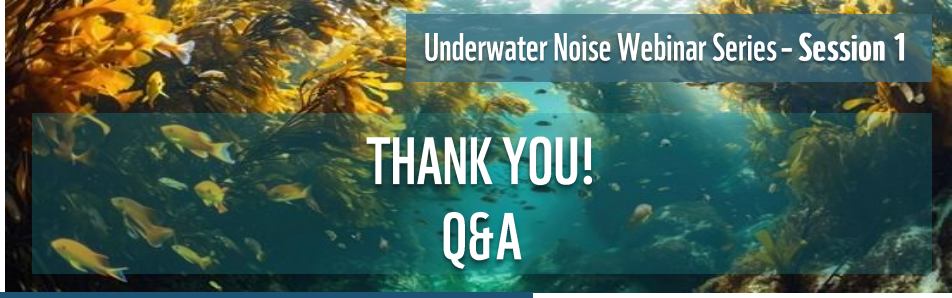

Underwater Noise Webinar Series – Session 1

THANK YOU!
Q&A

Questions for speakers?
Reminder - upcoming webinar sessions
Final thoughts and takeaways
Materials available for participants

For webinar inquiries or more information, please contact kpowell@wwfcanada.org