Temperate reef biodiversity change: Grand Challenges and Glimmers of Hope

Amanda Bates (she/her)
Professor and Impact Chair
Ocean Ecosystem Change and Conservation
Department of Biology
University of Victoria, Canada

I acknowledge and respect the lək̓ʷəŋən peoples on whose traditional territory the university stands and the Songhees, Esquimalt and W̱SÁNEĆ peoples whose historical relationships with the land continue to this day.

@AmandaEBates
amandabates@uvic.ca

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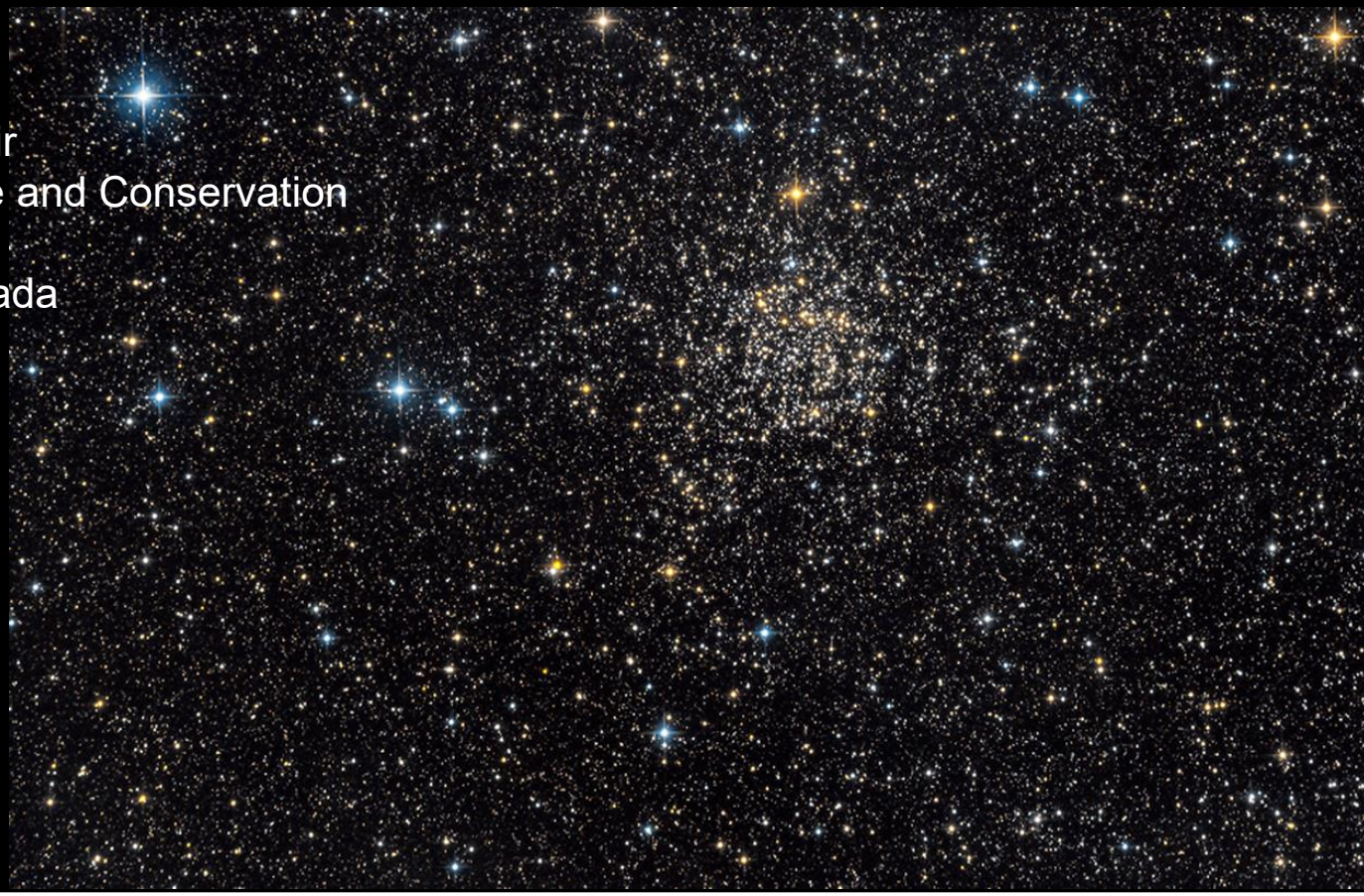

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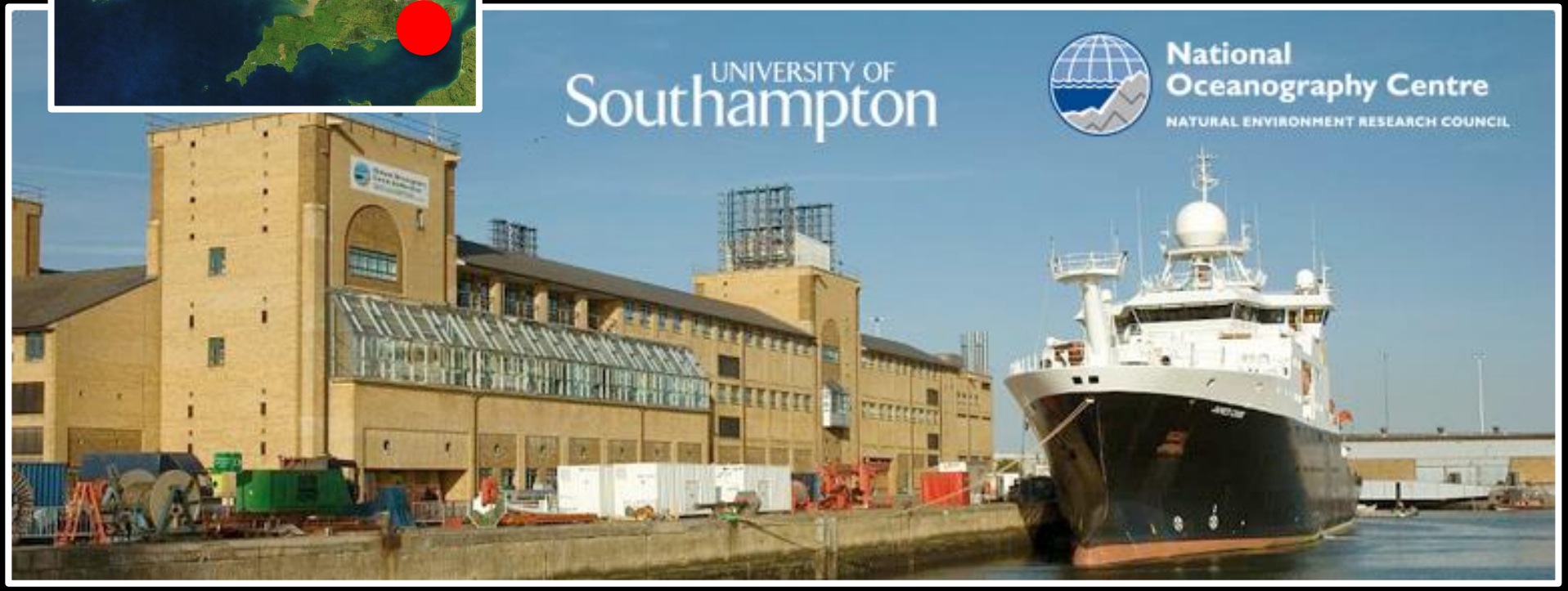
Southampton, United Kingdom



Ocean Sciences Centre
St. John's Newfoundland

MEMORIAL UNIVERSITY

UVIC

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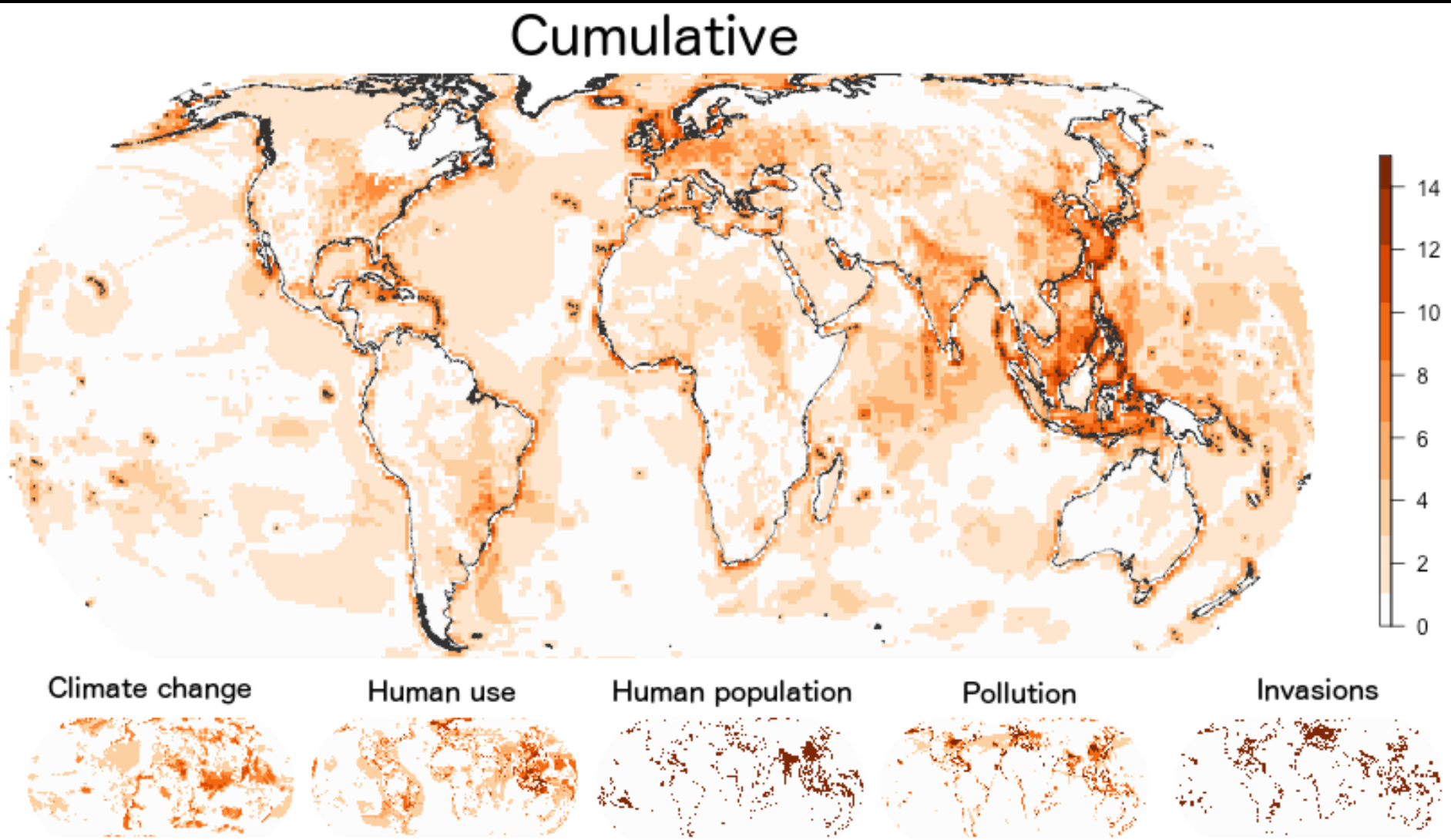
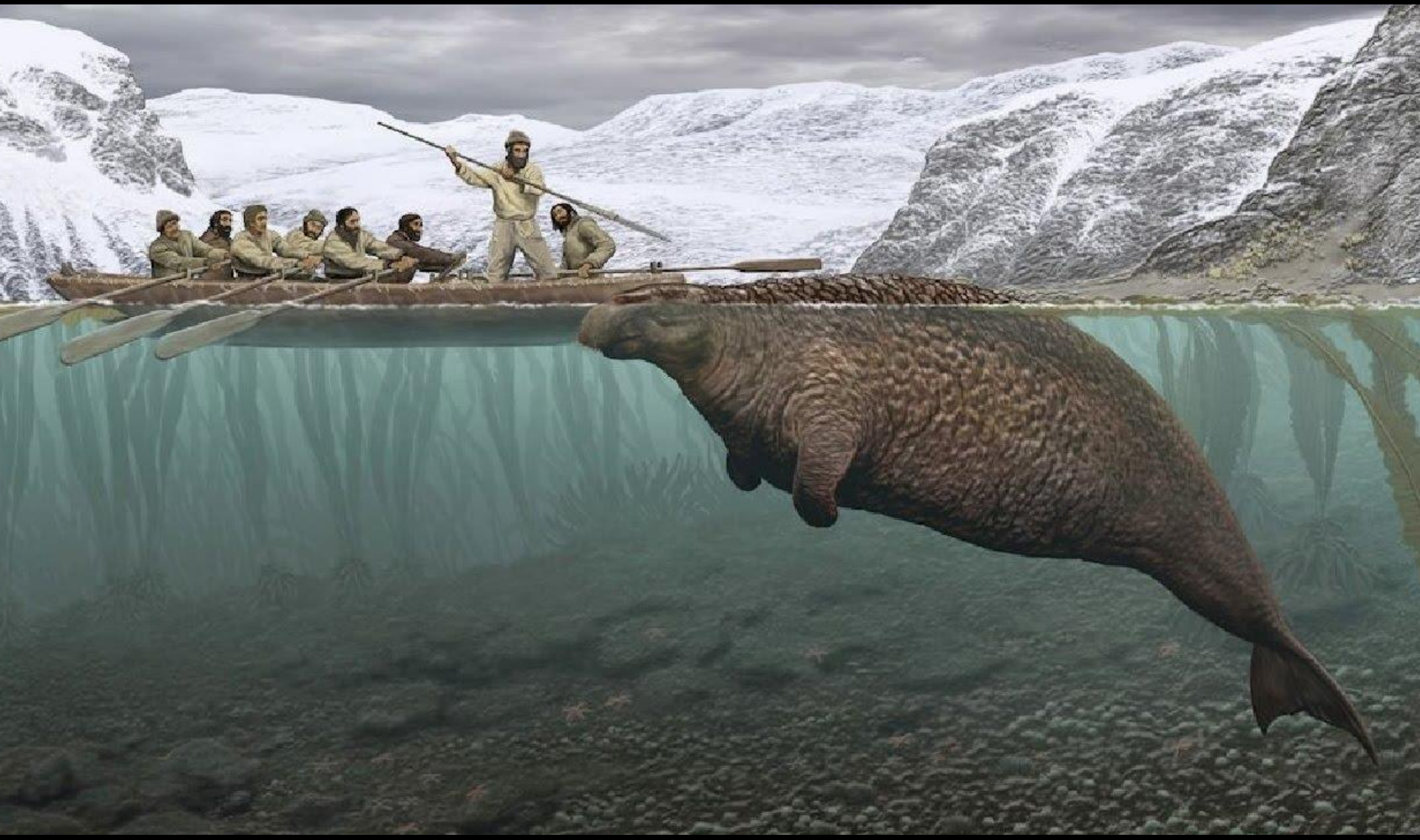
Vancouver Island
Canada

Bamfield Marine Sciences Center



The geography of the Anthropocene differs between the land and the sea.

D.E. Bowler, A.D. Bjorkman, M. Dornelas, I. Myers-Smith, L. M. Navarro, A. Niamir, S.R. Supp, C. Waldock, M. Vellend, S. A. Blowes, K. Böhning-Gaese, H. Bruelheide, R. Elahi, L.H. Antão, J. Hines, F. Isbell, H.P. Jones, A.E. Magurran, J. S. Cabral, M. Winter & A.E. Bates



Superposition of many **processes**, some weak, some strong, some fast, some slow, each one acting on its own scale in space and time

Protected Area Expansion

‘Global deal for nature’ fleshed out with specific conservation goals

Convention on Biological Diversity

To maintain a liveable planet, governments need to protect 30% of Earth's land and sea and sustainably manage another 20%, say researchers.

MARINE PROTECTED AREAS

Palau National Marine Sanctuary goes into effect

PEW

ENGLISH | MYANMAR

HEARTBEAT OF THE NATION

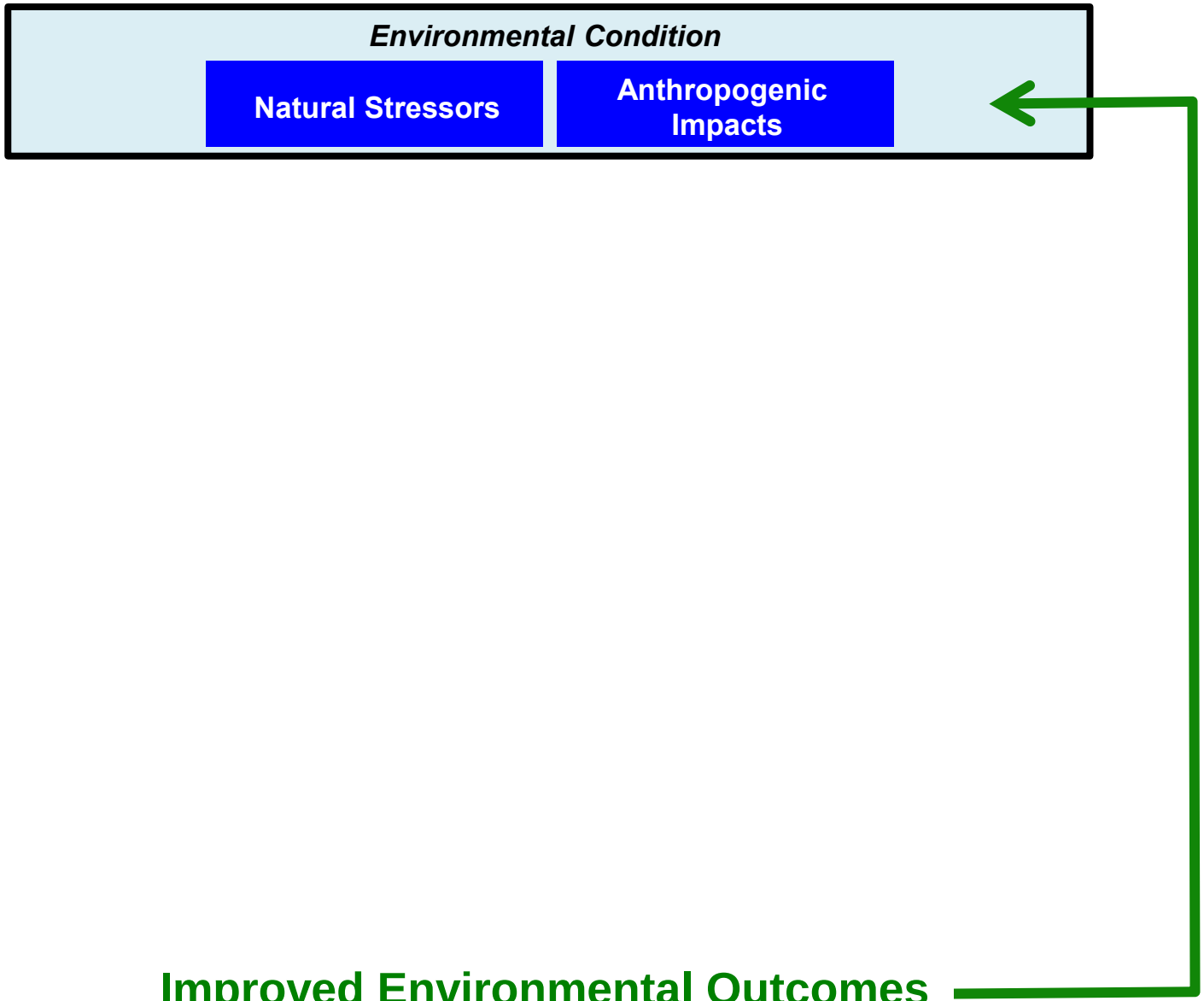
MYANMAR TIMES

MONDAY, MARCH 16, 2020

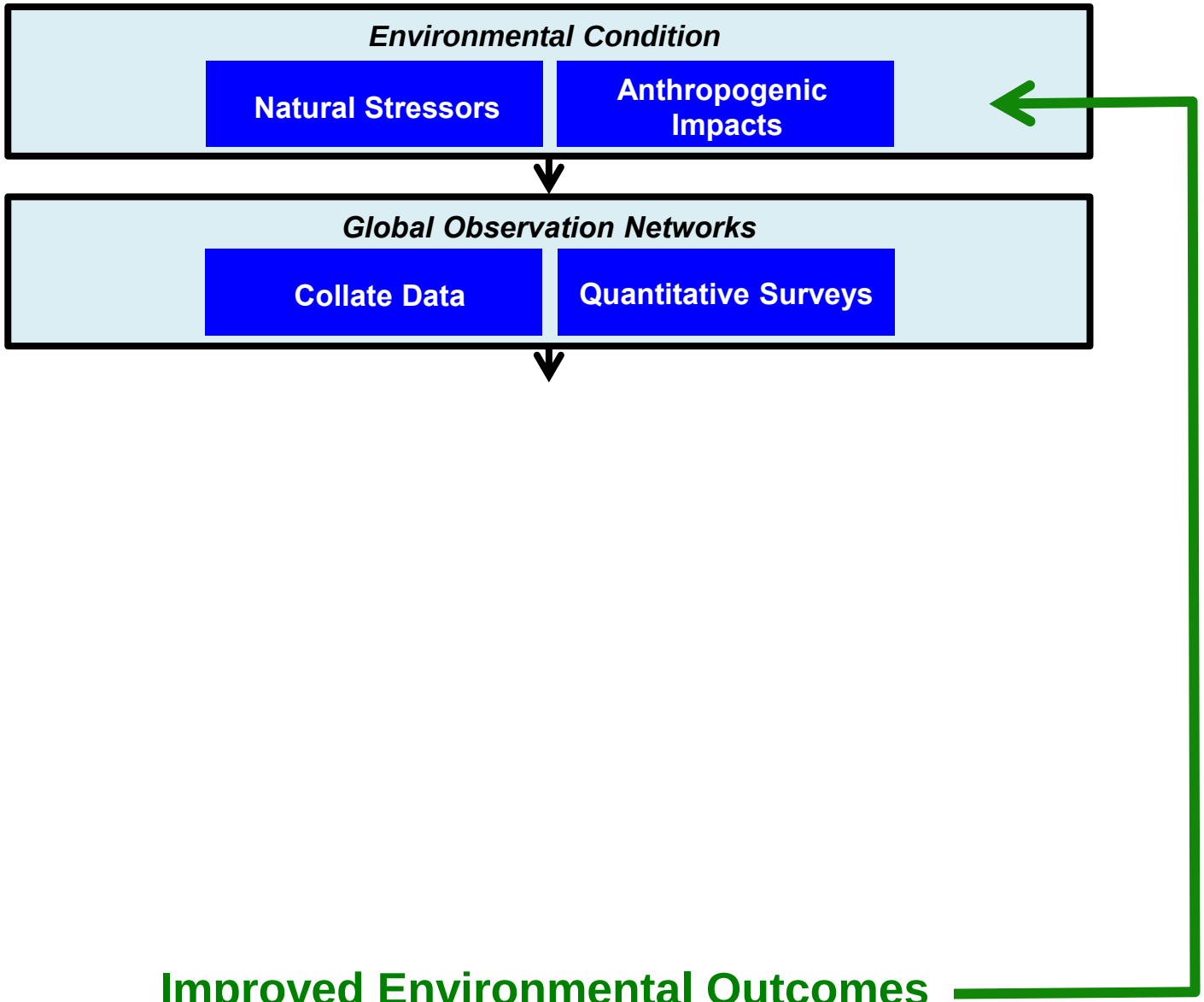
Home » National News » Govt names second marine protected area in Tanintharyi

Govt names second marine protected area in Tanintharyi

Florida Poised to Protect Gulf of Mexico’s Largest Seagrass Bed



Edgar, G.J., A.E. Bates, T.J. Bird, A.H. Jones, S. Kininmonth, R.D. Stuart-Smith, T.J. Webb (2016) New approaches to marine conservation through scaling up of ecological data. *Annual Review of Marine Science* 8: 435-461



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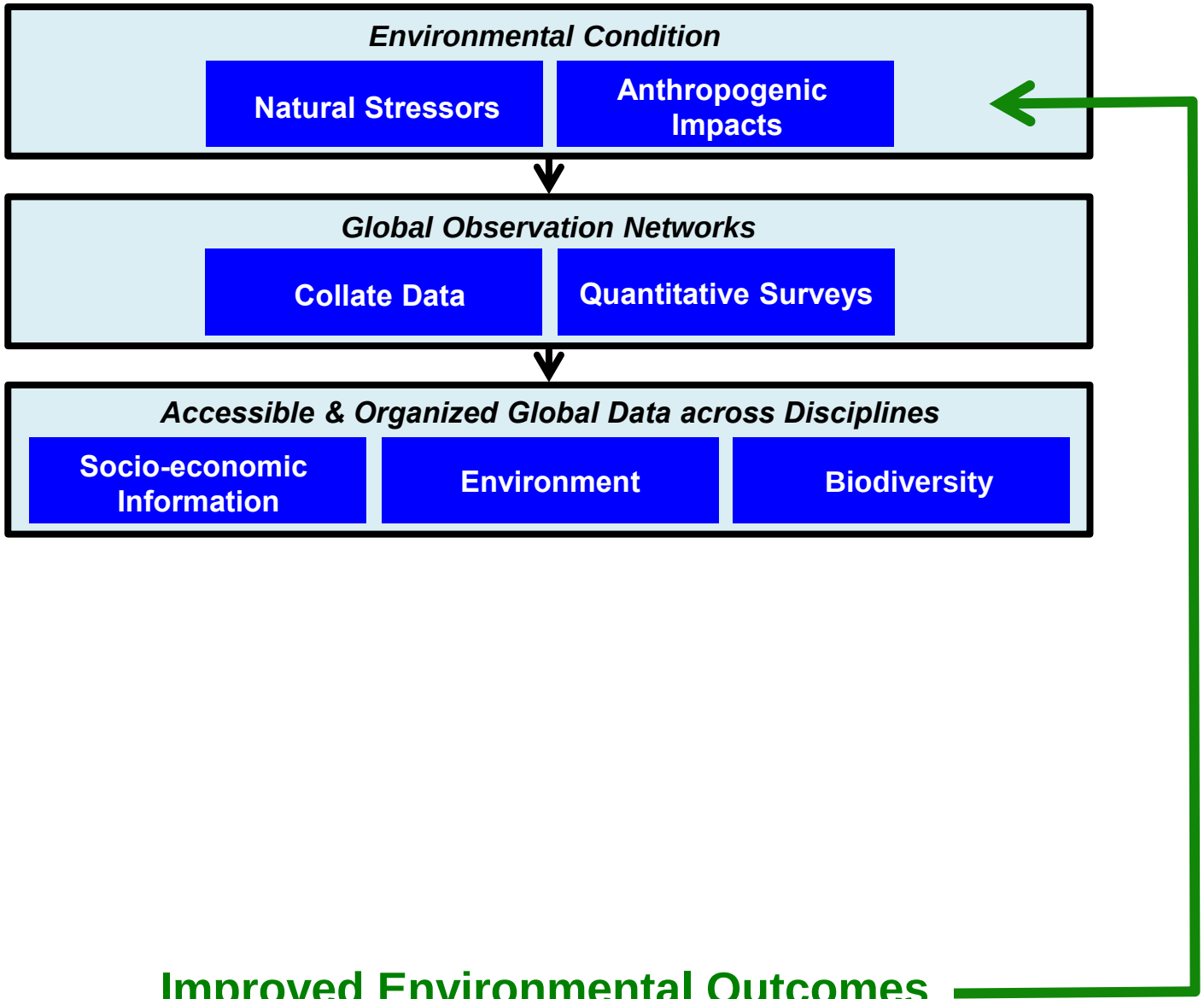
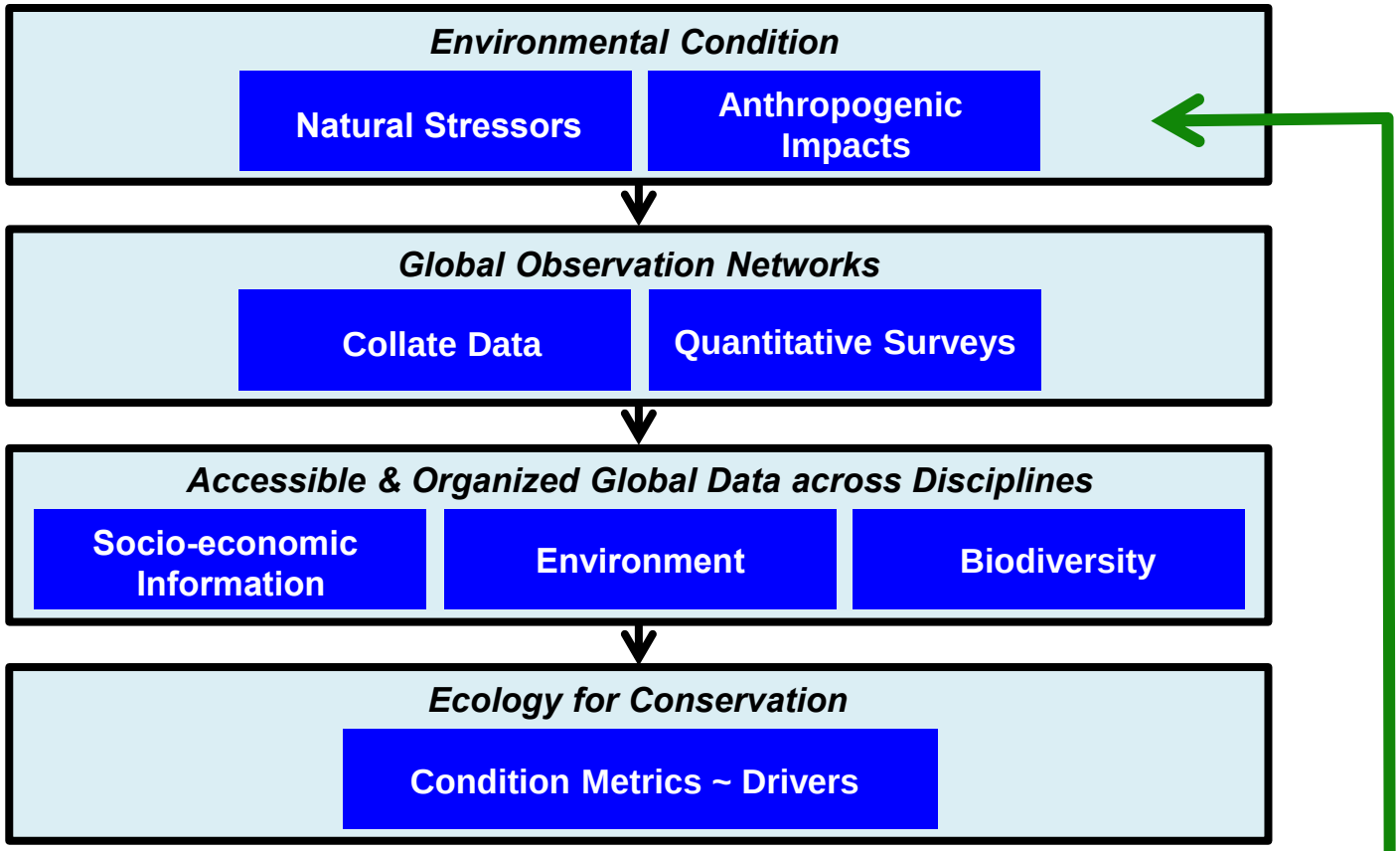


Edgar, G.J., A.E. Bates, T.J. Bird, A.H. Jones, S. Kininmonth, R.D. Stuart-Smith, T.J. Webb (2016) New approaches to marine conservation through scaling up of ecological data. *Annual Review of Marine Science* 8: 435-461



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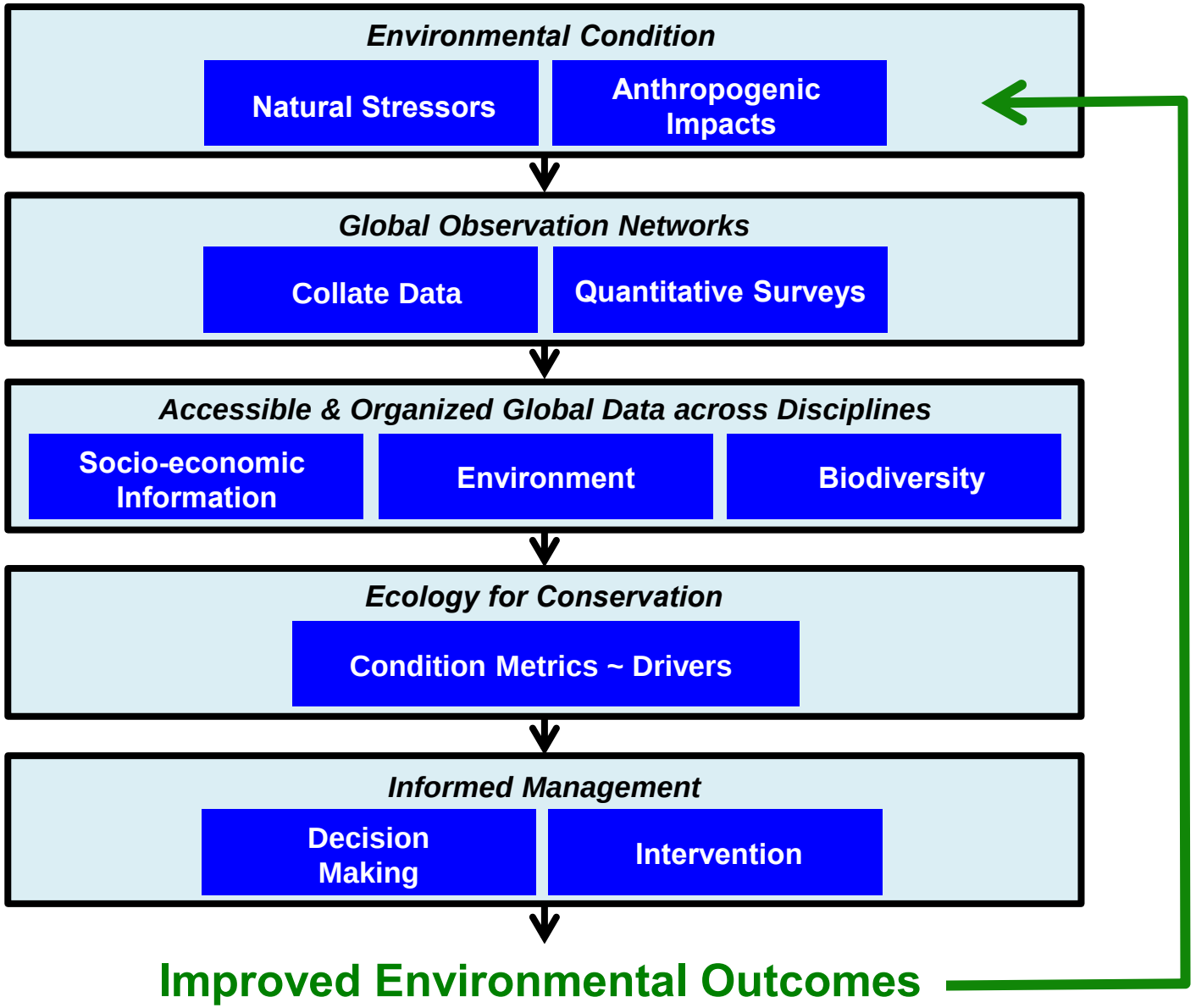

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☆Teamwork

MBON

Marine Biodiversity Observation Network

Fostering sustained standardized measurements of marine biodiversity from local to global scales

- Global community of practice
- Harmonized practice of marine biodiversity
- Protocols and practices for data products
- Sharing knowledge with society

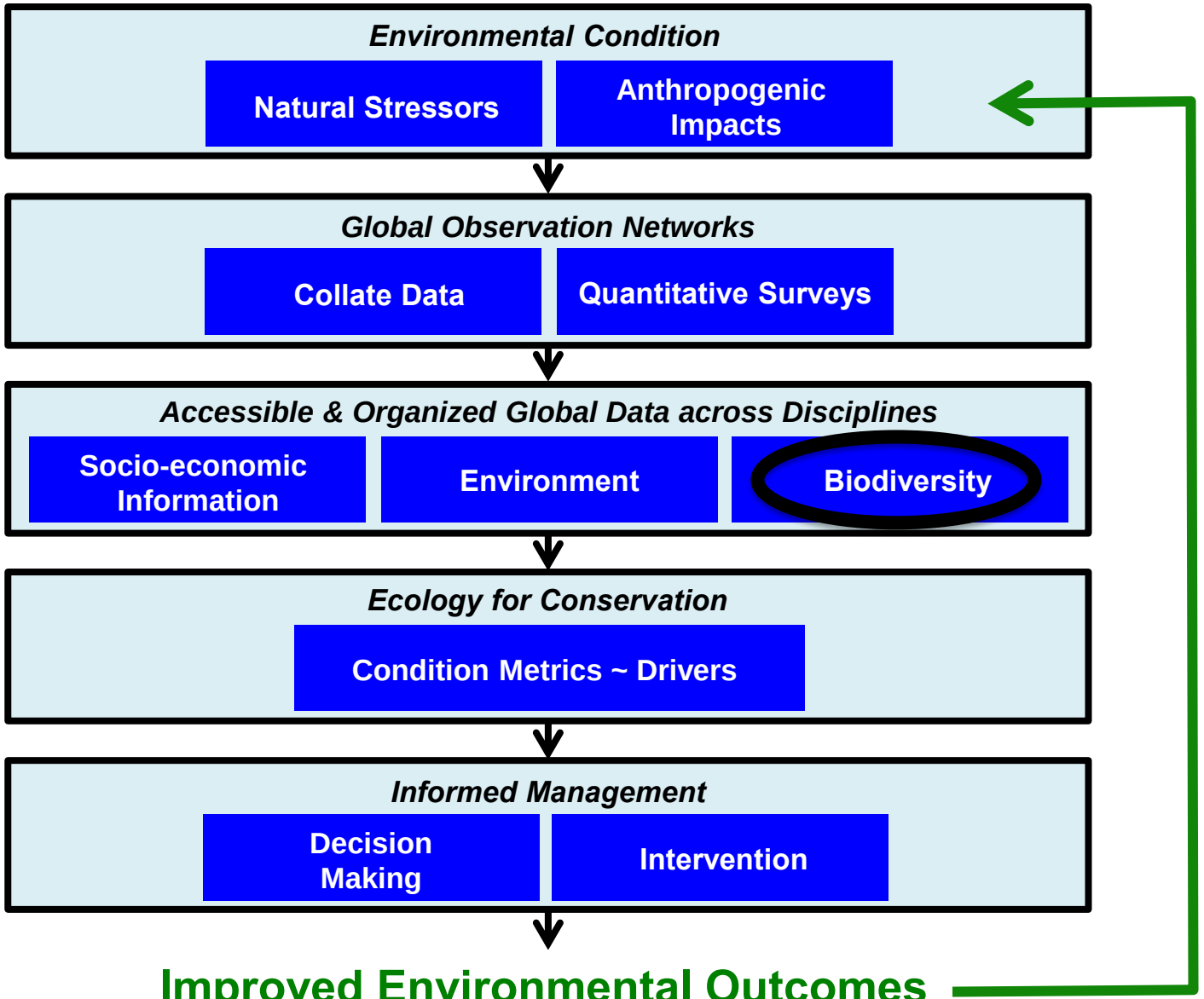
AIRCENTRE

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

GEO BON

Group on Earth Observations Biodiversity Observation Network

Mark Costello



Edgar, G.J., A.E. Bates, T.J. Bird, A.H. Jones, S. Kininmonth, R.D. Stuart-Smith, T.J. Webb (2016) New approaches to marine conservation through scaling up of ecological data. *Annual Review of Marine Science* 8: 435-461

Received: 2 May 2019 | Revised: 27 September 2019 | Accepted: 30 September 2019

DOI: 10.1111/geb.13025

MACROECOLOGY 30TH ANNIVERSARY

Global Ecology and Biogeography | A Journal of Macroecology

WILEY

Towards a macroscope: Leveraging technology to transform the breadth, scale and resolution of macroecological data

Maria Dornelas[1] | Elizabeth M. P. Madin[2] | Michael Bunce[3,4] | Joseph D. DiBattista[3,5] | Mark Johnson[6,7] | Joshua S. Madin[2] | Anne E. Magurran[1] | Brian J. McGill[8] | Nathalie Pettorelli[9] | Oscar Pizarro[10] | Stefan B. Williams[9,10] | Marten Winter[11] | Amanda E. Bates[12]

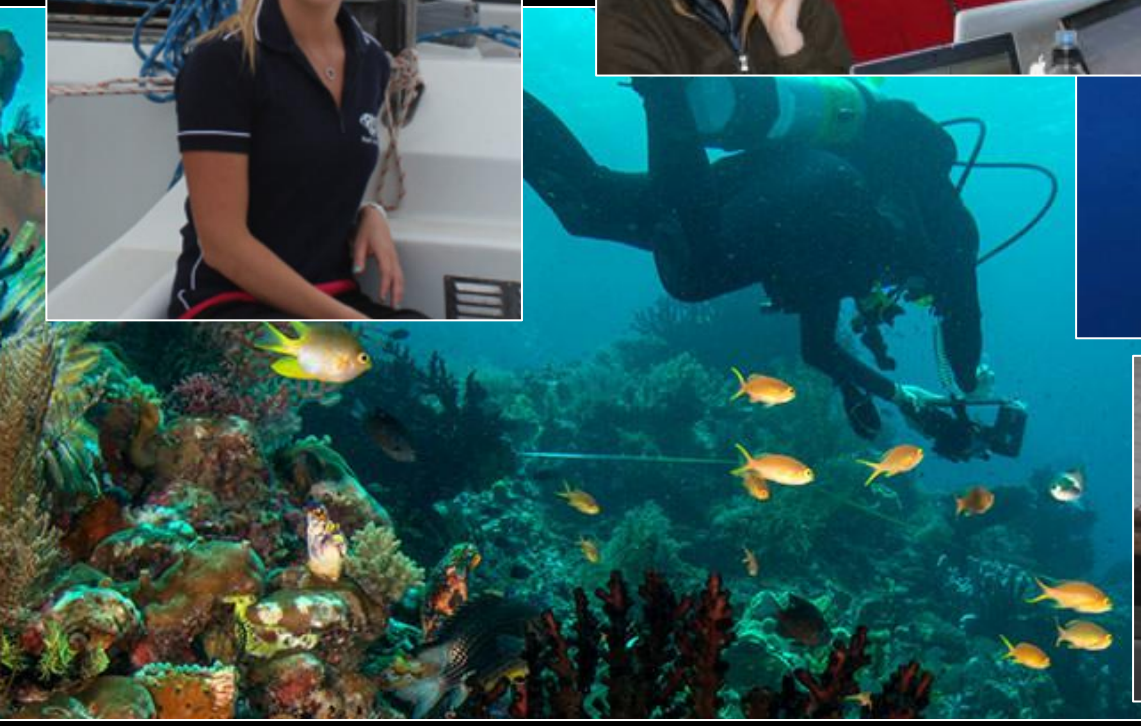
Maria Dornelas


Satellites
Passive acoustic monitoring
Bio-loger
Camera traps
e DNA
Humans as instruments
Drones

Graham Edgar

Rick Stuart-Smith

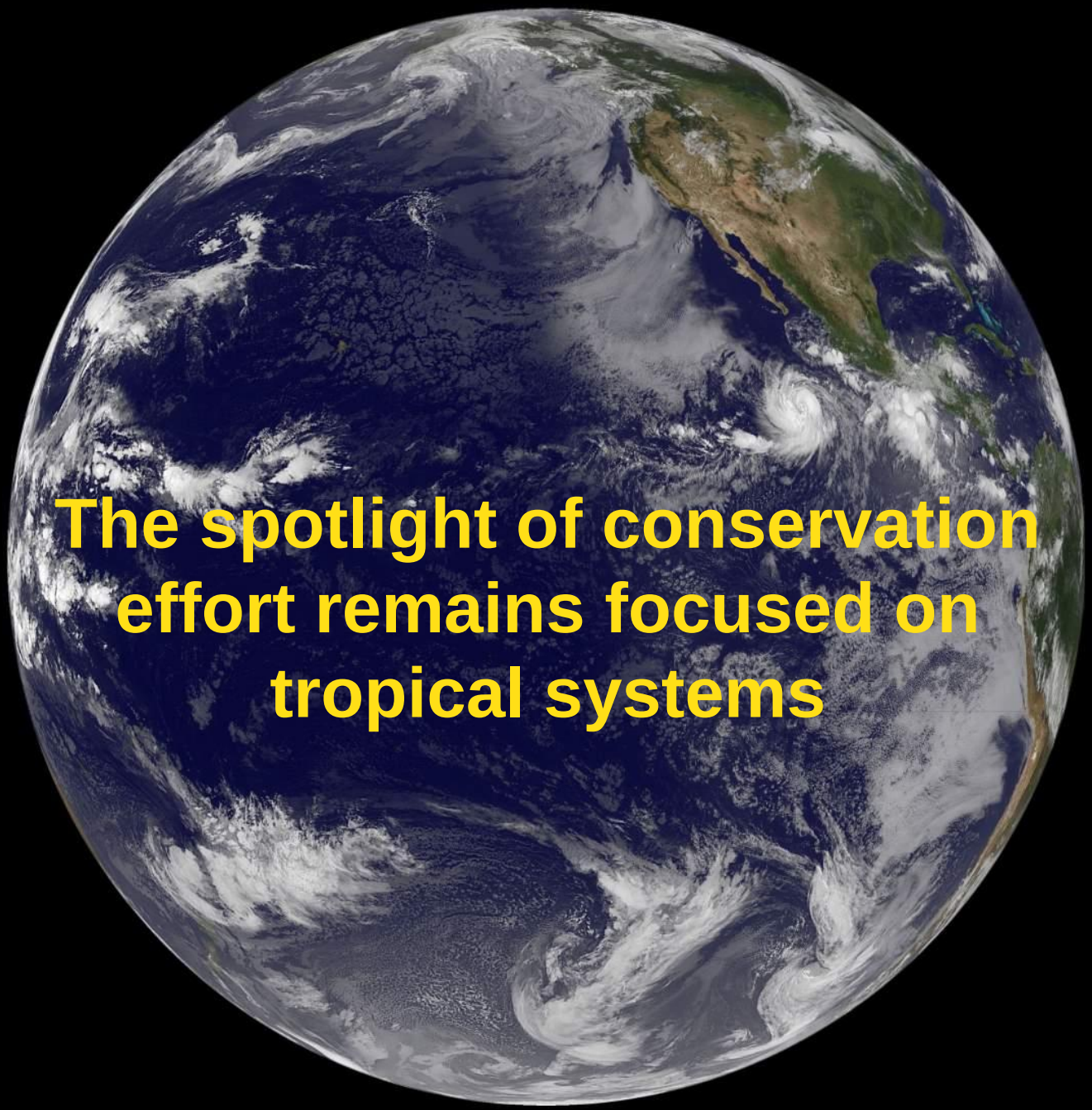
REEF LIFE SURVEY



CELEBRATING

10

YEARS

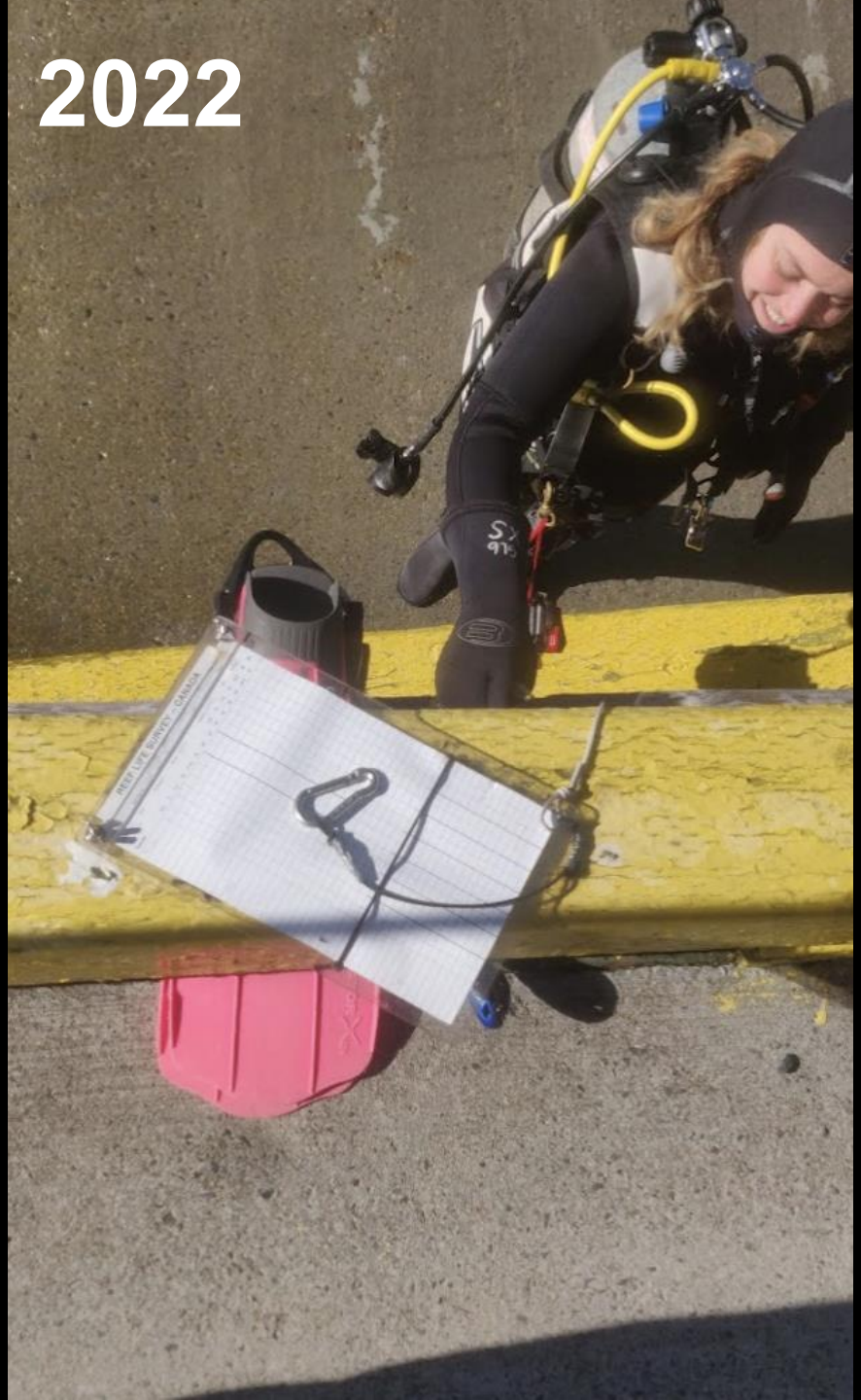

The spotlight of conservation effort remains focused on tropical systems

2018

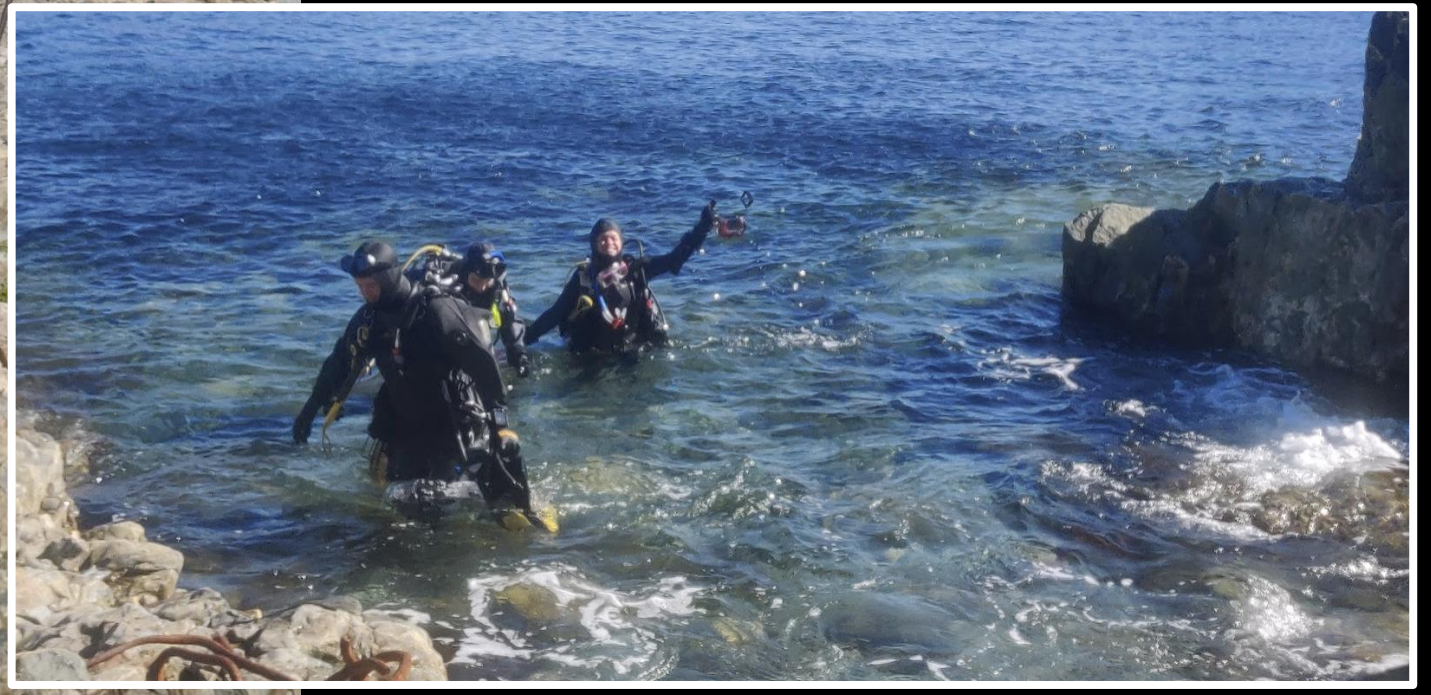
bmsc BAMFIELD MARINE SCIENCES CENTRE

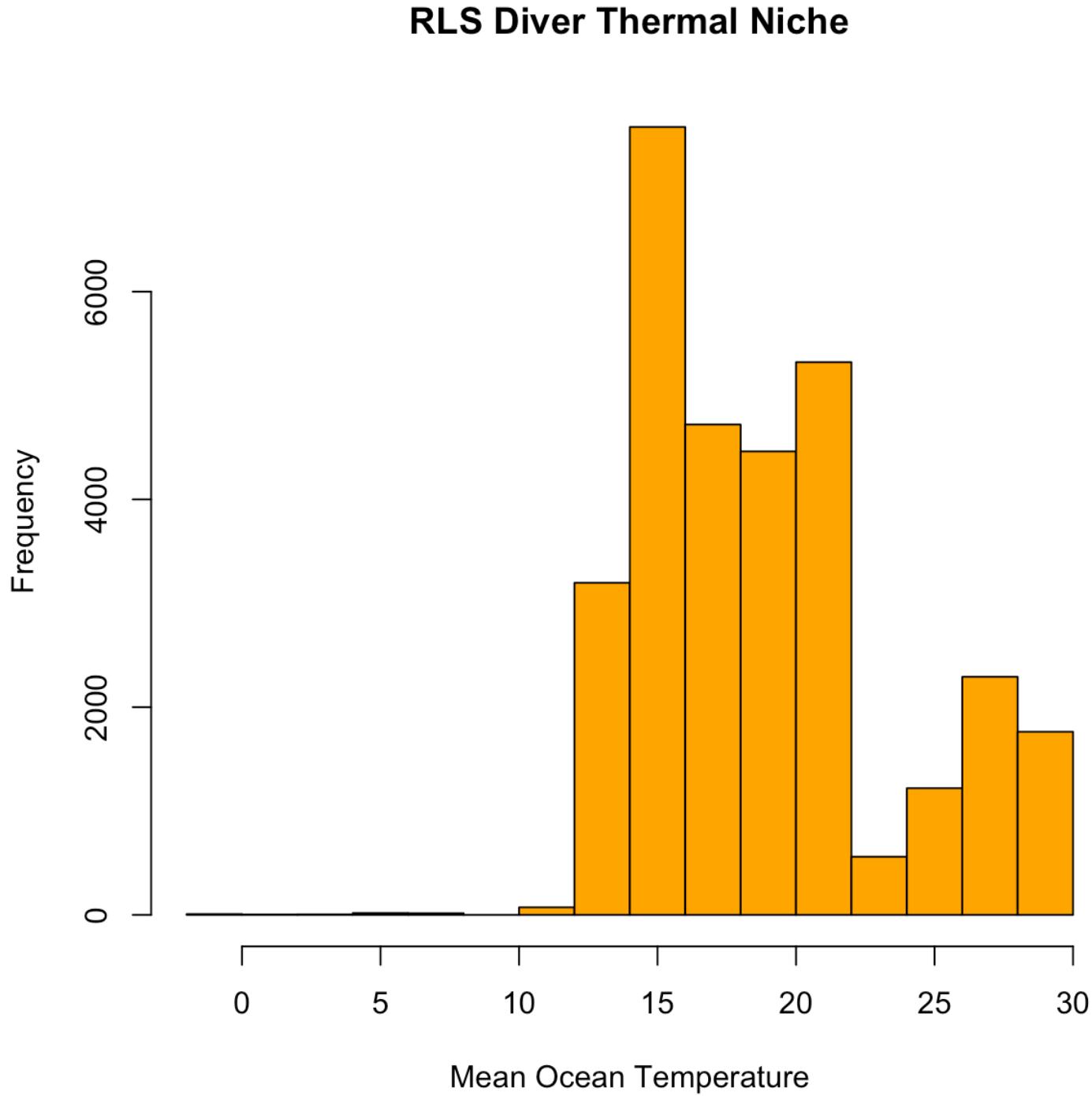

BARE

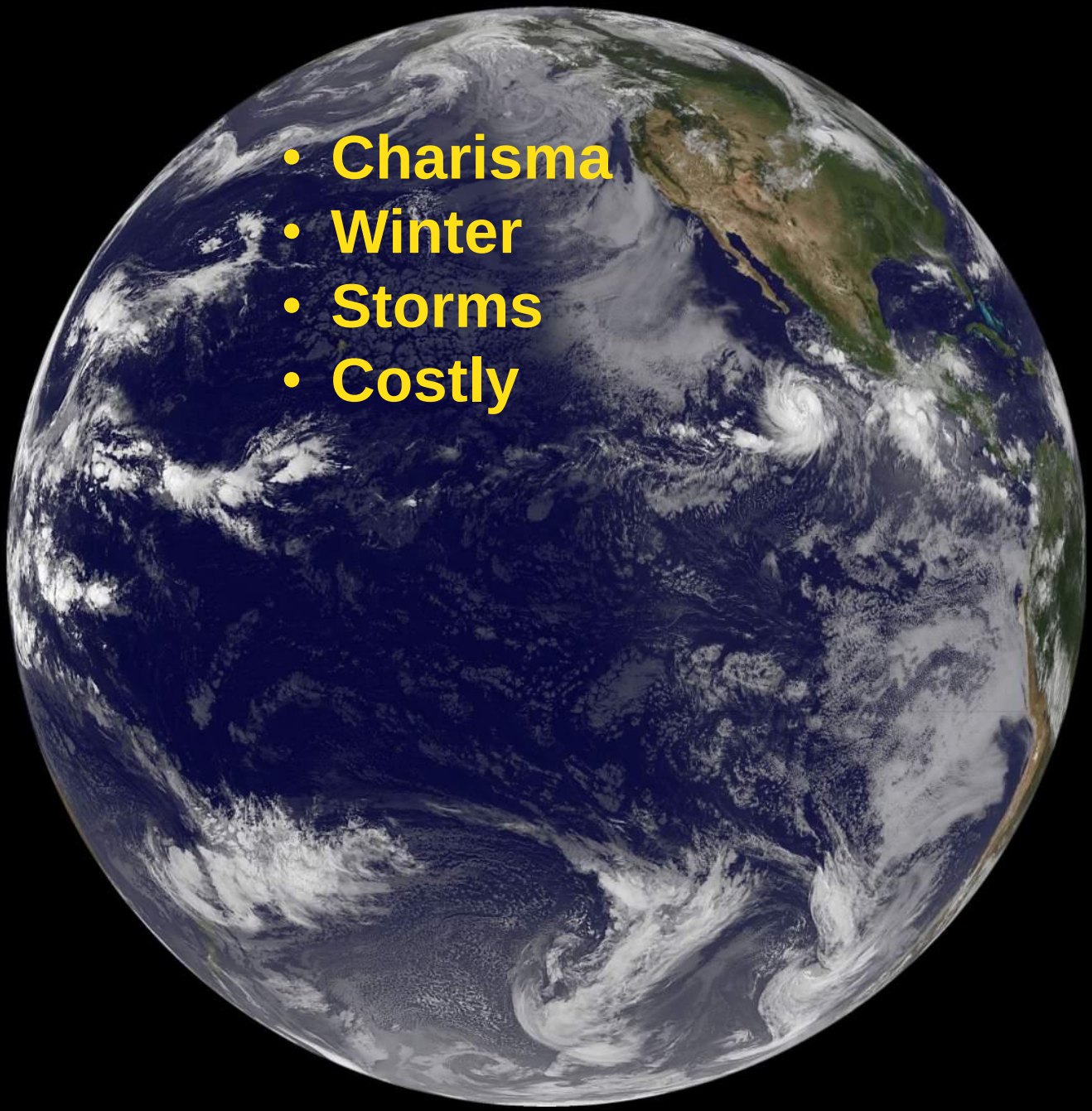
2022

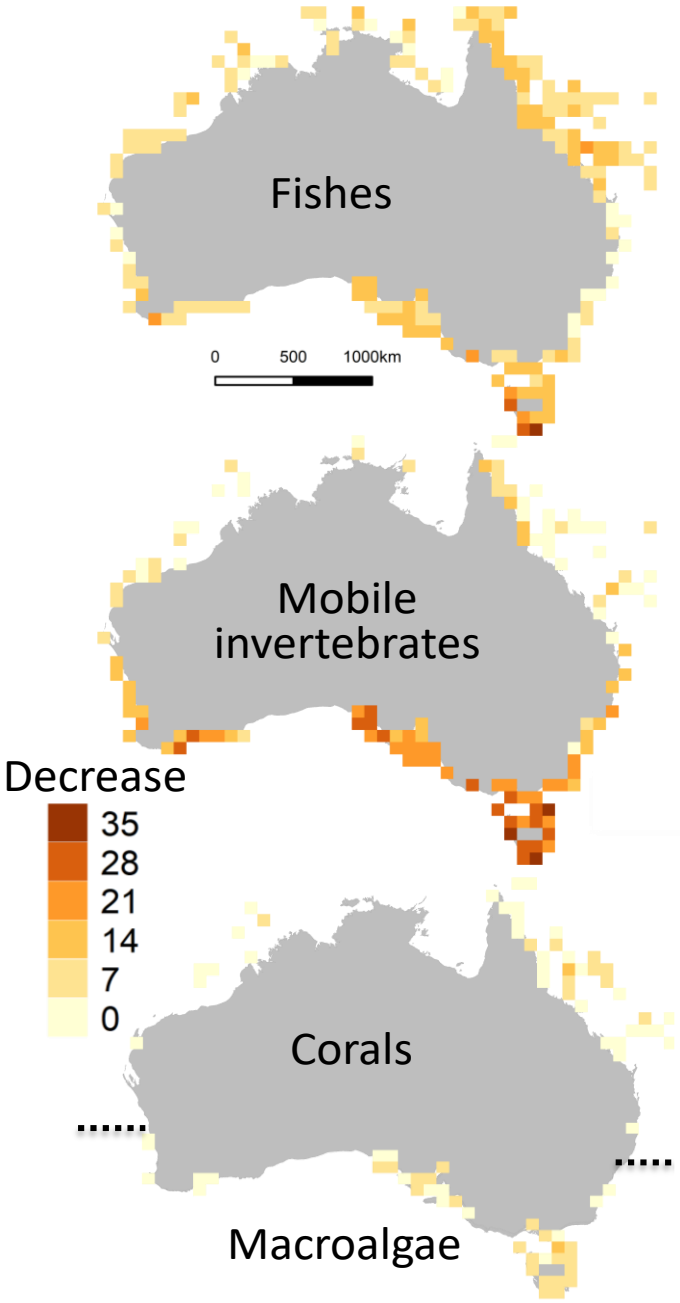



ABYSS




RLS Diver Thermal Niche
Frequency
0
2000
4000
6000
0
5
10
15
20
25
30
Mean Ocean Temperature


• Charisma
• Winter
• Storms
• Costly



Australian Government

Australian Institute of Marine Science

REEF LIFE SURVEY

ATRC
Australian Temperate Reef Collaboration

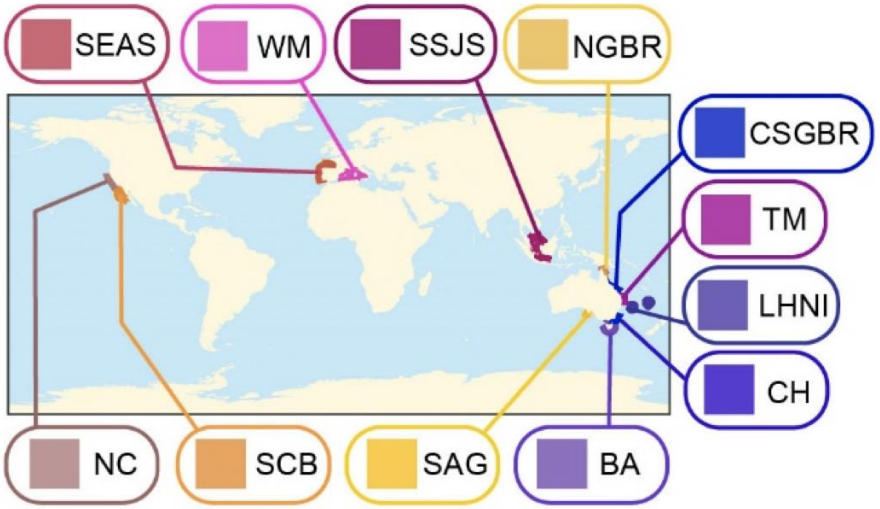
Edgar et al (in revision) Continent-wide declines in shallow reef species over a decade of ocean warming. *Nature*

Pycnopodia
Wasting disease

Macrocystis
Mass die-offs

Thymichthys politus
Rare fish


☆Restoration
Success



SEAS: South European Atlantic Shelf

WM: Western Mediterranean

SSJS: Sunda Shelf/Java Sea

NGBR: Torres Strait Northern Great Barrier Reef

CSGBR: Central and Southern Great Barrier Reef

TM: Tweed-Moreton

LHNI: Lord Howe and Norfolk Islands

CH: Cape Howe

BA: Bassian

SAG: South Australian Gulfs

SCB: Southern California Bight

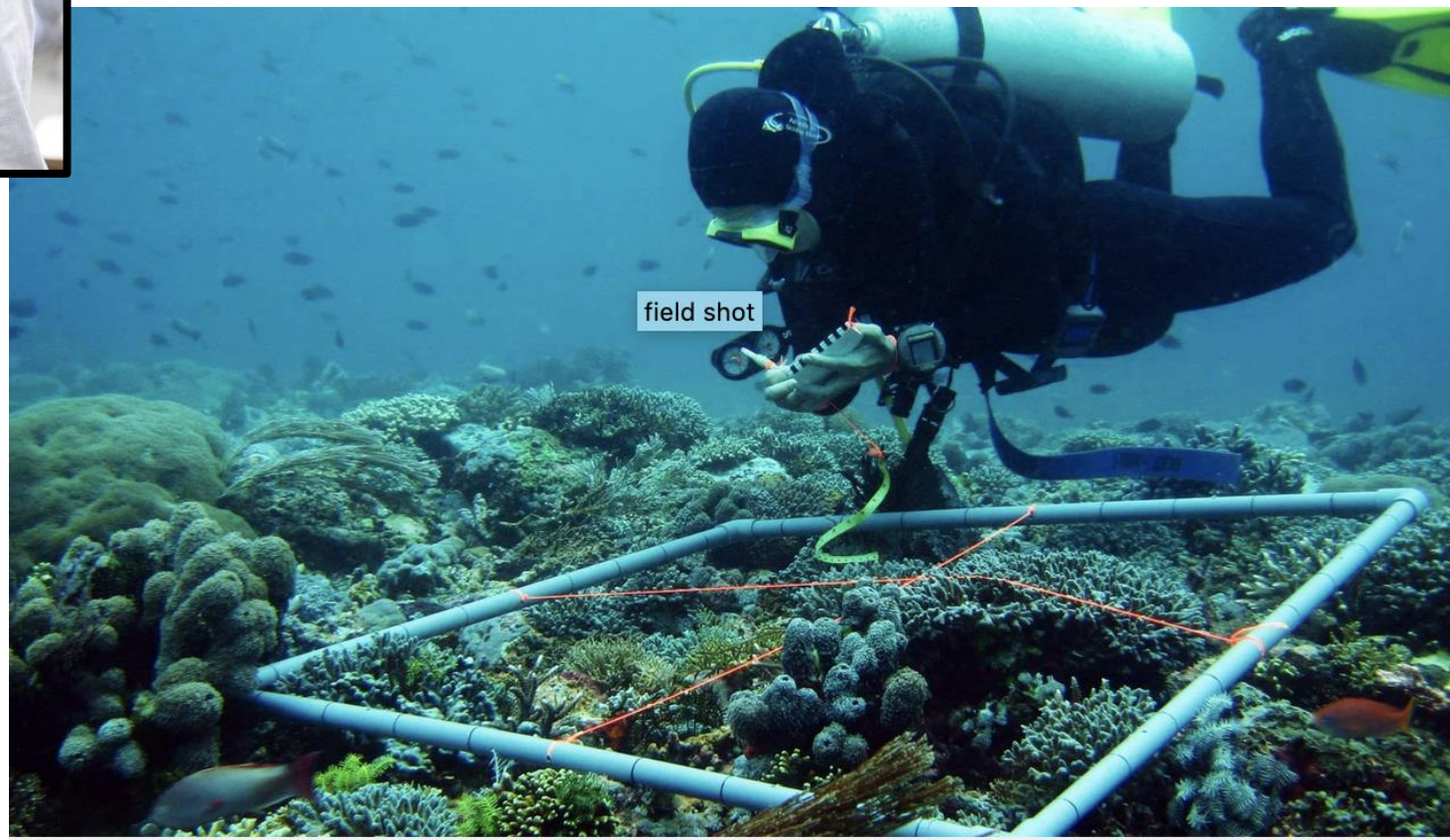
NC: Northern California

Lisandro Benedetti-Cecchi

Benedetti-Cecchi et al (in prep) Marine Protected Areas can stabilize reef fish abundance under global warming

Tries Razak
IPB University
Indonesia

Pew Marine Fellow



Tries Blandine Razak conducts a survey at an experimental reef rehabilitation site on a coral rubble field, created by chronic blast fishing, in Komodo National Park, East Nusa Tenggara, Indonesia. For her Pew fellowship, Razak will identify and test effective reef restoration practices.

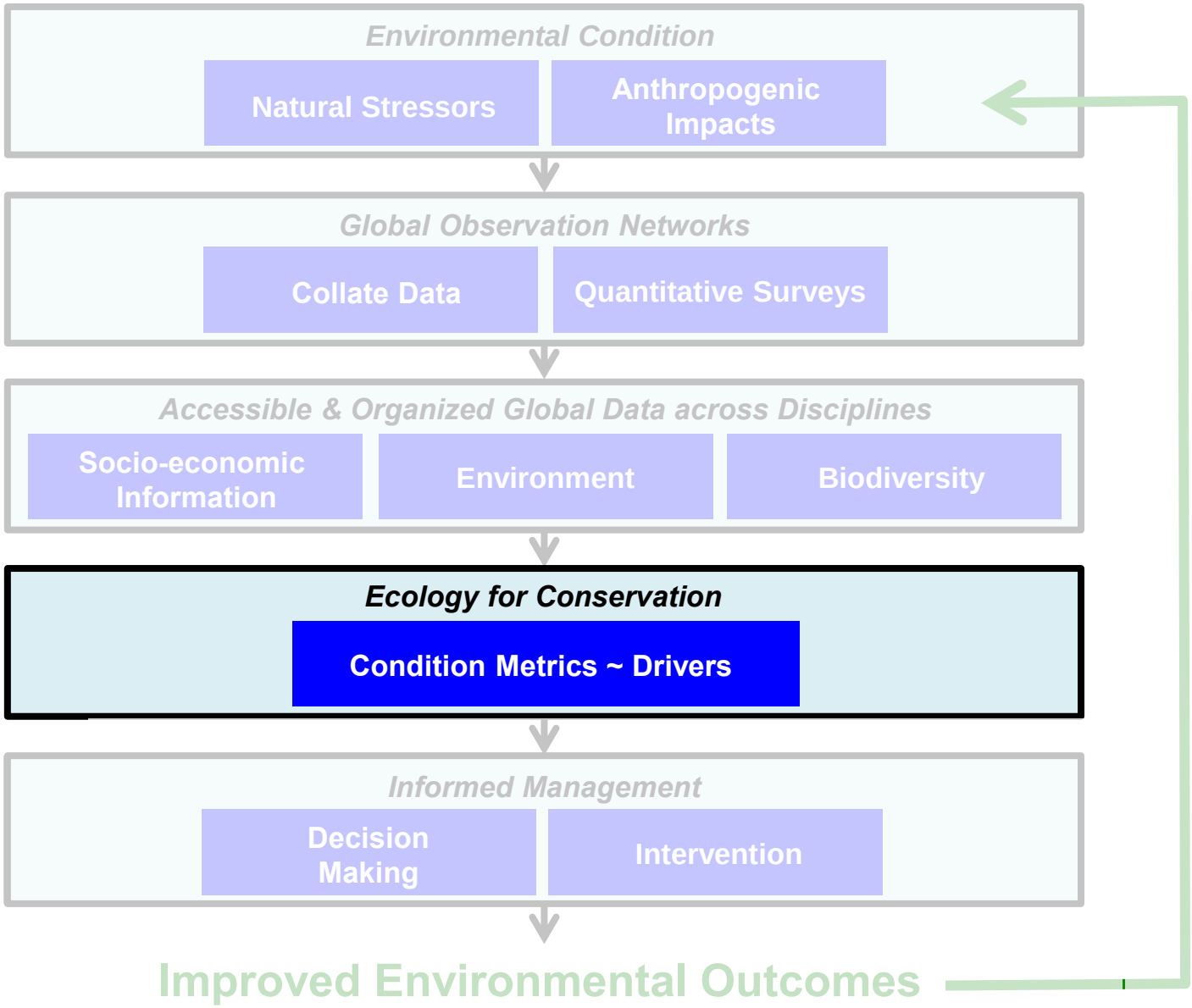
Sangeeta Mangubhai

GREEN GRAVEL
ACTION GROUP

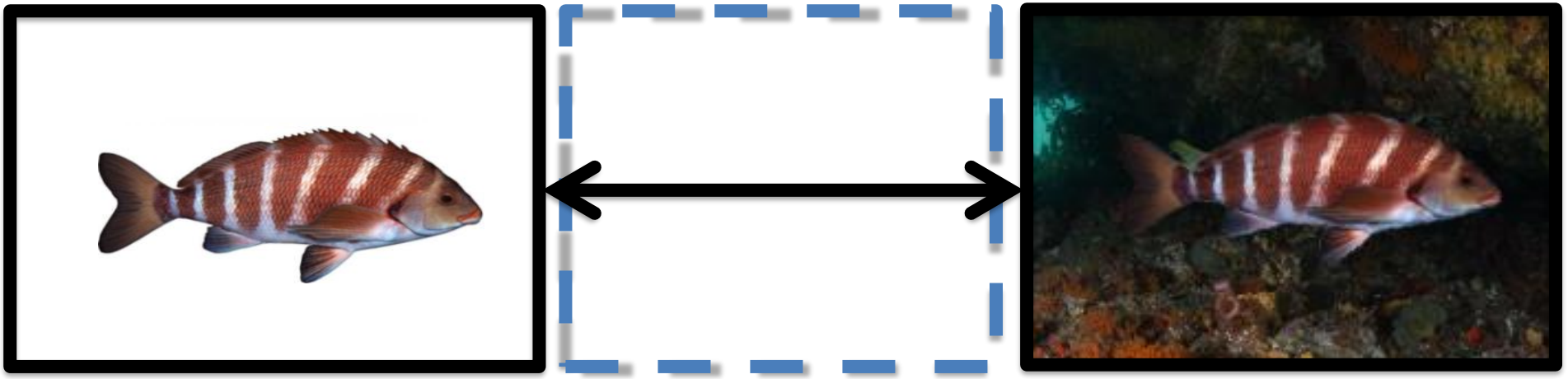
Handfish
Conservation
Project

⛤Ecology

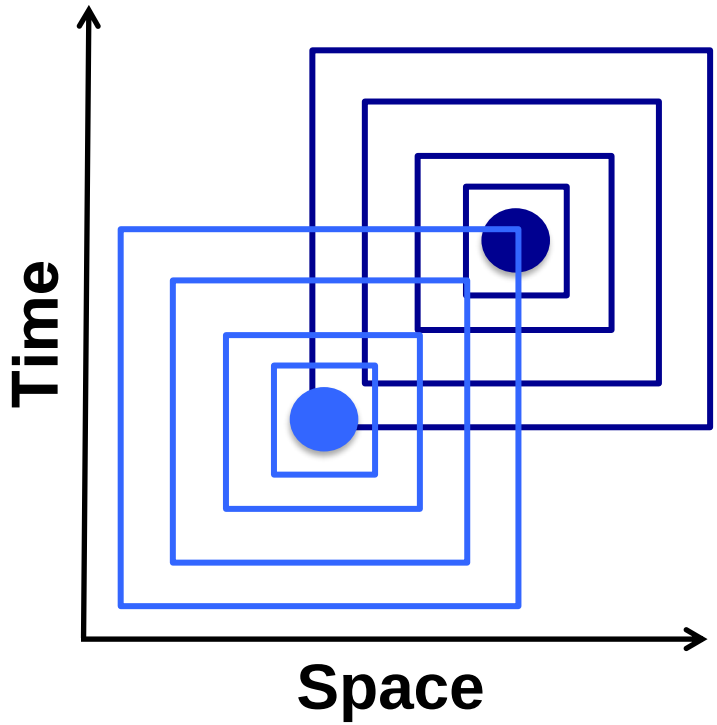
Impact Chair in Indigenous Art Practices
Carey Newman



Edgar, G.J., A.E. Bates, T.J. Bird, A.H. Jones, S. Kininmonth, R.D. Stuart-Smith, T.J. Webb (2016) New approaches to marine conservation through scaling up of ecological data. *Annual Review of Marine Science* 8: 435-461



ΔBiodiversity ~ Exposure + Sensitivity



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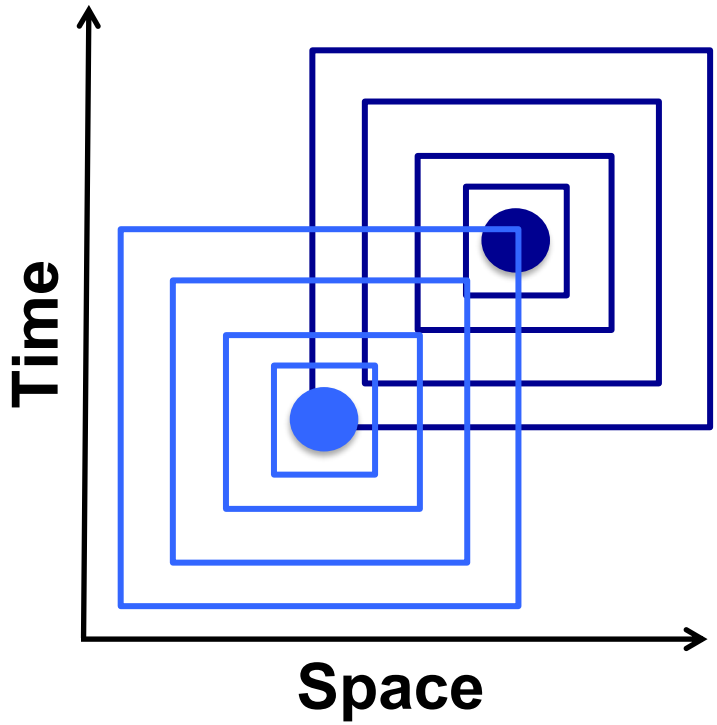
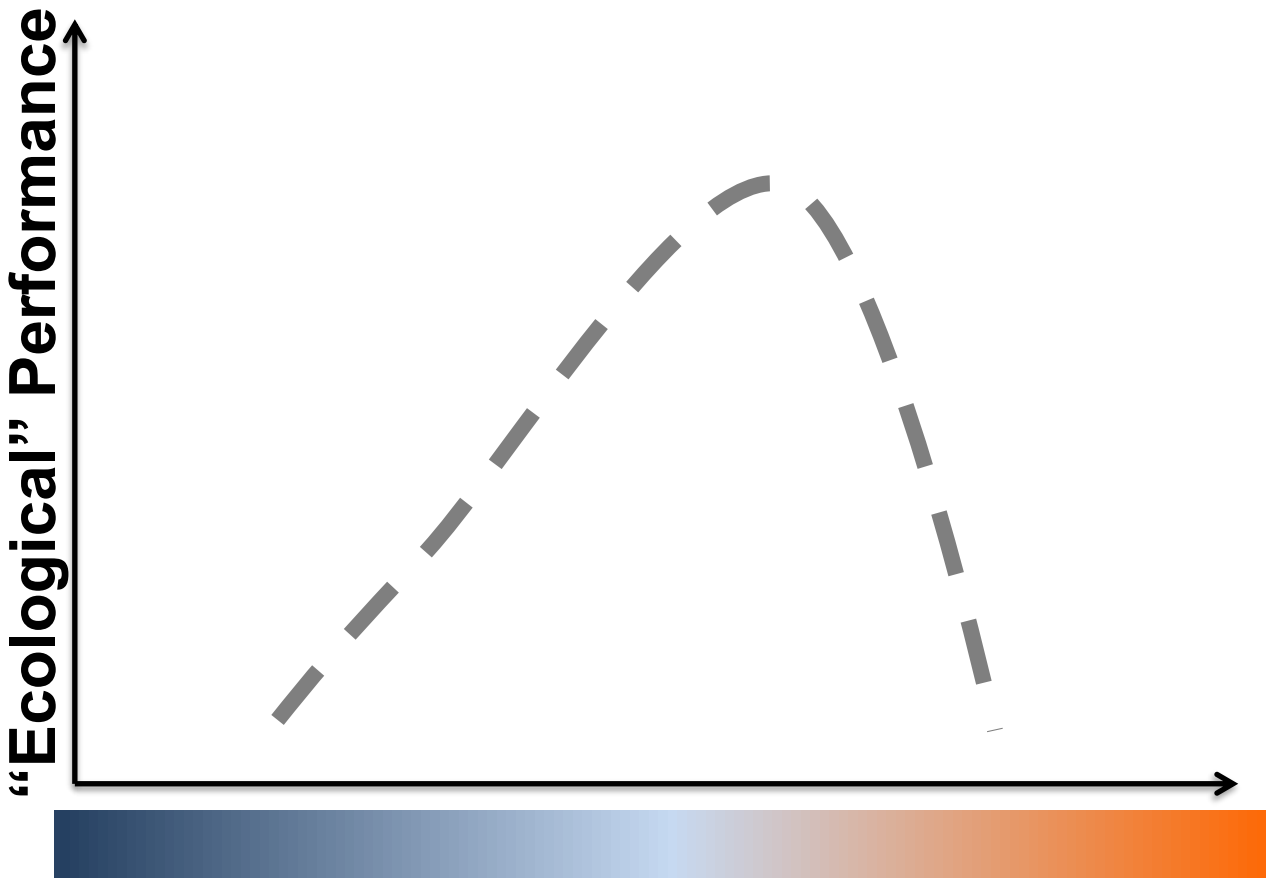



"Ecological" Performance
Realized Species Thermal Niche

ECOLOGY LETTERS

Ecology Letters, (2019) doi: 10.1111/ele.13222

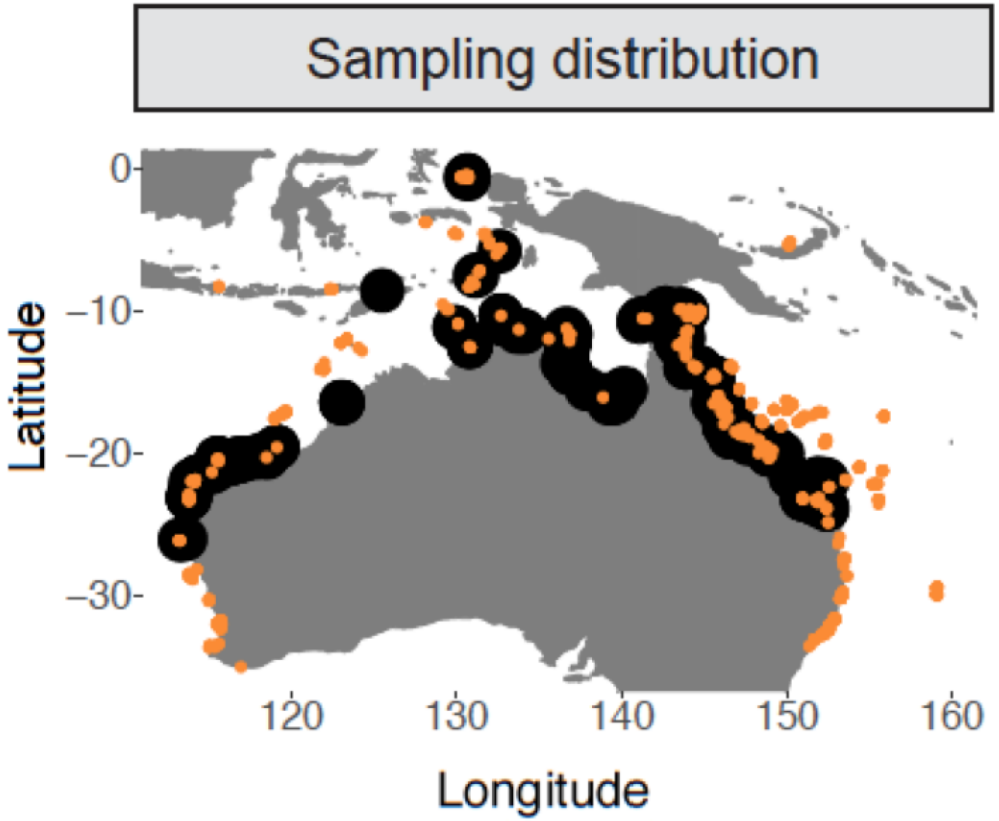
LETTER

The shape of abundance distributions across temperature gradients in reef fishes

Conor Waldock

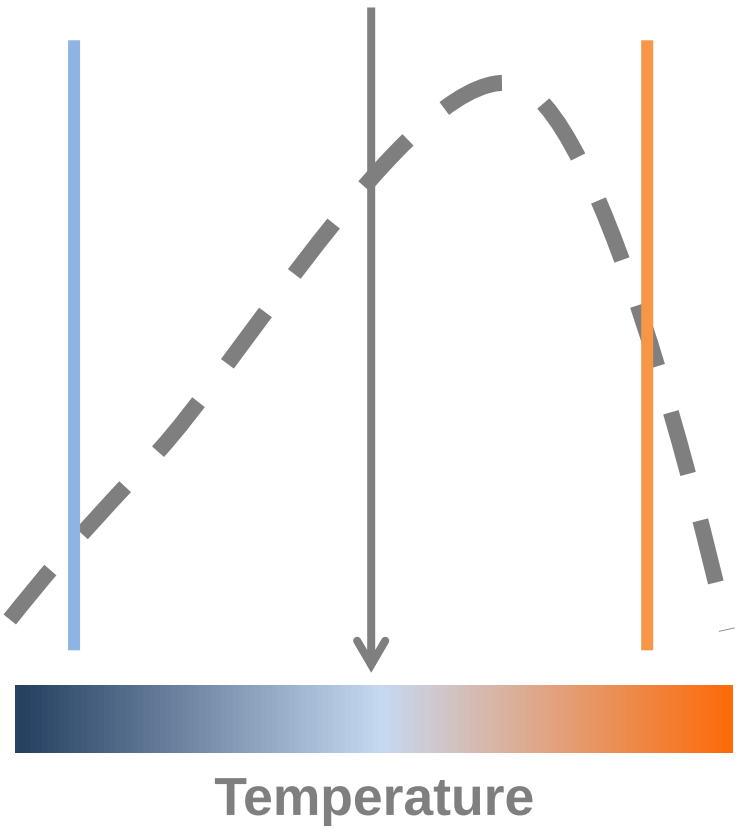
Maximum ecological performance

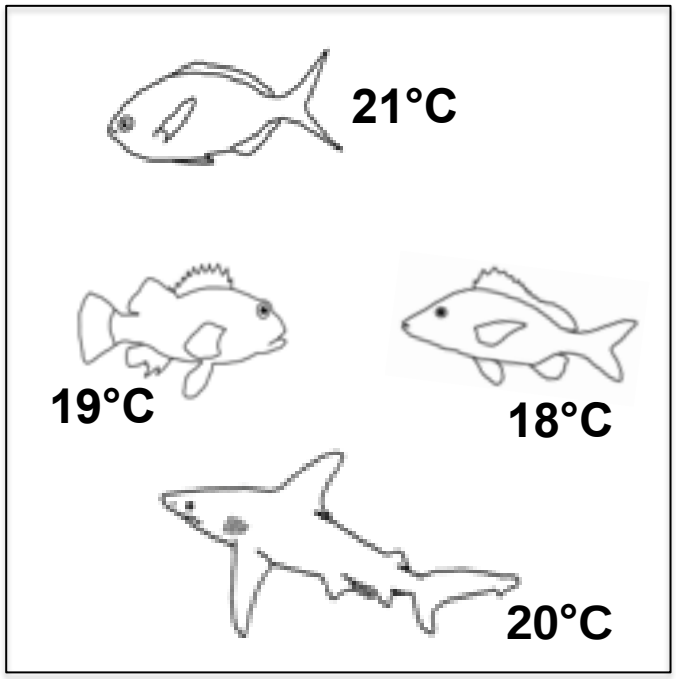
Lutjanus carponotatus



Species' Thermal Index

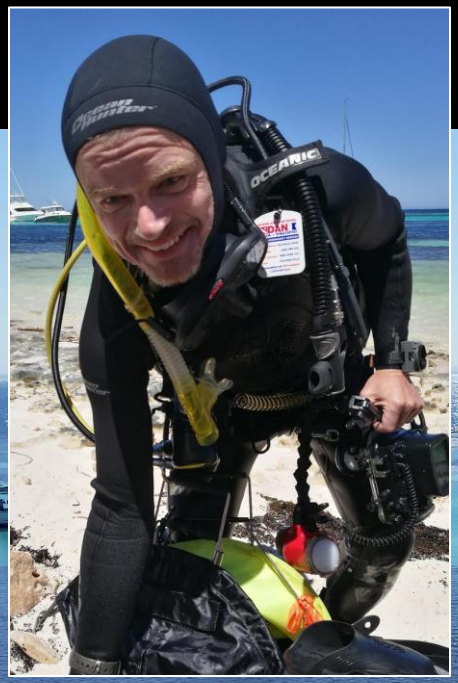
STI





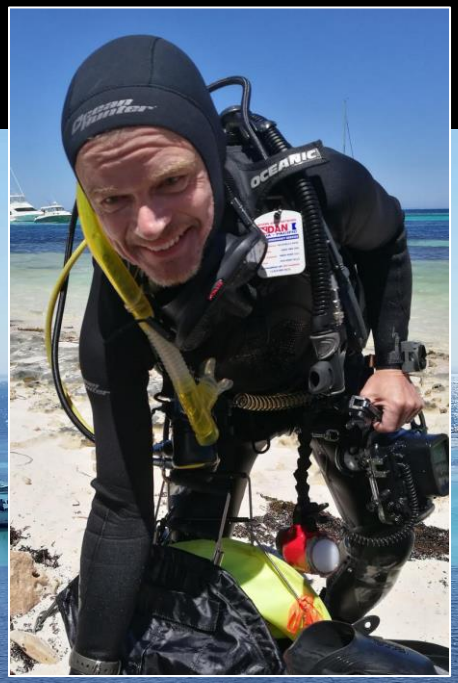
Community Thermal Index (CTI)
19.5°C

$$CTI = \sum_i^n STI_i w_i \Big/ \sum_i^n w_i$$



Paul Day
University of Tasmania

REEF LIFE SURVEY



Paul Day
University of Tasmania

BIODIVERSITY RESEARCH

WILEY Diversity and Distributions

Species' thermal ranges predict changes in reef fish community structure during 8 years of extreme temperature variation

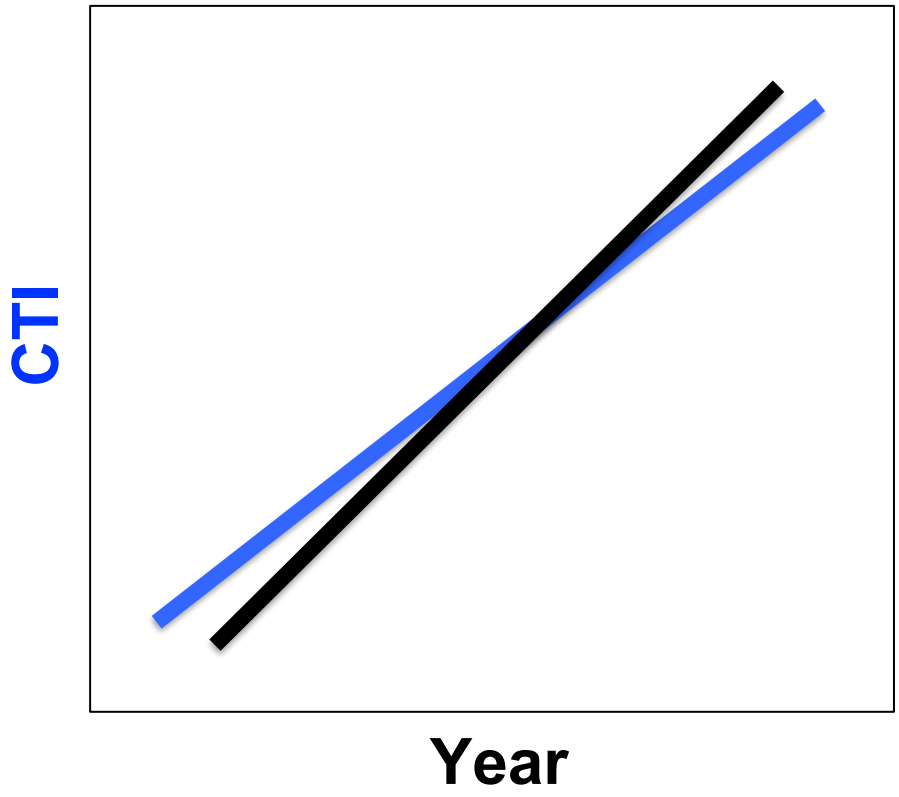
Paul B. Day[1] | Rick D. Stuart-Smith[1] | Graham J. Edgar[1] | Amanda E. Bates[2]

nature climate change

LETTERS

https://doi.org/10.1038/s41558-019-0631-5

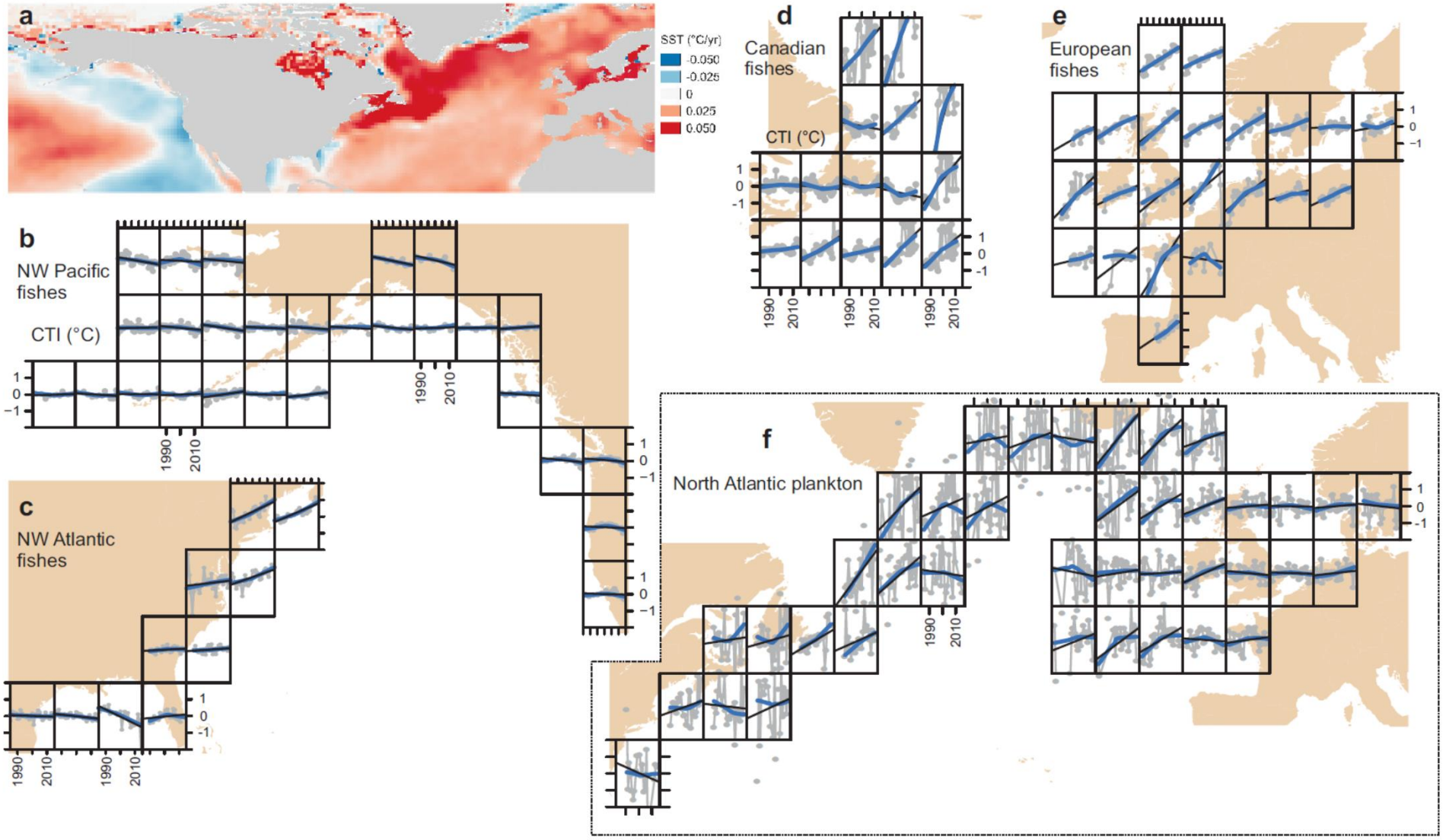
Ocean community warming responses explained by thermal affinities and temperature gradients



Mike Burrows

Michael T. Burrows[1*], Amanda E. Bates[2,3], Mark J. Costello[4], Martin Edwards[5,6], Graham J. Edgar[7], Clive J. Fox[1], Benjamin S. Halpern[8,9], Jan G. Hiddink[10], Malin L. Pinsky[11], Ryan D. Batt[11], Jorge García Molinos[12,13,14], Benjamin L. Payne[1], David S. Schoeman[15,16], Rick D. Stuart-Smith[7] and Elvira S. Poloczanska[17,18]

CTI Tracks Temperature



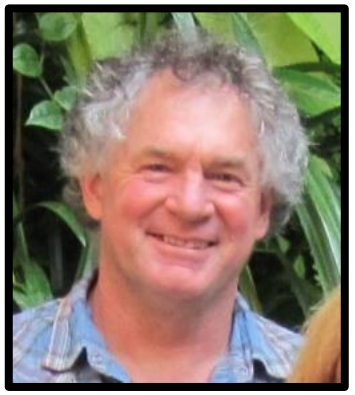
nature climate change

LETTERS

PUBLISHED ONLINE: 1 DECEMBER 2013 | DOI: 10.1038/NCLIMATE2062

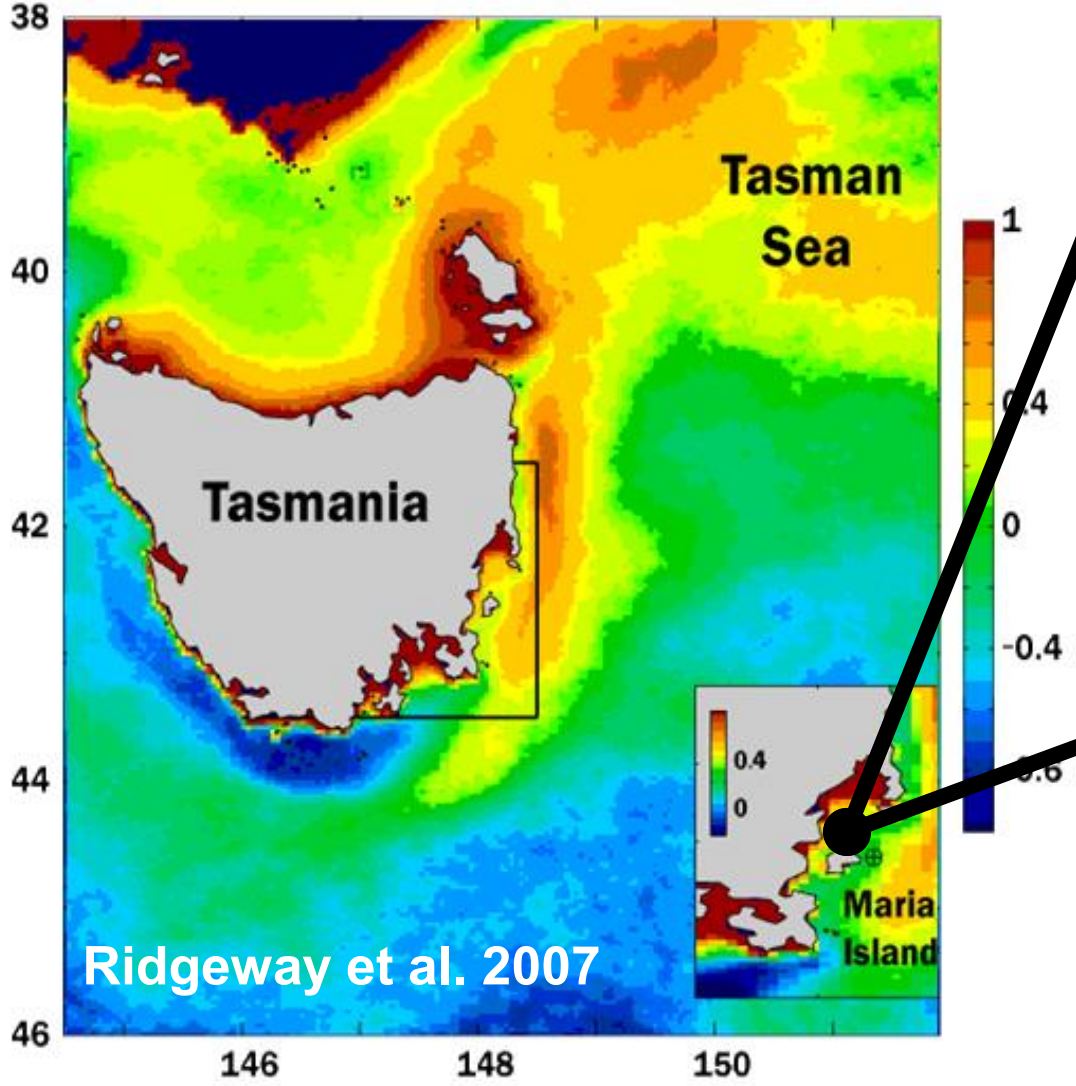
Resilience and signatures of tropicalization in protected reef fish communities

Amanda E. Bates[1,2]*, Neville S. Barrett[1], Rick D. Stuart-Smith[1], Neil J. Holbrook[1,3], Peter A. Thompson[4] and Graham J. Edgar[1]



Neville Barrett

Biodiversity Change in an Ocean Warming Hotspot



Annual surveys for reef fish abundance conducted annually for 20 years (1992 to 2012)

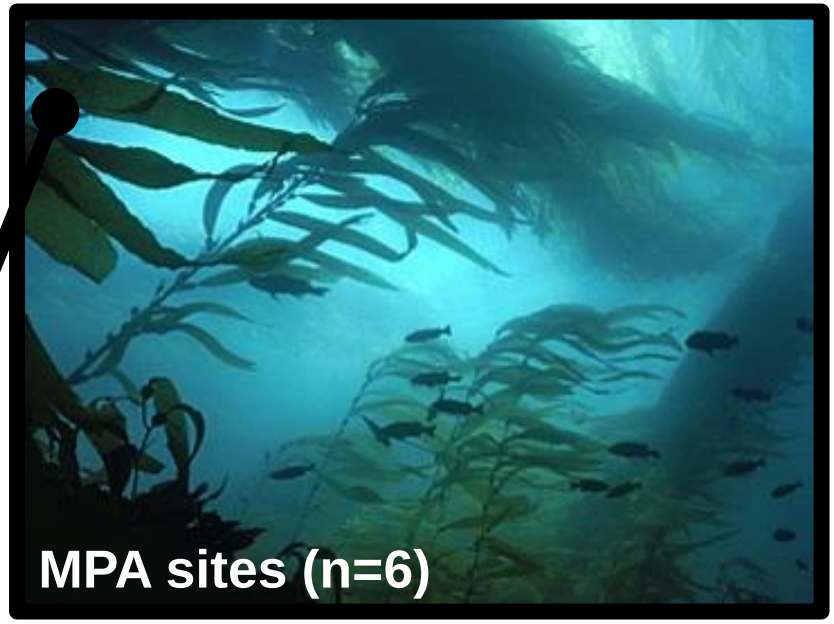
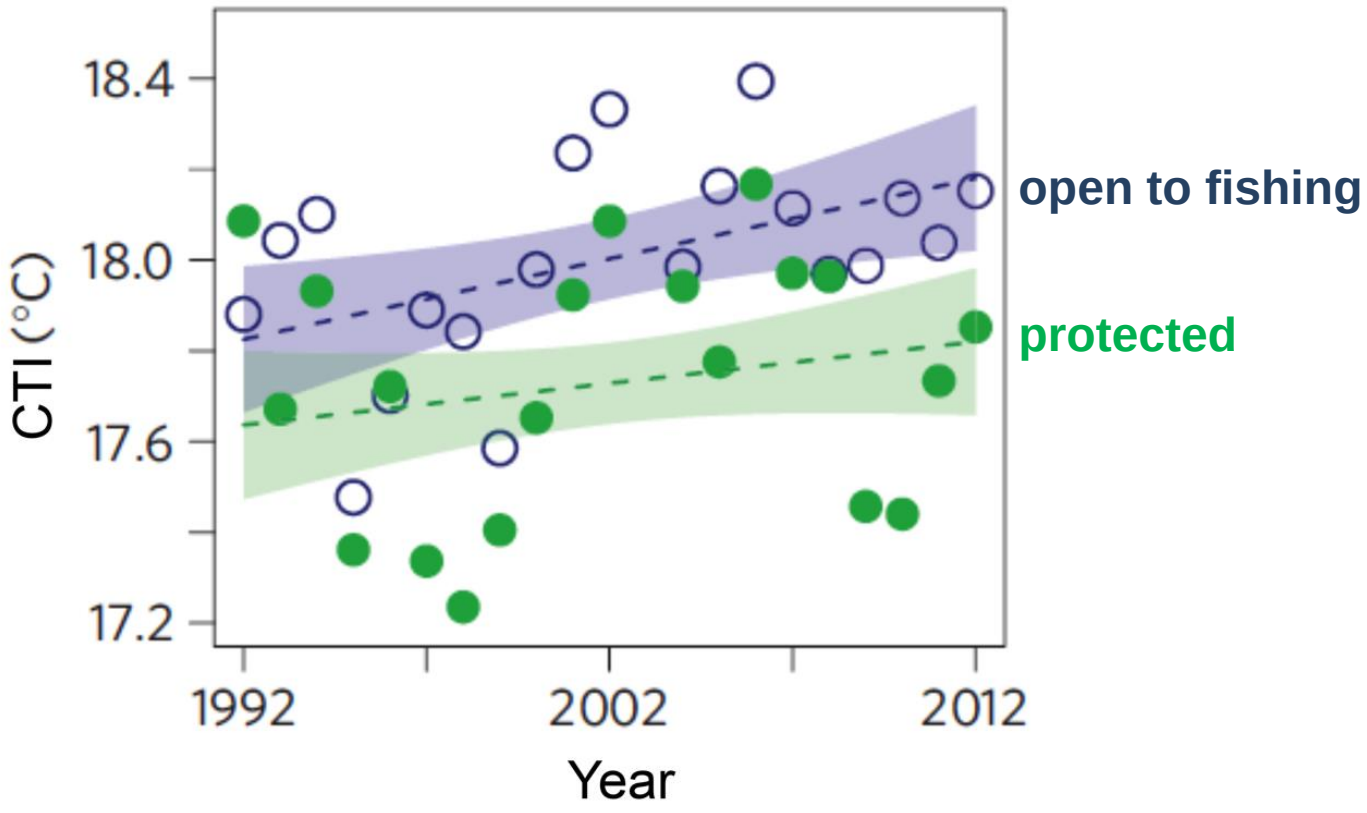


Image: R. Stuart-Smith

CTI Reveals Warming Resilience in MPAs



Global Ecology and Biogeography

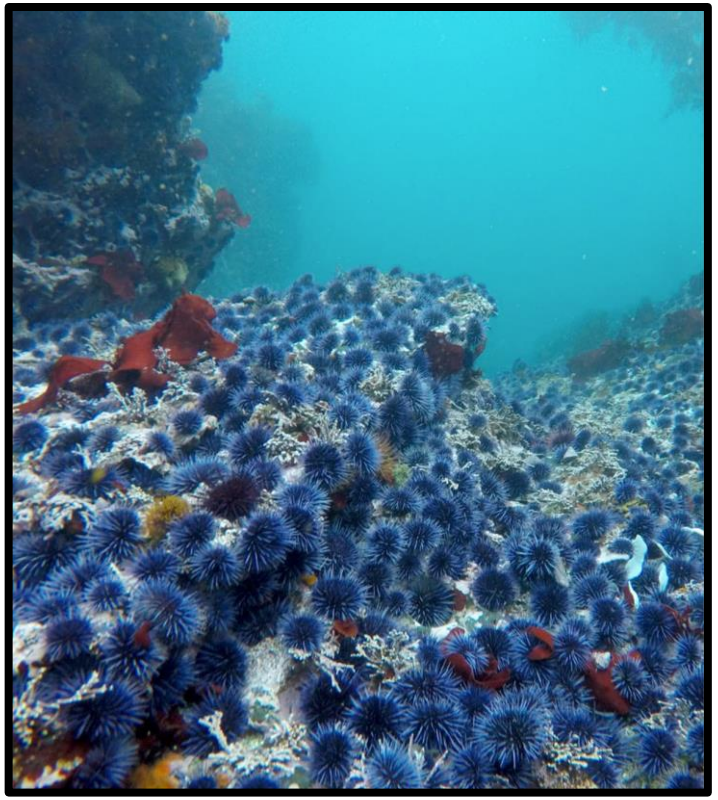
A Journal of Macroecology

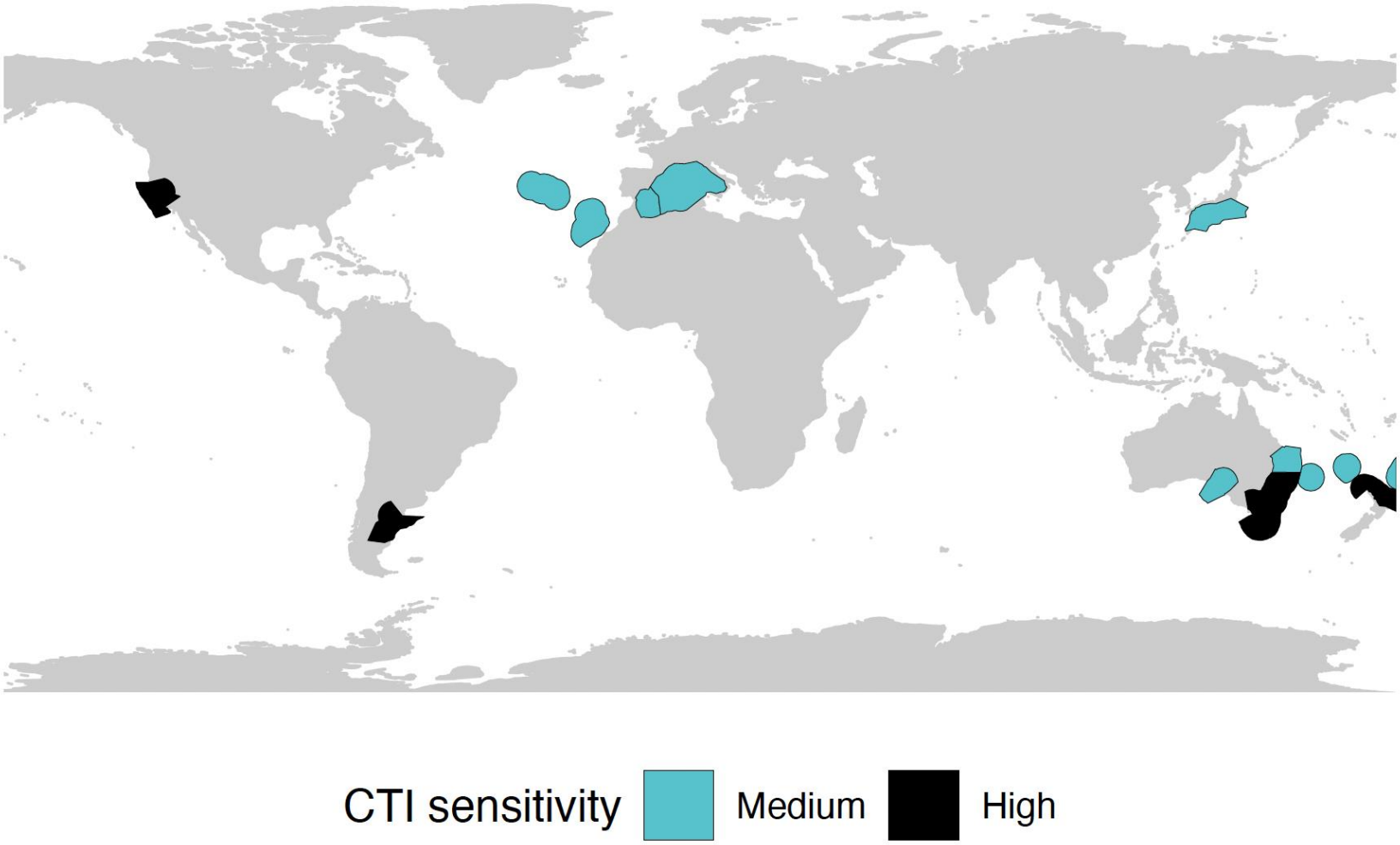
RESEARCH ARTICLE

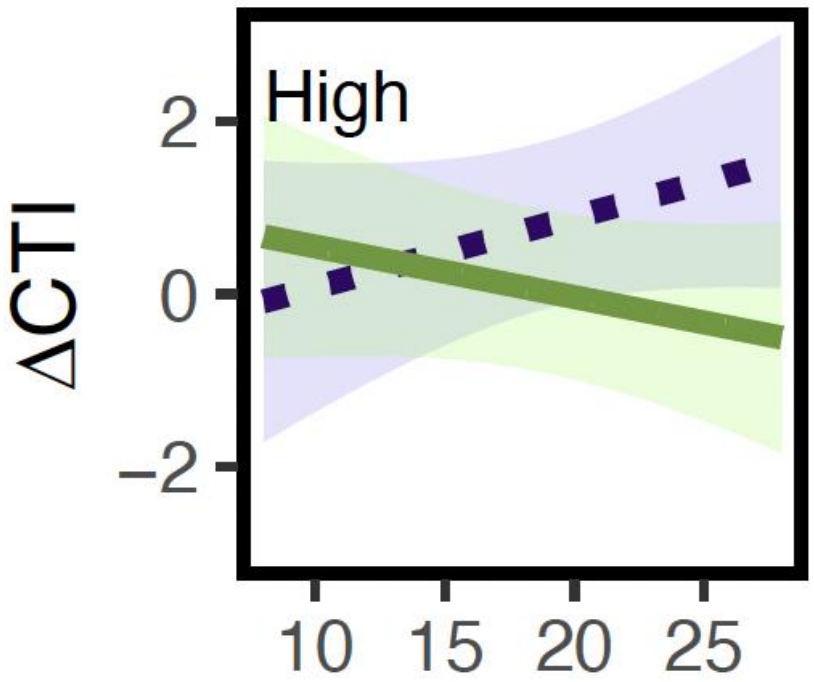
Tropicalization of temperate reef fish communities facilitated by urchin grazing and diversity of thermal affinities

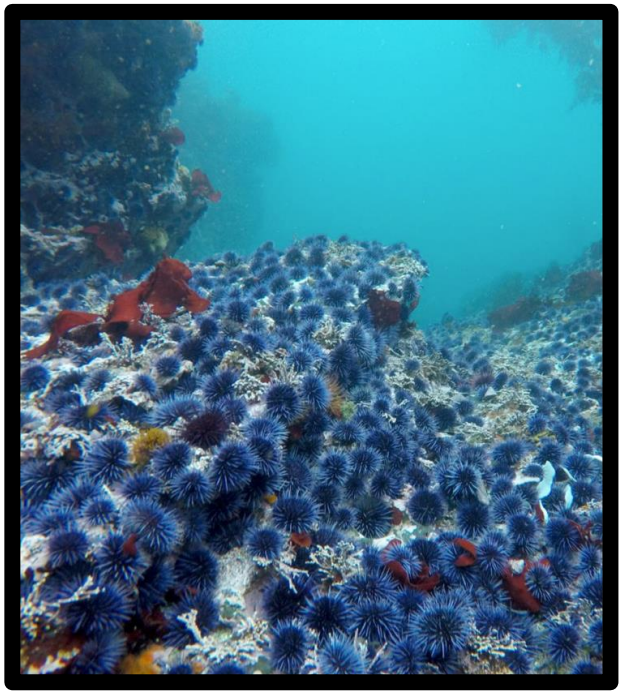
Jasmin M. Schuster ✉, Rick D. Stuart-Smith, Graham J. Edgar, Amanda E. Bates

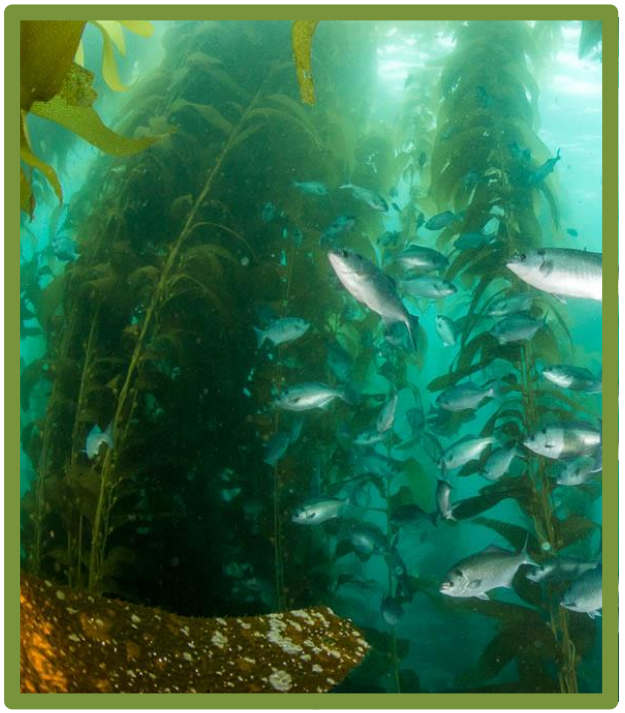
Jasmin Schuster




CTI sensitivity
Medium
High


High
2
0
−2
ΔCTI
10
15
20
25





Reef Fish Thermal Index

Indicator description

https://www.bipindicators.net/indicators/reef-fish-thermal-index

Related Aichi Targets

Expand

Primary target

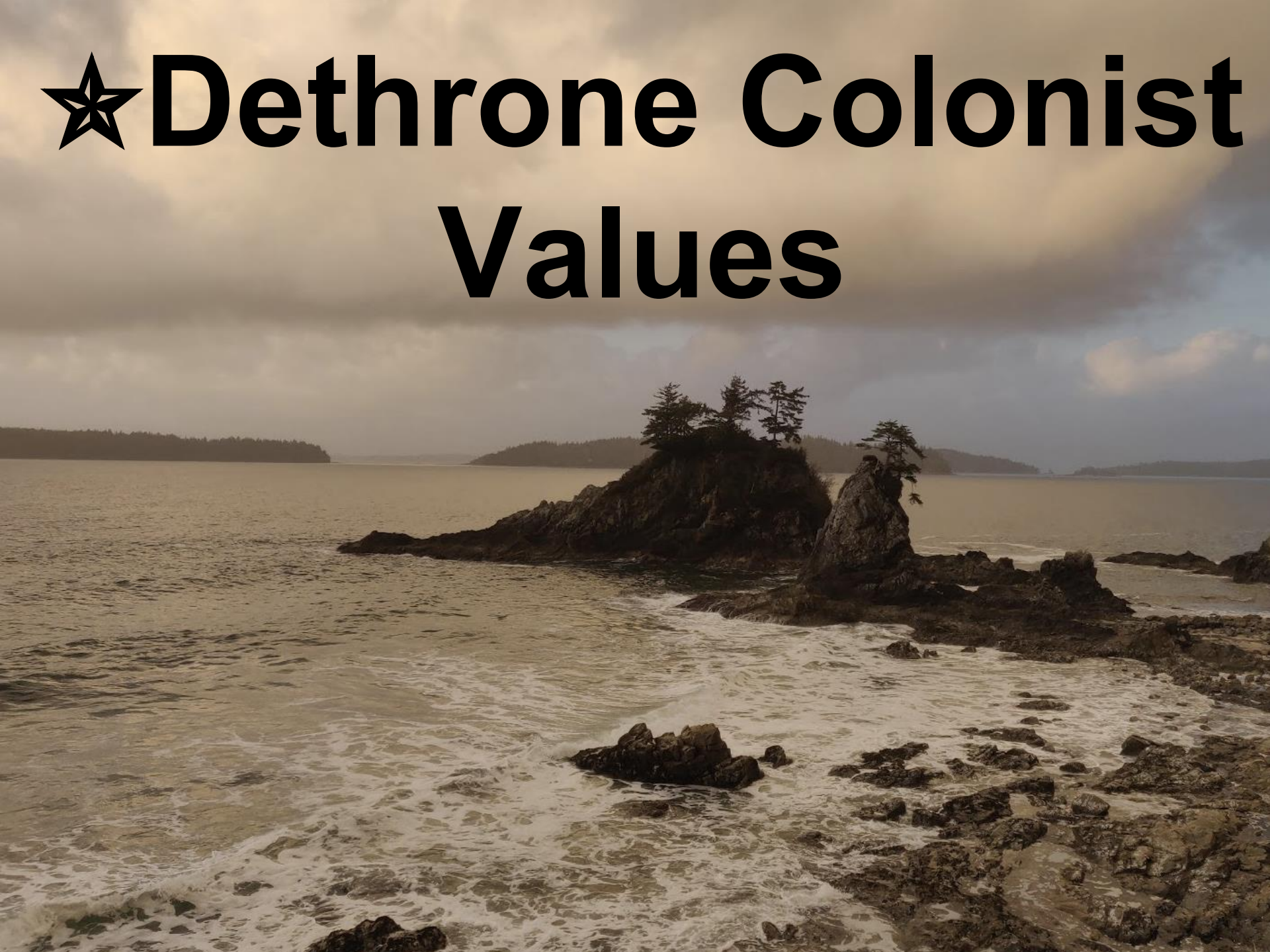
Target 10:
By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.

Related SDGs

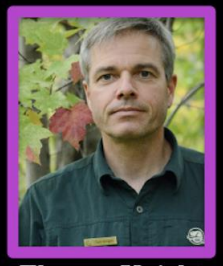
Expand

GOAL 14 - Conserve and sustainably use the oceans, seas and marine resources for sustainable development.

⛤Dethrone Colonist Values



Anna Metaxas
Dal



Thomas Knight
Parks Canada

Megan Bailey
Dal

Ian Fleming
MUN

Jennifer Janes
DFO

Rachel Sipler
MUN

Paul Snelgrove
MUN

Paul McCarney
NG

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Clark Richards
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Chantal Vis
Parks Canada

Sid Pain
Oceans North

Katleen Robert
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Dave Cote
DFO

Mary Denniston
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Joern Schmidt
Kiel

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Darroch Whitaker
Parks Canada

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Kirstin Meyer-Kaiser
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CPAWS

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Eric Oliver
Dal

Travis van Leeuwen
DFO

Melanie Zurba
Dal

Rodd Laing
NG

Susanna Fuller
Oceans North

Aaron MacNeil
Dal

Early Career | CRC | Senior Leader | International | Partner

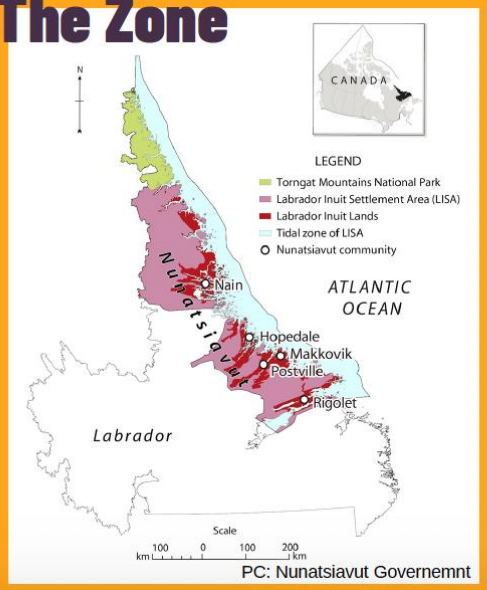
Who are we?

This is a ***transdisciplinary*** project in which scientists, community members and students **learn** together, build **relationships** and create **bonds.** This leads to the interaction of Inuit Knowledge and western science to understand the changes within Nunatsiavut's environment.

Project Focus

We aim to advance knowledge that will support informed decisions and planning for the Zone of the Labrador Inuit Settlement Area and ensure protection of Inuit interests into the future.

The Zone



PC: Nunatsiavut Governemnt

Our Work

How do we work together?

We interact with community members and project partners to learn about experiences with previous projects, and how to best work together in research. Identifying important topics of focus for Labrador Inuit.

On-ice and ocean monitoring

We organize community-engaged ocean and sea ice monitoring - involving community members in ice and water focused data collection.
E.g. Measuring sea ice thickness to examine environmental change across Nunatsiavut.

Coastal mapping and species migration

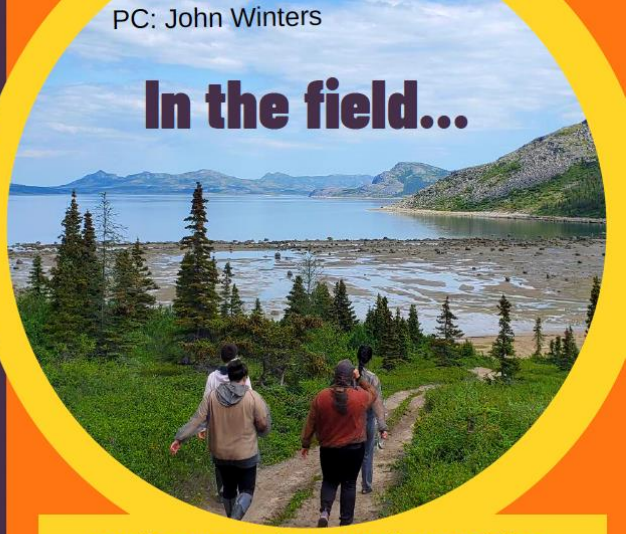
We are mapping the ocean floor by collecting information on research cruises, small boats and with drones. We also examine Arctic char health, migration patterns, eating habits, and more.

Predicting change

We gather information from across the project and from other diverse sources to create predictions that identify ecosystem and climate change indicators within the Zone.

PC: John Winters

In the field...



Project members Sydney Dicker, Kayla Wyatt, Nathan Jacque, and Katrina Anthony on their way to put out temperature collection devices in Annainaks brook, Nain.

In the lab...

PC: Sydney Dicker

Inuit Research Coordinator John Winters dissecting an Arctic char to collect its otolith (or "ear stone") for aging.

Imappivut (Our Oceans) is a Nunatsiavut marine plan guided by the values, knowledge, and interests of Labrador Inuit.

Imappivut - Our Oceans

@imappivut · Community

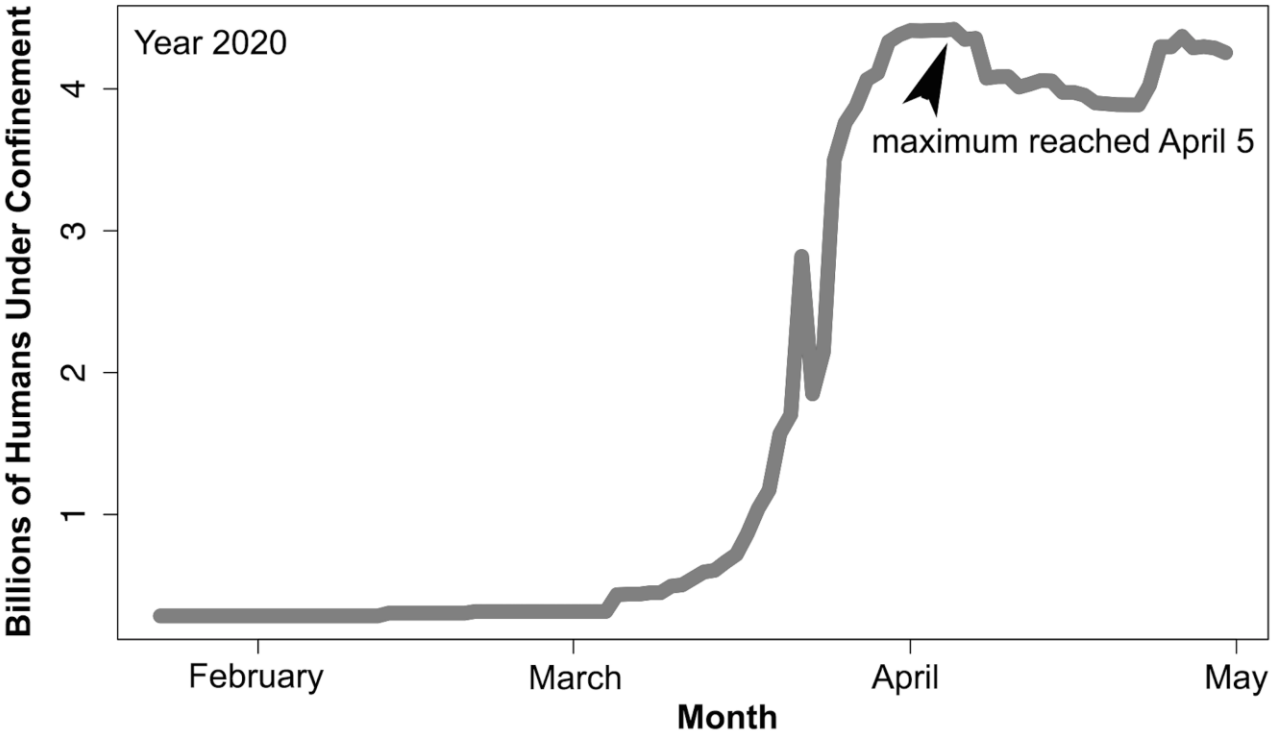
Send Message

ʔiisaak
Greater Respect. Personal and collective respect for the community and its people, traditional knowledge, the natural world, the metaphysical world and other peoples and communities.

ʔuuʔałuk
Taking Care Of… In this context, this is about taking care of present and future generations as well as taking care of the resources provided by the land and the natural world.

Hišuk ma c̓awak
Everything is One. A notion of the interconnected, interdependent and reciprocal relationship between the people, the land and wider worlds in a physical, spiritual and social sense.

Unexpected opportunity to examine relationships between humans and nature



Contents lists available at ScienceDirect

Biological Conservation

journal homepage: www.elsevier.com/locate/biocon

Policy analysis

COVID-19 pandemic and associated lockdown as a "Global Human Confinement Experiment" to investigate biodiversity conservation

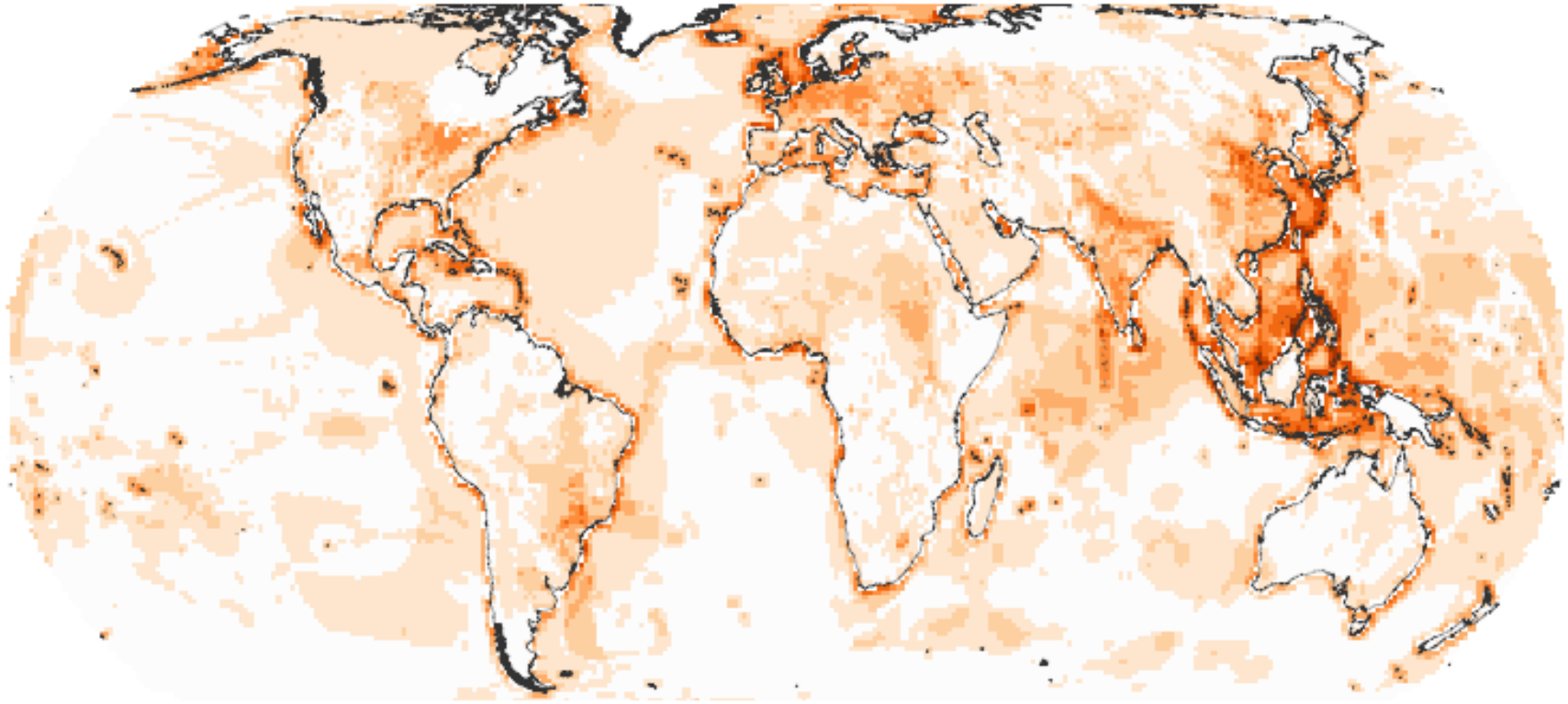
Amanda E. Bates[a,*], Richard B. Primack[b], Paula Moraga[c], Carlos M. Duarte[d]

Biological Conservation
Volume 263, November 2021, 109175

Global COVID-19 lockdown highlights humans as both threats and custodians of the environment

Amanda E. Bates [a], Richard B. Primack [b], Brandy S. Biggar [a], Tomas J. Bird [c], Mary E. Clinton [a], Rylan J. Command [d], Cerren Richards [a], Marc Shellard [e], Nathan R. Geraldi [e], Valeria Vergara [f], Orlando Acevedo-Charry [g], Zuania Colón-Piñeiro [h], David Ocampo [g], Natalia Ocampo-Peñuela [i], Lina M. Sánchez-Clavijo [i], Cristian M. Adamescu [j], Sorin Cheval [k], Tudor Racoviceanu [j], Matthew D. Adams [l], Egide Kalisa [l], Vincent Z. Kuuire [l], Vikram Aditya [m], Pia Anderwald [n], Samuel Wiesmann [n], Sonja Wipf [n], Gal Badihi [o], Matthew G. Henderson [o], Hanspeter Loetscher [p], Katja Baerenfaller [q], Lisandro Benedetti-Cecchi [r], Fabio Bulleri [r], Iacopo Bertocci [r], Elena Maggi [r], Luca Rindi [r], Chiara Ravaglioli [r], Kristina Boerder [s], Julien Bonnel [t], Delphine Mathias [u], Philippe Archambault [v], Laurent Chauvaud [w], Camrin D. Braun [x], Simon R. Thorrold [x], Jacob W. Brownscombe [y], Jonathan D. Midwood [y], Christine M. Boston [y], Jill L. Brooks [z], Steven J. Cooke [z], Victor China [aa], Uri Roll [aa], Jonathan Belmaker [ab, fr], Assaf Zvuloni [ac], Marta Coll [ad], Miquel Ortega [ae], Brendan Connors [af], Lisa Lacko [af]

Cumulative

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