Theory and empirics suggest

An end to overfishing will help Small-Scale Fisheries (SSFs) thrive in a warmer world

Erica M. Ferrer | Aburto Lab
Scripps Institution of Oceanography

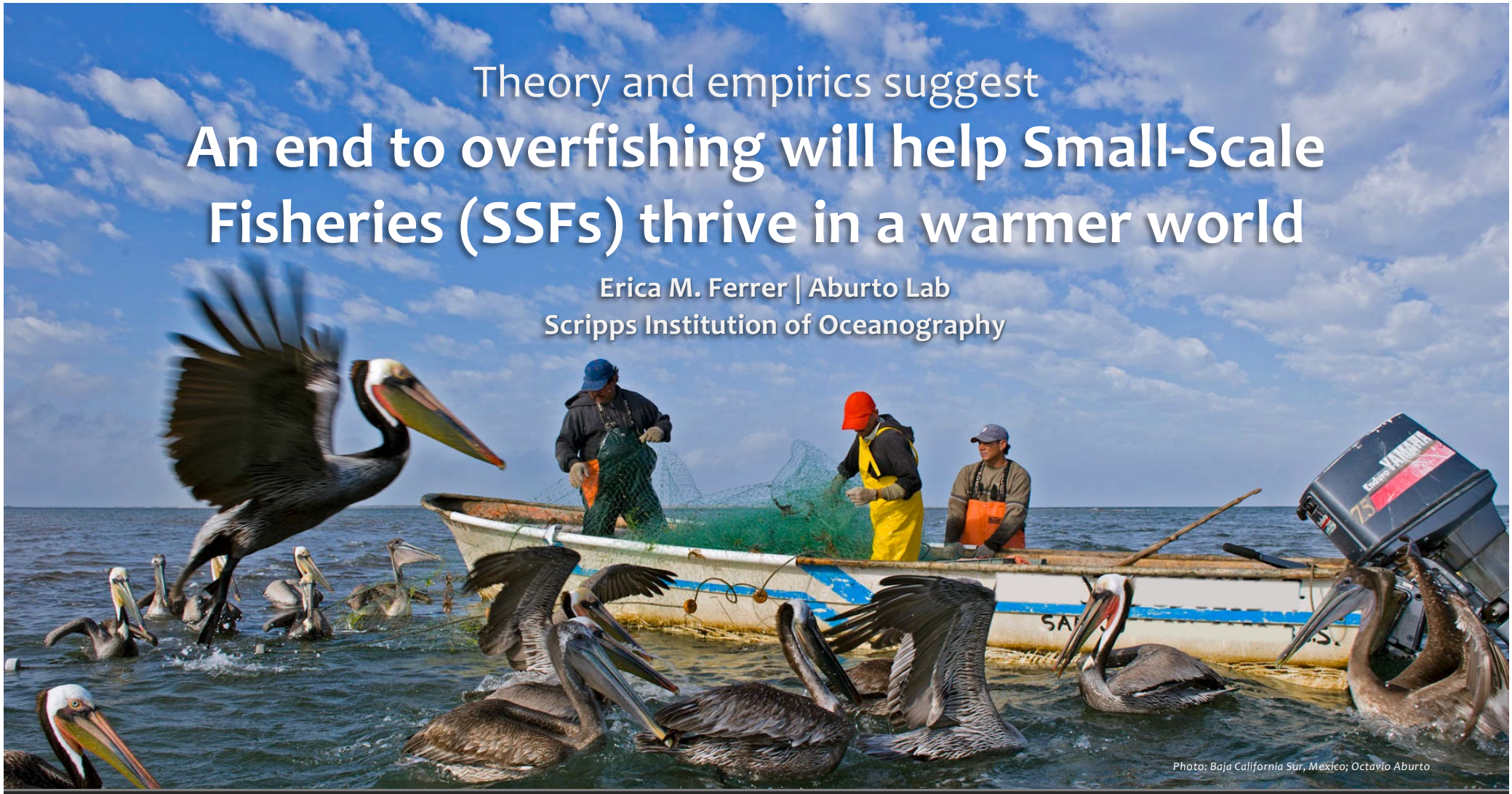


Photo: Baja California Sur, Mexico; Octavio Aburto


Pollution & human impact
Policy & decision making
CO_2 emissions of fishing vessels
Fish, marine life & food webs
Seafloor & marine habitat

Our Fish

An Impending Emergency

- Under the current version of countries' pledges to the Paris Agreement (known as "NDCs"), **we are on track for 2.9 – 3.4°C anthropogenic warming by 2100** (UNFCC IPCC 1.5°C Special Report, 2018, pp. 357).

- Simultaneously, we are confronted with the question **how best to feed an expanding human population?** (FAO SOFIA Report, 2018 ; FAO SOFI Report, 2019)

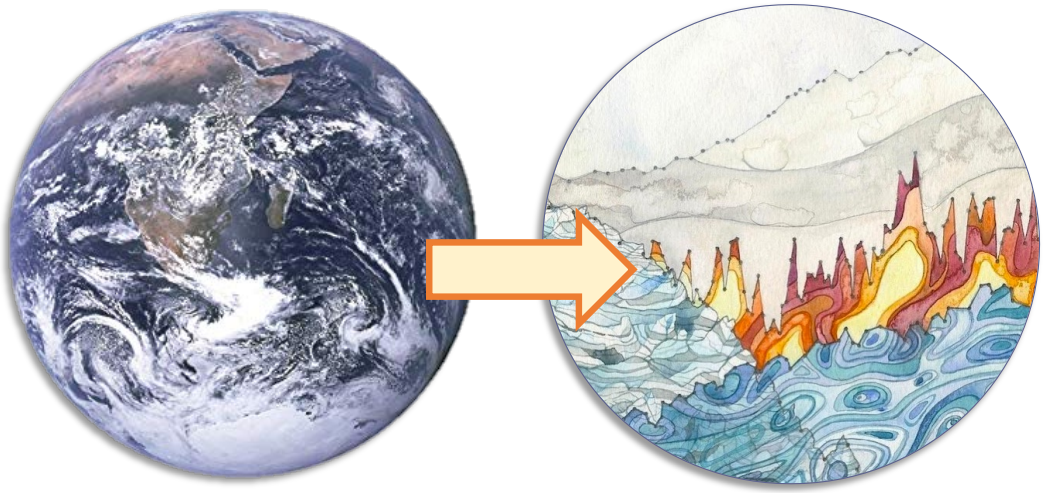
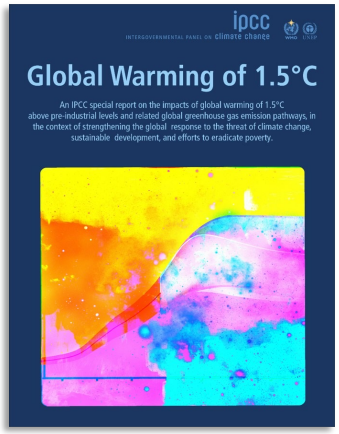
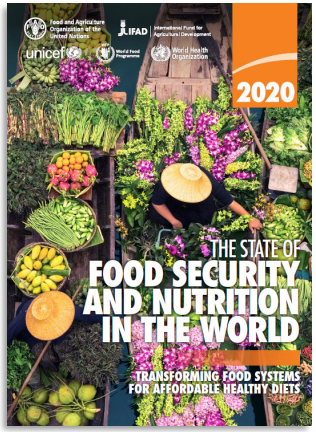


Image: Landscape of Change, Jill Pelto





- Food accounts for ~1/3 of all anthropogenic greenhouse gas emissions (Crippa et al., 2021).
- Some studies have pointed to seafood as a source of low-carbon protein (e.g., Hilborn et al., 2018).
- Of the studies that provide carbon dioxide (CO_2) or CO_2-equivalent (CO_2e) estimates for food, only a handful provide information about small-scale fisheries (SSFs).
- This is at odds with the important role that SSFs play around the world.

Images: Pixabay, royalty free

In addition to reducing emissions, climate action requires carbon accounting &

An understanding of what we're doing right vs. wrong

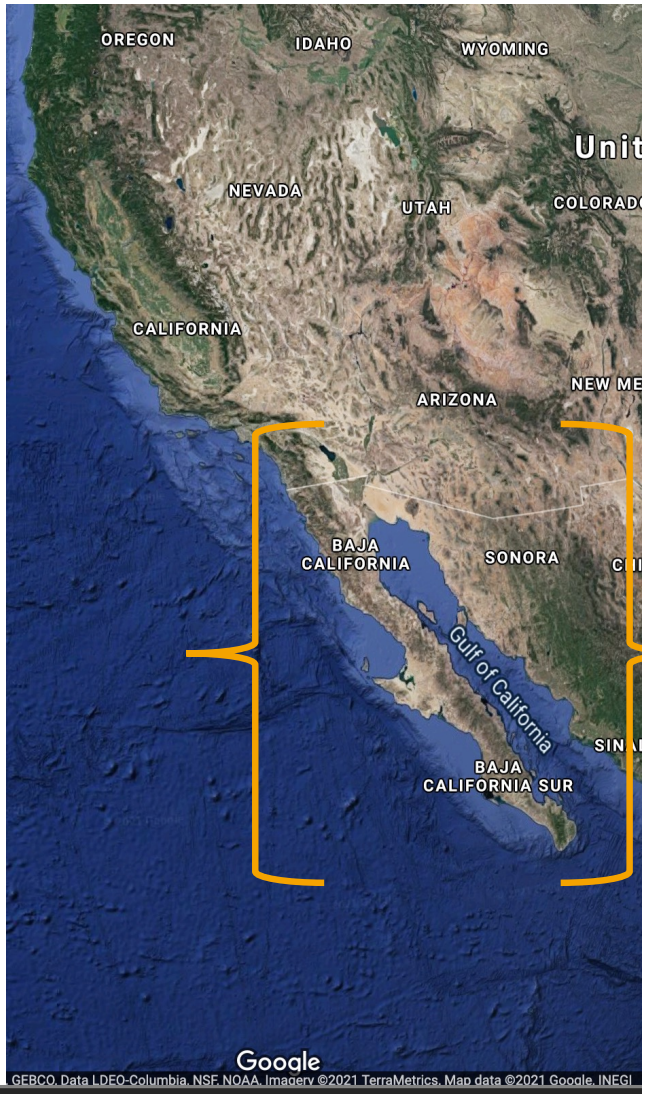
Images: Pixabay

SSFs in Northwest Mexico, ca. Baja California

- SSFs in NW are highly productive contributing over half of the biomass (kg) landed by Mexican SSFs (dataMares – CONAPESCA, 2020).

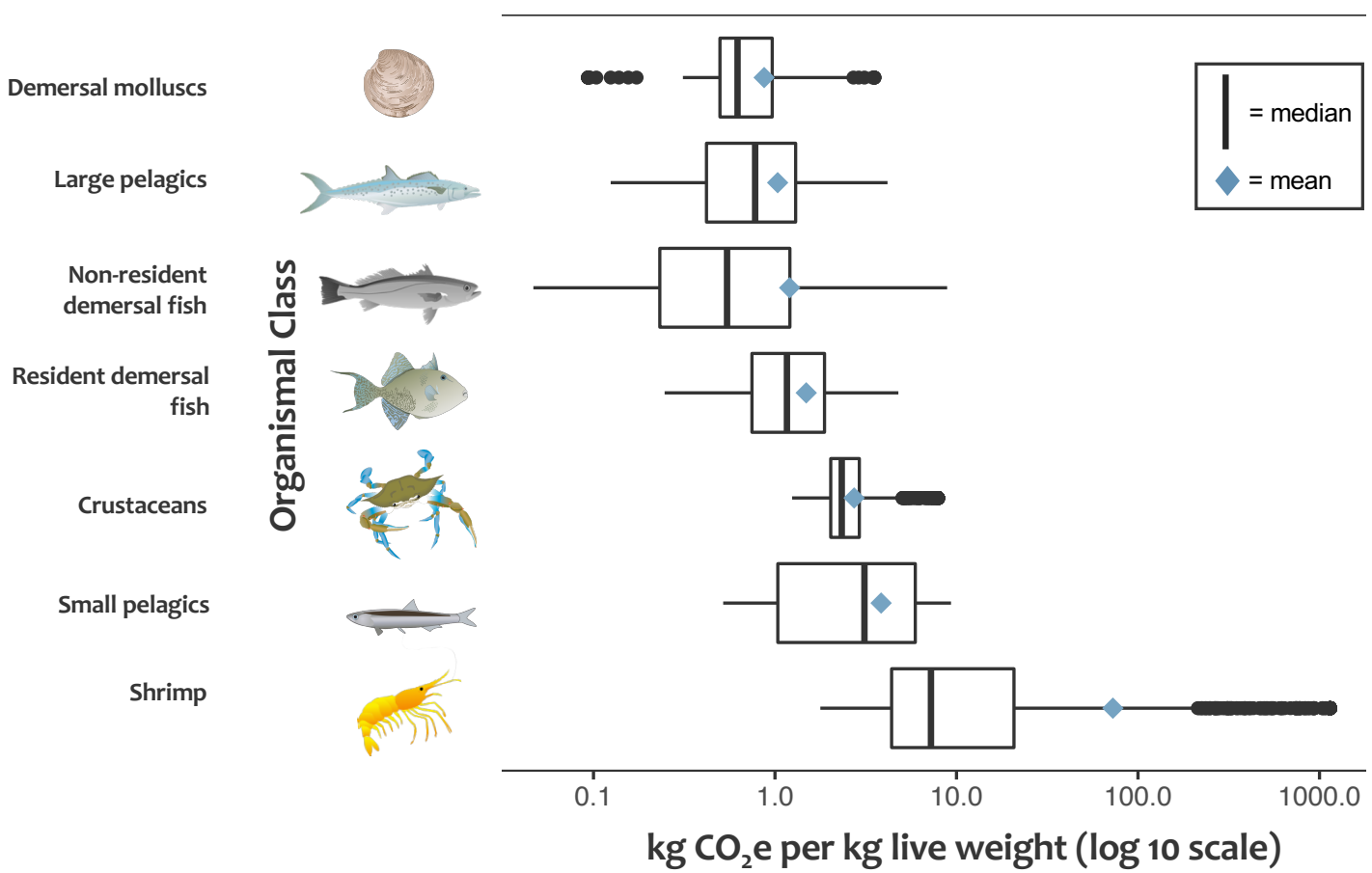
GC MARINE PROGRAM

- As part of the Gulf of California Marine Program (GCMP), we have collected novel tracking data as well as traditional fisheries logbook data for nearly 10 years.



Emission Intensities for Common SSF Products

Ferrer et al. (2021) *Fisheries, in press*



kg CO_2e per kg live weight *(/kg protein)*

0.87 *(10.89)*

1.03 *(12.93)*

1.20 *(15.06)*

1.49 *(18.58)*

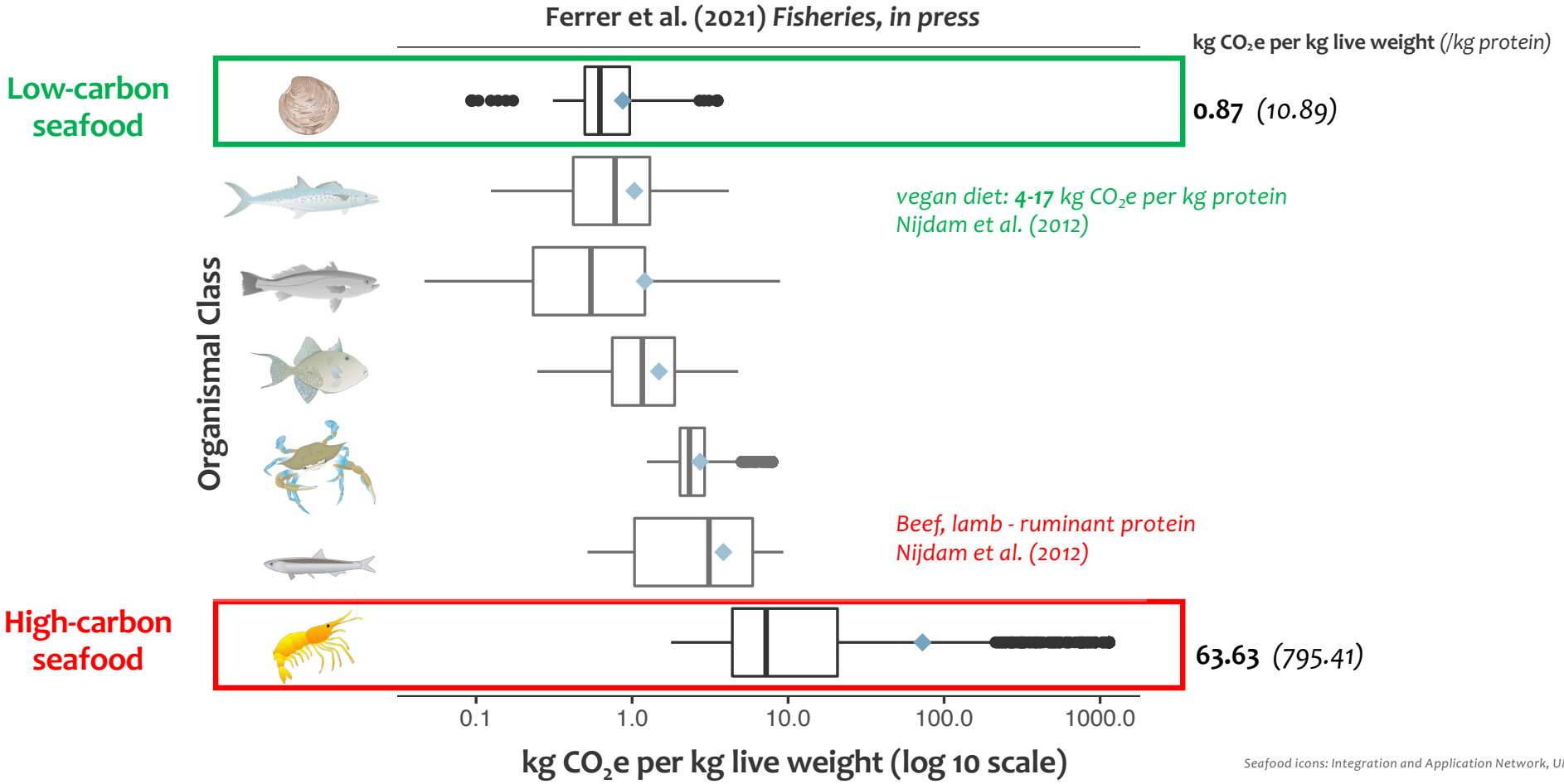
2.73 *(34.12)*

3.84 *(48.05)*

72.73 *(909.18)*

Seafood icons: Integration and Application Network, UMCES

Emission Intensities for Common SSF Products



Seafood icons: Integration and Application Network, UMCES

Emission Intensities for Common SSF Products

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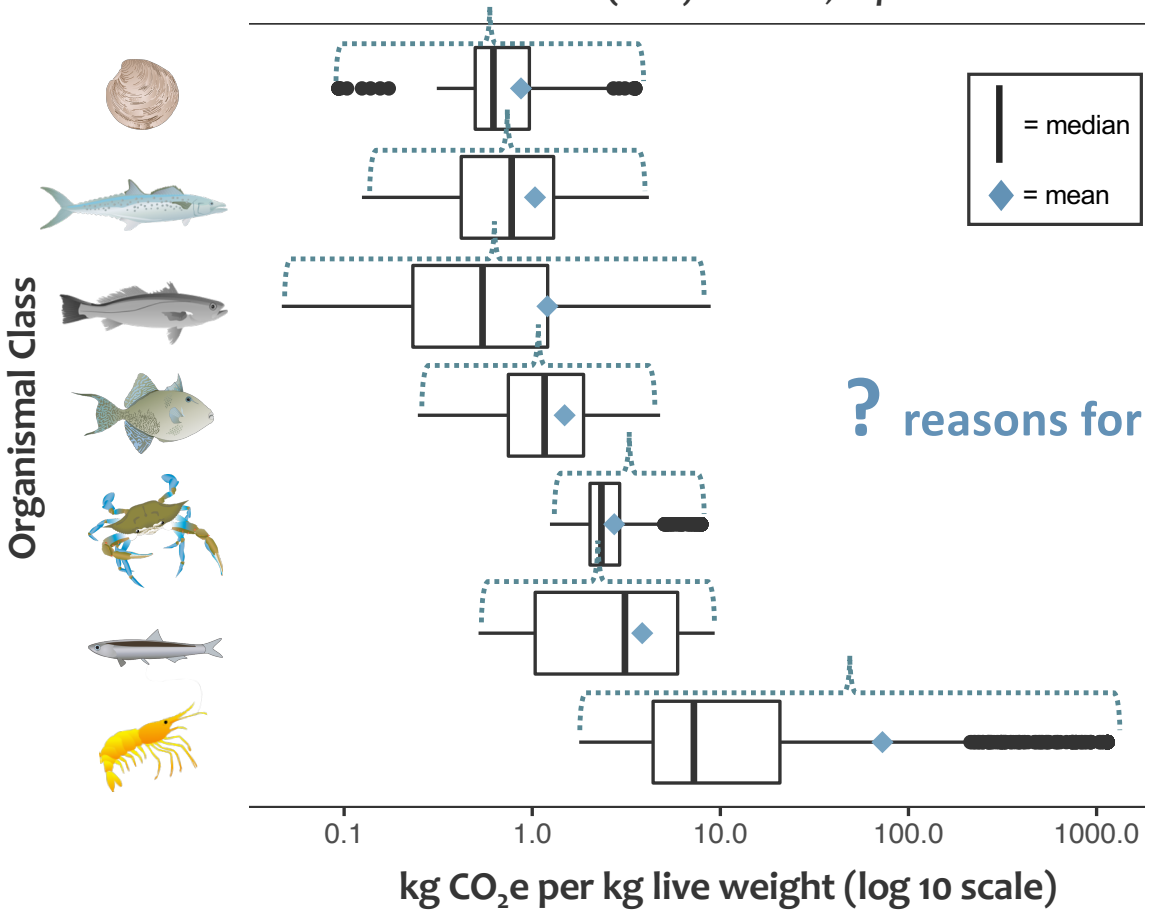
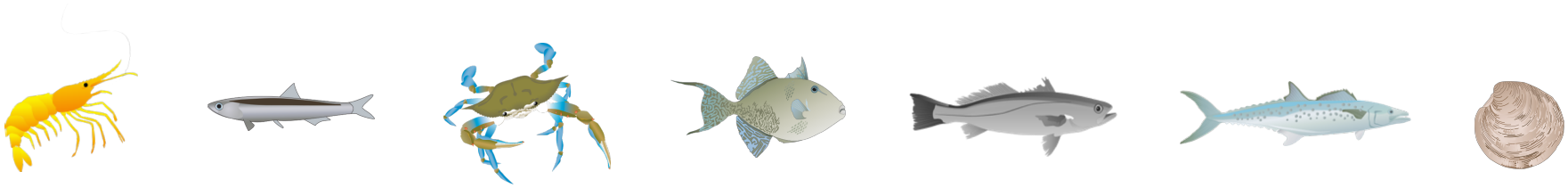


? reasons for variability

Seafood icons: Integration and Application Network, UMCES

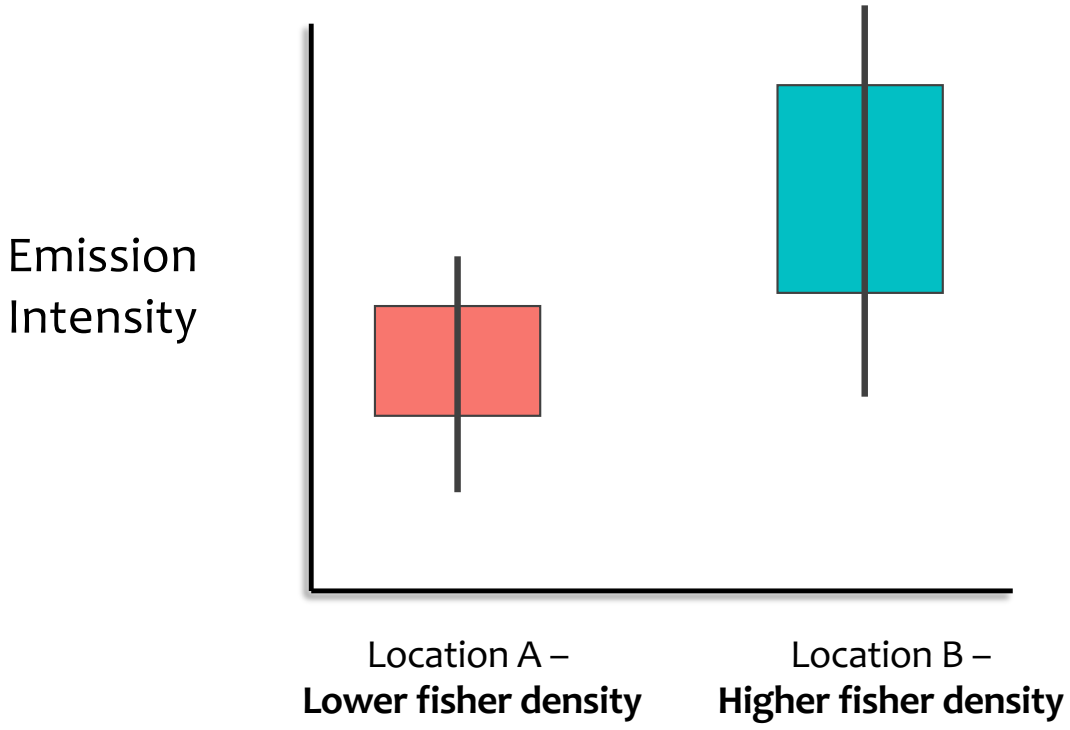
How does Emission Intensity relate to fishing pressure?

Emission Intensity vs Overfishing



Seafood icons: Integration and Application Network, UMCES

Emission Intensity is Higher in Areas with High Fisher Density



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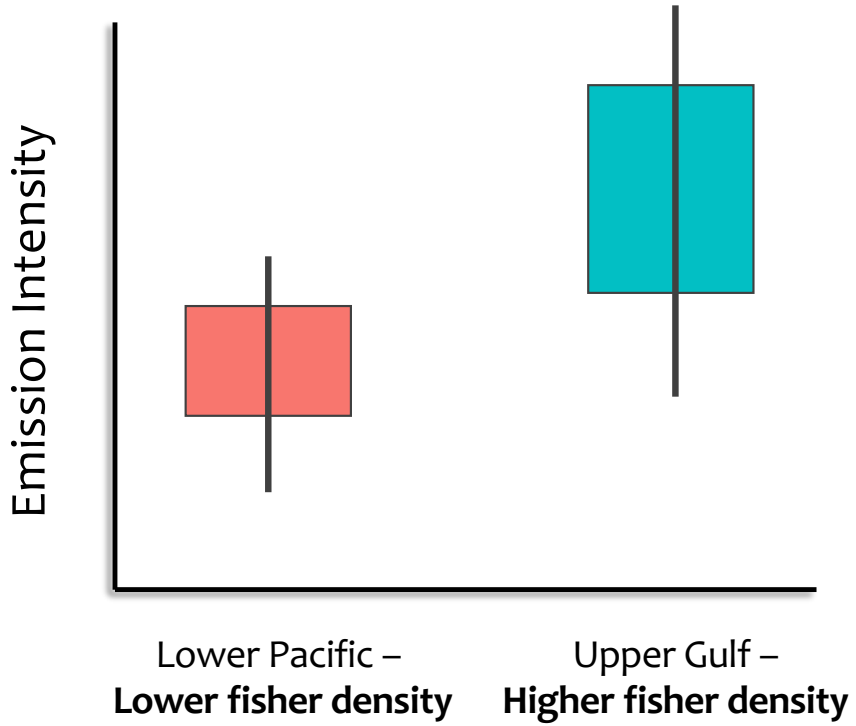
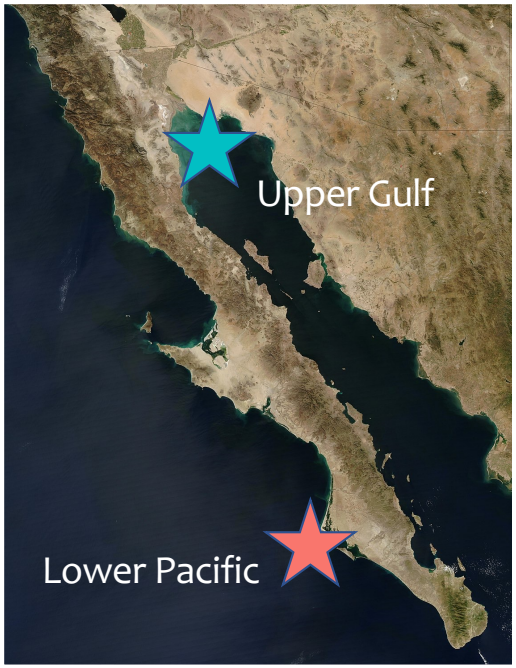
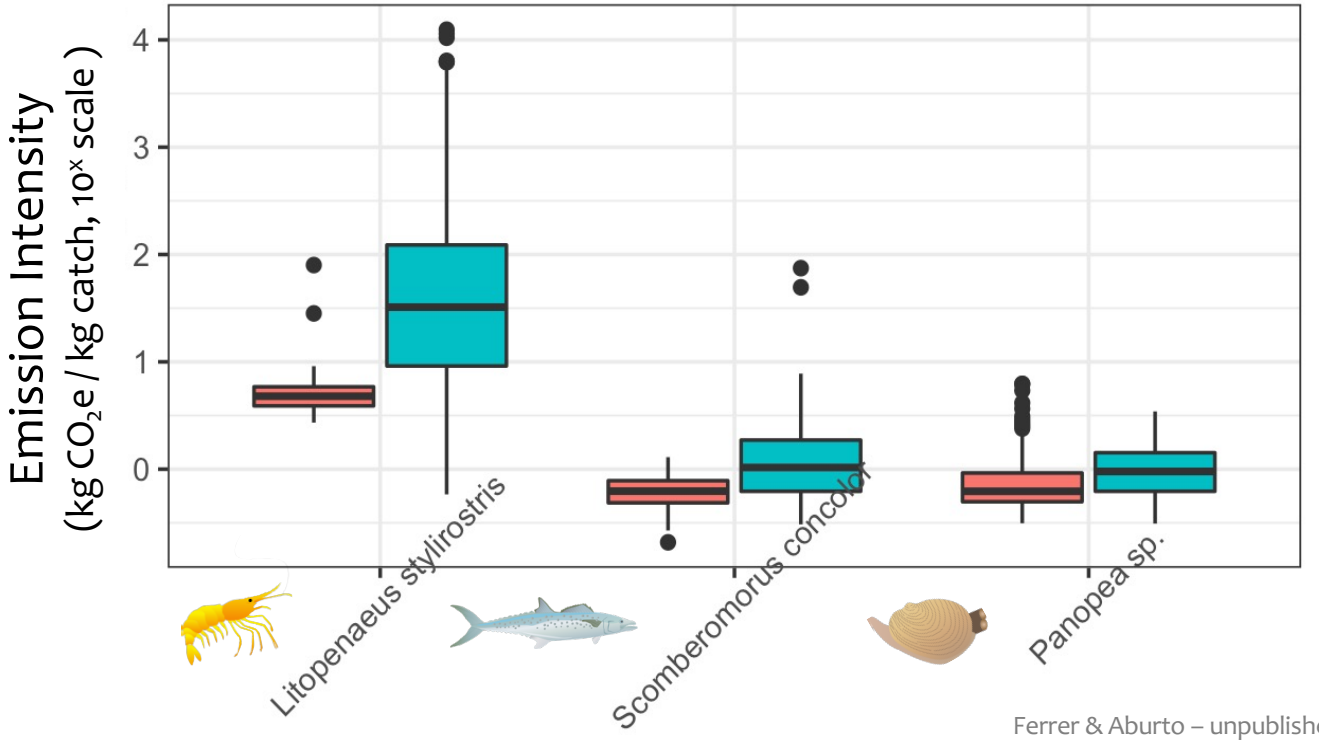


Preliminary Evidence



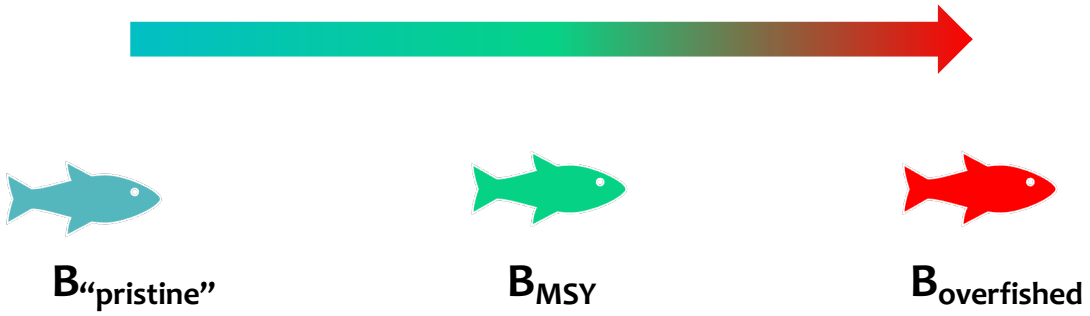


Ferrer & Aburto – unpublished

Seafood icons: Integration and Application Network, UMCES

Fishery Stock Biomass (kg)

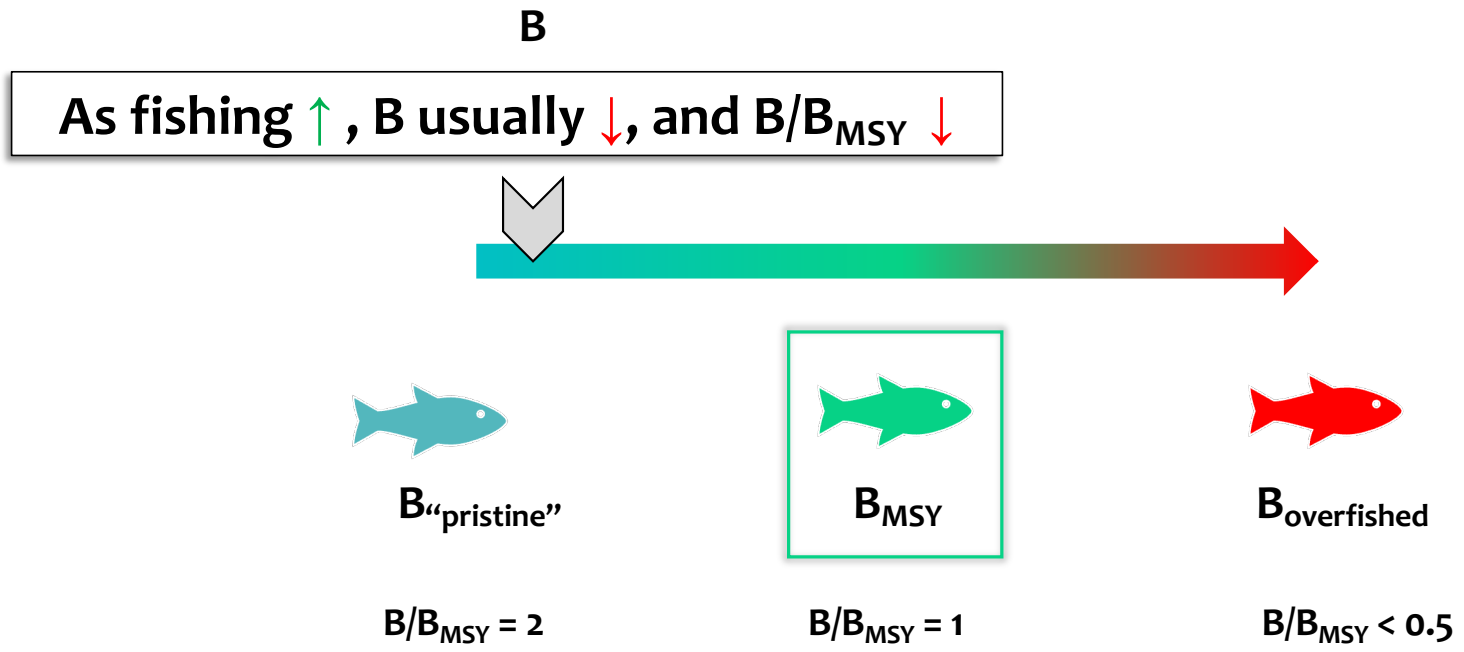
The status of fishery stock biomass exists on a gradient from “pristine” to “overfished”…



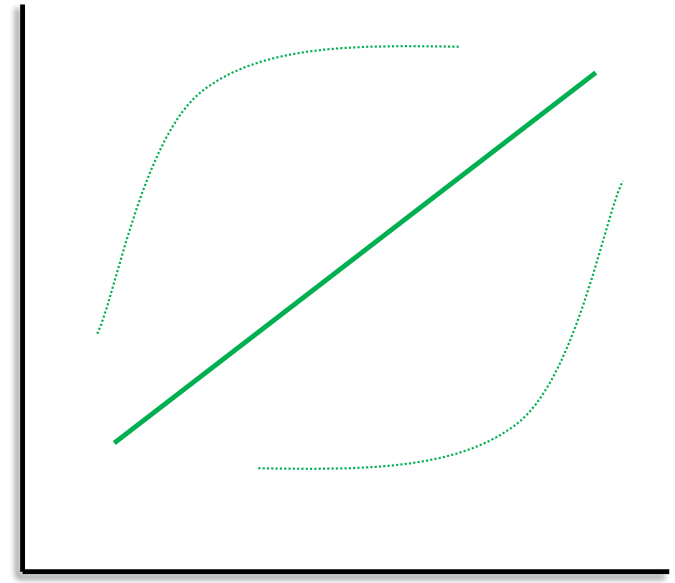
MSY = the highest possible annual catch that can be sustained over time

Fishery Stock Biomass (kg)

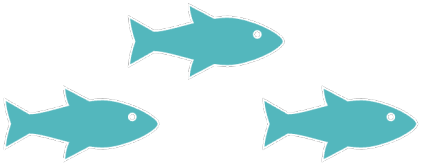
One proxy we can use to determine fishery stock status & fishery sustainability is B/B_{MSY} - available biomass (B) divided by $Biomass_{@MSY}$



Hypothetical Relationship
Between stock status and fuel intensity



Average Fuel *or*
Emissions Intensity



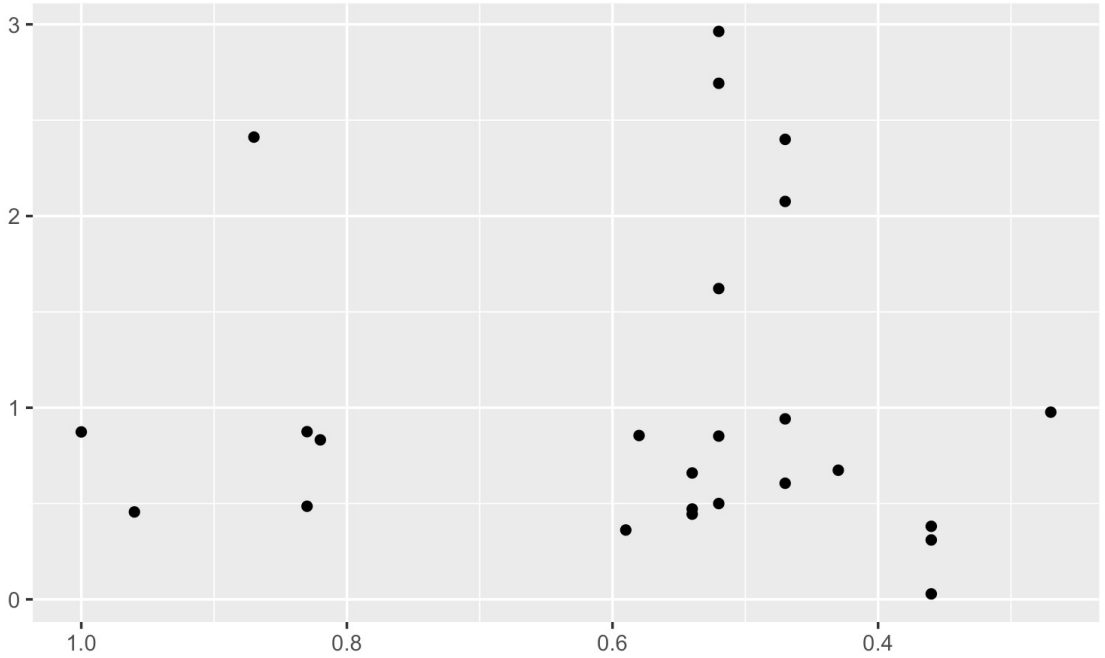
"Pristine" Biomass

Stock Biomass (B/B_{MSY})

Overexploited Biomass
(Overfishing)

Initial Evidence

Average Fuel Intensity
(liter per kg catch)

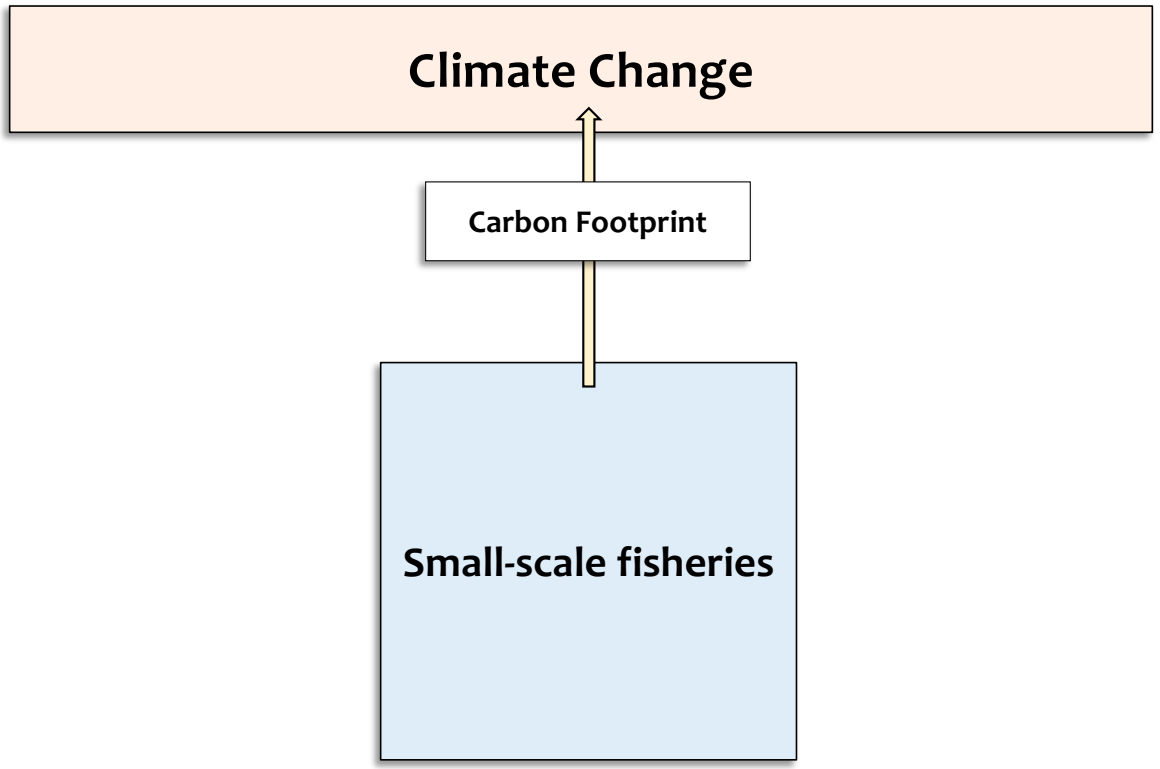


Stock Biomass (B/B_{MSY})

Based on methods by **Froese et al. (2017)** and research by **Giron-Nava et al. (2019)**

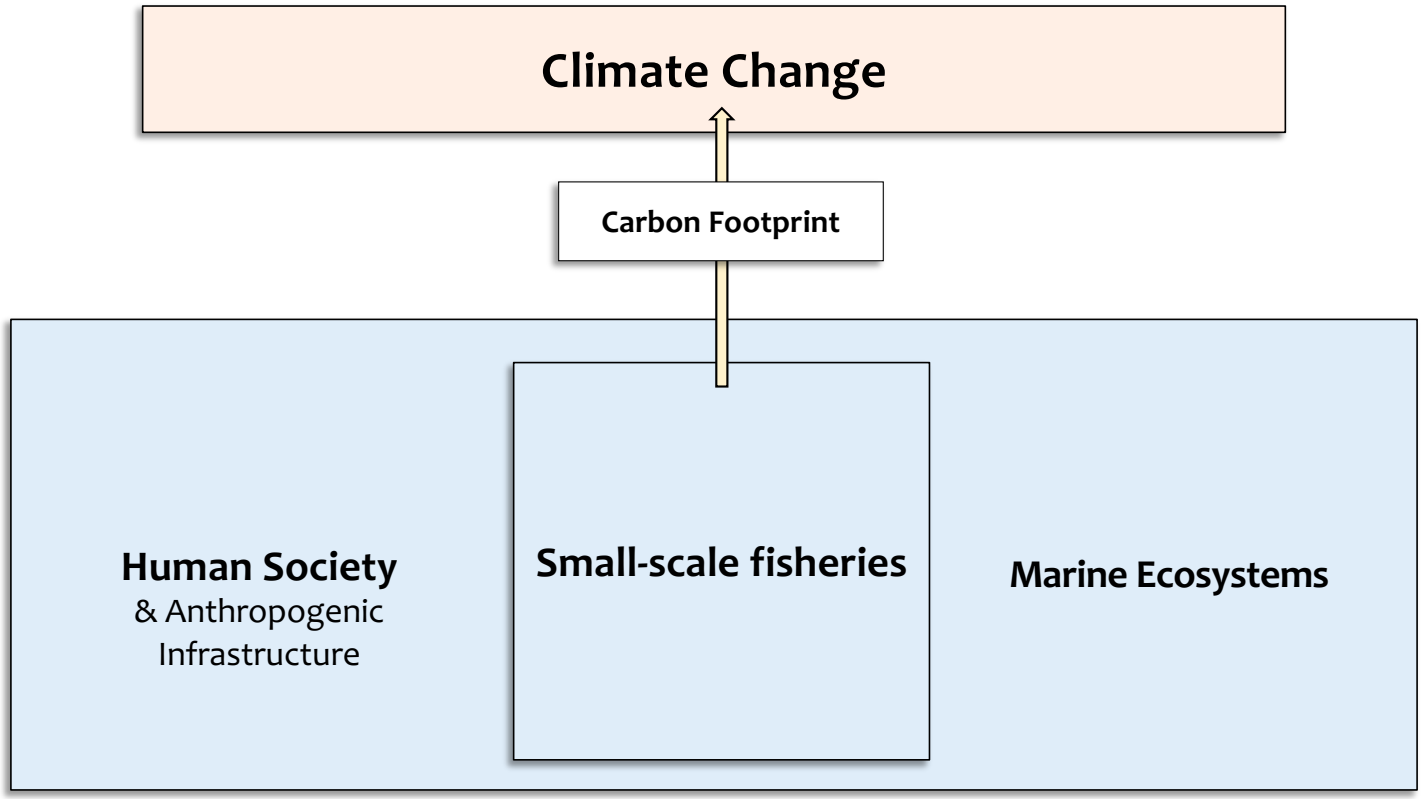
Ferrer & Aburto – unpublished, incomplete

Fisheries contribute to climate change via their carbon footprint



Small-scale fisheries are part of social-ecological systems

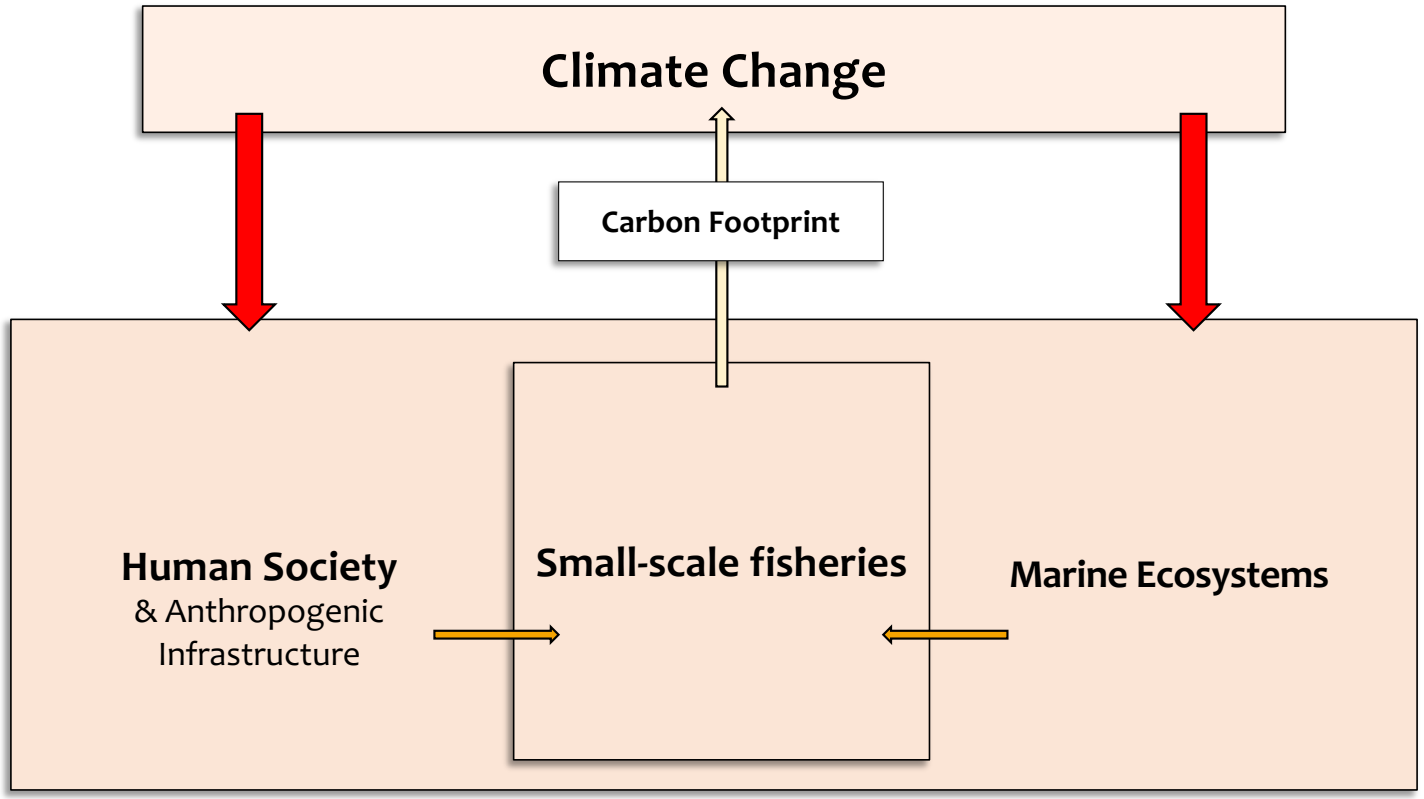
(e.g., Ostrom, 2007)



Ferrer & Aburto – unpublished

Climate change is likely to have negative effects on SSFs

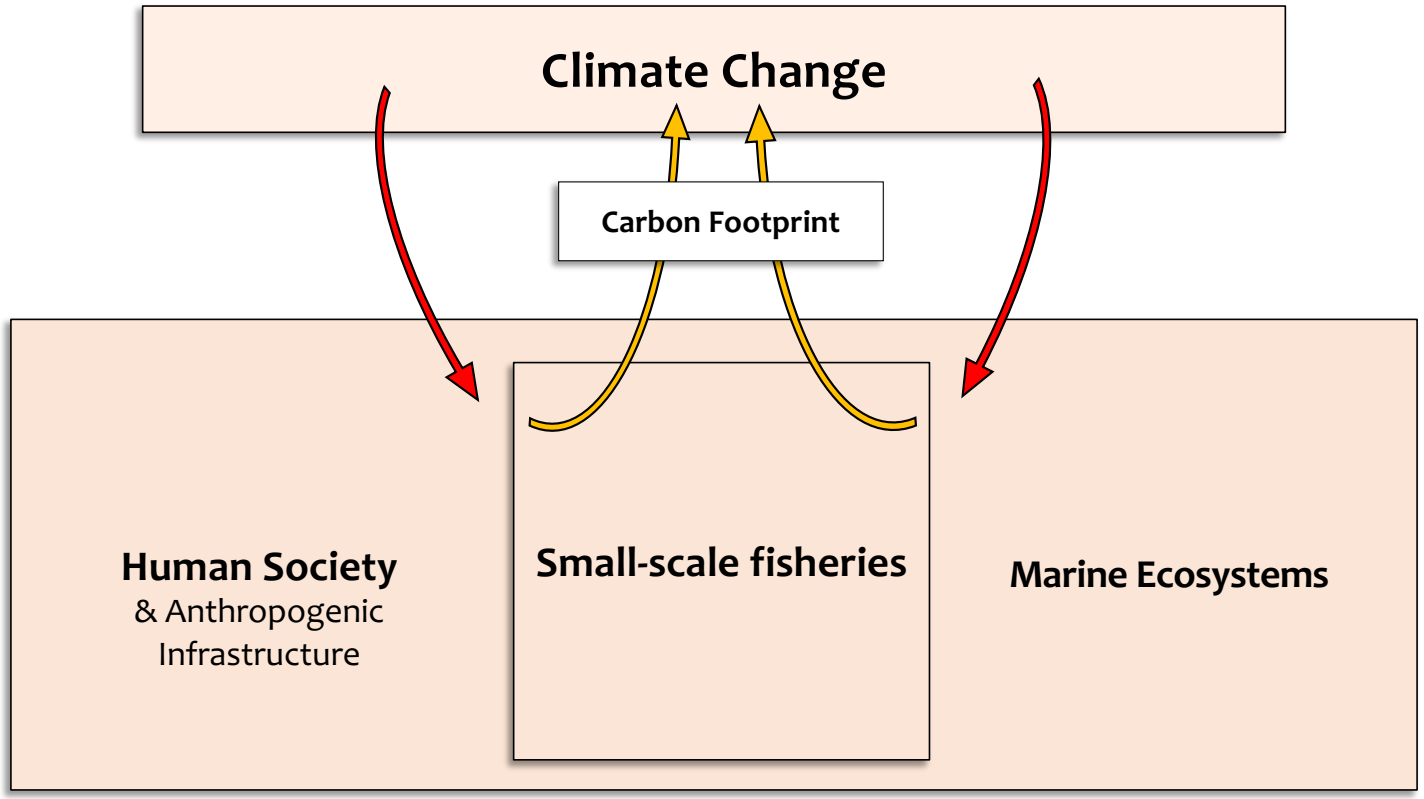
(see Allison et al., 2009; FAO SOFIA Report, 2018)



Ferrer & Aburto – unpublished

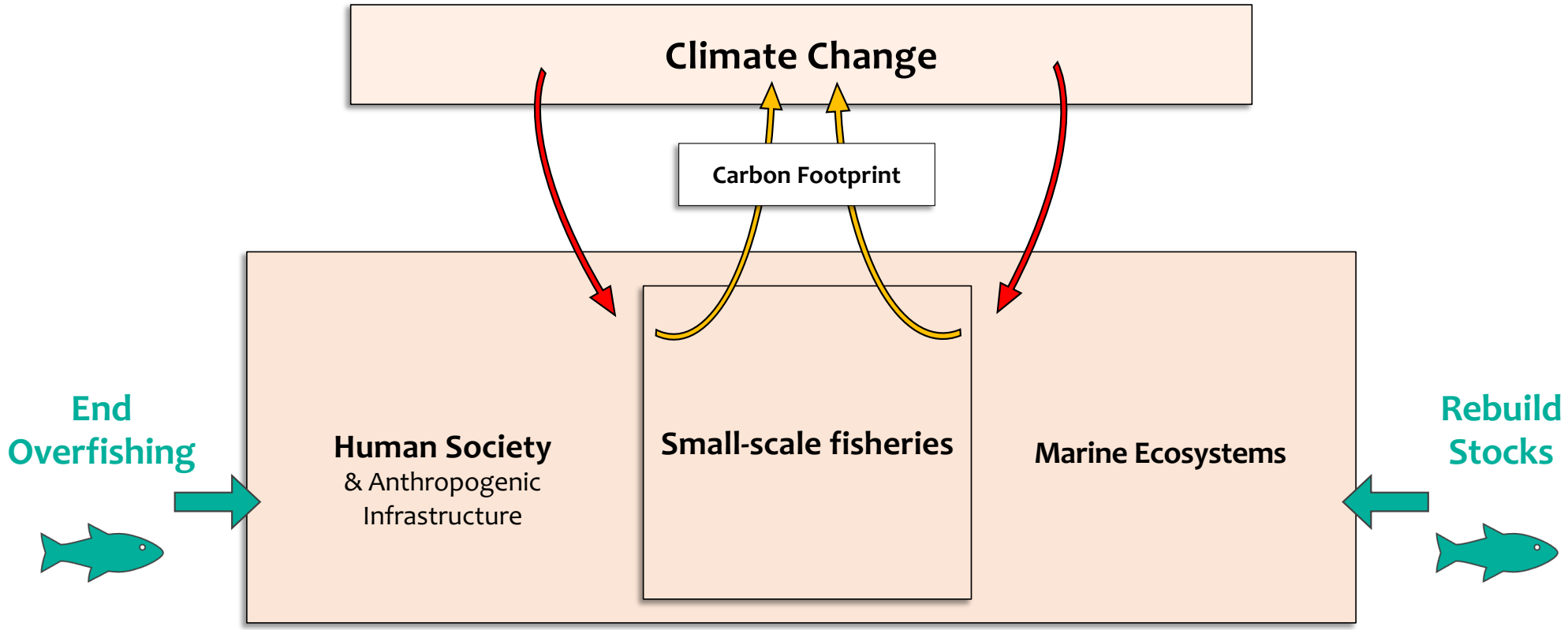
Creating a feedback loop

(see World Bank - The Sunken Billions Revisited, 2017)



Ferrer & Aburto – unpublished

Disrupt the cycle



Ferrer & Aburto – unpublished

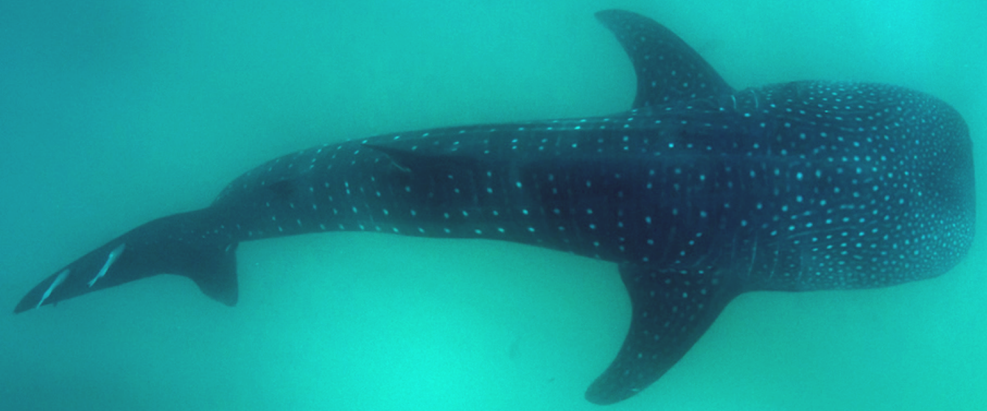
Takeaways

- Emissions vary considerably among small-scale fisheries (SSFs).
- Fishing intensity contributes to some of this variability.
- As a global society, we can enhance the resistance & resilience of SSFs to climate change by ending overfishing and rebuilding stocks.

Isla Holbox, Yucatan Peninsula, Mexico; Octavio Aburto

FIN

Thank you for listening & engaging with these important topics!



GCMP collaborators -
Octavio Aburto-Oropeza,
J. Alfredo Girón-Nava
Catalina López-Sagástegui,
J. José Cota-Nieto,
Ismael Mascareñas-Osorio,
Victoria Jiménez-Esquievel

Thank you to the fishers and community members who make this work possible.

Contact info -
Erica M. Ferrer
emferrer@ucsd.edu
Aburto Lab, UCSD
Scripps Institution of Oceanography

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