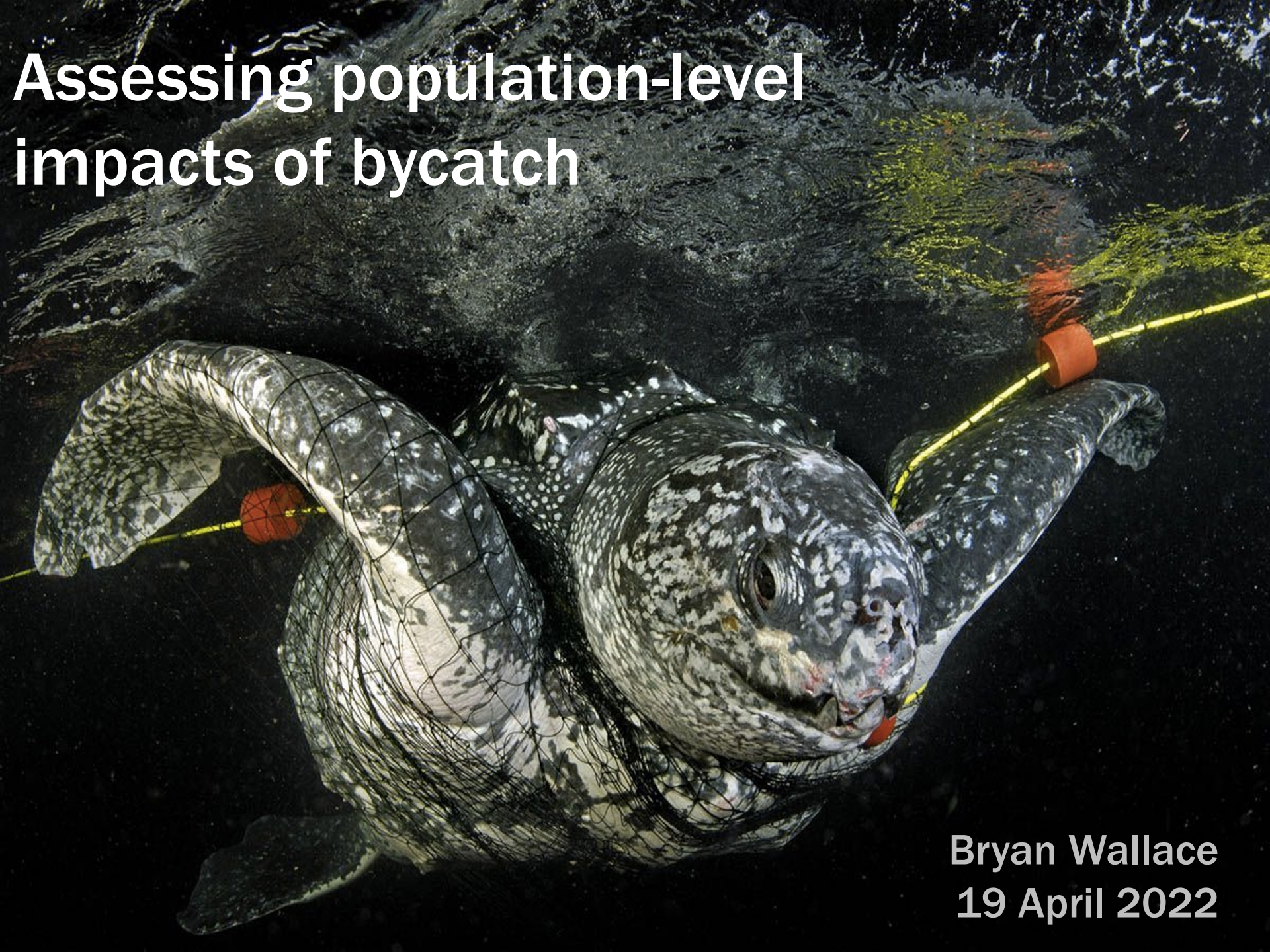


Assessing population-level impacts of bycatch



Bryan Wallace
19 April 2022

photo: Brian Skerry

Acknowledgements



IUCN Marine Turtle Specialist Group, Burning Issues Working Group

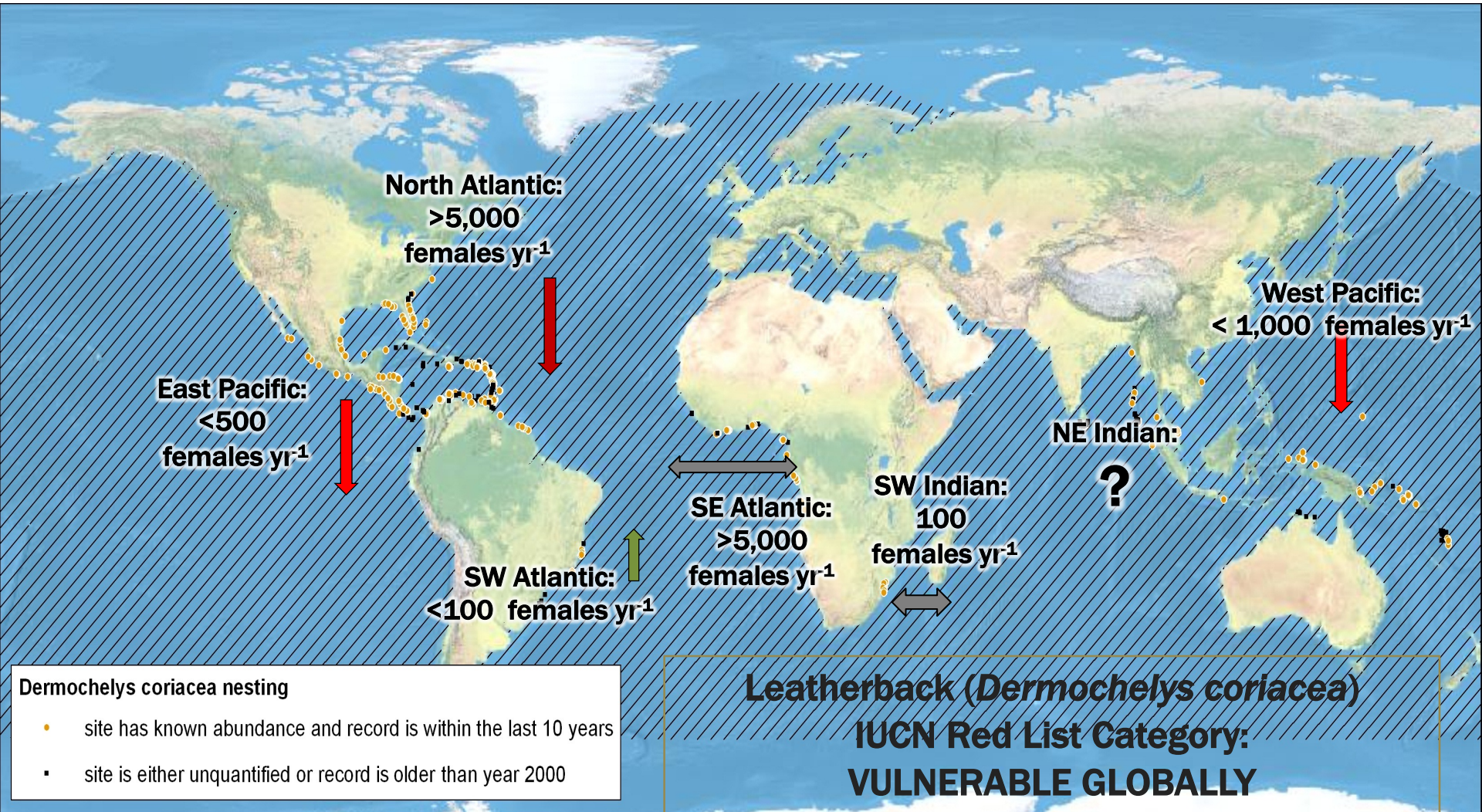
Project GloBAL, Duke University

Red de la Conservación de la Tortuga Laúd en el Océano Pacífico Oriental

Interamerican Convention for the Protection and Conservation of Sea Turtles (IAC)

InterAmerican Tropical Tuna Commission Ecosystem and Bycatch Working Group

leatherback nesting and global distribution



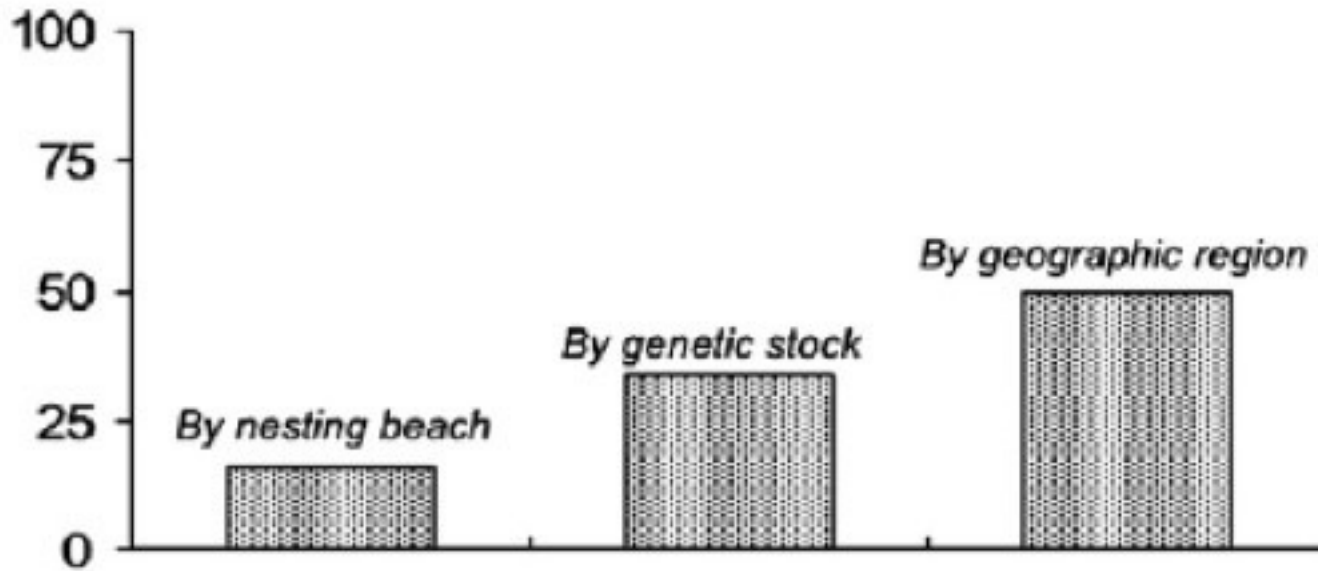
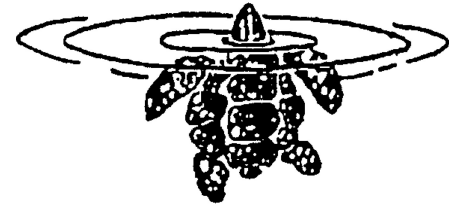
what are our conservation priorities?

IUCN-Marine Turtle Specialist Group

Red List member survey

(50 respondents, 23 countries)

IUCN-SSC MARINE TURTLE
SPECIALIST GROUP



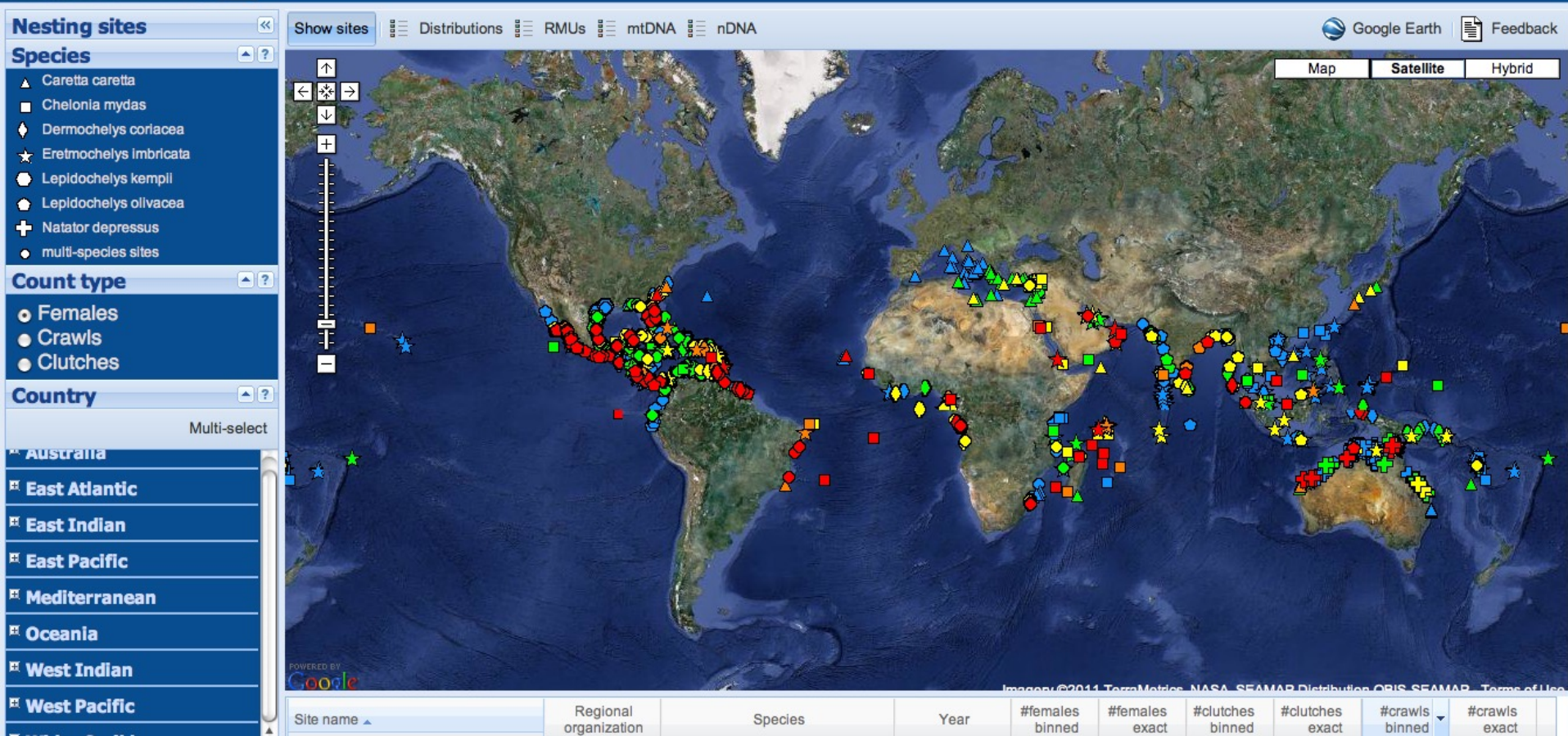
**what is the appropriate population segment
for a regional assessment?**

from Seminoff and Shanker (2008)

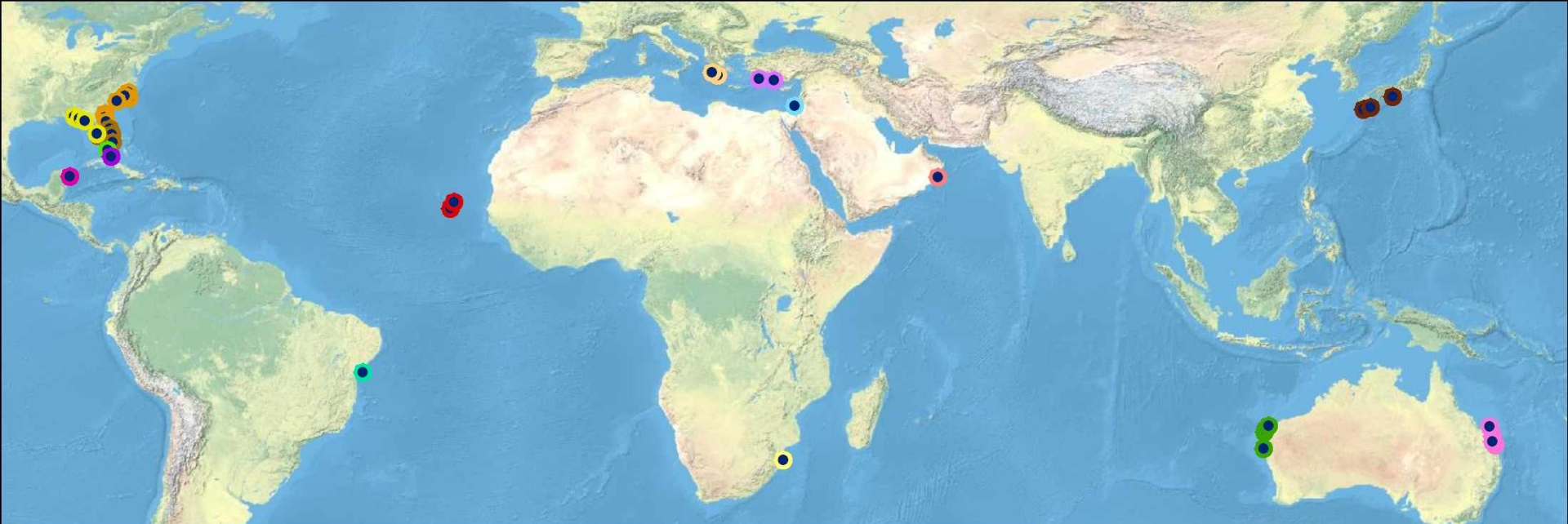
IUCN Marine Turtle Specialist Group: Burning Issues Working Group

Regional Management Units (RMUs)

- a geographically explicit population segment based on biogeographical data that can be applied to regionally appropriate management issues
- for all species, globally
 - nesting sites, mtDNA, nDNA, satellite telemetry, tag returns, etc.
- diversity and gap analyses, conservation priority-setting, threat impacts assessments



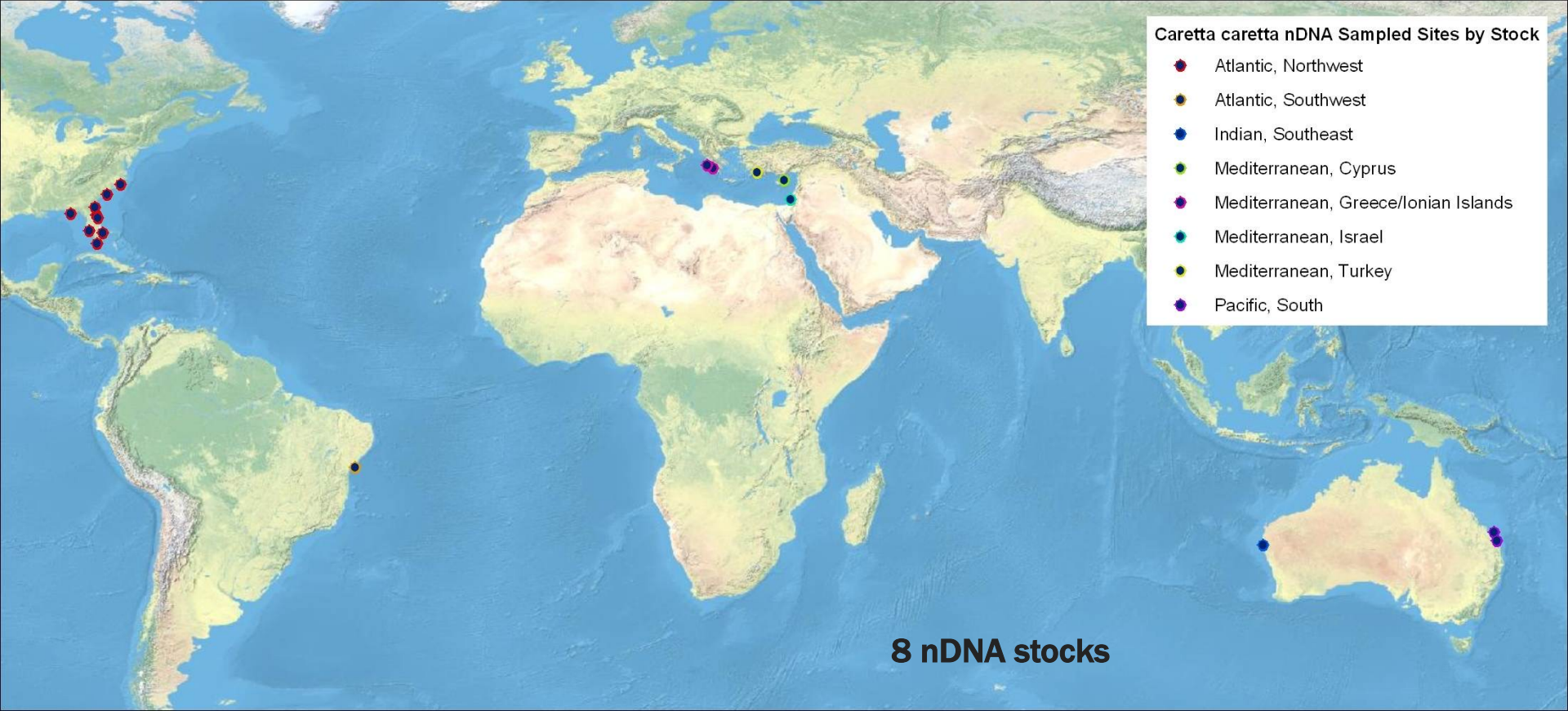
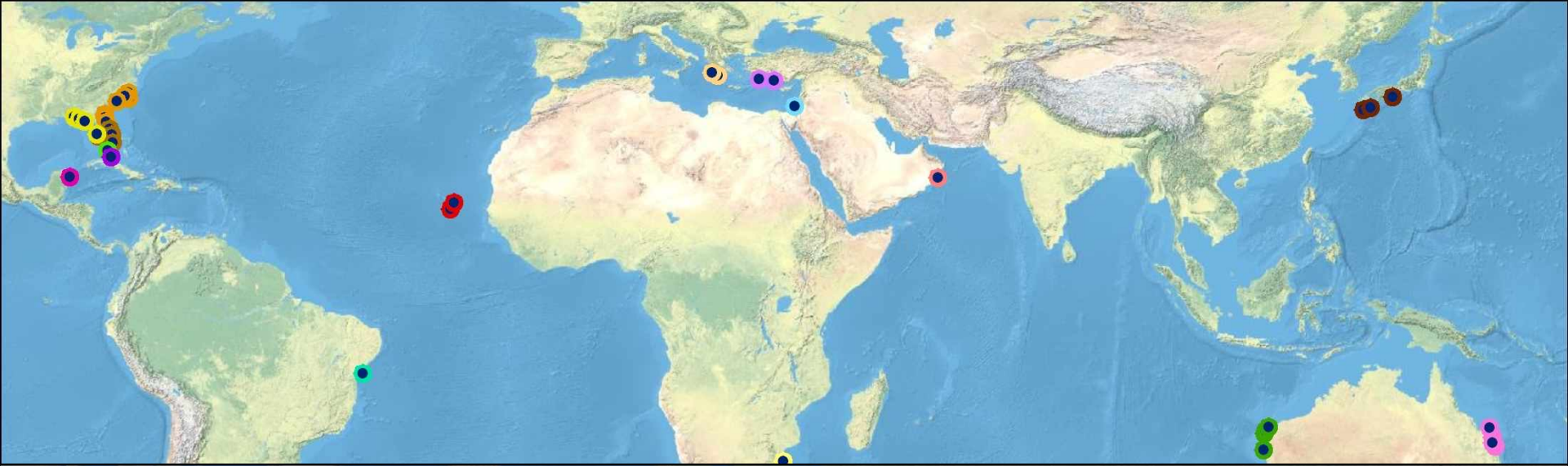
since 2004: >500 contributors; >2,800 nesting sites; all species



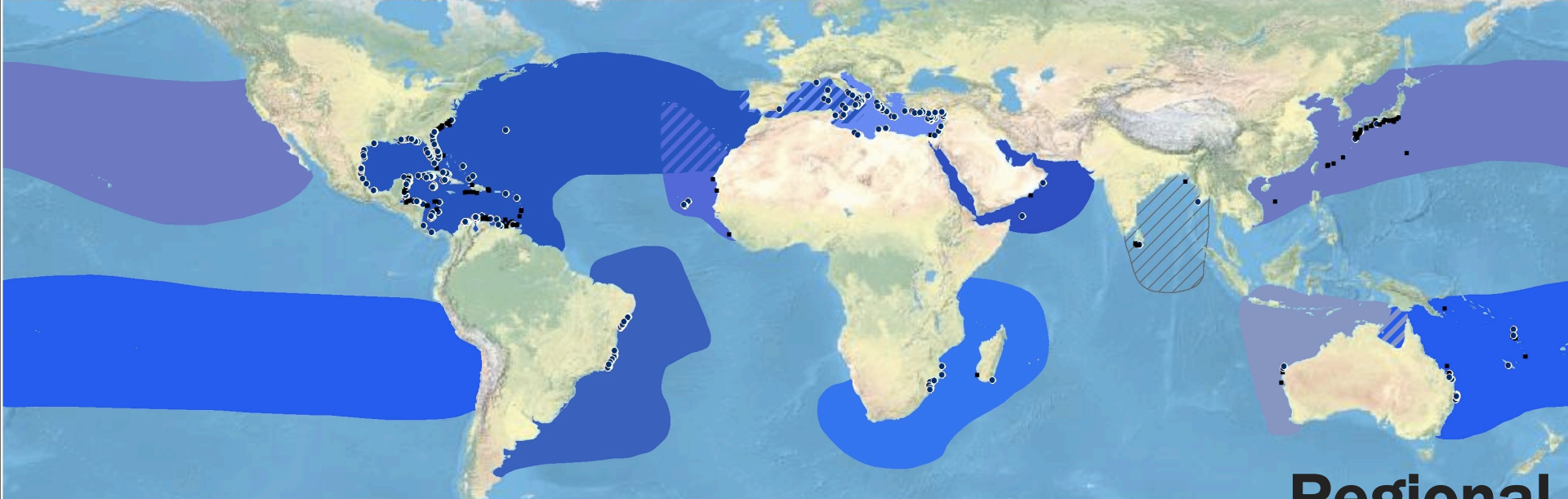
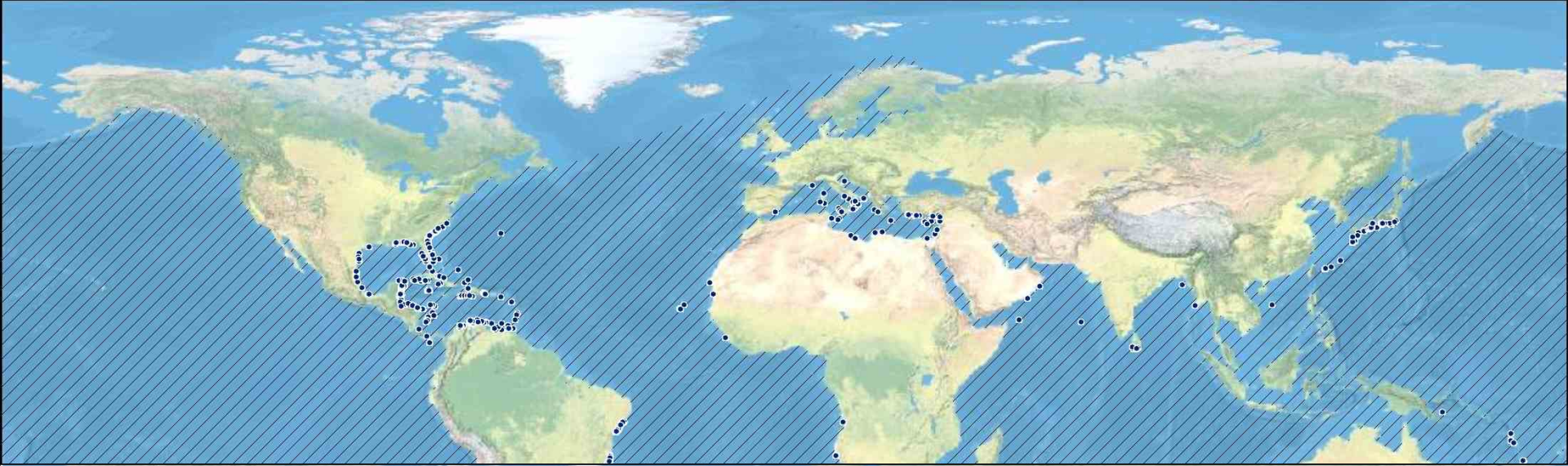
Caretta caretta mtDNA sampled sites by stock

- | | | |
|--|--|---|
| Atlantic, Northeast | Atlantic, Northwest (Southern Florida) | Mediterranean (Greece and the Ionian Islands) |
| Atlantic, Northwest (Bahamas) | Atlantic, Northwest (Yucatan) | Mediterranean (Israel) |
| Atlantic, Northwest (Dry Tortugas) | Atlantic, Southwest | Mediterranean (Turkey) |
| Atlantic, Northwest (Northwestern Florida and Gulf States) | Indian, Northwest | Pacific, North |
| Atlantic, Northwest (Northern Florida to North Carolina) | Indian, Southeast | Pacific, South |
| | Indian, Southwest | |

16 mtDNA stocks



8 nDNA stocks



Caretta caretta RMUs

	Atlantic, Northeast		Indian, Northeast *		Indian, Southeast
	Atlantic, Northwest		Indian, Northwest		Pacific, South
	Atlantic, Southwest		Indian, Southwest		Pacific, North

* denotes putative RMU

**Regional
Management
Units**

Regional Management Units for Marine Turtles: A Novel Framework for Prioritizing Conservation and Research across Multiple Scales

Bryan P. Wallace^{1,2,3*}, Andrew D. DiMatteo^{1,4}, Brendan J. Hurley^{1,2}, Elena M. Finkbeiner^{1,3}, Alan B. Bolten^{1,5}, Milani Y. Chaloupka^{1,6}, Brian J. Hutchinson^{1,2}, F. Alberto Abreu-Grobois^{1,7}, Diego Amorocho^{1,8}, Karen A. Bjorndal^{1,5}, Jerome Bourjea^{1,9}, Brian W. Bowen^{1,10}, Raquel Briseño Dueñas^{1,11}, Paolo Casale^{1,12,13}, B. C. Choudhury^{1,14}, Alice Costa^{1,15}, Peter H. Dutton^{1,16}, Alejandro Fallabrino^{1,17}, Alexandre Girard^{1,18}, Marc Girondot^{1,19}, Matthew H. Godfrey^{1,20}, Mark Hamann^{1,21}, Milagros López-Mendilaharsu^{1,22,23}, Maria Angela Marcovaldi^{1,22}, Jeanne A. Mortimer^{1,24}, John A. Musick^{1,25}, Ronel Nel^{1,26}, Nicolas J. Pilcher^{1,27}, Jeffrey A. Seminoff^{1,28}, Sebastian Troeng^{1,2,29,30}, Blair Witherington^{1,31}, Roderic B. Mast^{1,2}

1 International Union for Conservation of Nature (IUCN)/SSC Marine Turtle Specialist Group – Burning Issues Working Group, Arlington, Virginia, United States of America, **2** Global Marine Division, Conservation International, Arlington, Virginia, United States of America, **3** Center for Marine Conservation, Duke University, Beaufort, North Carolina, United States of America, **4** Marine Geospatial Ecology Laboratory, Duke University, Durham, North Carolina, United States of America, **5** Department of Biology, Archie Carr Center for Sea Turtle Research, University of Florida, Gainesville, Florida, United States of America, **6** Ecological Modelling Services, Pty Ltd, University of Queensland, Brisbane, Australia, **7** Unidad Académica Mazatlán, Instituto de Ciencias del Mar y Limnología, Universidad Nacional Autónoma de México, Mazatlán, Sinaloa, México, **8** Centro de Investigación para el Medio Ambiente y Desarrollo, Cali, Colombia, **9** Laboratoire Ressources Halieutiques, IFREMER, Ile Reunion, France, **10** Hawaii Institute of Marine Biology, Kaneohe, Hawaii, United States of America, **11** Banco de Información sobre Tortugas Marinas (BITMAR), Unidad Mazatlán, Instituto de Ciencias del Mar y Limnología, Universidad Nacional Autónoma de México, Mazatlán, Sinaloa, México, **12** Department of Biology and Biotechnology “Charles Darwin,” University of Rome “La Sapienza,” Rome, Italy, **13** World Wildlife Fund (WWF) Mediterranean Turtle Programme, World Wildlife Fund-Italy, Rome, Italy, **14** Department of Endangered Species Management, Wildlife Institute of India, Dehradun, Uttarakhand, India, **15** World Wildlife Fund-Mozambique, Maputo, Mozambique, **16** Southwest Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration (NOAA), La Jolla, California, United States of America, **17** Karumbé, Montevideo, Uruguay, **18** Association RENATURA, Albens, France, and Pointe-Noire, Congo, **19** Laboratoire d’Ecologie, Systématique et Evolution, Université Paris-Sud, Orsay, France, **20** North Carolina Wildlife Resources Commission, Beaufort, North Carolina, United States of America, **21** School of Earth and Environmental Sciences, James Cook University, Townsville, Australia, **22** Projeto Tamar-ICMBio/Fundação Pro Tamar, Salvador, Bahia, Brazil, **23** Department of Ecology, Institute of Biology, Universidade do Estado do Rio de Janeiro, Rio de Janeiro, Brazil, **24** Department of Biology, University of Florida, Gainesville, Florida, United States of America, **25** Virginia Institute of Marine Sciences, College of William and Mary, Gloucester Point, Virginia, United States of America, **26** School of Environmental Sciences, Nelson Mandela Metropolitan University, Summerstrand Campus, South Africa, **27** Marine Research Foundation, Sabah, Malaysia, **28** Marine Turtle Ecology and Assessment Program, Southwest Fisheries Science Center, NOAA-National Marine Fisheries Service, La Jolla, California, United States of America, **29** Department of Animal Ecology, Lund University, Lund, Sweden, **30** Scientific Advisory Committee, Sea Turtle Conservancy, Gainesville, Florida, United States of America, **31** Florida Fish and Wildlife Conservation Commission, Melbourne Beach, Florida, United States of America

Citation: Wallace BP, DiMatteo AD, Hurley BJ, Finkbeiner EM, Bolten AB, et al. (2010) Regional Management Units for Marine Turtles: A Novel Framework for Prioritizing Conservation and Research across Multiple Scales. PLoS ONE 5(12): e15465. doi:10.1371/journal.pone.0015465

**CURRENTLY BEING UPDATED BY IUCN MTSG;
RMUs 2.0 COMING THIS SUMMER**

how to apply RMUs and conservation priorities to assessing bycatch?



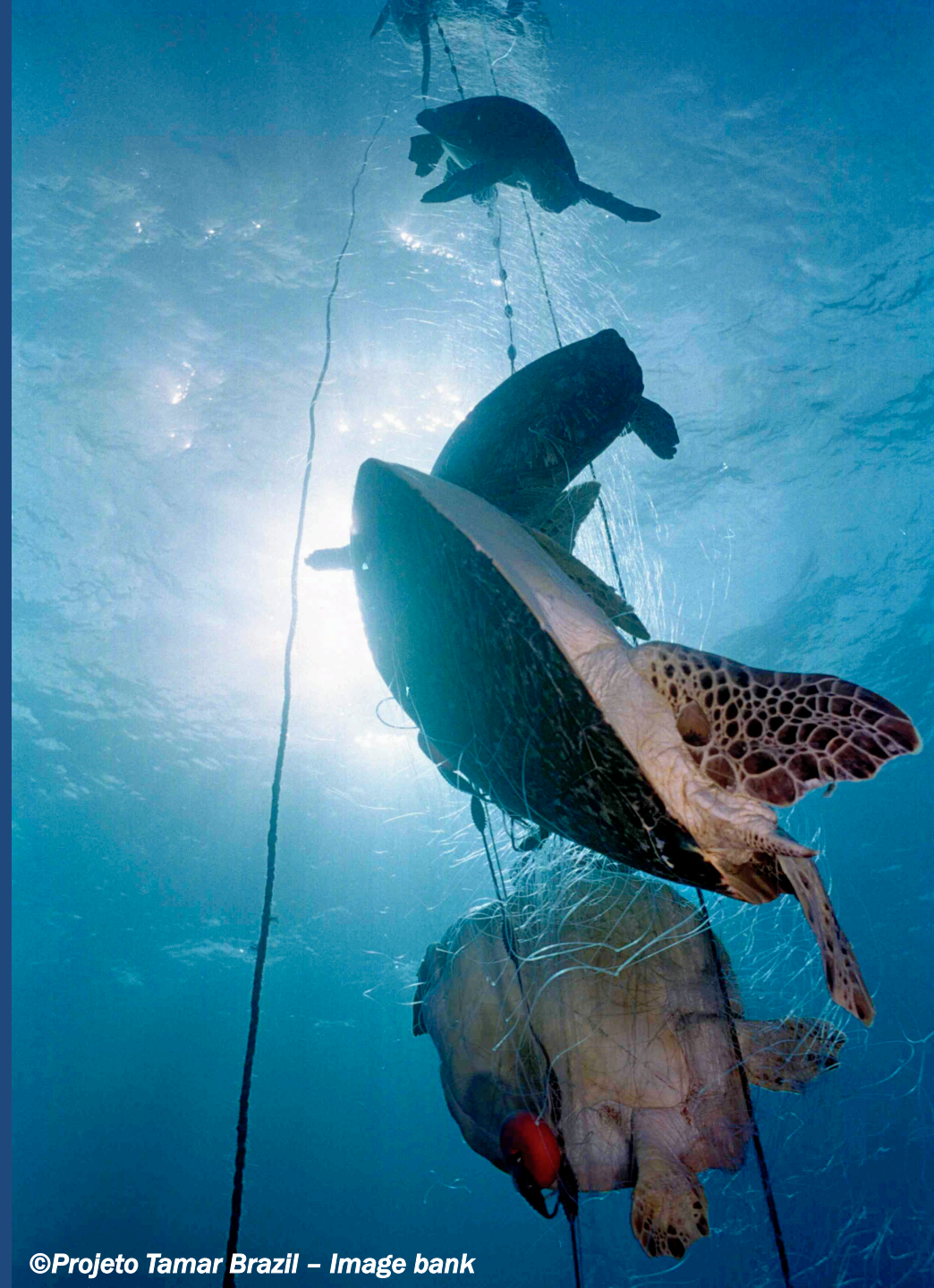
marine turtle bycatch

major threat globally

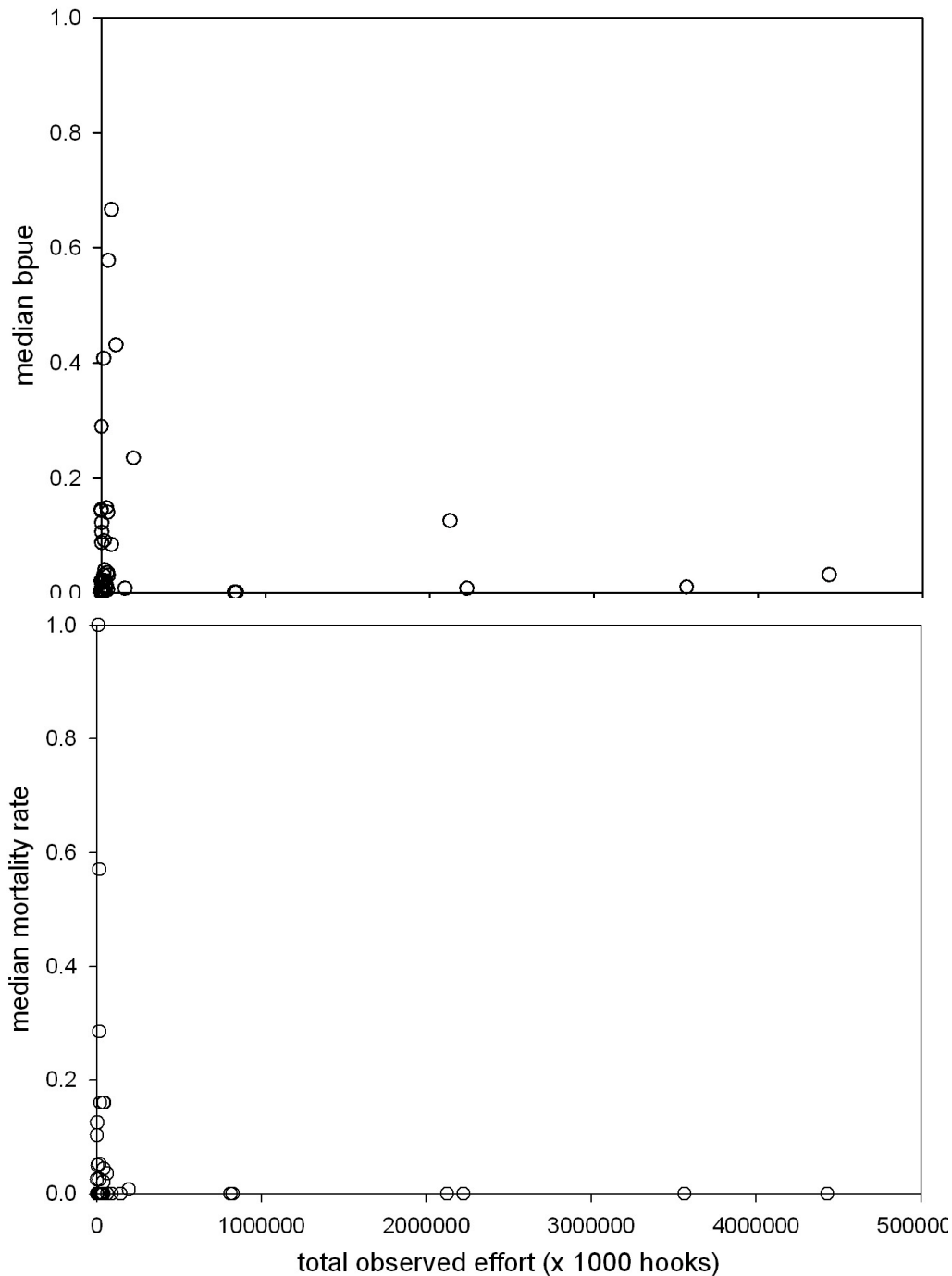
most important threat
for all species

most studies limited in
scale

global synthesis too
broad in scale



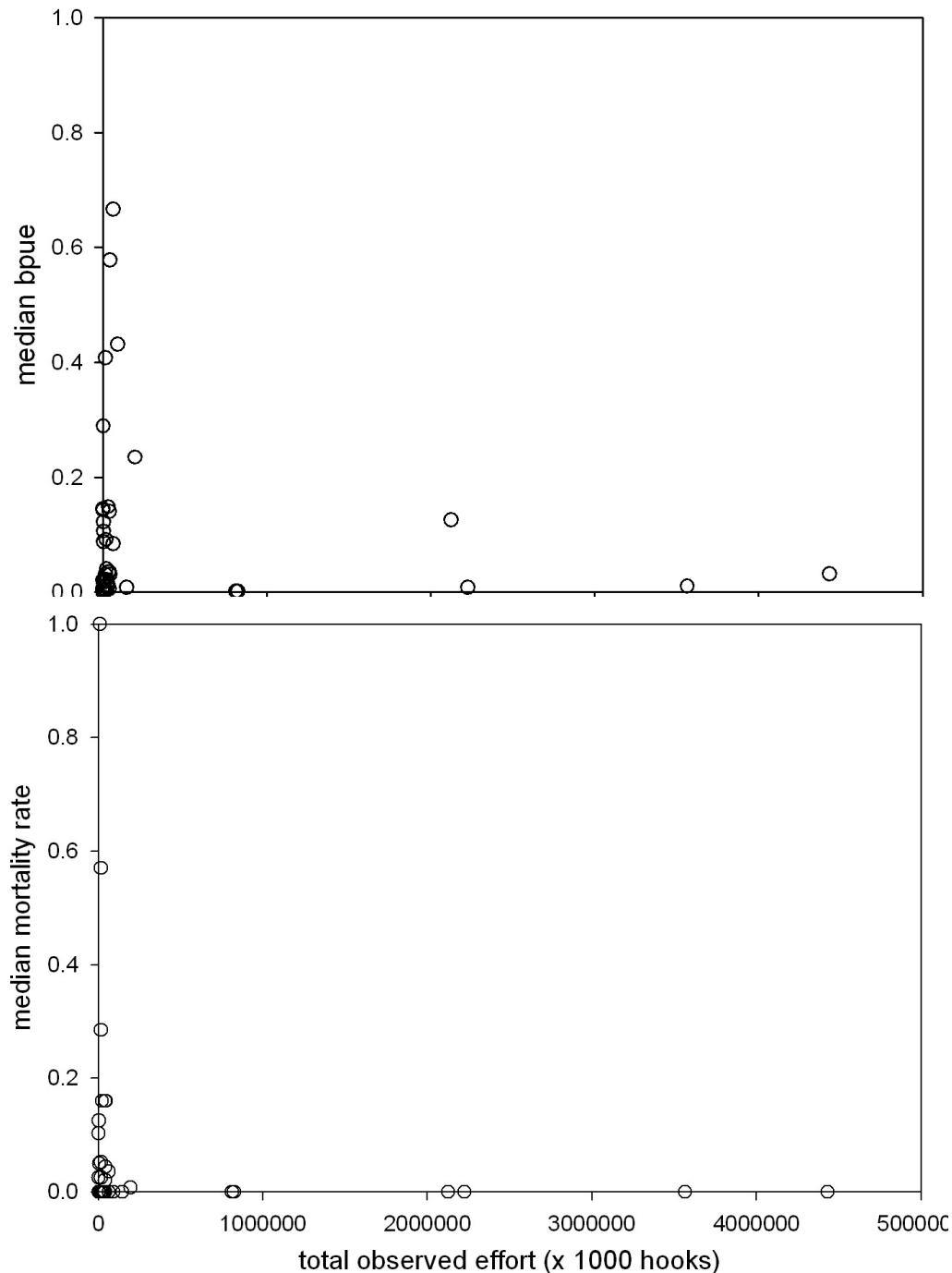
what do bycatch data tell us?



↑ observed effort
↓ bpue

↑ observed effort
↓ mortality rates

what do bycatch data tell us?

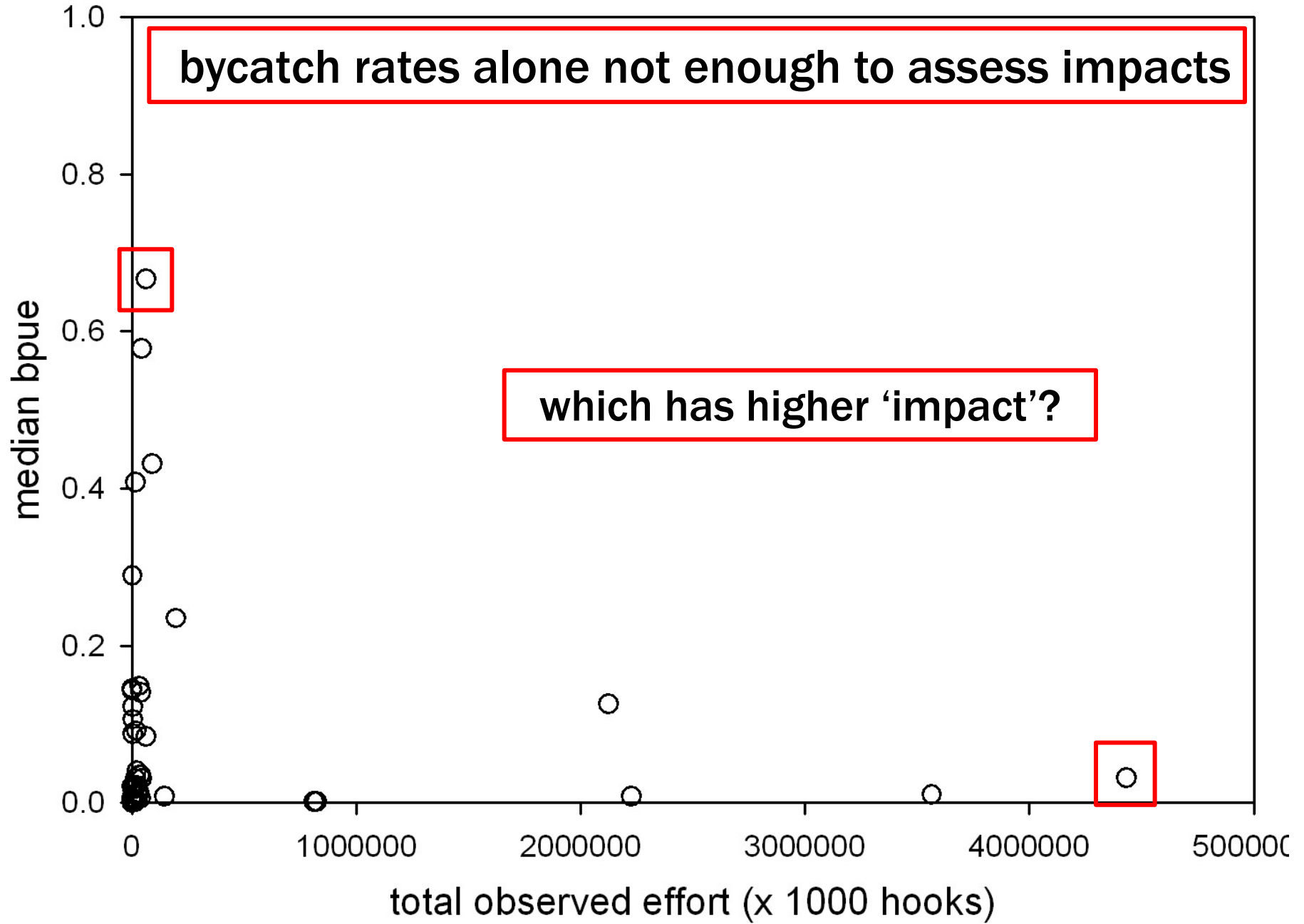


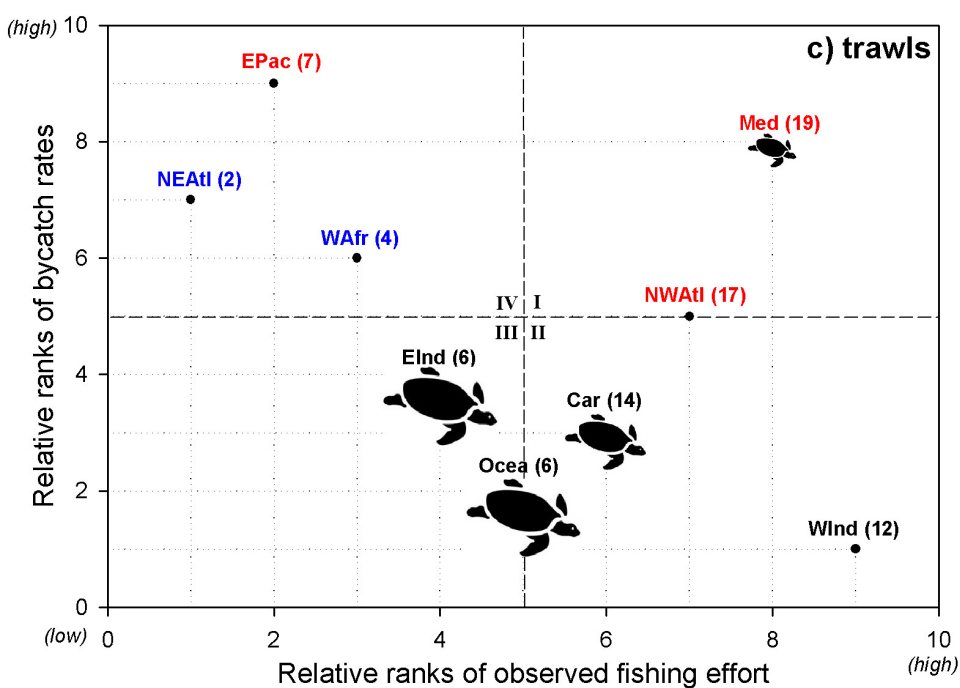
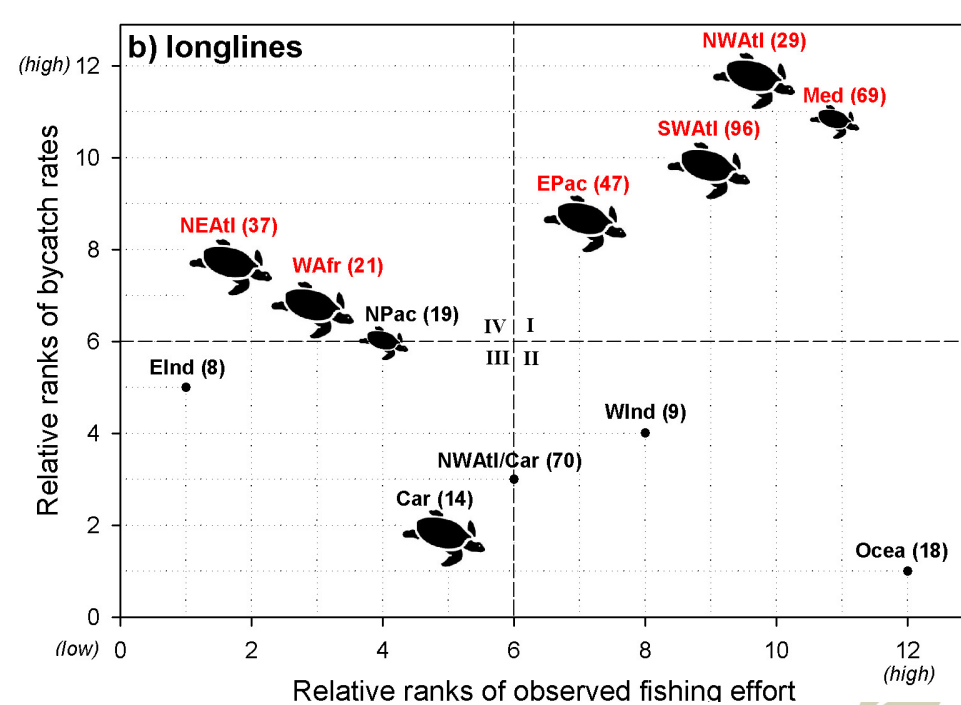
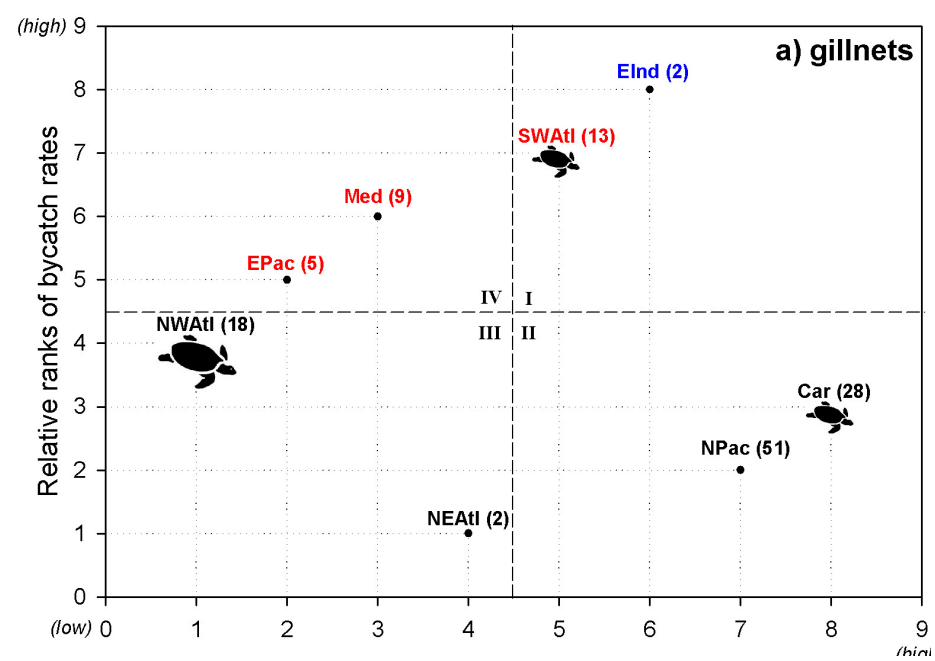
why?

**1. turtle density +
amount of gear
= bycatch**

2. reporting bias

what do bycatch data tell us?





REVIEW

Global patterns of marine turtle bycatch

Bryan P. Wallace^{1,2}, Rebecca L. Lewison³, Sara L. McDonald², Richard K. McDonald^{2,4}, Connie Y. Kot^{2,5}, Shaleyla Kelez², Rhema K. Bjorkland², Elena M. Finkbeiner², S'rai Helmbrecht², & Larry B. Crowder²

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³ Department of Biology, San Diego State University, San Diego, CA 92182, USA

⁴ University of Richmond, Richmond, VA 23173, USA

⁵ Marine Geospatial Ecology Lab, Duke University, Durham, NC 27708, USA

Keywords

Bycatch rates; fisheries bycatch; fishing effort; gillnets; longlines; marine conservation; marine megafauna; marine turtles; trawls.

Correspondence

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Received 18 September 2009; accepted 18 February 2010.

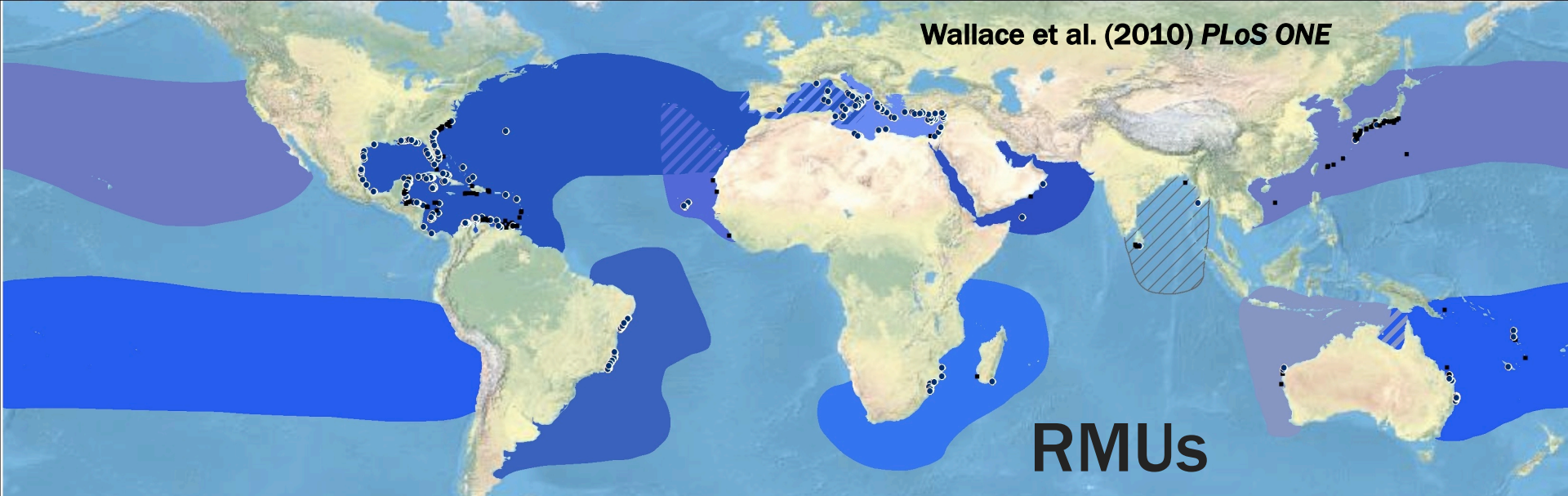
Editor: Dr. Nicholas Dulvy

doi: 10.1111/j.1755-263X.2010.00105.x

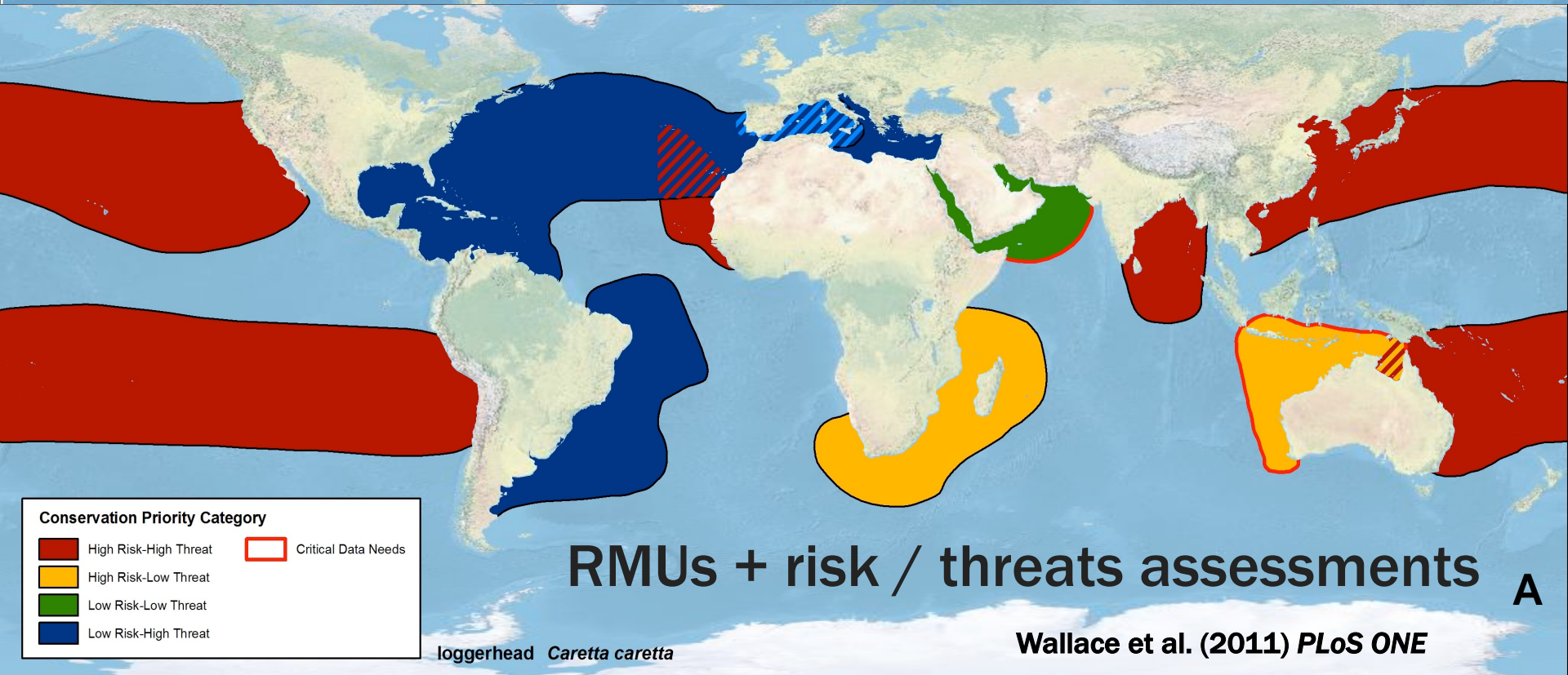
Abstract

Fisheries bycatch is a primary driver of population declines in several species of marine megafauna (e.g., elasmobranchs, mammals, seabirds, turtles). Characterizing the global bycatch seascape using data on bycatch rates across fisheries is essential for highlighting conservation priorities. We compiled a comprehensive database of reported data on marine turtle bycatch in gillnet, longline, and trawl fisheries worldwide from 1990 to 2008. The total reported global marine turtle bycatch was ~85,000 turtles, but due to the small percentage of fishing effort observed and reported (typically <1% of total fleets), and to a global lack of bycatch information from small-scale fisheries, this likely underestimates the true total by at least two orders of magnitude. Our synthesis also highlights an apparently universal pattern across fishing gears and regions where high bycatch rates were associated with low observed effort, which emphasizes the need for strategic bycatch data collection and reporting. This study provides the first global perspective of fisheries bycatch for marine turtles and highlights region-gear combinations that warrant urgent conservation action (e.g., gillnets, longlines, and trawls in the Mediterranean Sea and eastern Pacific Ocean) and region-gear combinations in need of enhanced observation and reporting efforts (e.g., eastern Indian Ocean gillnets, West African trawls).





RMUs



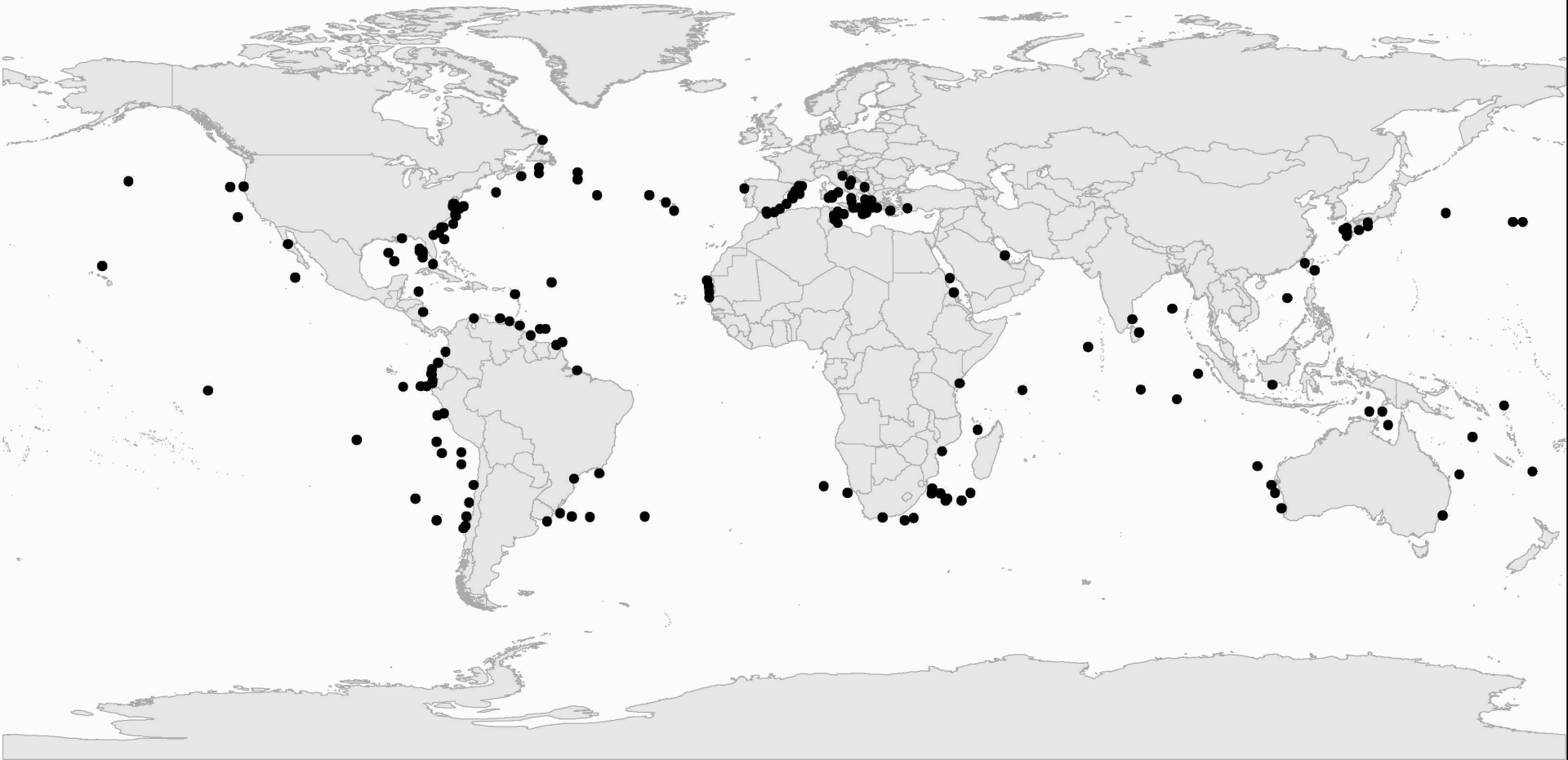
Conservation Priority Category

- High Risk-High Threat
- High Risk-Low Threat
- Low Risk-Low Threat
- Low Risk-High Threat
- Critical Data Needs

RMUs + risk / threats assessments

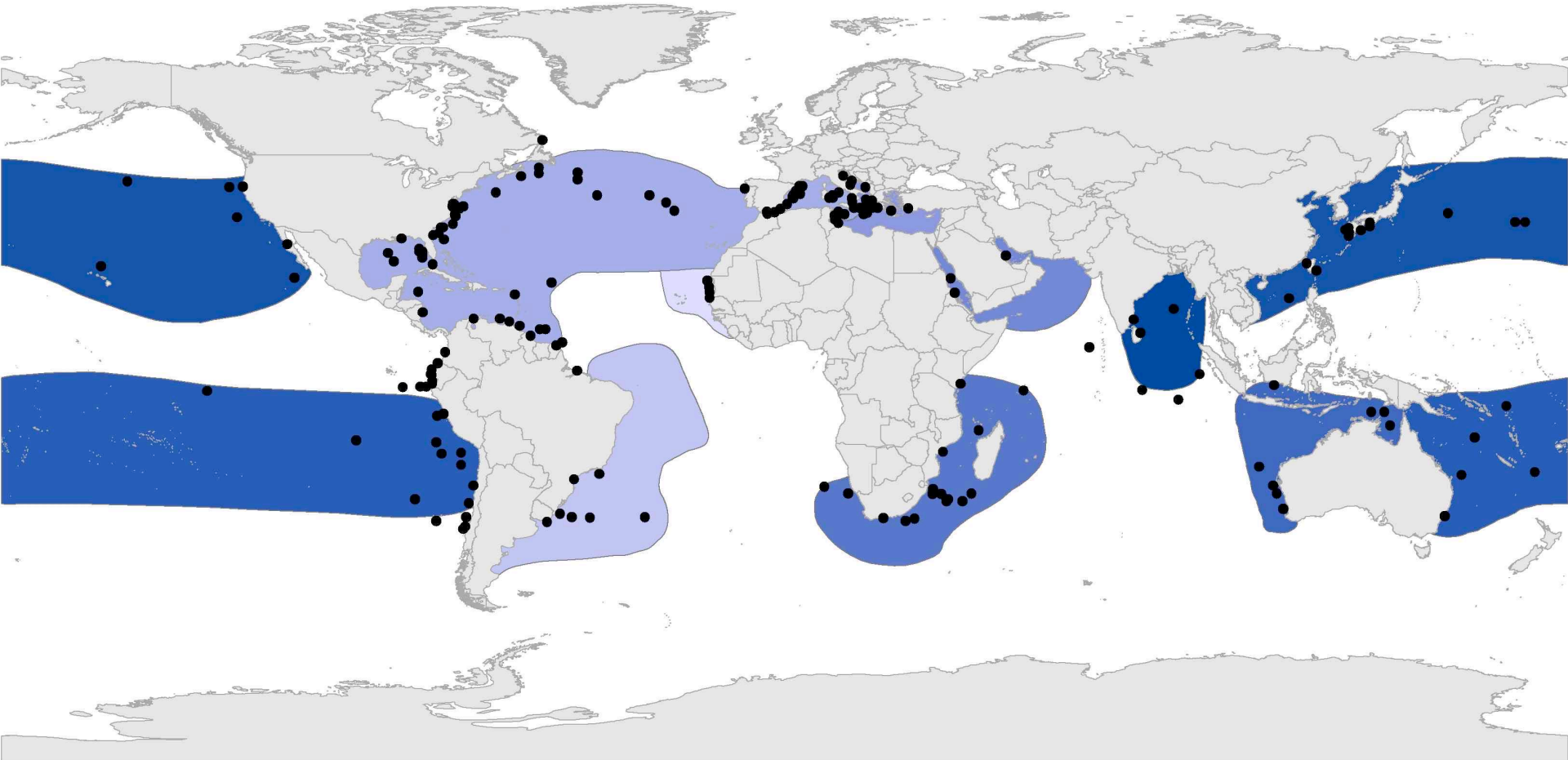
A

loggerhead bycatch worldwide



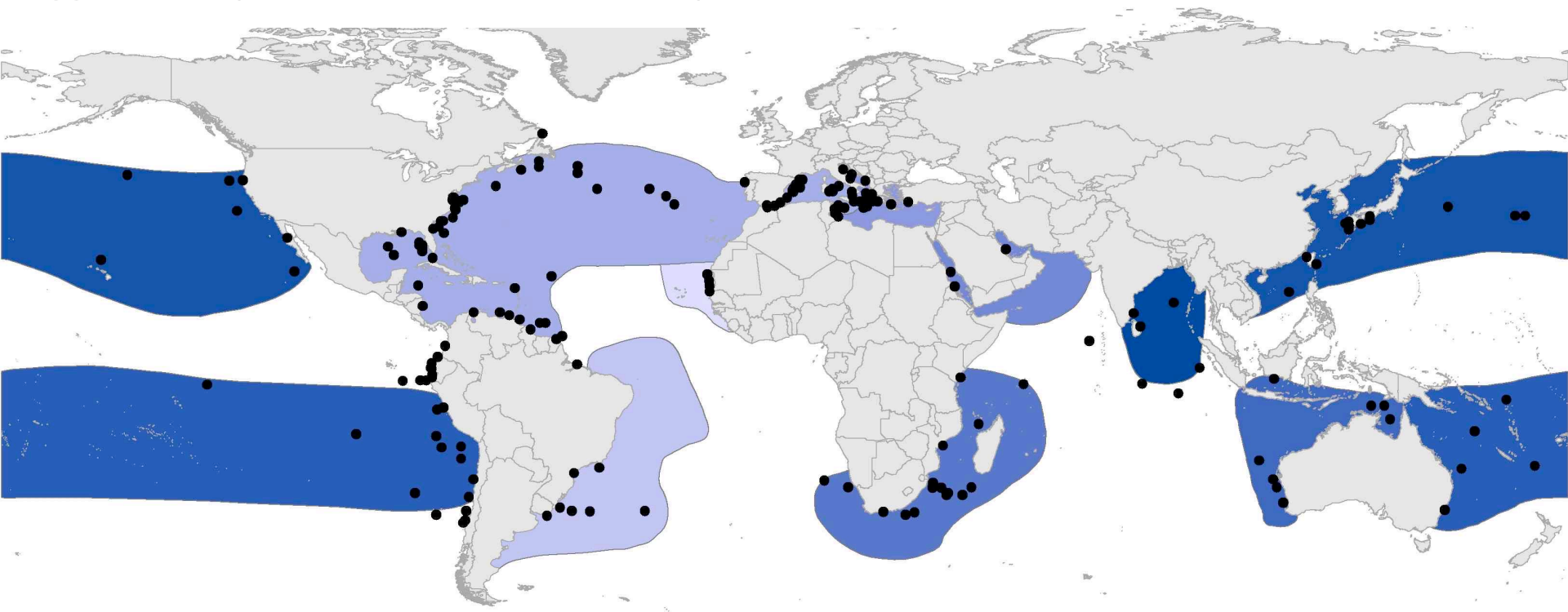
how can RMUs and conservation priorities inform bycatch assessments?

loggerhead bycatch worldwide, divided by RMUs

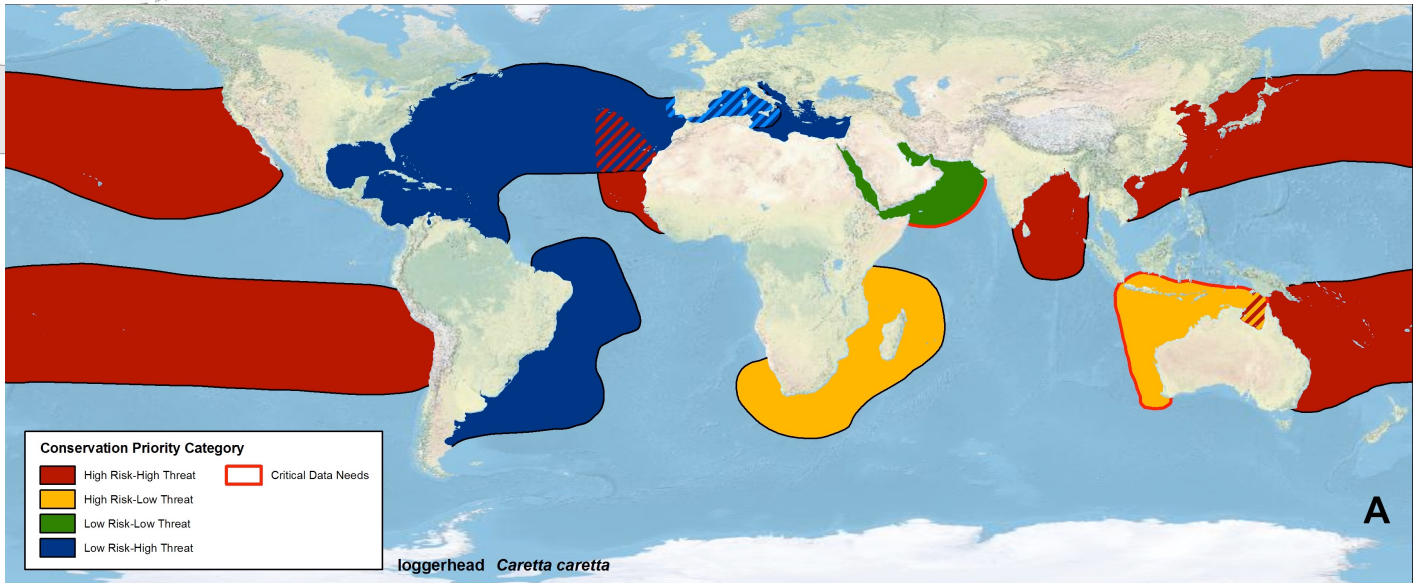


**bycatch impacts can be attributed to particular RMUs
can examine bycatch patterns across and within gears, species, regions**

loggerhead bycatch worldwide, divided by RMUs



GOAL: scale impacts by RMU risk scores to evaluate relative bycatch impacts and identify most important gears



methods

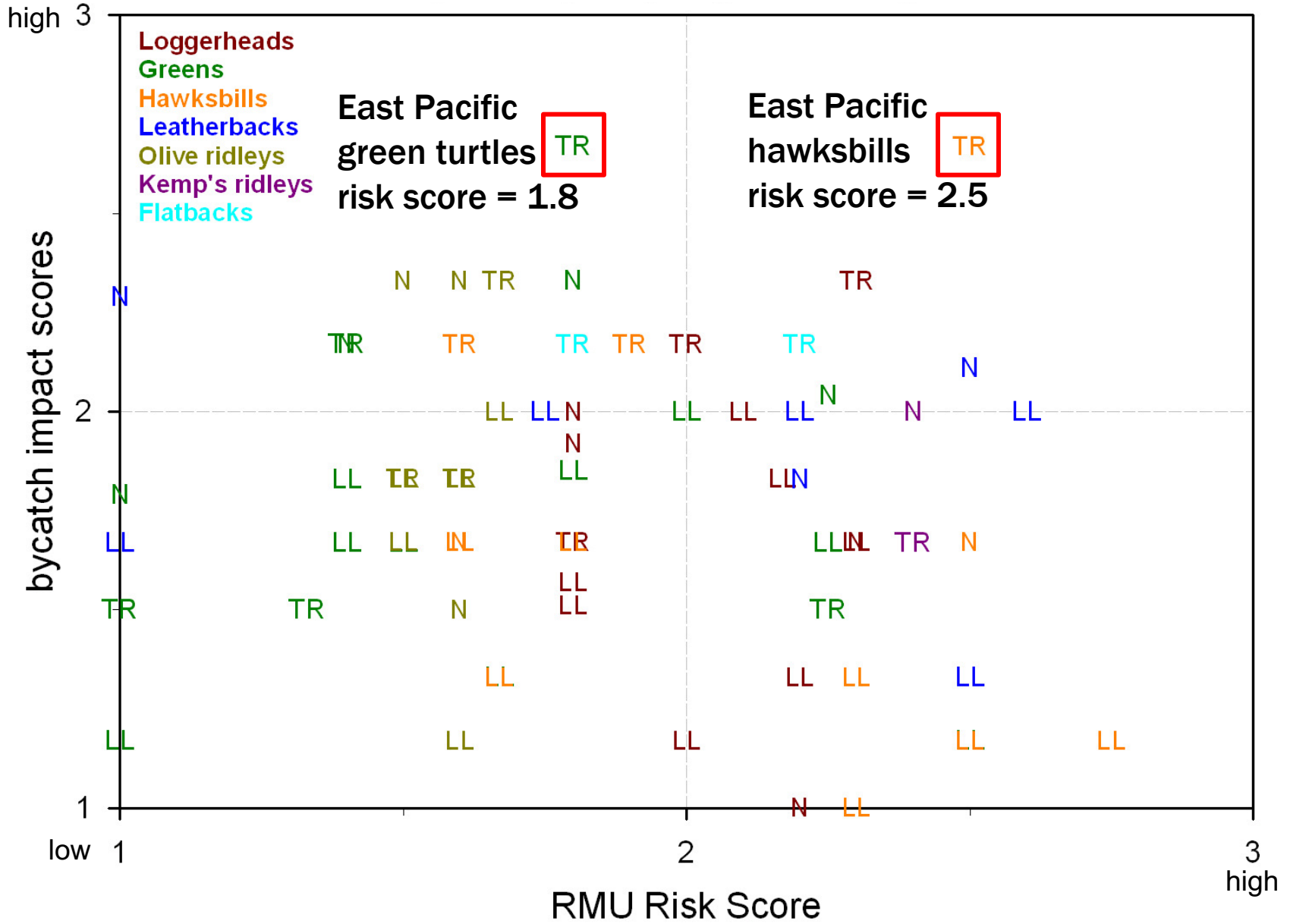
>200 studies, >1200 records (~900 used in analyses); between 1990 - 2011

bycatch impact score = combines info from BPUEs, observed effort, mortality rates, body sizes of turtles caught

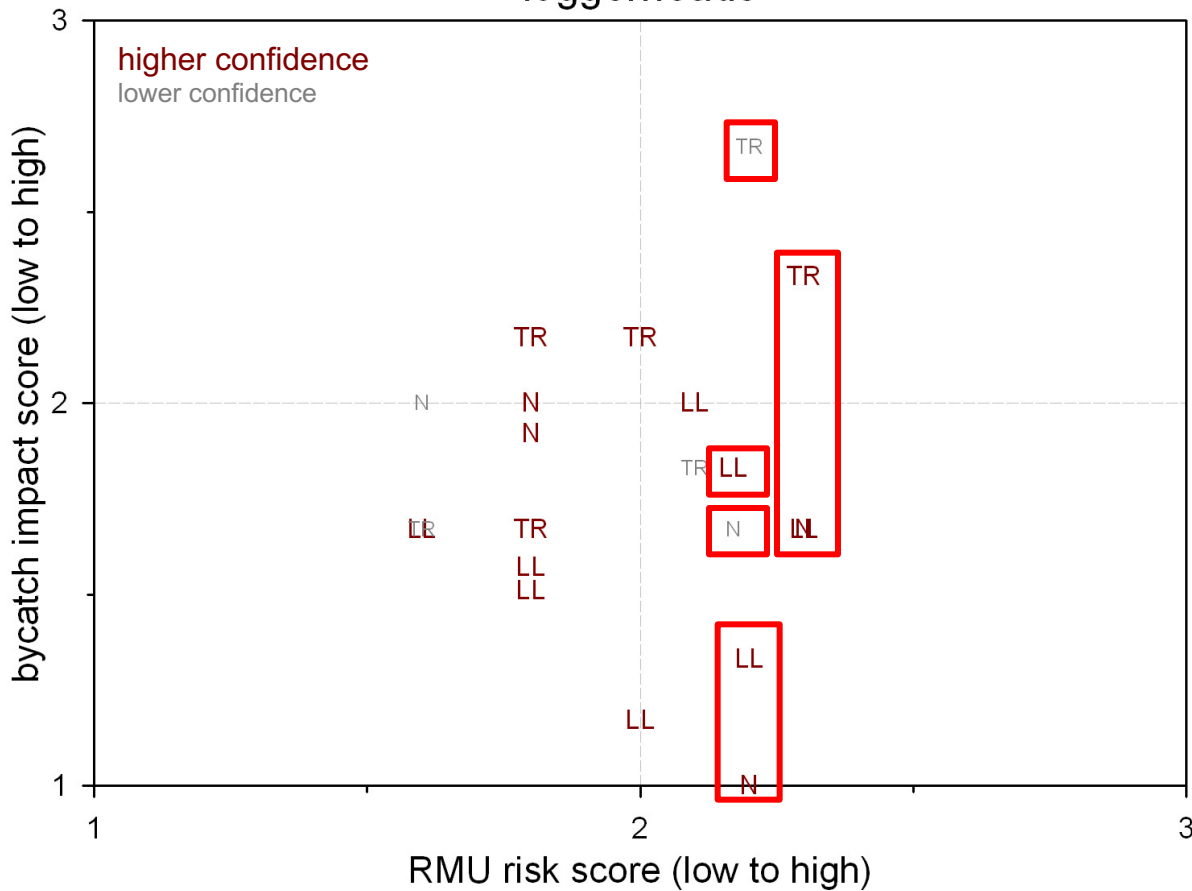
plotted against RMU risk scores (i.e. population viability characteristics)

for each gear category and subgears

RMU risk scores vs bycatch impact scores for all gear categories



loggerheads



ID gears and data gaps for 'high-risk/high-threat' loggerhead RMUs

- Northeast Indian
- North Pacific
- South Pacific
- Northeast Atlantic

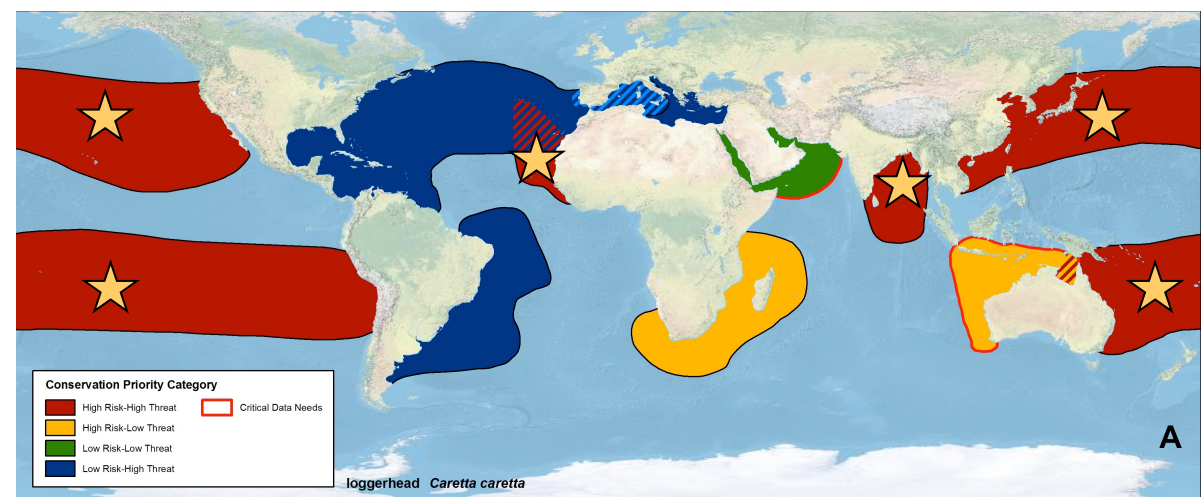


Photo: Sean Whelan (WHOI)



The case of the East Pacific leatherback turtle

Comisión Interamericana del Atún Tropical Inter-American Tropical Tuna Commission



10th Meeting of the IATTC Working Group on Bycatch, 5 May 2021 (Document BYC-10 INF-B)

Update on the vulnerability assessment for the East Pacific leatherback turtle (*Dermochelys coriacea*) stock using the EASI-Fish approach:

A continued collaboration between IATTC and IAC Sea Turtle Convention staff

Background

Recent publication:

- Current status is grave, but there is still time
- Must reduce adult and subadult mortality by 20% (or more), starting immediately
- Also critical to sustain leatherback nesting beach protection and increase hatchling production



LAÚD OPO
RED LAÚD DEL OCEANO
PACIFICO ORIENTAL

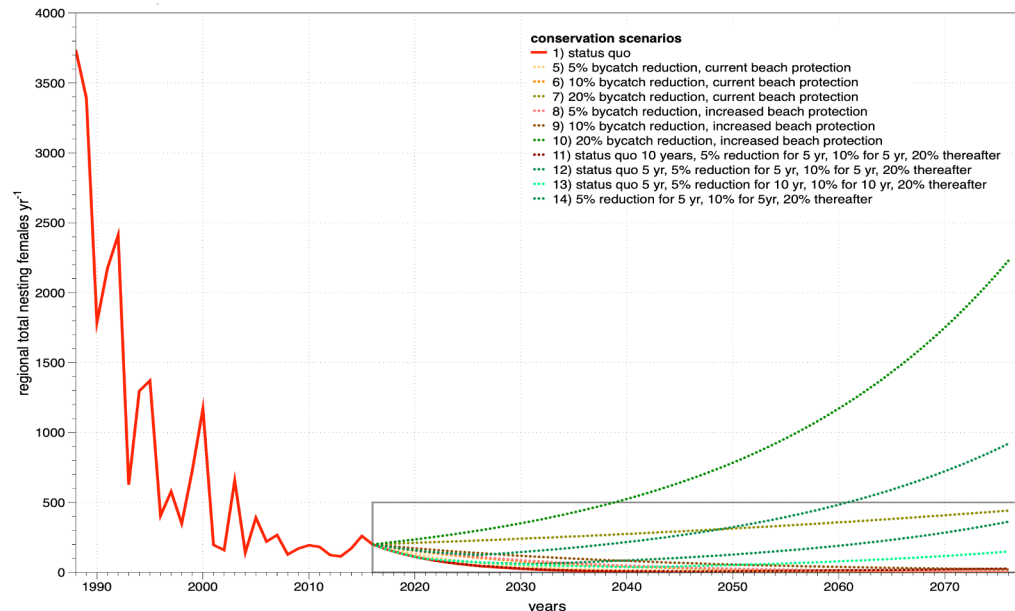
www.nature.com/scientificreports

**SCIENTIFIC
REPORTS**
nature research

OPEN

Enhanced, coordinated conservation efforts required to avoid extinction of critically endangered Eastern Pacific leatherback turtles

The Laúd OPO Network[†]



Laúd OPO Network (2020) *Scientific Reports*

Background



Convención Interamericana para la Protección y Conservación de las
Tortugas Marinas
Séptima Conferencia de las Partes
24-26 de Junio, 2015 – Ciudad de México

CIT-COP7-2015-R2

Resolución sobre la Conservación de la Tortuga Baula (*Dermochelys coriacea*) del Pacífico
Oriental

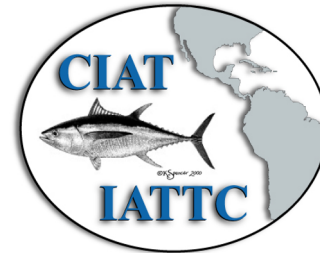
COMISIÓN INTERAMERICANA DEL ATÚN TROPICAL

94ª REUNIÓN

Bilbao, España
22-26 de julio de 2019

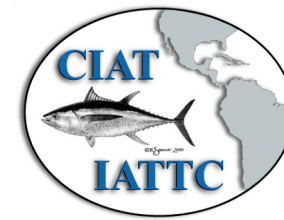
RESOLUCION C-19-04

RESOLUCIÓN PARA MITIGAR LOS IMPACTOS SOBRE LAS TORTU-
GAS MARINAS



- Strengthen measures for monitoring and reduction of bycatch impacts on sea turtles
- A major focus on Eastern Pacific leatherbacks
- Need to support implementation with viable options and resources

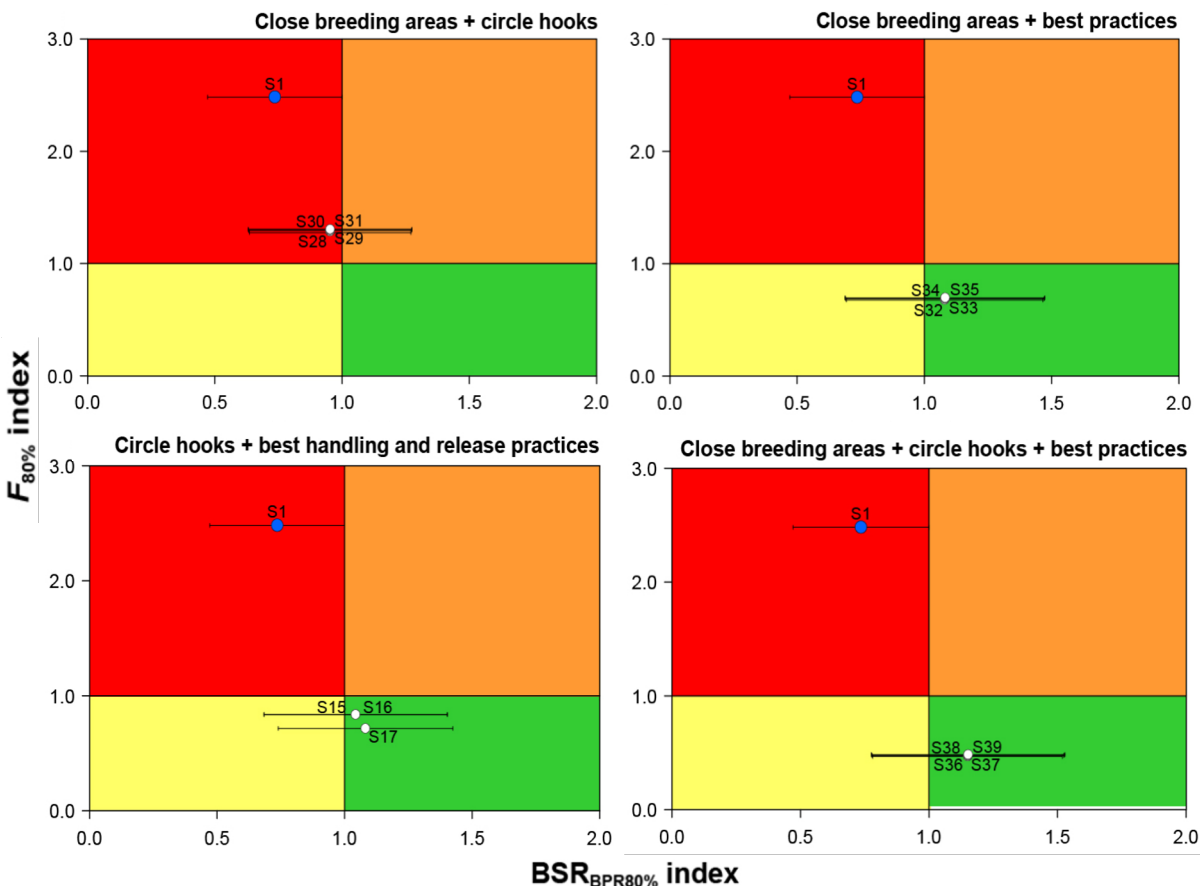
Background



- Following recommendation of Bycatch Working Group May 2019, collaboration between IAC Leatherback Task Force and IATTC under 2011 MoU
- EASI-Fish model: Assessing leatherback vulnerability to impacts of bycatch in various fisheries, and potential efficacy of bycatch reduction measures



Phase 1: May 2019-May 2020



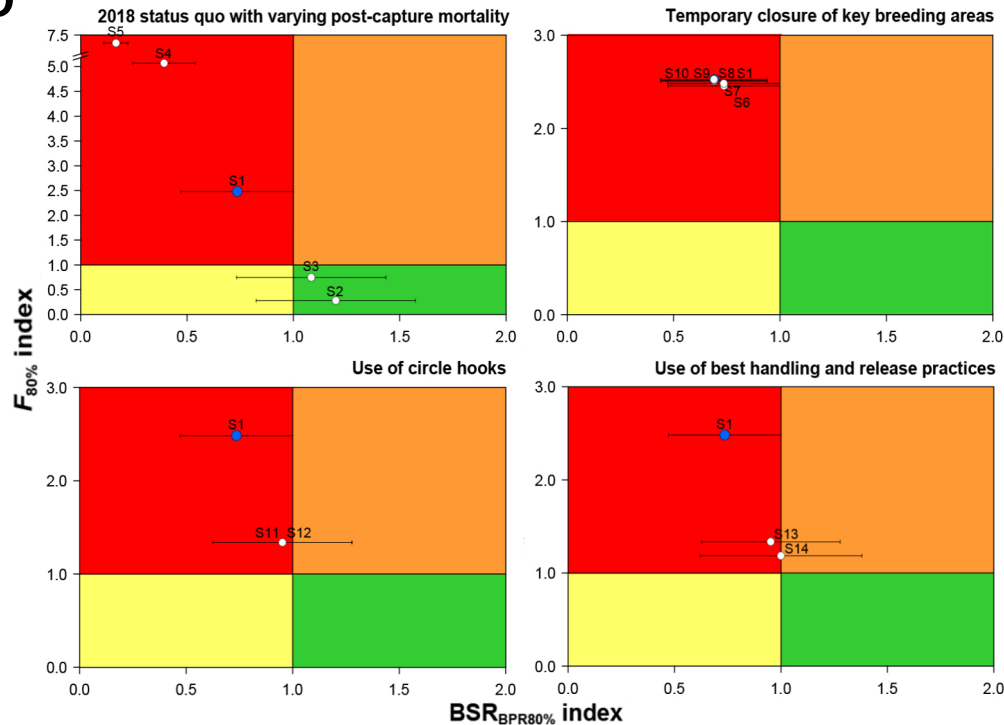
- EASI-Fish: method to evaluate vulnerability to fisheries impacts
- Phase 1 demonstrated feasibility of method
- Explored several CMMs, individually and in combination
- Identified several areas for improvement
- Established a standing working group of IAC and IATTC collaborators



Improvements in Phase 2: December 2020-present

Updated data coverage and CMM scenarios for various fisheries to be included in EASI-Fish

- Phase 2: updated species distribution model
- Phase 2: Added new datasets and expanded set of 70 scenarios
 - Based on C-19-04 and hypothetical CMMs,
 - Includes EPO purse seine, industrial and artisanal longline and gillnet fisheries,
 - Vary CMM effectiveness and implementation,
 - Vary post-capture mortality estimates



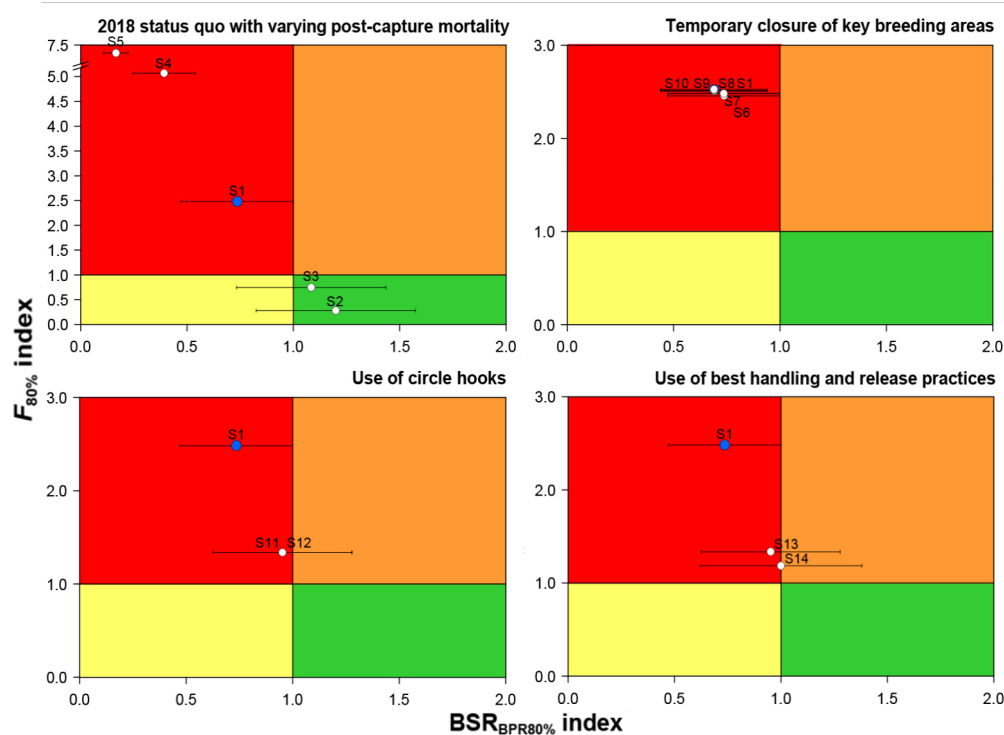
Improvements in Phase 2: December 2020-present

Final report to be presented at IATTC Bycatch Working Group meeting, May 2022

Scenarios assume full implementation, so showing what's possible

Expected results: highlight scenarios that decrease impacts on leatherbacks

Scenarios that include more than one conservation measure will have higher efficacy



What have we learned

Bycatch data are complicated

Evaluating bycatch impacts on populations requires a lot of information

To assess population-level impacts of bycatch, and compared to other threats, need to consider:

- **Population status,**
- **Number, fate, and value to the population of animals affected per fishing gear type (or other threat)**

Data gaps remain, but enough is known to inform conservation actions



Thanks!