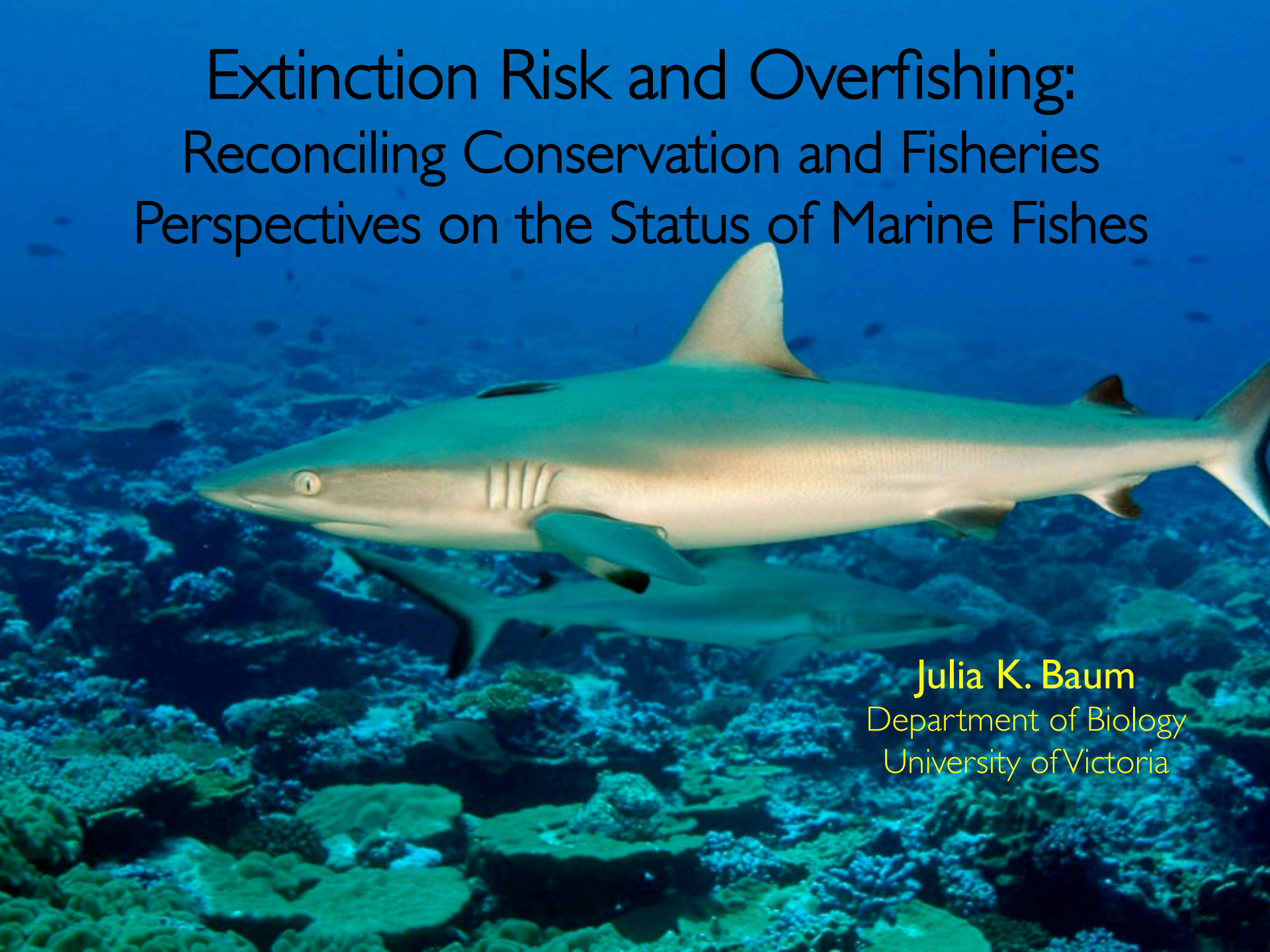
Extinction Risk and Overfishing:
Reconciling Conservation and Fisheries Perspectives on the Status of Marine Fishes

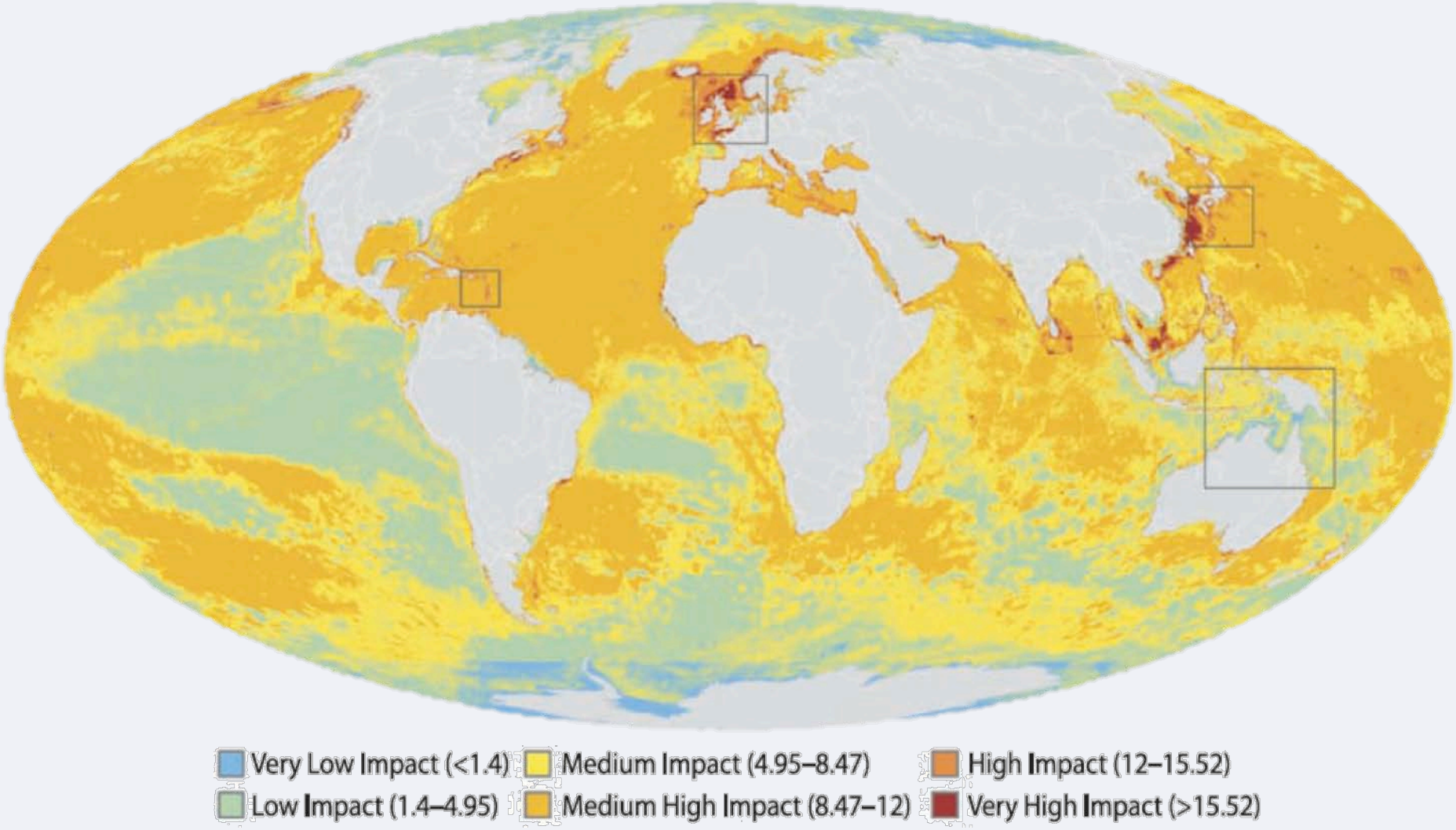


Julia K. Baum
Department of Biology
University of Victoria

"Probably all the great sea fisheries are inexhaustible; that is to say that nothing we do seriously affects the number of the fish."

-Thomas Huxley, 1883

Human dominated oceans



Halpern et al. 2008 *Science*

WHOA! HALF EMPTY! DEFINITELY HALF EMPTY!! :CHOKE: :GASP:
JUST LISTEN TO YOU! ALWAYS THE PESSIMIST!

"Managing fisheries is hard: it's like managing a forest, in which the trees are invisible and keep moving around."

-John Shepherd, 1978

Global fisheries catch data

SEA AROUND US PROJECT
Fisheries, Ecosystems & Biodiversity

The PEW CHARITABLE TRUSTS

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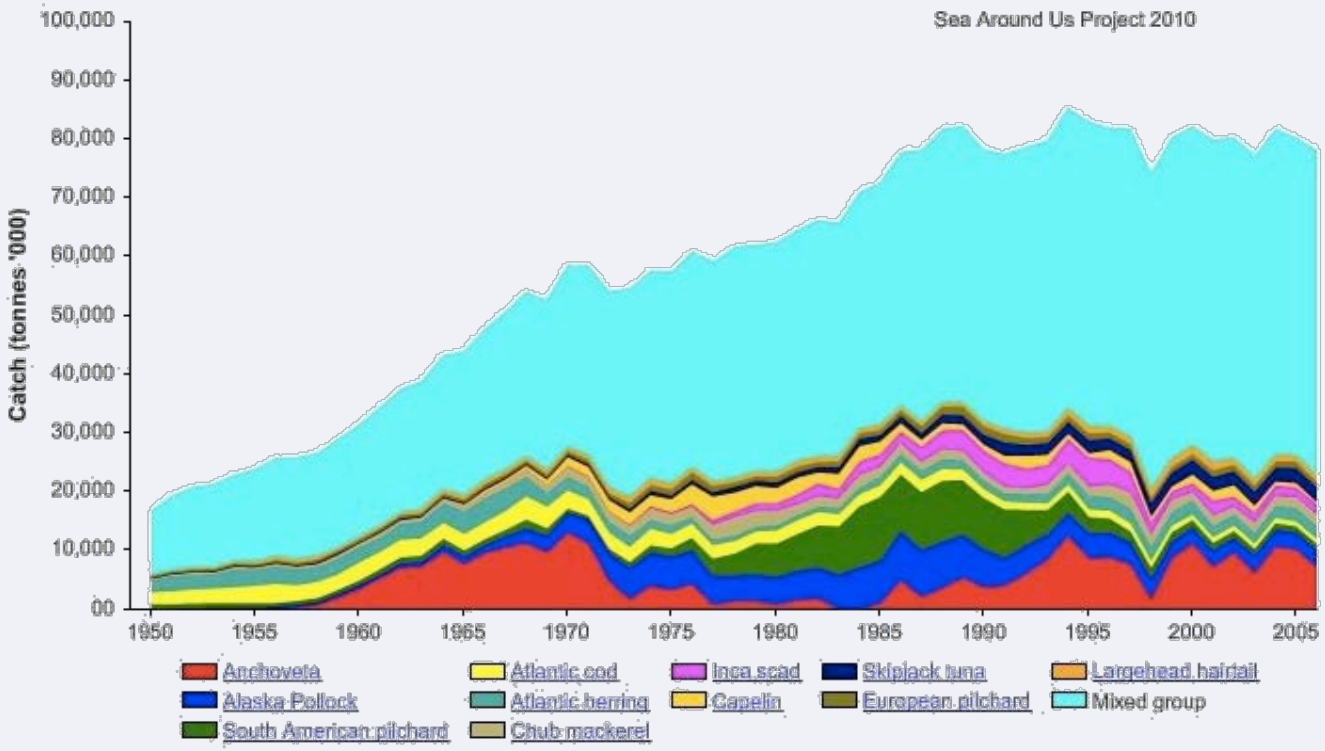
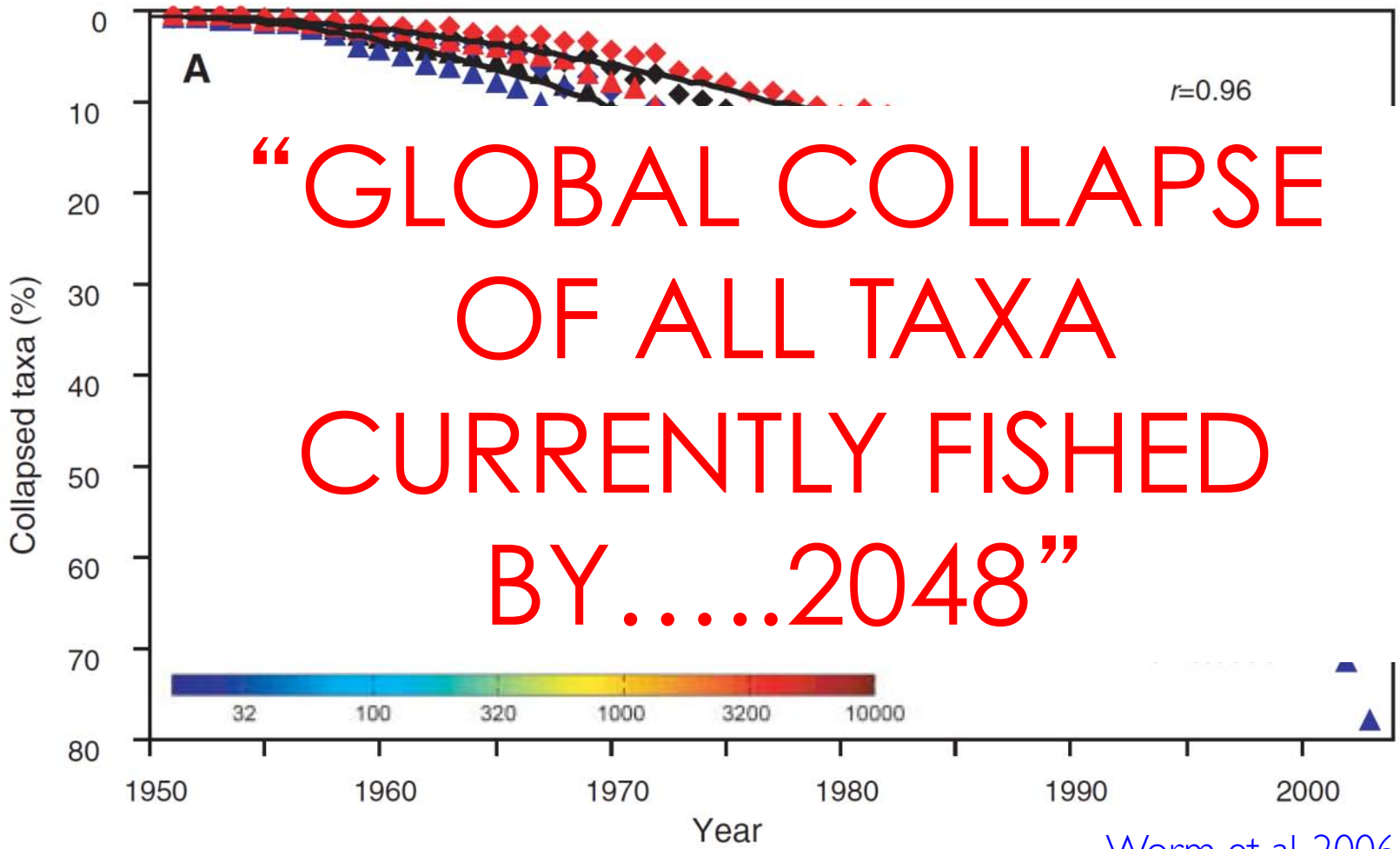
LANDINGS BY SPECIES IN THE GLOBAL OCEAN



Impacts of Biodiversity Loss on Ocean Ecosystem Services

Boris Worm,[1*] Edward B. Barbier,[2] Nicola Beaumont,[3] J. Emmett Duffy,[4] Carl Folke,[5,6] Benjamin S. Halpern,[7] Jeremy B. C. Jackson,[8,9] Heike K. Lotze,[1] Fiorenza Micheli,[10] Stephen R. Palumbi,[10] Enric Sala,[8] Kimberley A. Selkoe,[7] John J. Stachowicz,[11] Reg Watson[12]

This trend is of serious concern because it projects the global collapse of all taxa currently fished by the mid–21st century (based on the extrapolation of regression in Fig. 3A to 100% in the year 2048).



"GLOBAL COLLAPSE OF ALL TAXA CURRENTLY FISHED BY…..2048"

Worm et al. 2006 *Science*

Source: Time magazine, November 2006

Comment on "Impacts of Biodiversity Loss on Ocean Ecosystem Services"

John Jaenike

Michael J. Wilberg* and Thomas J. Miller

Franz Hölker,[1*] Doug Beare,[1] Hendrik Dörner,[1] Antonio di Natale,[2] Hans-Joachim Rätz,[3] Axel Temming,[4] John Casey[5]

Doubt and certainty in fishery science: Are we really headed for a global collapse of stocks?

Alan Longhurst*

Not all fisheries will be collapsed in 2048

Trevor A. Branch*

Biodiversity Loss in the Ocean: How Bad Is It?

STEVEN MURAWSKI,[1] RICHARD METHOT,[2] GALEN TROMBLE[3]

Apocalypse Forestalled: Why All the World's Fisheries Aren't Collapsing

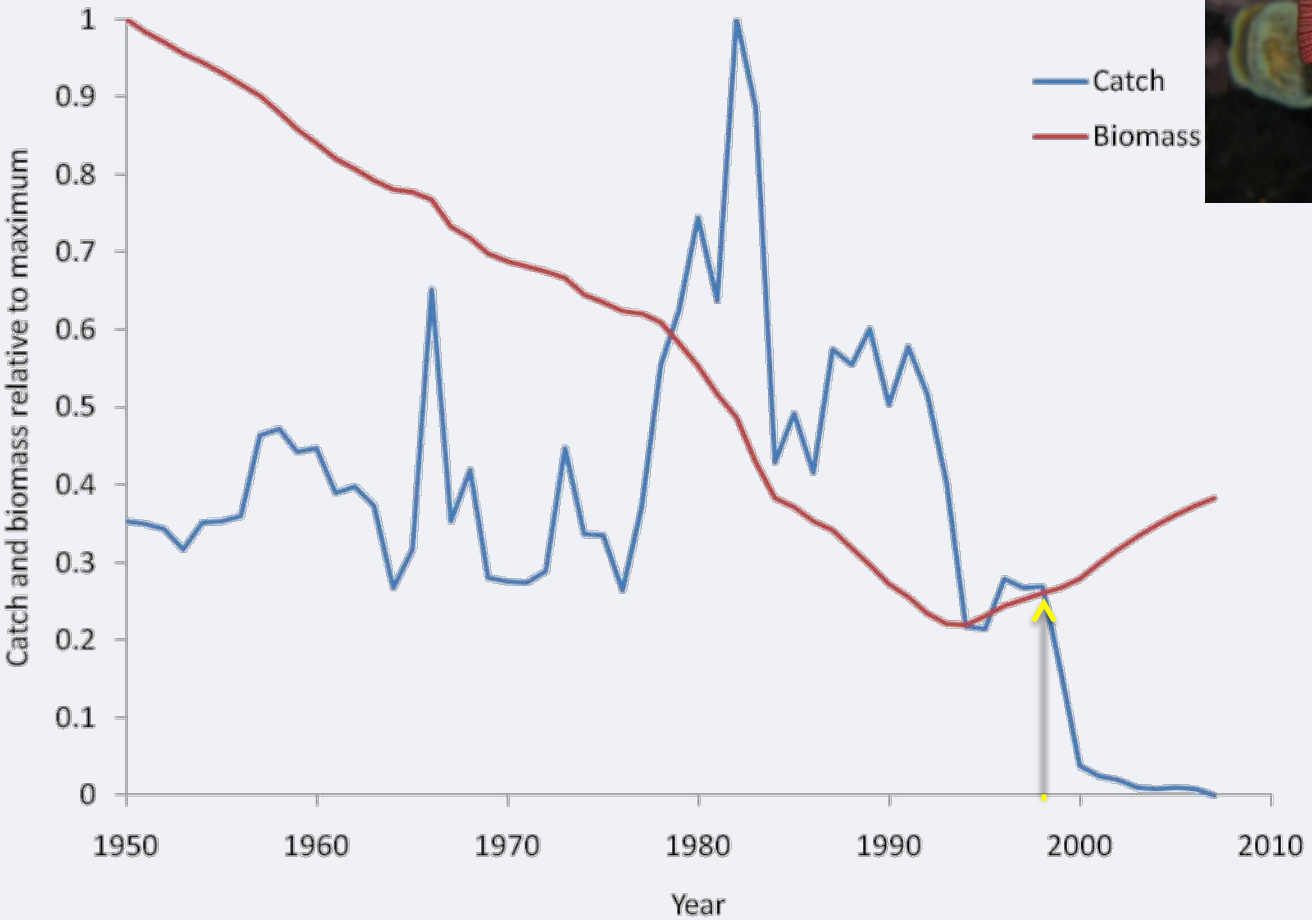
Ray Hilborn

Reinterpreting the State of Fisheries and their Management

Ray Hilborn

Do fisheries catches track population numbers?

Canary Rockfish



Branch et al. 2011 *Conservation Biology*

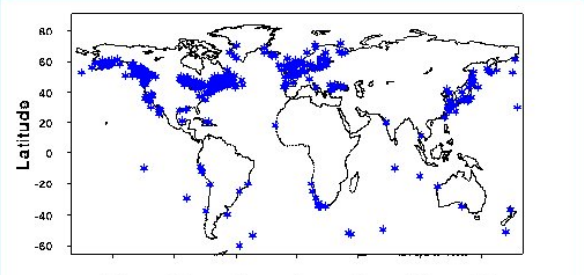
The original Myers SR Database

About This Site | Maps | Online Data and Plots | Related Papers

Welcome to Ransom Myers'

Stock Recruitment Database

This site consists of maps, plots, and numerical data relating to over 600 fish populations (over 100 species) from all over the world. Approximately 100 new populations are added per year. Ransom Myers is currently the Killam Chair of Ocean Studies at Dalhousie University, Canada. For more information on Dr. Myers, feel free to visit Ransom Myers' home page.



RAM Legacy Stock Assessment Database

http://ramlegacy.marinebiodiversity.ca/ram-legacy-stock-assessment-database

RAM legacy

Site Map Accessibility Contact

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LiveSearch ↓ only in current section

taxonomy
Species list with Taxonomic Serial Number and taxonomic hierarchy information

Advanced Search...

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You are here: Home > srDB > updated srDB

- Publications
- fish.dal.ca archive
- srDB
  - updated srDB
    - Stock-recruitment database entity relationship diagram
    - Instructions for contributing data
  - Latest spreadsheet template
  - Database tables
  - Examples of completed assessment spreadsheets
  - stock list from RAM's data

RAM Legacy Stock Assessment Database: Introduction and Fair Use Policy

Details about the RAM Legacy Stock Assessment database and policy for using database

Please contact Daniel Ricard (ricardd@mathstat.dal.ca) if you are interested in using the database and contributing to its development.

The **RAM Legacy Stock-Recruit Database** (srdb for short) is a database of marine fish assessments inspired by the original Myers Stock-Recruit database built by Ransom Myers, Nick Barrowman, and Jessica Bridson in the mid-1990s. We are currently still in development phase, actively adding new assessments, quality-controlling the data, and writing sql scripts for using the database. We envision the srdb as a user-built database, in that scientists interested in using it while it is still developing will first make a significant investment in contributing new assessments or ancillary data. We view this as an important component of completing this first version of the database and keeping it up-to-date as new assessments become available, but also as an important step for users to become familiar with assessments and the database.

For each stock, the database contains data from the most recent stock assessment (except in cases where a full assessment was not done in the most recent assessment, or there were problems with the most recent assessment, in which case the next most recent assessment is used). Assessments from NMFS, DFO, NAFO, ICES, Australia, New Zealand, Argentina, South Africa, and RFMOs are currently being input, and we welcome assessments from other regions. We are also in the process of inputting all of the data from the original Myers Stock-Recruit Database, so that comparisons can be made between the two.

Fair Use Policy We welcome collaborators who are interested in using the database in their research, and request that you contact Daniel Ricard and Julia Baum (baum@nceas.ucsb.edu) if you would like to do so. Use of the database is subject to a 'Fair Use' policy, which includes the following criteria:

-We are currently actively working on a number of analyses of the database, and request that you coordinate with us so that we can ensure your research is complementary, either by:

(i) joining us on existing papers when our efforts overlap, or

(ii) offering the database developers the opportunity to become involved in your research as co-authors when your research is separate from our existing efforts.

-Please note that access to the database is for the research discussed. Additional use should be discussed with us.

-We request that while we are still actively developing the database, if you would like to conduct analyses using these data, that you also make a significant contribution of new assessments or ancillary data to the database. We will work with you to help facilitate these contributions.

-Analyses to be submitted for publication must be based on the quality-controlled (QAQC'd) stocks.

-Primary publications based on analyses of the database must cite the primary paper describing the database:

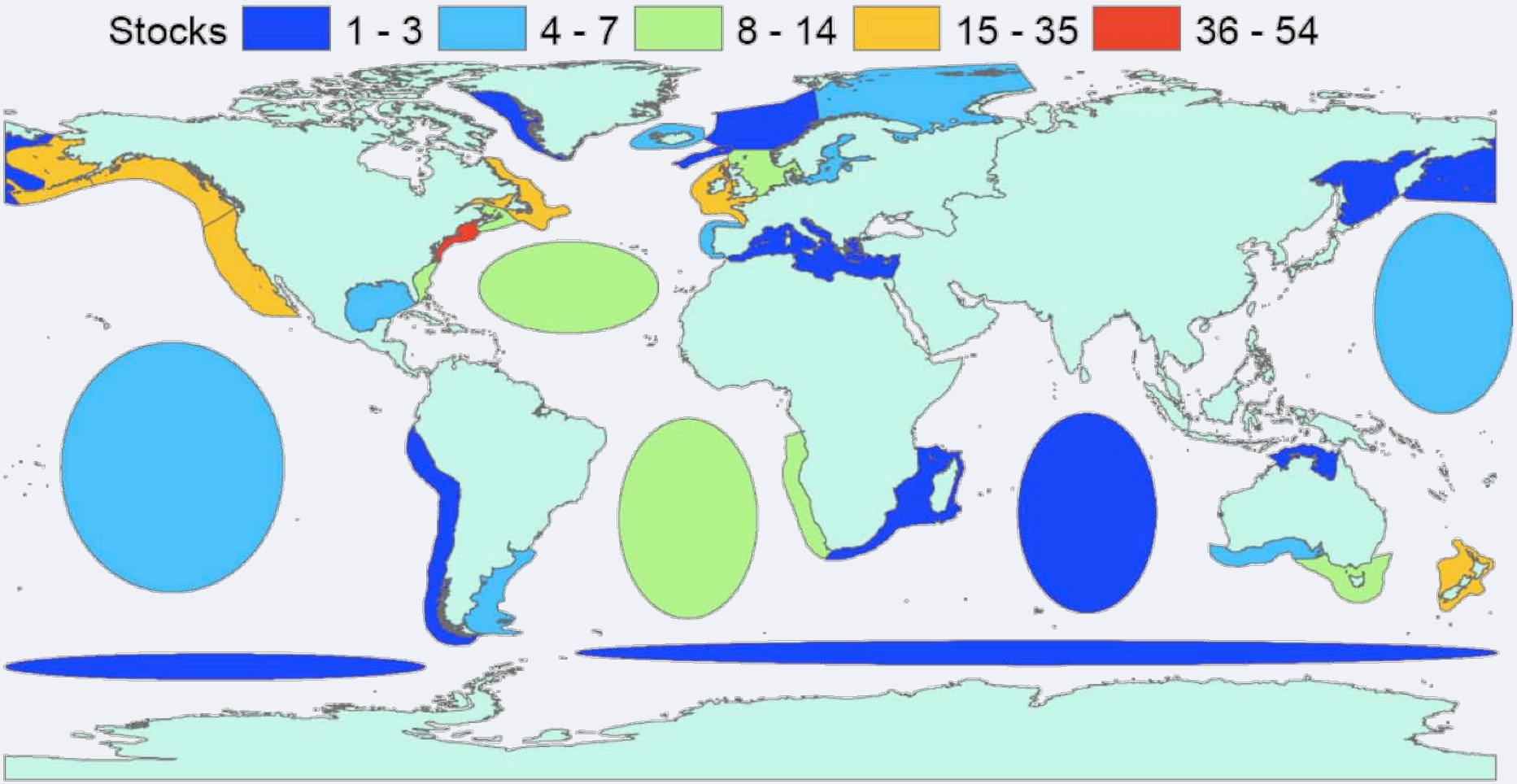
News

"RAM's steps" stairwell memorial officially opened
Apr 01, 2010

More news...

RAM Legacy Stock Assessment Database

Geographic Coverage



Ricard, Minto, Jensen, Baum 2012 *Fish and Fisheries*

Assessing the state of fisheries

LETTER

doi:10.1038/nature09528

The trophic fingerprint of marine fisheries

Trevor A. Branch[1], Reg Watson[2], Elizabeth A. Fulton[3], Simon Jennings[4,5], Carey R. McGilliard[1], Grace T. Pablico[2], Daniel Ricard[6] & Sean R. Tracey[7]

Biodiversity indicators provide a vital window on the state of the

We compiled ecosystem models[21] from 25 different ecosystems
ain scenarios to examine the
and ecosystem MTL (Fig. 1).
, as already outlined, 'fishing
of low-trophic-level fisheries
drives MTL, 'based on avail-
ecies with high biomass are
accessible stocks with lower

PNAS

Unexpected patterns of fisheries collapse in the world's oceans

Malin L. Pinsky[a,1], Olaf P. Jensen[b], Daniel Ricard[c], and Stephen R. Palumbi[a]

[a]Hopkins Marine Station, Department of Bi
New Brunswick, NJ 08901; and [c]Departmer

Edited by Daniel E. Schindler, University of
12, 2010)

Understanding which species are mo

RAPID COMMUNICATION / COMMUNICATION RAPIDE

Trends in the abundance of marine fishes

ard, Julia K. Baum, and

FISH and FISHERIES

FISH and FISHERIES, 2012, 13, 267–290

ed a target in 2002 to reduce the rate of biodiversity
pulations (108 species), we examine whether the 201
ion biomass relative to maximum sustainable yield,
eclining before 1992 (a pattern consistent with a liter
gsy has remained unchanged and the rate of decline l
$5B_{MSY}$. Combining population trends, a global multi-

Can catch share fisheries better track management targets?

Michael C Melnychuk[1], Timothy E
Jason S Link[4*], Steven J D Martell[5],

[1]School of Aquatic and Fishery Science
and Wildlife, Oregon State University,
Rutgers University, 71 Dudley Rd., Ne
Fisheries Science Center, 166 Water S
Columbia, 2202 Main Mall, Vancouve
Chubut, Argentina; [7]NRC (Europe) Ltd
[8]Commonwealth Scientific and Industr
Tasmania 7001, Australia

FISH and FISHERIES

FISH and FISHERIES, 2012, 13, 380–398

Examining the knowledge base and status of commercially exploited marine species with the RAM Legacy Stock Assessment Database

Daniel Ricard[1], Cóilín Minto[1*], Olaf P Jensen[2†] & Julia K Baum[3‡]

[1]Department of Biology, Dalhousie University, Halifax, NS, Canada B3H 4R2; [2]School of Aquatic and Fishery Sciences,

RESEARCH ARTICLES

Rebuilding Global Fisheries

Boris Worm,[1*] Ray Hilborn,[2*] Julia K. Baum,[3] Trevor A. Branch,[2] Jeremy S. Collie,[4] Christopher Costello,[5] Michael J. Fogarty,[6] Elizabeth A. Fulton,[7] Jeffrey A. Hutchings,[1] Simon Jennings,[8,9] Olaf P. Jensen,[2] Heike K. Lotze,[1] Pamela M. Mace,[10] Tim R. McClanahan,[11] Cóilín Minto,[1] Stephen R. Palumbi,[12] Ana M. Parma,[13] Daniel Ricard,[1] Andrew A. Rosenberg,[14] Reg Watson,[15] Dirk Zeller[15]

After
fishe
pers

Conservation Biology

Contributed Paper

Contrasting Global Trends in Marine Fishery Status Obtained from Catches and from Stock Assessments

OPEN ACCESS Freely available online

PLOS | ONE

Eco-Label Conveys Reliable Information on Fish Stock Health to Seafood Consumers

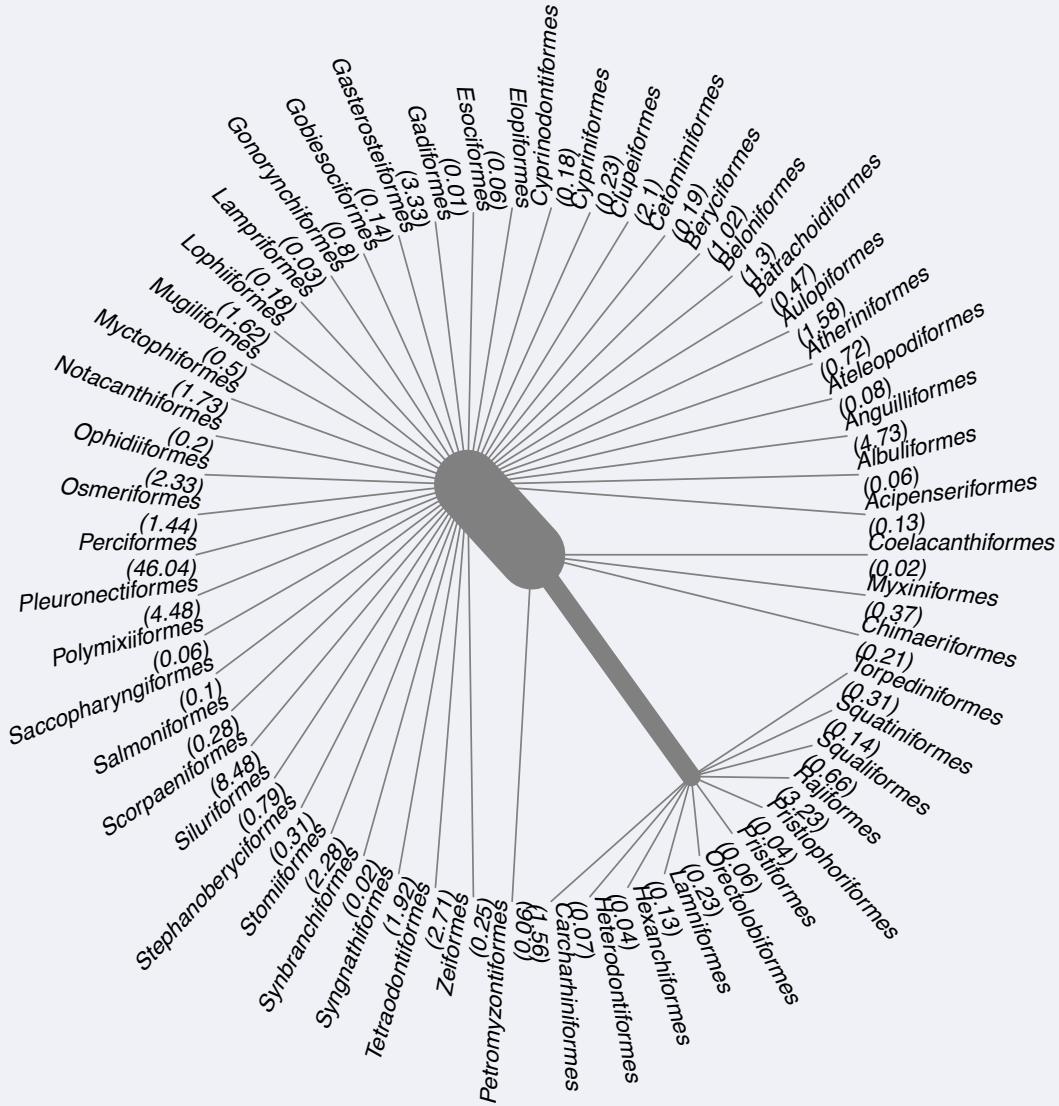
Nicolás L. Gutiérrez[1*], Sarah R. Valencia[2], Trevor A. Branch[3], David J. Agnew[1], Julia K. Baum[4],
ricia L. Bianchi[1], Jorge Cornejo-Donoso[5,6], Christopher Costello[2], Omar Defeo[7], Timothy E. Essington[3],
Hilborn[3], Daniel D. Hoggarth[1], Ashley E. Larsen[8], Chris Ninnes[1], Keith Sainsbury[9], Rebecca L. Selden[8],
eta Sistla[8], Anthony D. M. Smith[10], Amanda Stern-Pirlot[1], Sarah J. Teck[8], James T. Thorson[3],
holas E. Williams[11]

rine Stewardship Council, London, United Kingdom, 2 Bren School of Environmental Science and Management, University of California Santa Barbara, Santa Barbara,
rnia, United States of America, 3 School of Aquatic and Fishery Sciences, University of Washington, Seattle, Washington, United States of America, 4 Department of
gy, University of Victoria, Victoria, British Columbia, Canada, 5 Interdepartmental Graduate Program in Marine Science, Marine Science Institute, University of
rnia Santa Barbara, Santa Barbara, California, United States of America, 6 Universidad Austral de Chile, Centro Trapananda, Coyhaique, Chile, 7 UNDECIMAR, Facultad
encias, Montevideo, Uruguay, 8 Department of Ecology, Evolution and Marine Biology, University of California Santa Barbara, Santa Barbara, California, United States
merica, 9 University of Tasmania, Tasmanian Aquaculture & Fisheries Inst, Taroona, Tasmania, Australia, 10 Commonwealth Scientific and Industrial Research
nization, Wealth from Oceans Flagship, Hobart, Tasmania, Australia, 11 Department of Anthropology, University of California Santa Barbara, Santa Barbara, California,
d States of America

Abstract

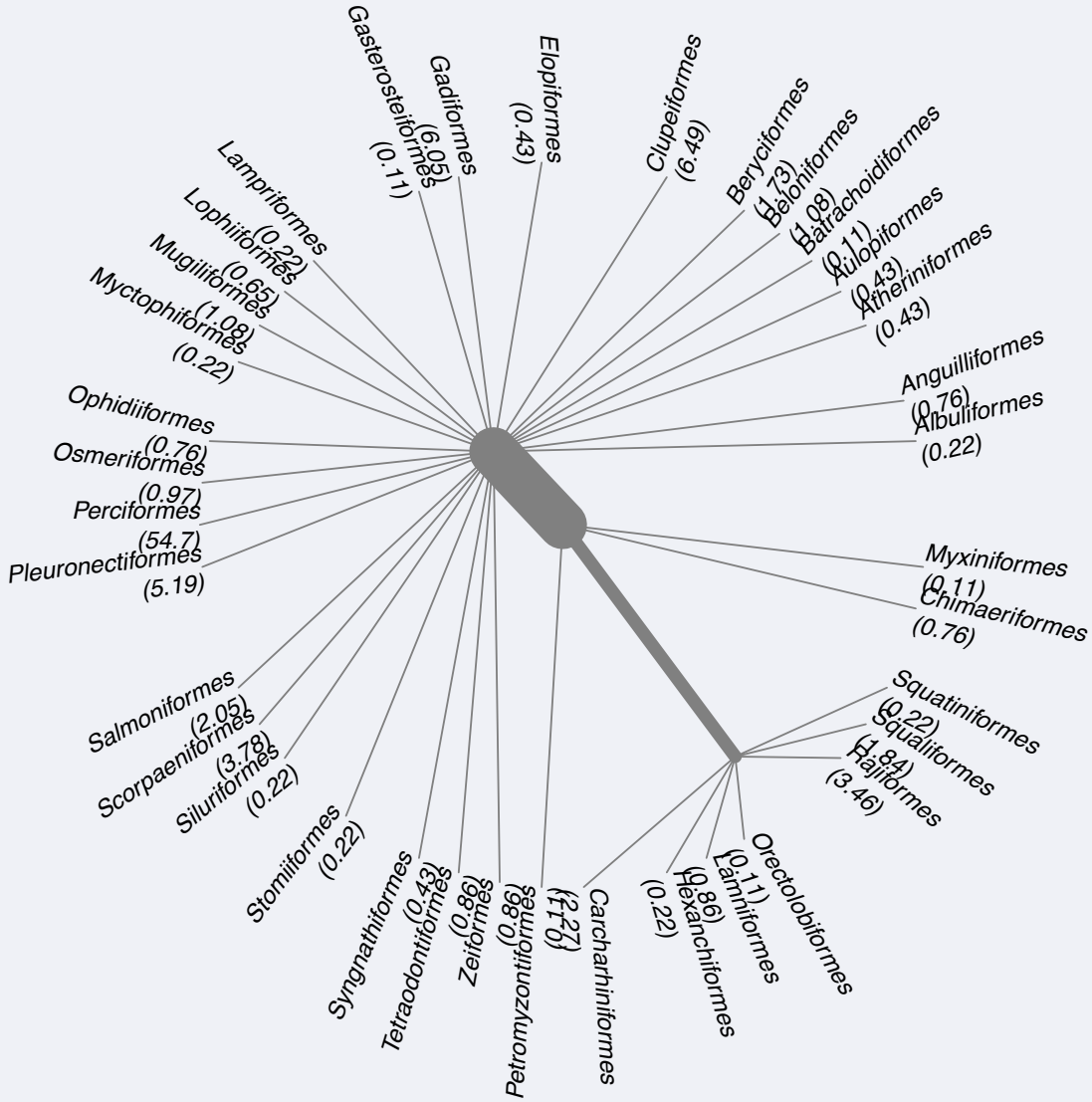
Concerns over fishing impacts on marine populations and ecosystems have intensified the need to improve ocean management. One increasingly popular market-based instrument for ecological stewardship is the use of certification and eco-labeling programs to highlight sustainable fisheries with low environmental impacts. The Marine Stewardship Council (MSC) is the most prominent of these programs. Despite widespread discussions about the rigor of the MSC standards, no comprehensive analysis of the performance of MSC-certified fish stocks has yet been conducted. We compared status and abundance trends of 45 certified stocks with those of 179 uncertified stocks, finding that 74% of certified fisheries were above biomass levels that would produce maximum sustainable yield, compared with only 44% of uncertified fisheries. On average, the biomass of certified stocks increased by 46% over the past 10 years, whereas uncertified fisheries increased by just 9%. As part of the MSC process, fisheries initially go through a confidential pre-assessment process. When certified

All orders of marine fishes



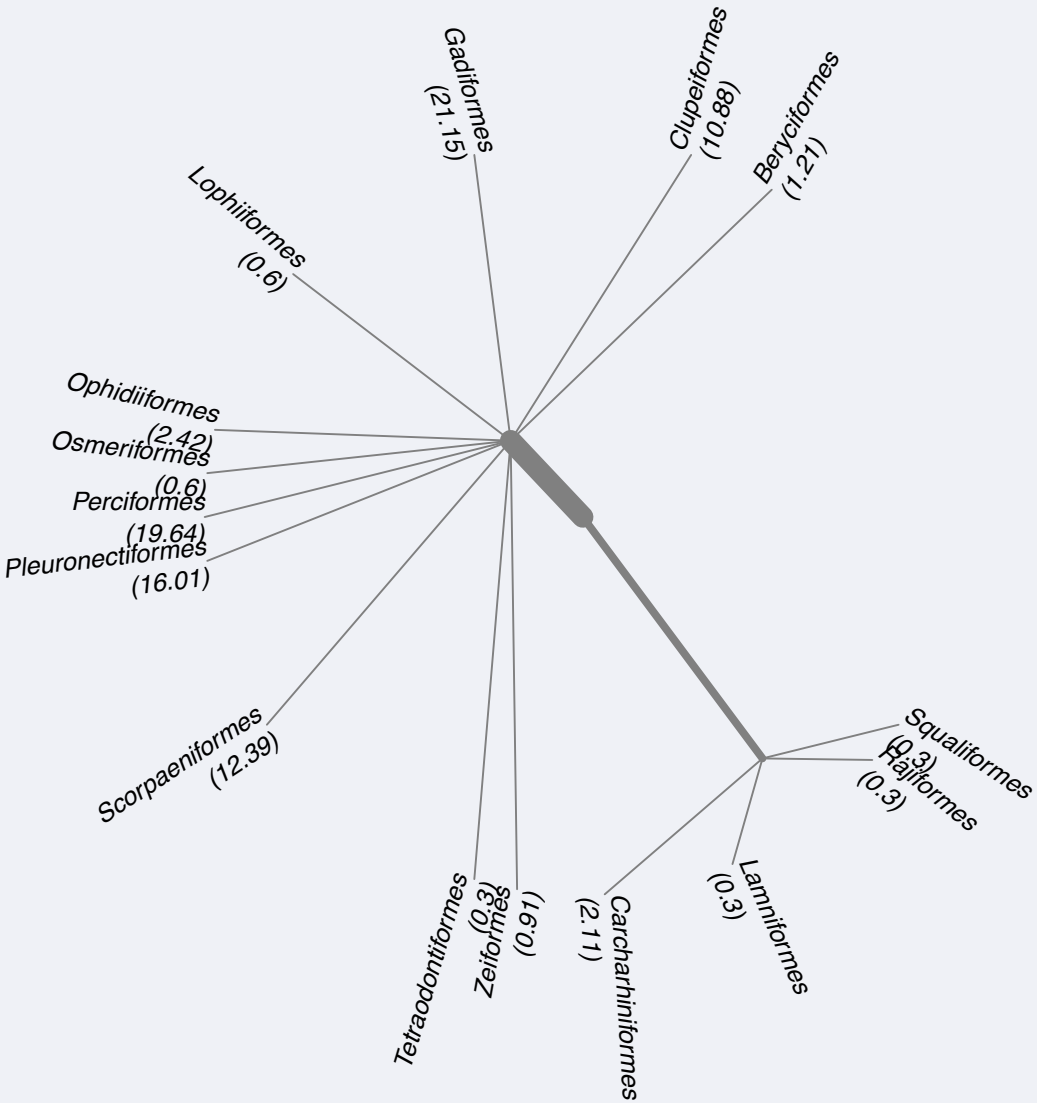
Ricard, Minto, Jensen, Baum 2012 *Fish and Fisheries*

Harvested orders of marine fishes



Ricard, Minto, Jensen, Baum 2012 *Fish and Fisheries*

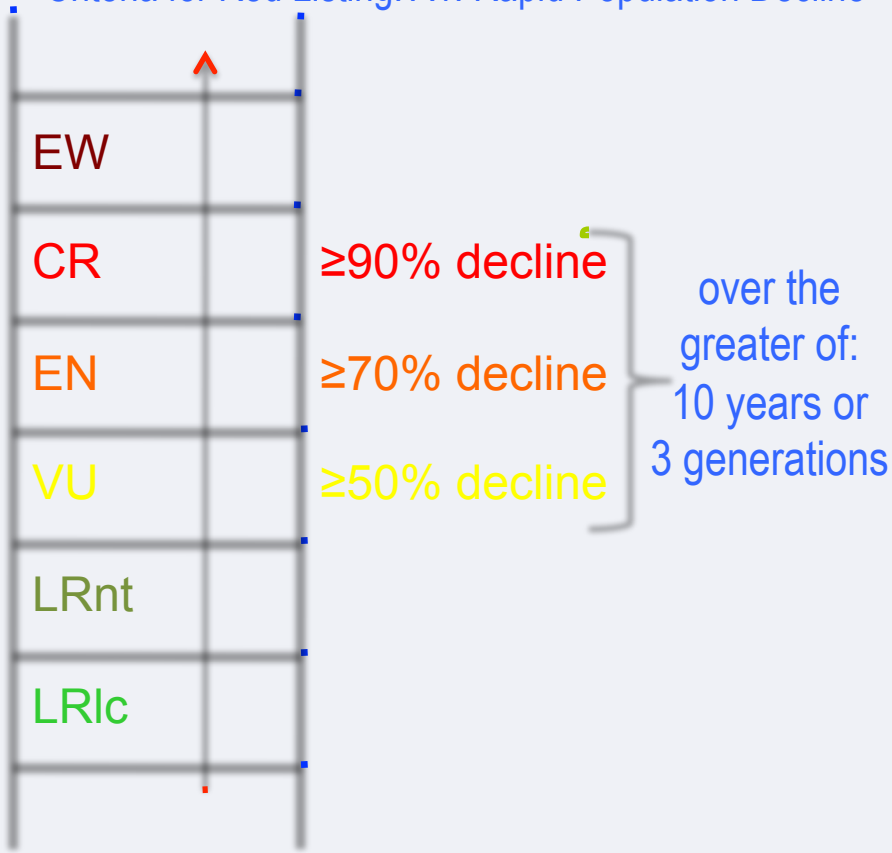
Assessed orders of marine fishes



Ricard, Minto, Jensen, Baum 2012 *Fish and Fisheries*

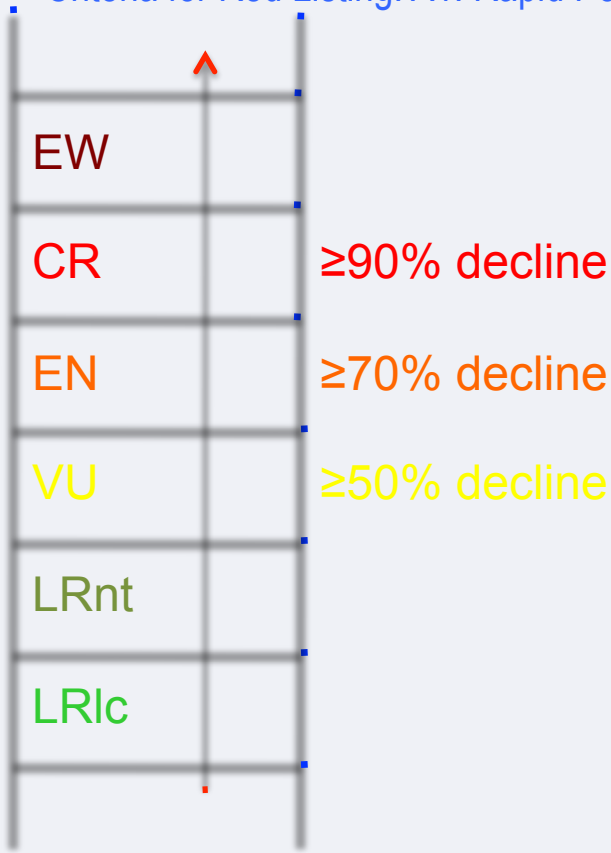
A conservation perspective on the status of marine fishes

Criteria for Red Listing: A1. Rapid Population Decline



A conservation perspective on the status of marine fishes

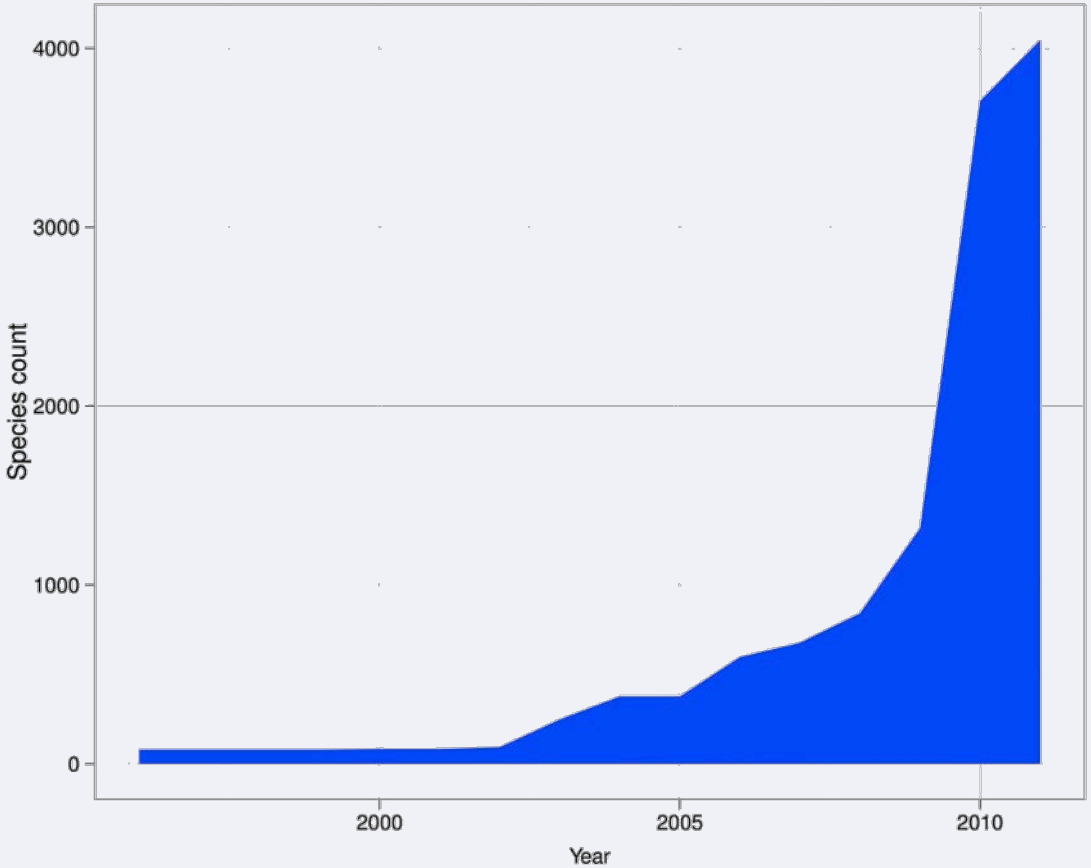
Criteria for Red Listing: A1. Rapid Population Decline



≥90% decline

≥70% decline

≥50% decline



Reconciling Conservation and Fisheries Perspectives on the Status of Marine Fishes

What is the status of marine fishes according to fisheries and conservation metrics?

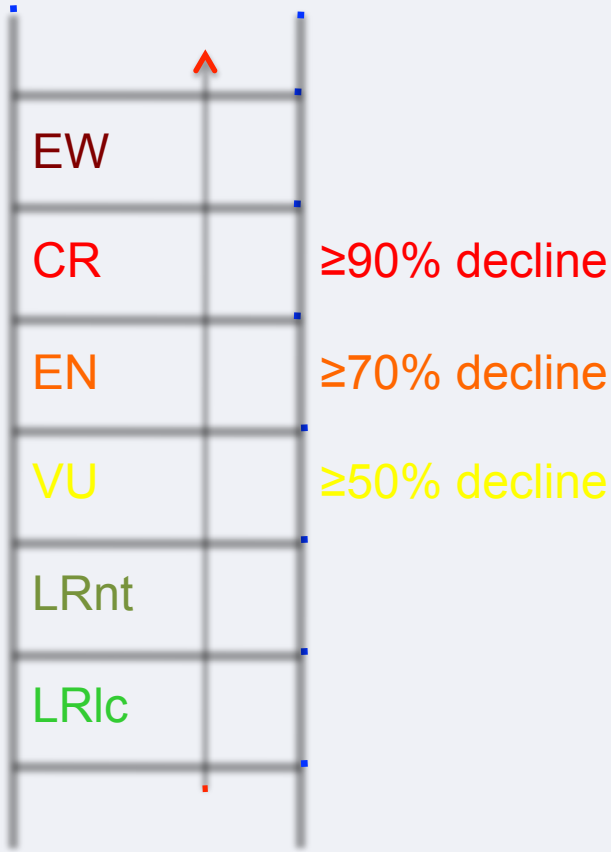
How well do these metrics align?

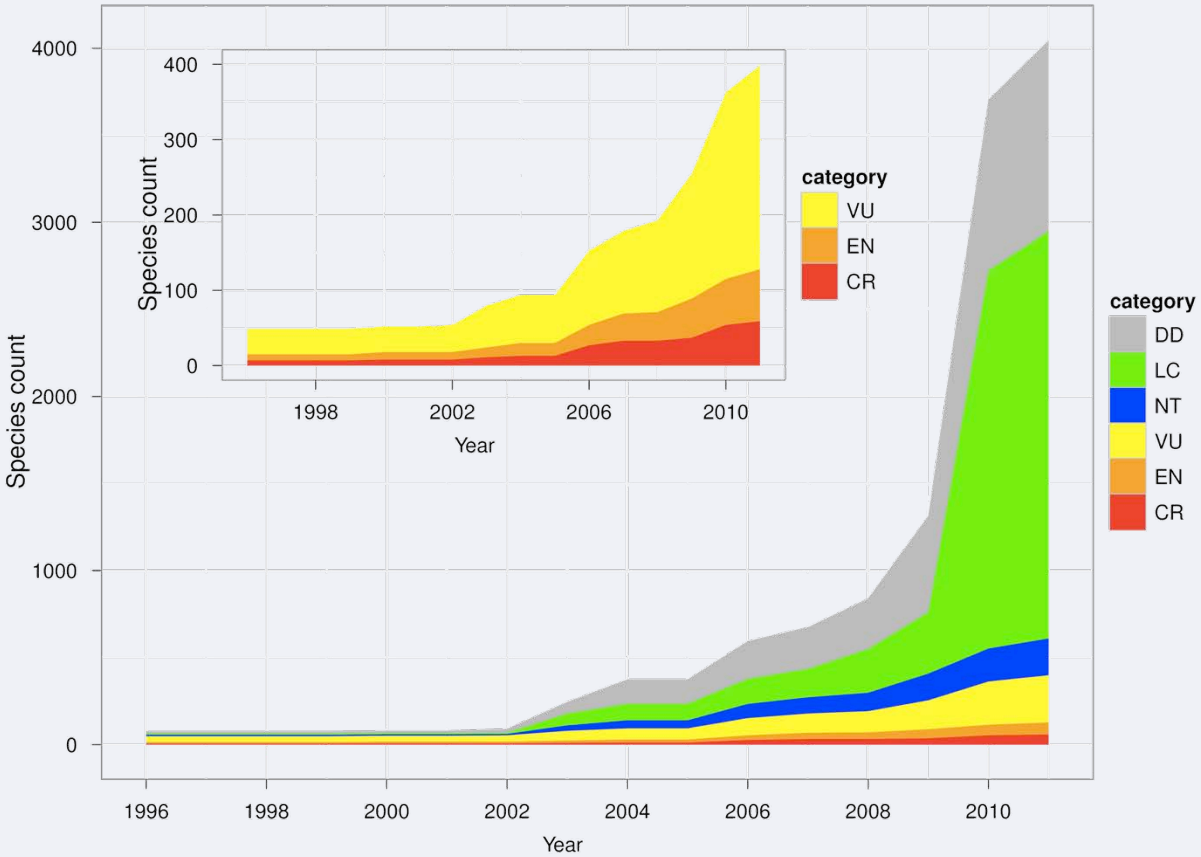
Hypothesis: Poor alignment (near thresholds) if Red List is an accurate measure of extinction risk

Alternatively: Good alignment, indicating the metrics provide consistent signals of when a population is in trouble; but suggests Red List exaggerates extinction risk

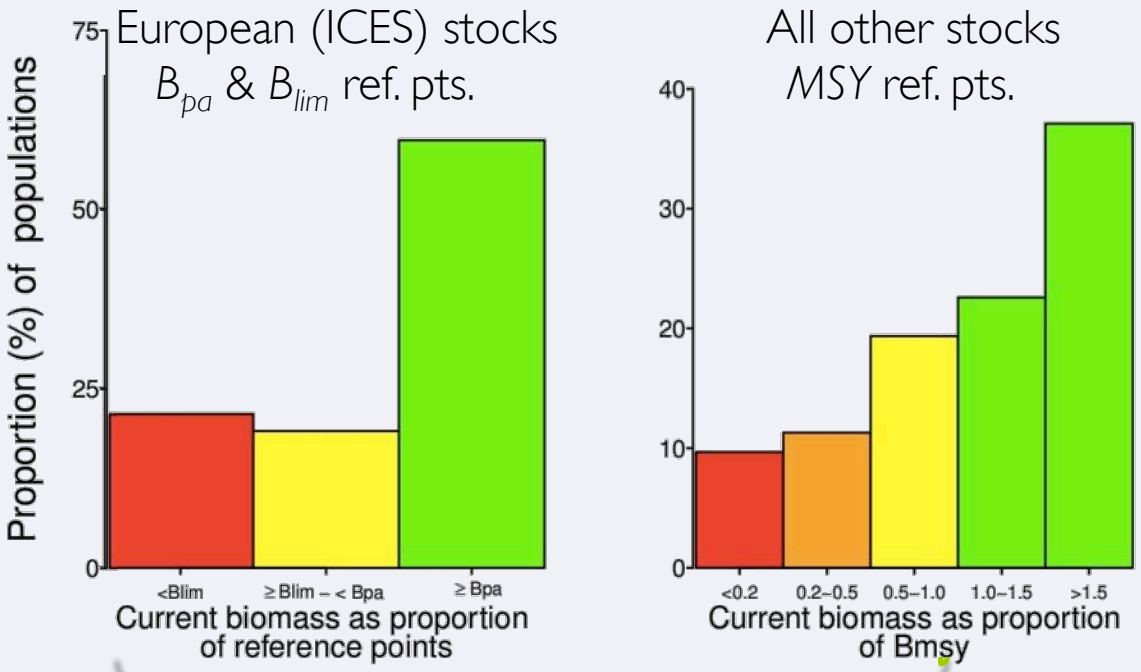
What is the status of marine fishes according to fisheries and conservation metrics?

Red List status of marine fishes



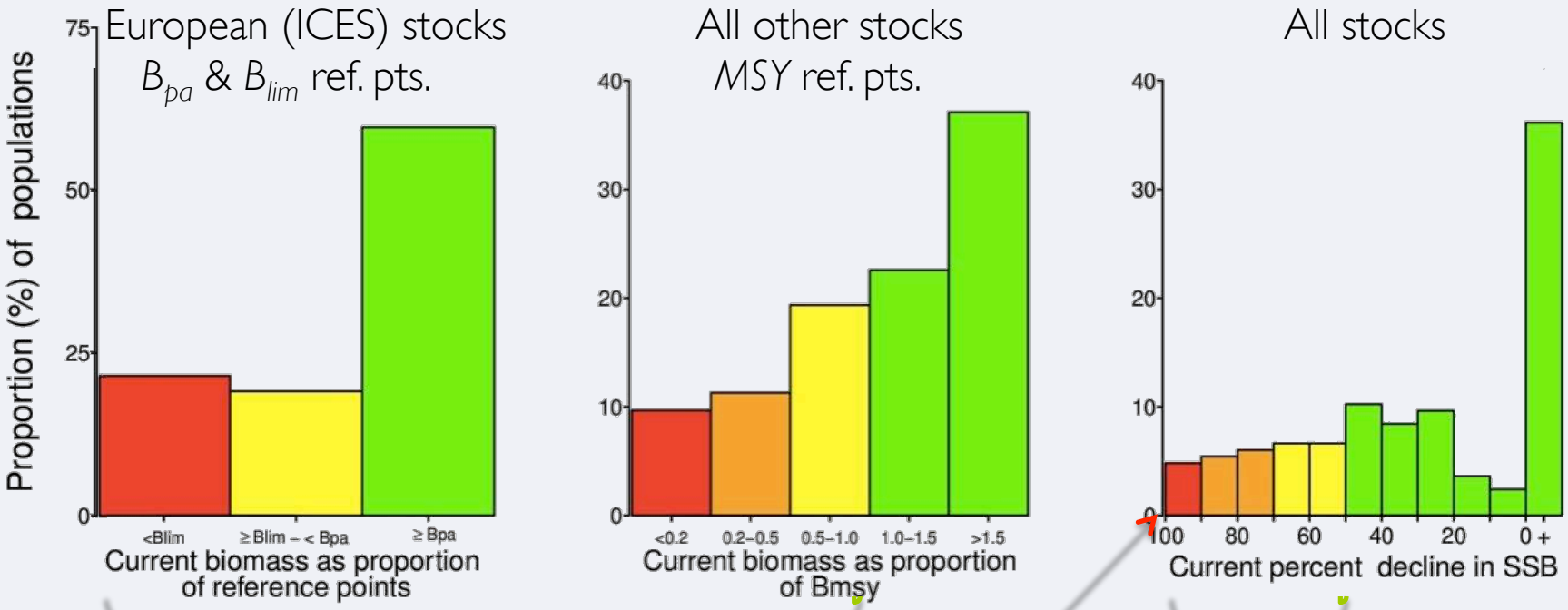


Status of marine fishes: comparing apples to apples



40% 'in trouble' (below upper reference point)

Current status of marine fishes: comparing apples to apples



40% 'in trouble' (below upper reference point)

29.5% 'in trouble' (>50% decline)

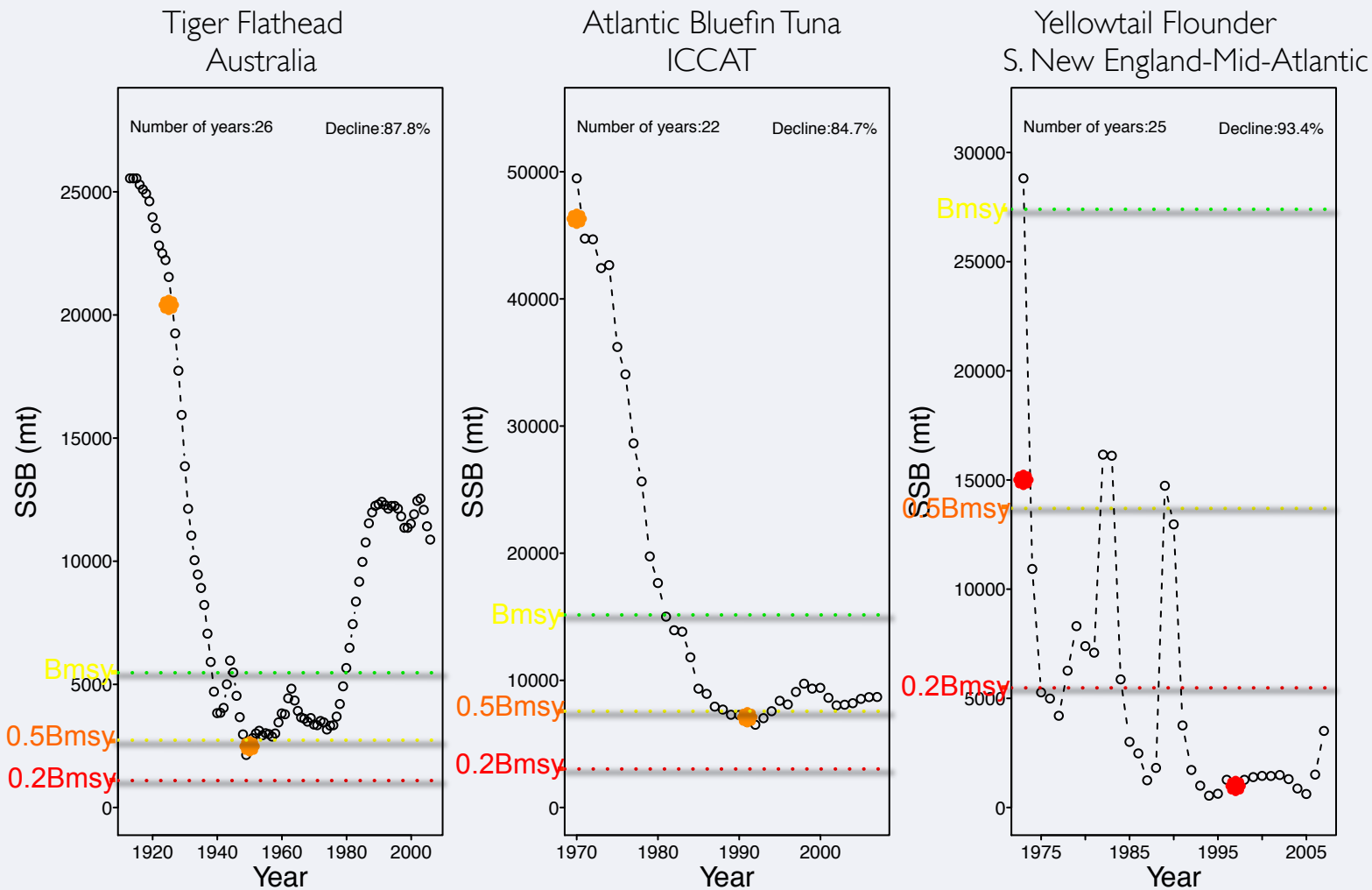
Only 8 stocks (<5%) CR

How well do fisheries and conservation metrics align?

How well do fisheries and conservation metrics align?

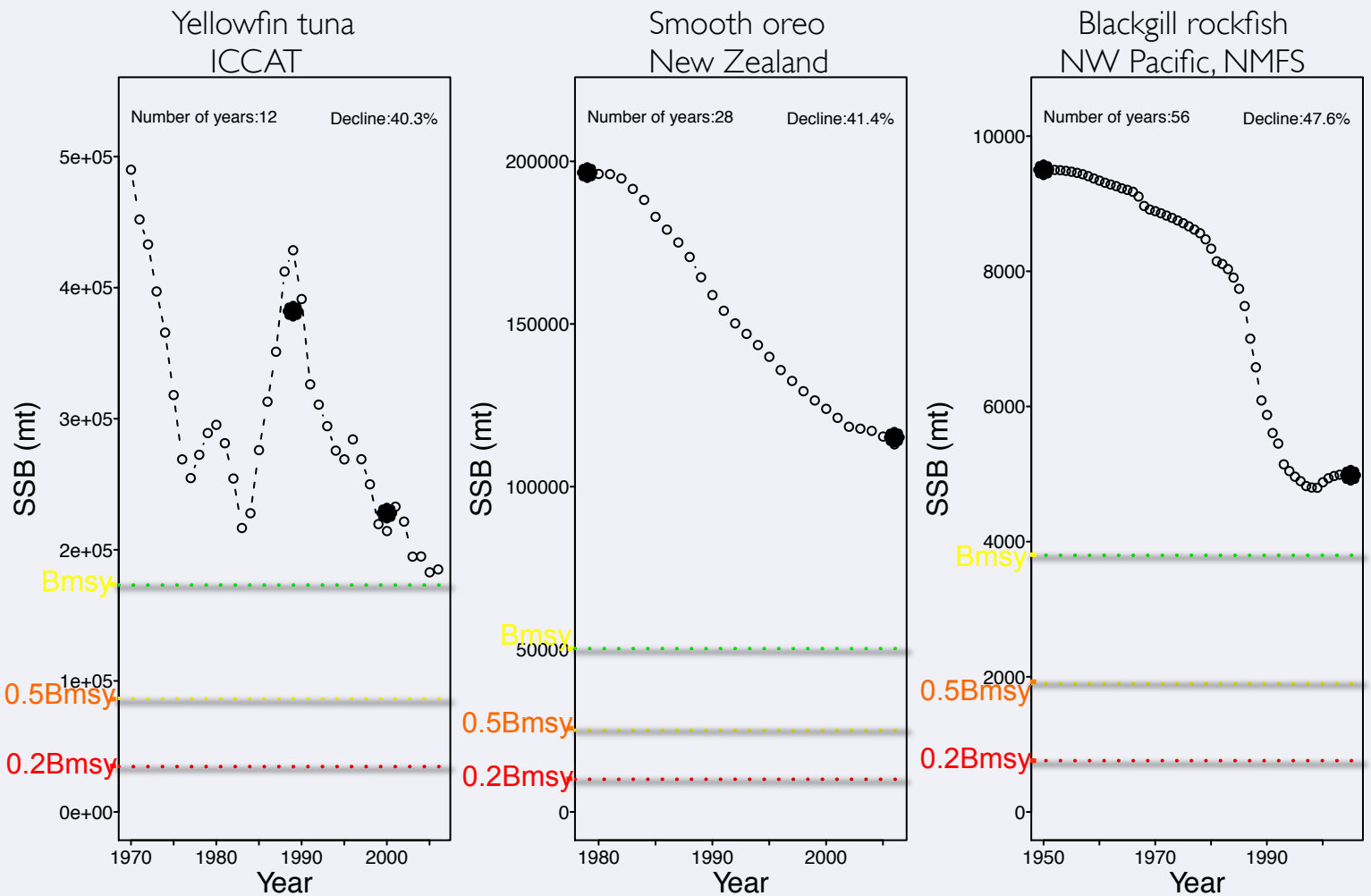
	IUCN Red List Status (% decline)	
Fishery Status	Threatened	Not Threatened
OK (Above reference point)		HIT (True Negative)
In trouble (Below ref. pt.)	HIT (True Positive)	

Hits (positive)



Davies and Baum 2012 *Scientific Reports*

Hits (negative)



Davies and Baum 2012 *Scientific Reports*

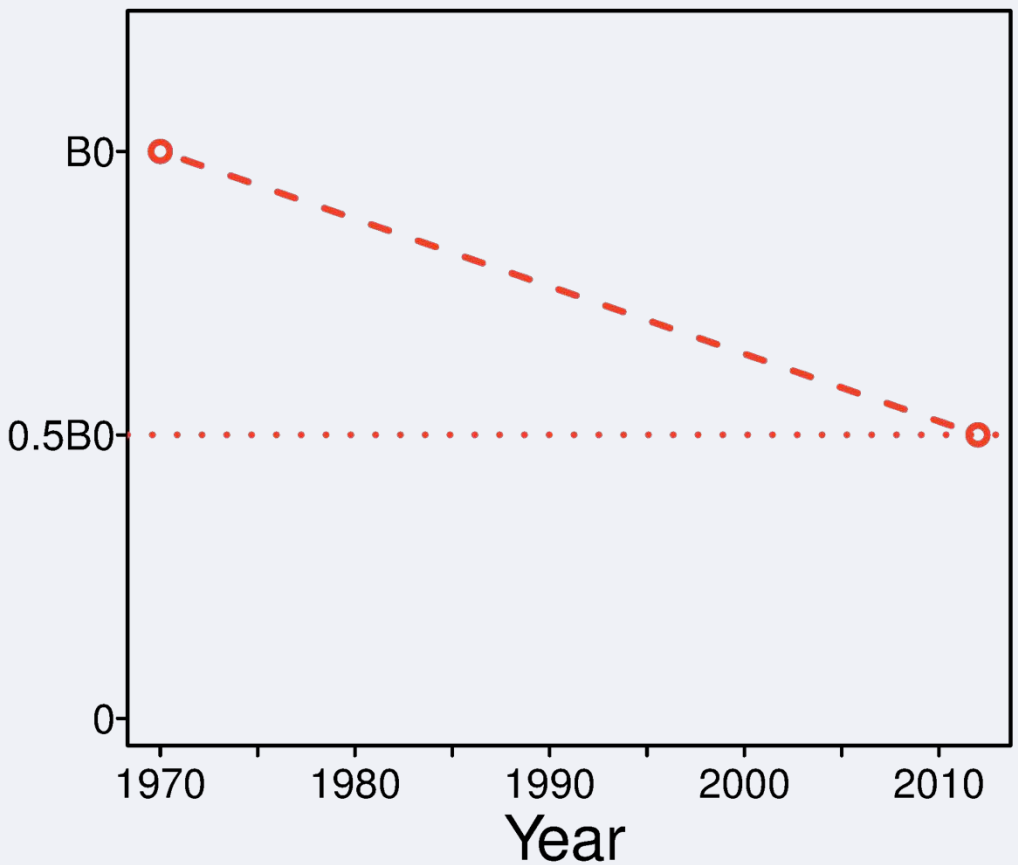
How well do fisheries and conservation metrics align?

	IUCN Red List Status (% decline)	
Fishery Status	Threatened	Not Threatened
OK (Above reference point)	FALSE ALARM	
In trouble (Below ref. pt.)		

False alarms

The Mathematical Disconnect:

Fundamentally different methodologies (Rate of decline vs. Relative biomass levels)



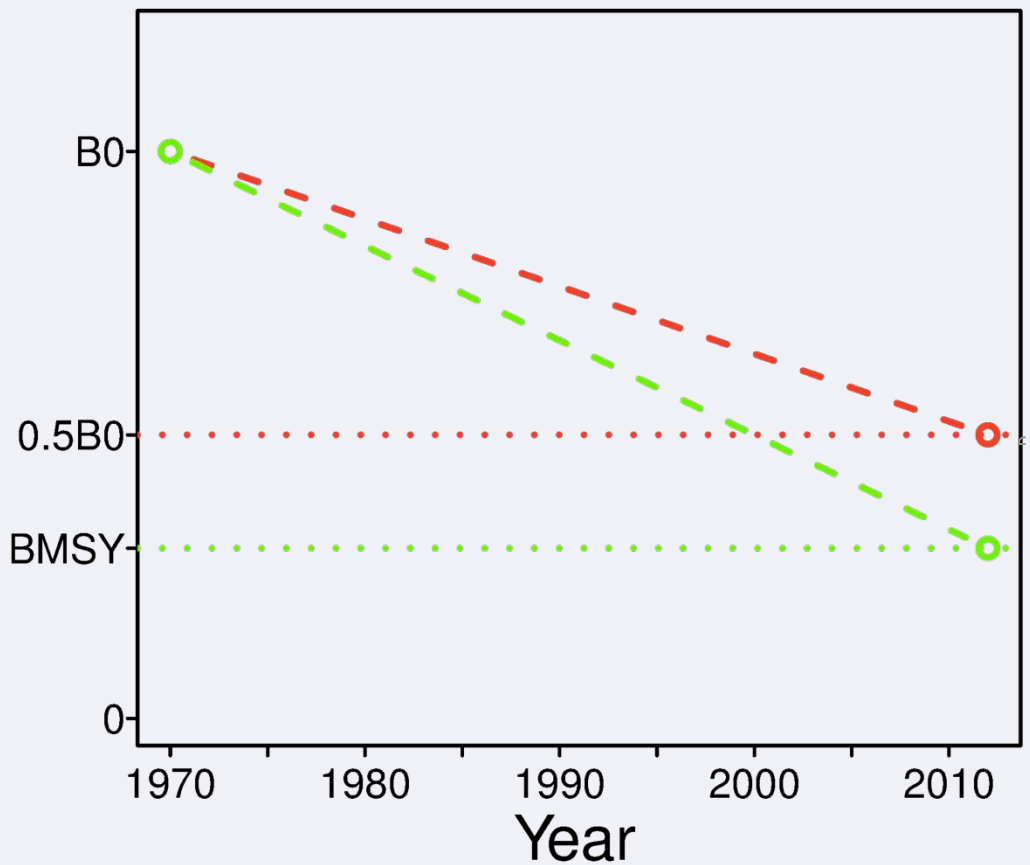
Schaefer model offers the potential for perfect alignment

Davies and Baum 2012 *Scientific Reports*

False alarms

The Mathematical Disconnect:

Fundamentally different methodologies (Rate of decline vs. Relative biomass levels)



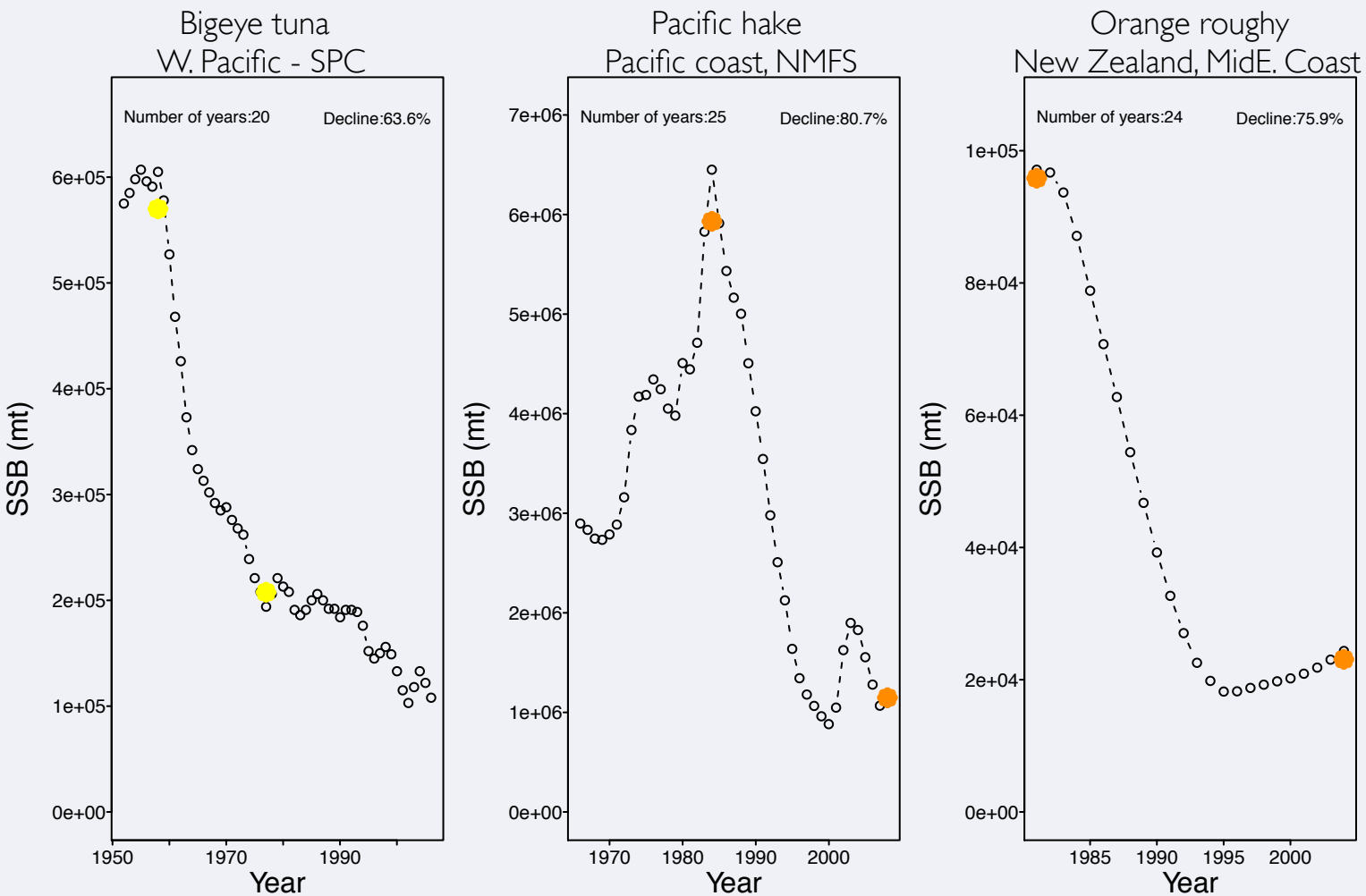
<u>Productive stocks</u>

B_{MSY} can be at $0.3B_0$

50% vs. 70% decline

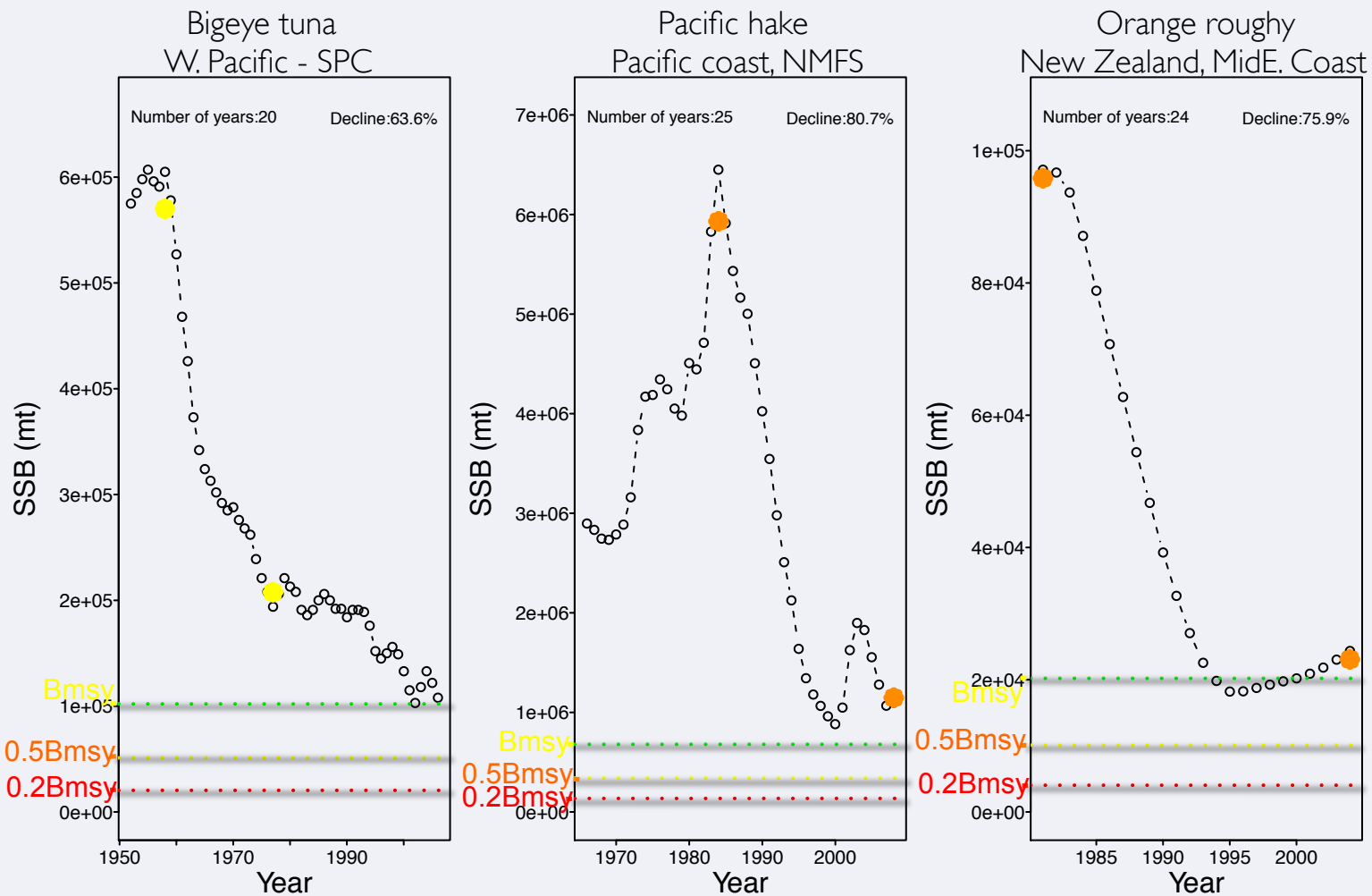
Davies and Baum 2012 *Scientific Reports*

False alarms



Davies and Baum 2012 *Scientific Reports*

False alarms

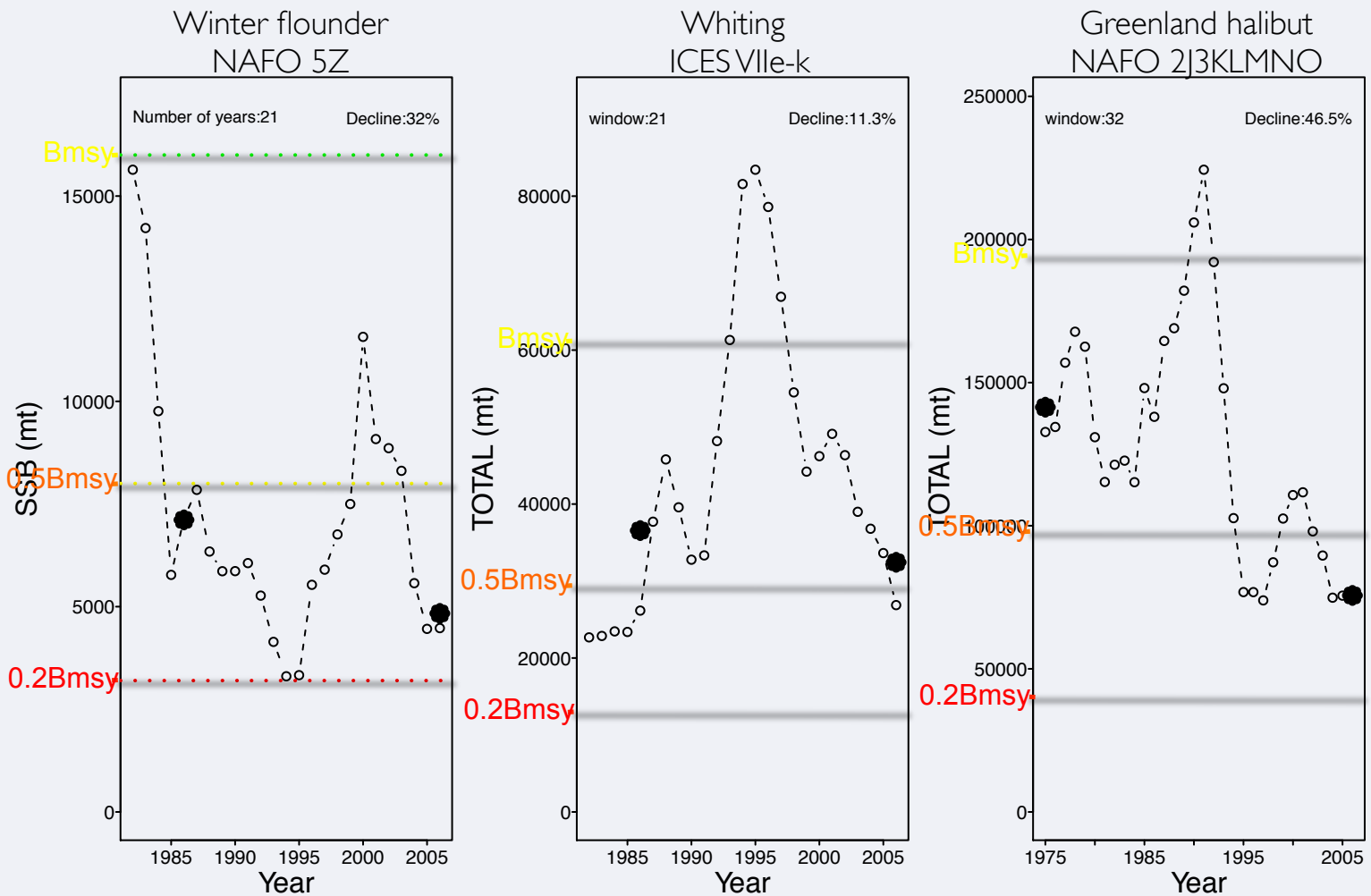


Davies and Baum 2012 *Scientific Reports*

How well do fisheries and conservation metrics align?

	IUCN Red List Status (% decline)	
Fishery Status	Threatened	Not Threatened
OK (Above reference point)		
In trouble (Below ref. pt.)		MISS

Misses



Davies and Baum 2012 *Scientific Reports*

How well do fisheries and conservation metrics align?

	IUCN Red List Status (% decline)	
Fishery Status	Threatened	Not Threatened
OK (Above reference point)	6.6% FALSE ALARMS	53% HITS (True Negative)
In trouble (Below ref. pt.)	22.9% HITS (True Positive)	

Davies and Baum 2012 *Scientific Reports*

How well do fisheries and conservation metrics align?

	IUCN Red List Status (% decline)	
Fishery Status	Threatened	Not Threatened
OK (Above reference point)	6.6% FALSE ALARMS	53% HITS (True Negative)
In trouble (Below ref. pt.)	22.9% HITS (True Positive)	17.5% MISSES

¾ Alignment

Davies and Baum 2012 *Scientific Reports*

Reconciling Conservation and Fisheries Perspectives on the Status of Marine Fishes

What is the status of marine fishes according to fisheries and conservation metrics?

- *40% of stocks currently below their upper ref. pt.; 29.5% of which qualify as threatened on Red List*

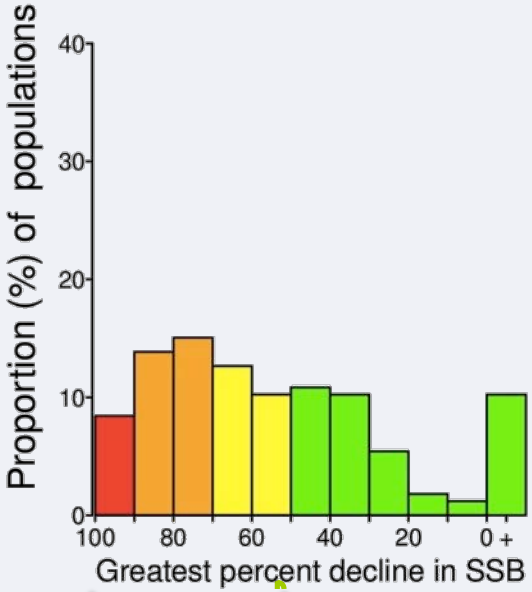
How well do these metrics align?

- *Red List not biased toward 'false' threat listings*
- *Conservation and fisheries metrics typically provide consistent signals (75.9% of stocks)*

What is the *'worst case'* status of marine fishes according to fisheries and conservation metrics?

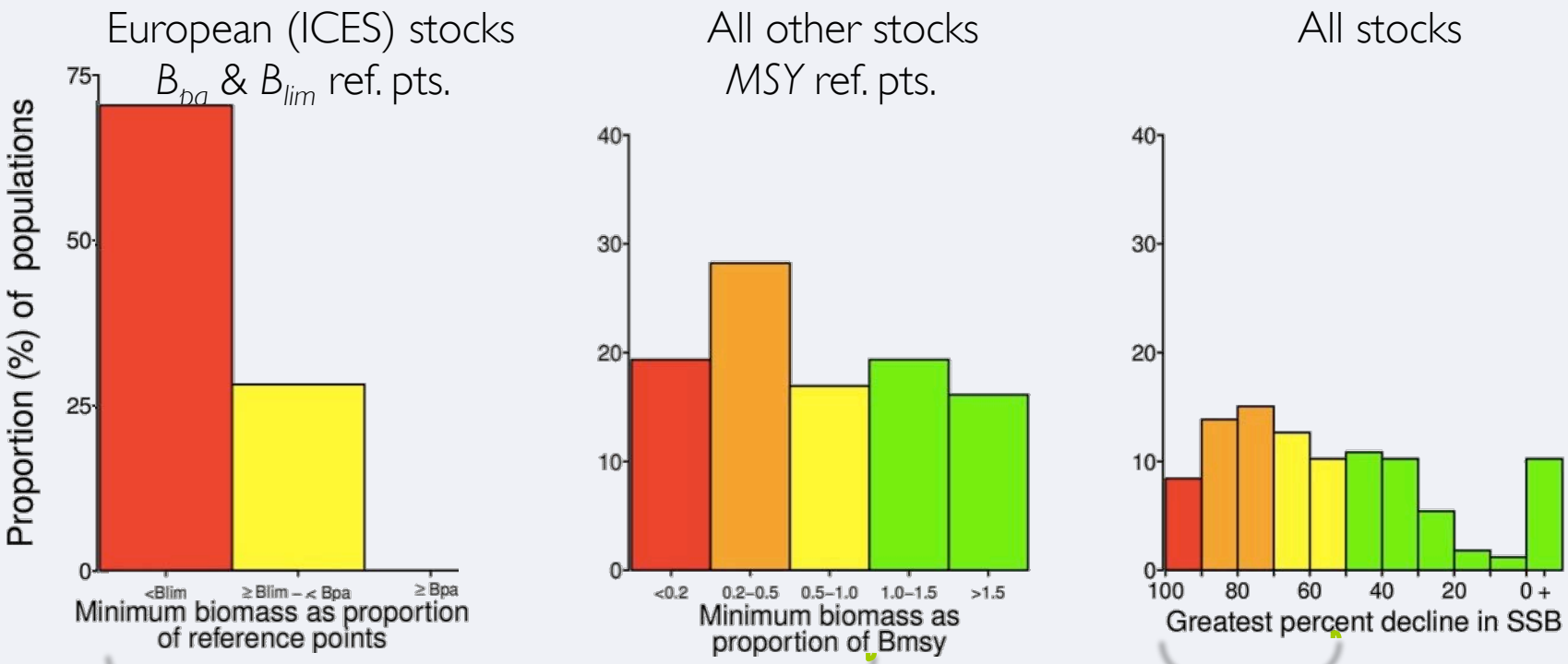
Comparing the 'worst case' statuses of marine fishes:

All stocks



60% 'in trouble' (>50% decline) at some point in their past

Comparing the 'worst case' statuses of marine fishes:



73% 'in trouble' (below upper reference point) at some point in their past

54% fall below lower reference point at some point

60% 'in trouble' (>50% decline) at some point in their past

Reconciling Conservation and Fisheries Perspectives on the Status of Marine Fishes

What is the status of marine fishes according to fisheries and conservation metrics?

- *40% of stocks currently below their upper ref. pt.; 29.5% of which qualify as threatened on Red List*
- *Overfishing is the norm (73% below upper, 54% below lower ref pt.); 60% qualify for Red List*

How well do fisheries and conservation metrics align under the '*worst case*' scenario?

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	IUCN Red List Status (% decline)	
Fishery Status	Threatened	Not Threatened
OK (Above reference point)		33% HITS (True Negative)
In trouble (Below ref. pt.)	47% HITS (True Positive)	

Davies and Baum 2012 *Scientific Reports*

How well do fisheries and conservation metrics align under the 'worst case' scenario?

	IUCN Red List Status (% decline)	
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Davies and Baum 2012 *Scientific Reports*

How well do fisheries and conservation metrics align under the 'worst case' scenario?

	IUCN Red List Status (% decline)	
Fishery Status	Threatened	Not Threatened
OK (Above reference point)	13.3% FALSE ALARMS	33% HITS (True Negative)
In trouble (Below ref. pt.)	47% HITS (True Positive)	6.6% MISSES

80% Alignment

Davies and Baum 2012 *Scientific Reports*

Reconciling Conservation and Fisheries Perspectives on the Status of Marine Fishes

What is the status of marine fishes according to fisheries and conservation metrics?

- *40% of stocks currently below their upper ref. pt.; 29.5% of which qualify as threatened on Red List*
- *Overfishing is the norm (73% below upper, 54% below lower ref pt.); 60% qualify for Red List*

How well do these metrics align?

- *Red List not biased toward 'false' threat listings*
- *Conservation and fisheries metrics typically provide consistent signals (76 - 80% of stocks)*
- *Implication: Red List exaggerates extinction risk*

Take Home Message: Conservation and fisheries scientists should be able to agree on the status of exploited marine fishes in most cases.

Remaining challenge: What are appropriate management responses for populations of mutual concern?

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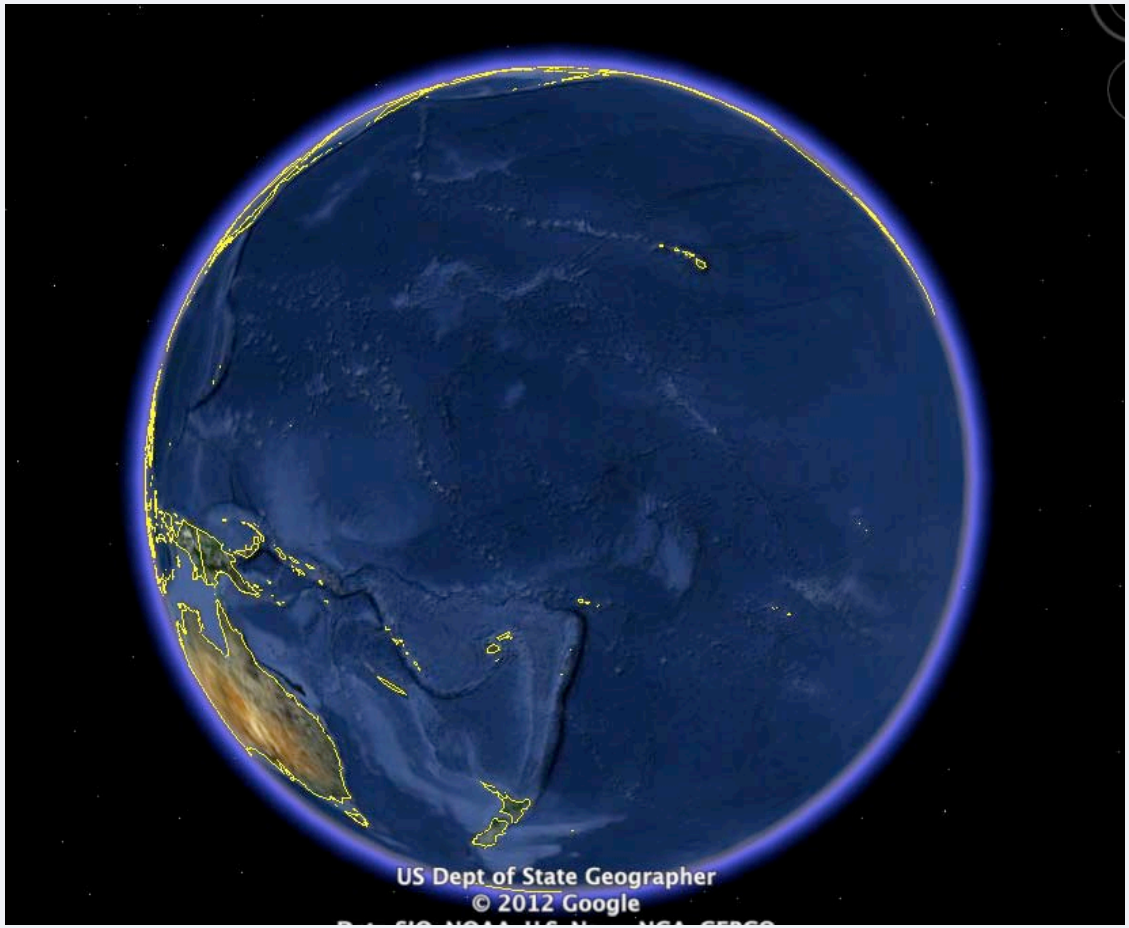
How are anthropogenic disturbances changing the abundance of oceanic predators?
What are the ecosystem consequences of predator losses?
How are multiple stressors changing marine ecosystems?



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