The Catches of Global Marine Fisheries: The Unseen Cost of Shifting Baselines

Daniel Pauly
Sea Around Us

New Zealand Fisheries Symposium
Snells Beach, April 8, 2016

Once upon a time: Key West trophies, 1956

McClenachan *(Conservation Biology)* 2007

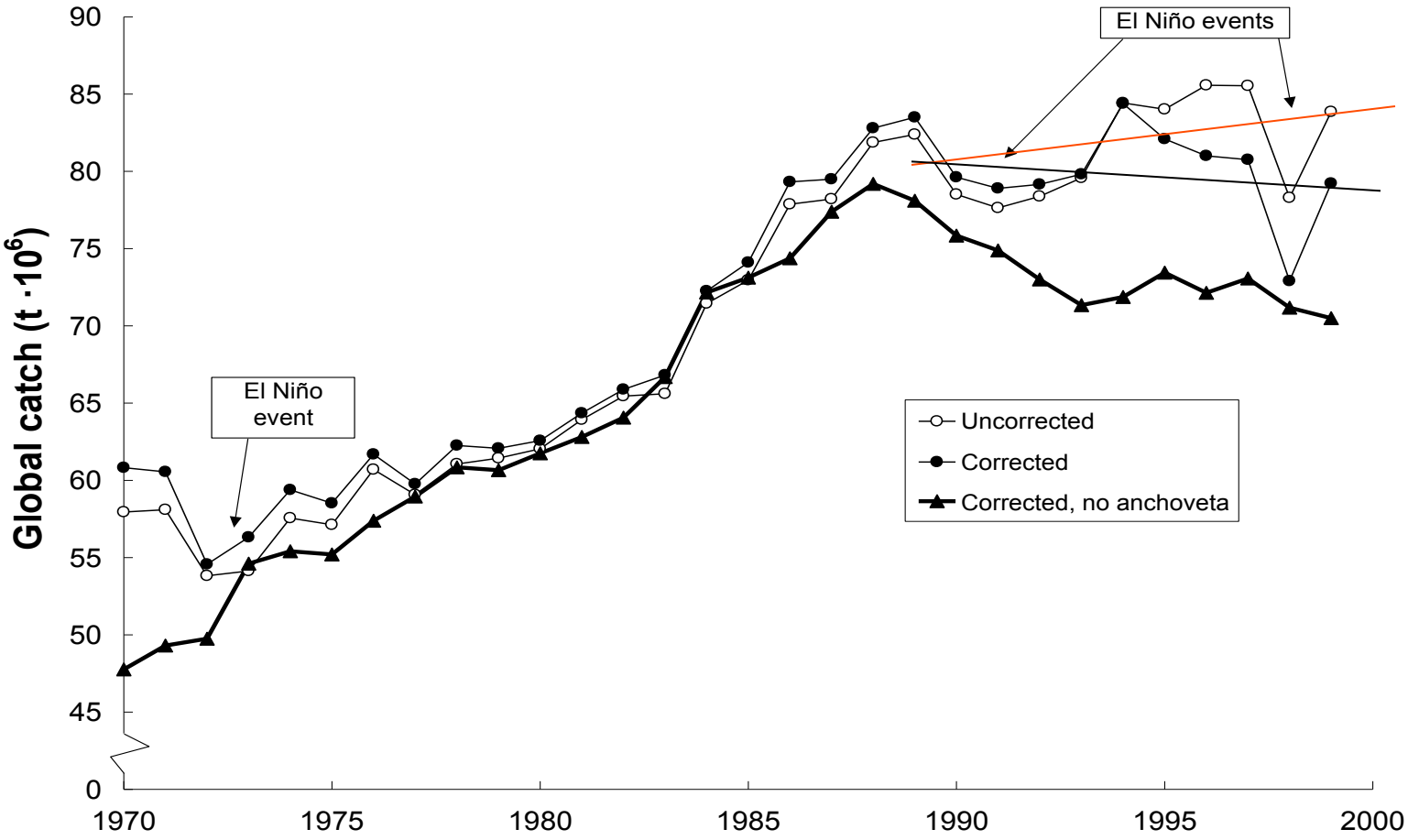
They are still happy and proud: Key West trophies, 1980s

McClenachan *(Conservation Biology)* 2007

Shifting baseline:
Key West trophies, 2007

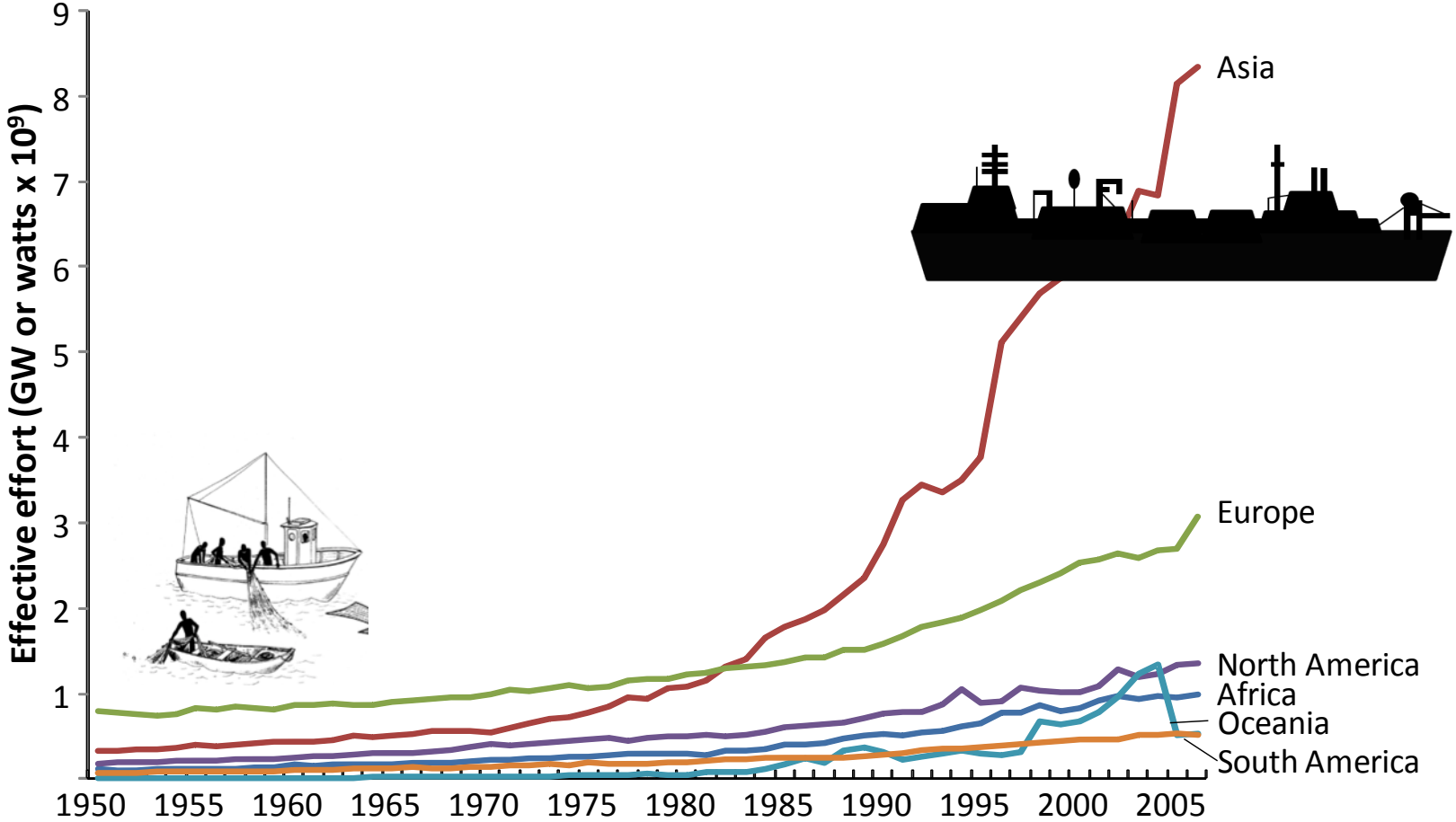
McClenachan *(Conservation Biology)* 2007

Fisheries landings, despite (or because of) this increasing fishing effort, have been declining since the late 1980s, a fact long hidden by over-reporting from China:



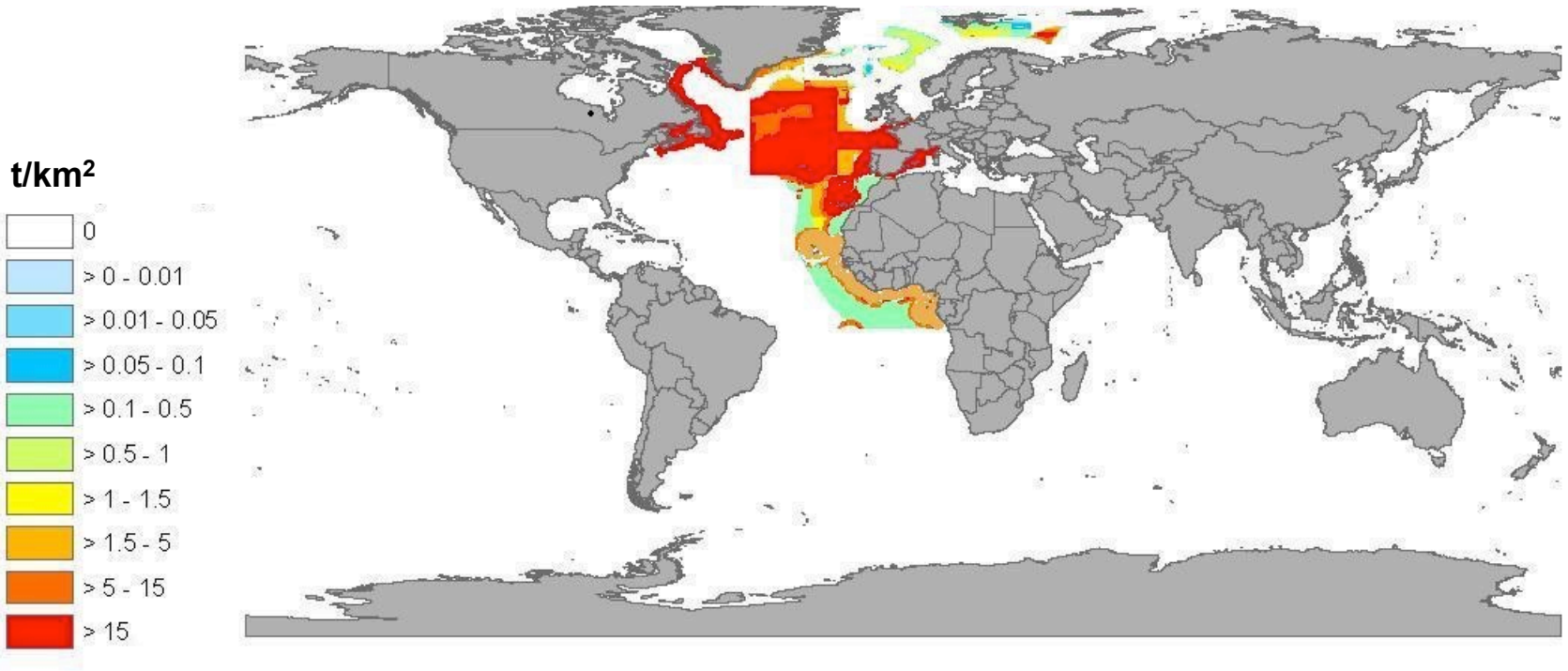
Watson and Pauly (*Nature,* 2001).

The decline is is not surprising, given the growth of ‘effective’ fishing effort (1950-2006)



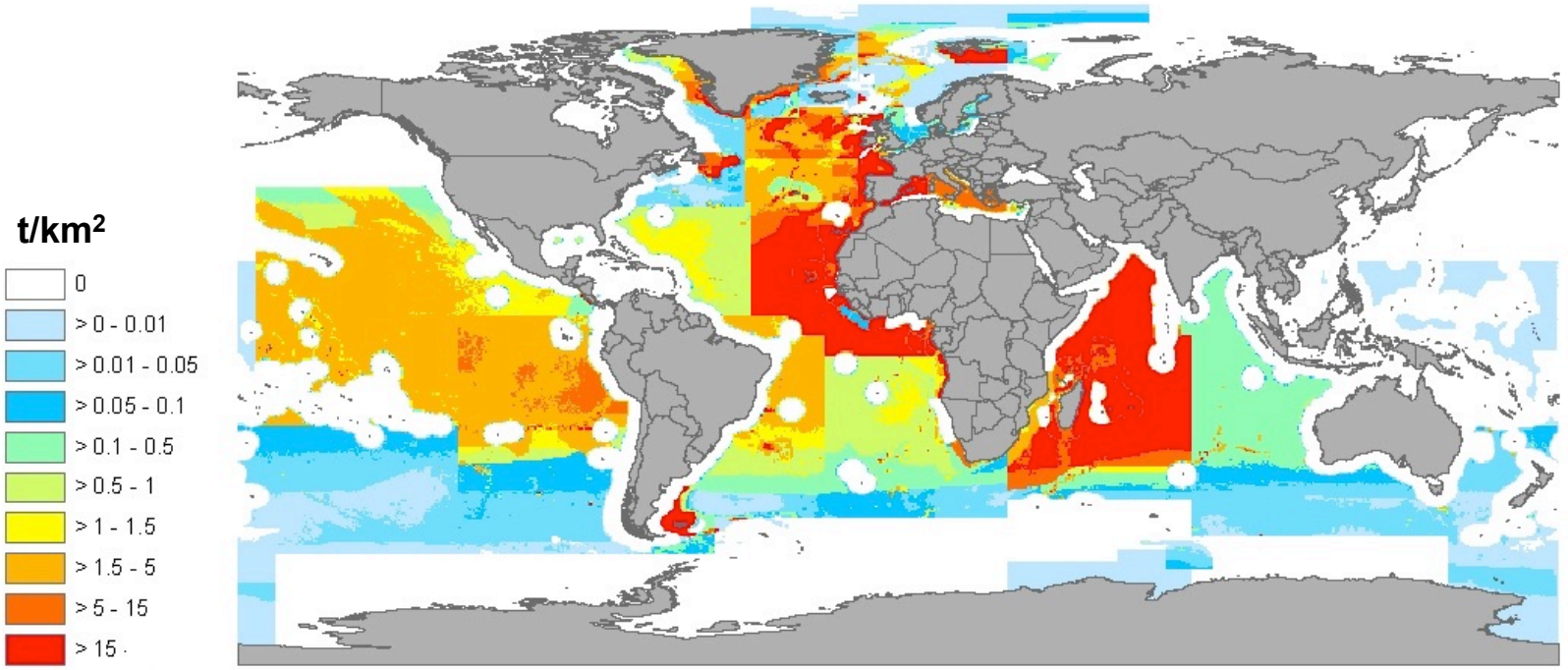
Anticamara *et al.* (*Fisheries Research,* 2011)

The response to local depletion by most countries is expanding the reach of their fisheries, as illustrated by Spain in the 1950s...



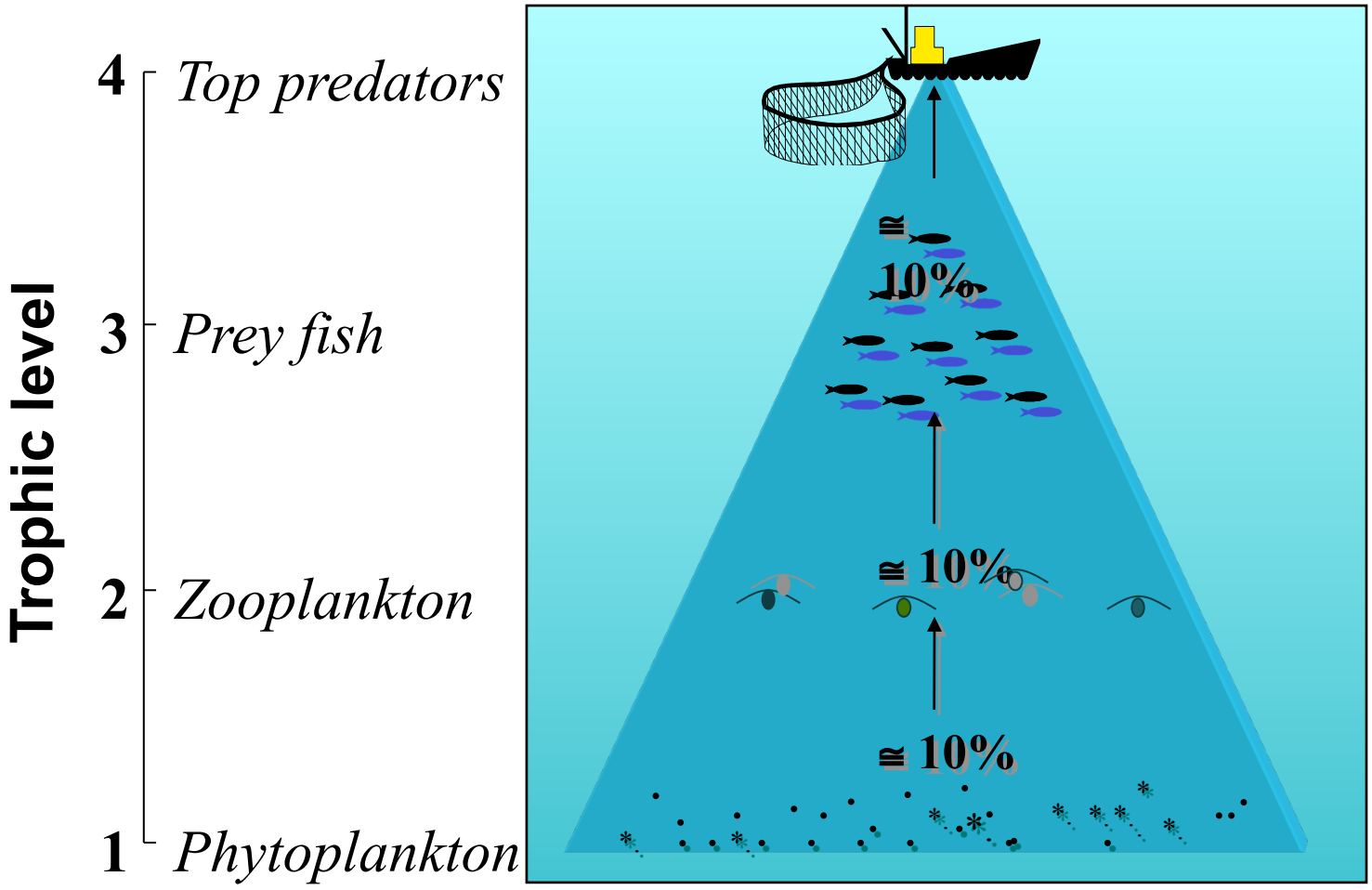
see www.seaaroundus.org

Now, Spain's fisheries cover the whole world (as do the fisheries of France, Japan, etc.)



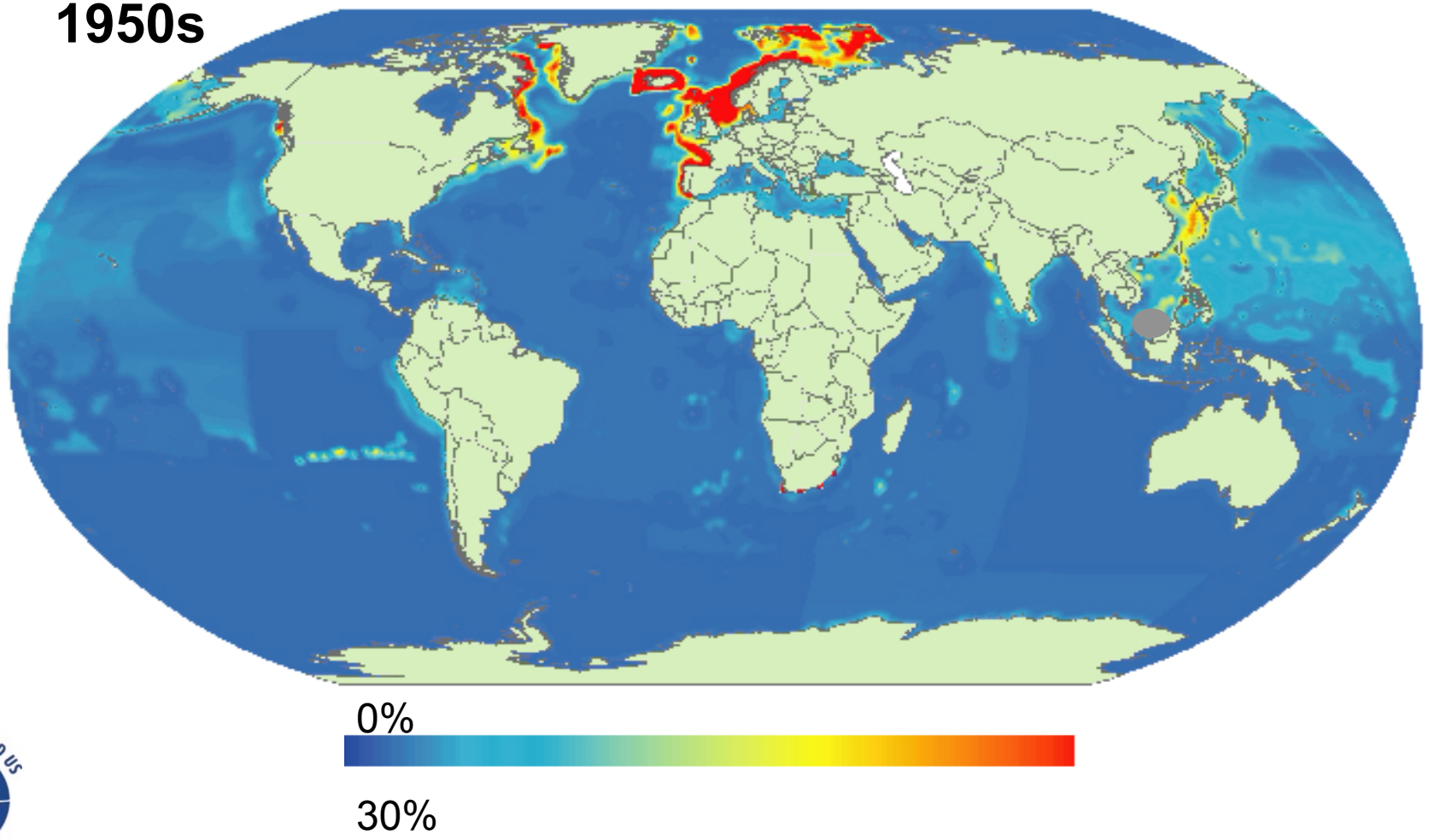
see www.seaaroundus.org

Now recall that ecosystem fluxes move up ‘trophic pyramids,’ and each species tends to have its own trophic level…

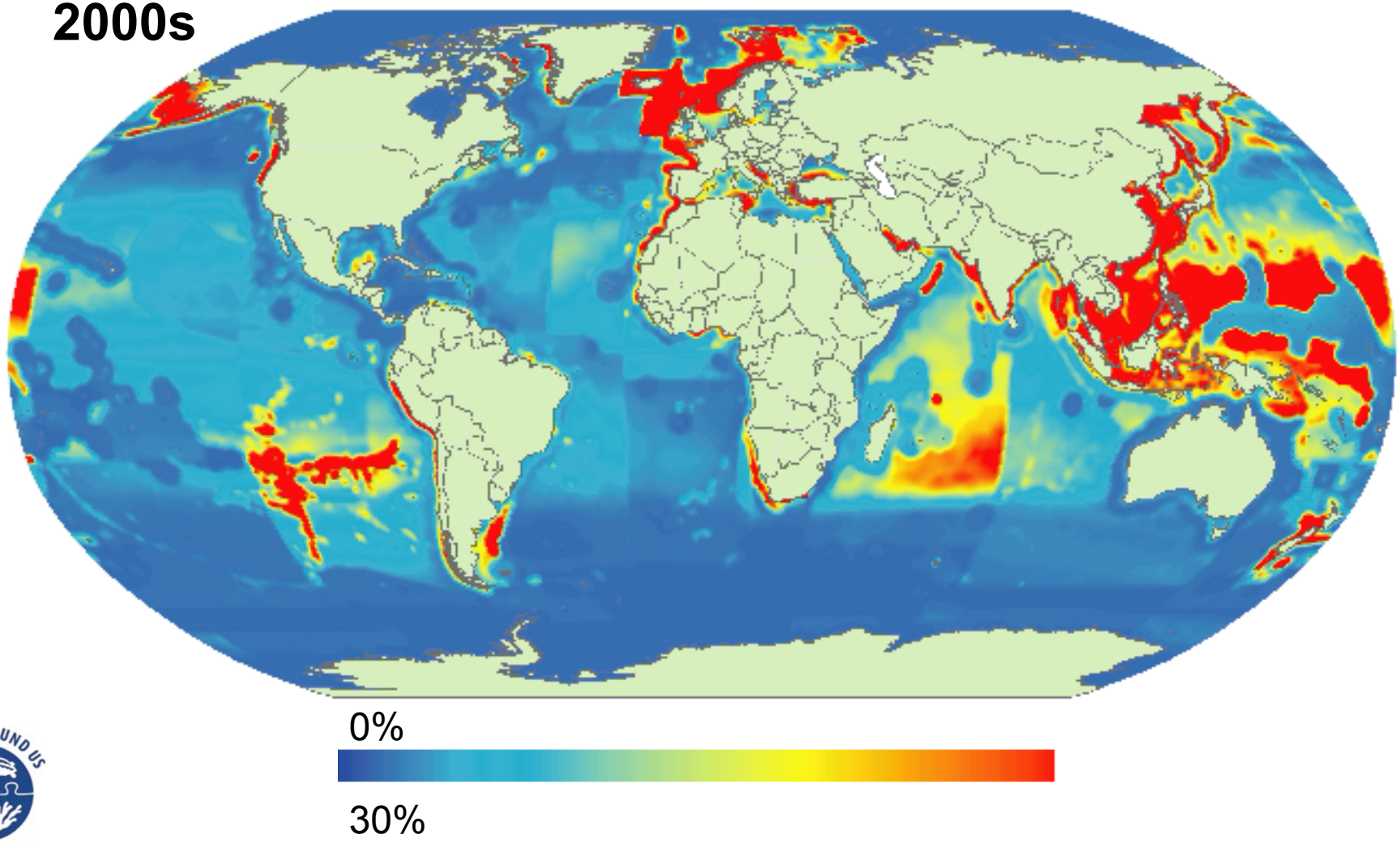


Pauly and Christensen (*Nature,* 1995); trophic levels from FishBase.

We can thus identify the areas where the primary Production Required (PPR) for the catch reported to FAO reached, e.g., 30% in the 1950s…



and compare that with the distribution of PPR in the 2000s…



Nature asked a misleading question:

COMMENT

ENERGY Shale gas and oil will run out faster than champions predict p.307 | ANTHROPOLOGY Napoleon Chagnon sets the record straight p.310 | BIOGRAPHY A flattering life of impish physicist Freeman Dyson p.311 | HEALTH Iran needs international help to fight HIV epidemic p.314

DENIS DUNNE

Does catch reflect abundance?

Researchers are divided over the wisdom of using estimates of the amount of fish hauled in each year to assess the health of fisheries.

POINT
Yes, it is a crucial signal

The only data available for most fisheries are the weight of fish caught each year, insists Daniel Pauly.

In developed countries such as the United States, Australia and members of the European Union, many fisheries are monitored by fisheries scientists using expensive stock assessments. To infer the size of the fish populations being exploited, scientists use the age and size distributions of the fish caught; the results of scientific surveys carried out from research vessels; and information about growth and migration from tag and recapture studies. Yet the only data ▶

COUNTERPOINT
No, it is misleading

Many factors as well as abundance determine the hauls of fishermen, warn Ray Hilborn and Trevor A. Branch.

The major database on all the fisheries of the world is the *FAO Yearbook. Fishery and Aquaculture Statistics*. This collates the amount (in weight) of haddock, bream, cod and more than 1,000 other species hauled in each year by fishermen, whether from commercial trawlers or canoes, using estimates sent in by officials from individual countries.

For the past few years, researchers have been conducting analyses ▶

21 FEBRUARY 2013 | VOL 494 | NATURE | 303

SEA AROUND US

As posed by *Nature*, this question is misleading because even if the answer were negative, we still require catch data when working on fisheries, because:

1. The size of a fishery, relevant to assessing whether, e.g., it warrants devoting resources to its study and management;
2. The gross value of a fishery (when landings are multiplied with ex-vessel prices), as required, e.g., for negotiations about bilateral fisheries access agreement;
3. The magnitude of the environmental impacts of fisheries (especially when combined with the catch rate of various habitat impacting gear); and
4. The extent of criminal and/or fraudulent activities in the case of illegal catches, etc.

Indeed, one could argue that we don't know a fishery when we don't know its catch – since it is conducted, after all, to produce a catch.

Which is where accurate statistics come in...

When working on the fisheries of their country, fisheries scientists, staff of environmental NGO's and other parties, usually work with their own, and/or national data, and there are few problems of accuracy.

When working on foreign countries, most actors use FAO statistics, which are based on annual submissions by their member countries.

The FAO statistics are misleading. I worked with them for decades, and thought at first that they were roughly correct, i.e., that their errors are more or less randomly distributed (except for the famous case of China).

I was wrong: the FAO data (with a few exceptions) are strongly biased downward because the countries do not see it fit to report on all of their fisheries, especially on their small-scale fisheries, which turn out to be the main source of IUU catches (i.e., unreported)

But how can we know what FAO and/or its member countries don't? (Or more accurately: don't bother with.)

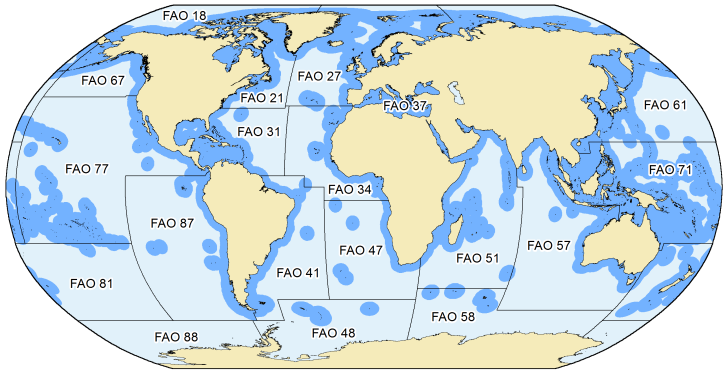
This is where catch reconstruction comes in, which are based on two pillars:

1) Fishing is a *social* activity, which therefore throws a 'shadow' on the economy and the society that it is embedded in. Thus, in literate societies, it is not possible to operate a fishery which will leave no written trace on other sectors of the economy and/or on society at large'; and

2) Almost any reasonable estimate, even a guess based on this societal 'shadow' in (1) will be a better than the estimate of *zero* that is implied when, absent detailed statistics, a bureaucrat simply ignores a fishery.

The *Sea Around Us* and our network of colleagues throughout the world have completed about 200 reconstructions for the EEZs (or 'chunks' thereof) for about 150 maritime countries and their territories, i.e., a total of 275 reconstructions, by sector and species, for 1950 to 2010 (updates will follow), covering all marine fisheries of he world (see www.seaaroundus.org).

This will allow for a re-assessment of fishery trends in the world. Some examples will be presented, but first some definitions:



Reconstruction approach

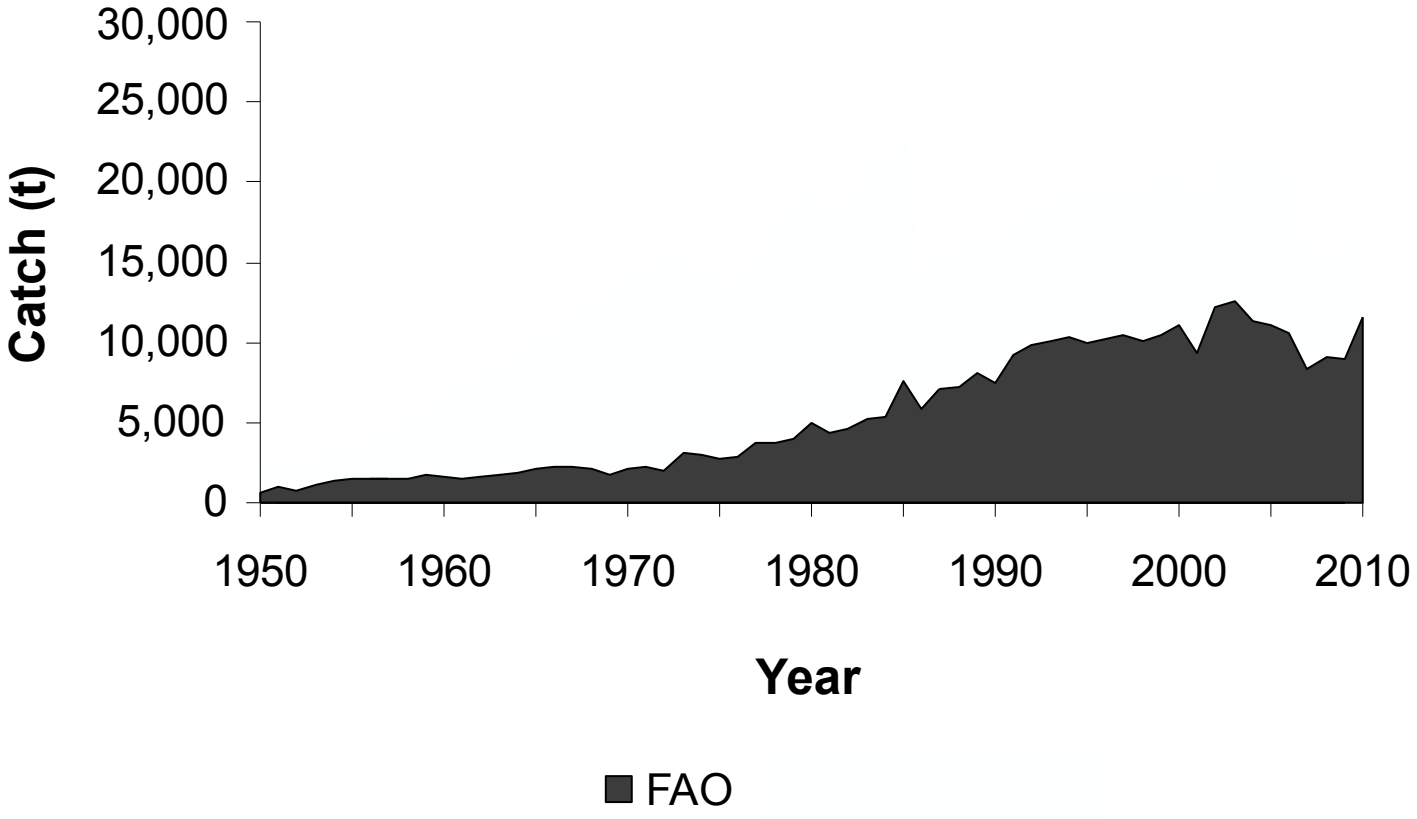
1. Review reported catch times series
   - ICES/FAO and National data
2. Identify ‘missing data’;
   - sectors, time periods, species
3. Alternative data sources
   - literature searches & local experts
4. Data anchor points→ country-wide estimates
5. Interpolate and (cautiously) extrapolate
6. Total catch = reported + missing components
7. Assessing the uncertainty of the results.

see, e.g., Zeller *et al*. (*Coral Reefs,* 2014)

“No data….”

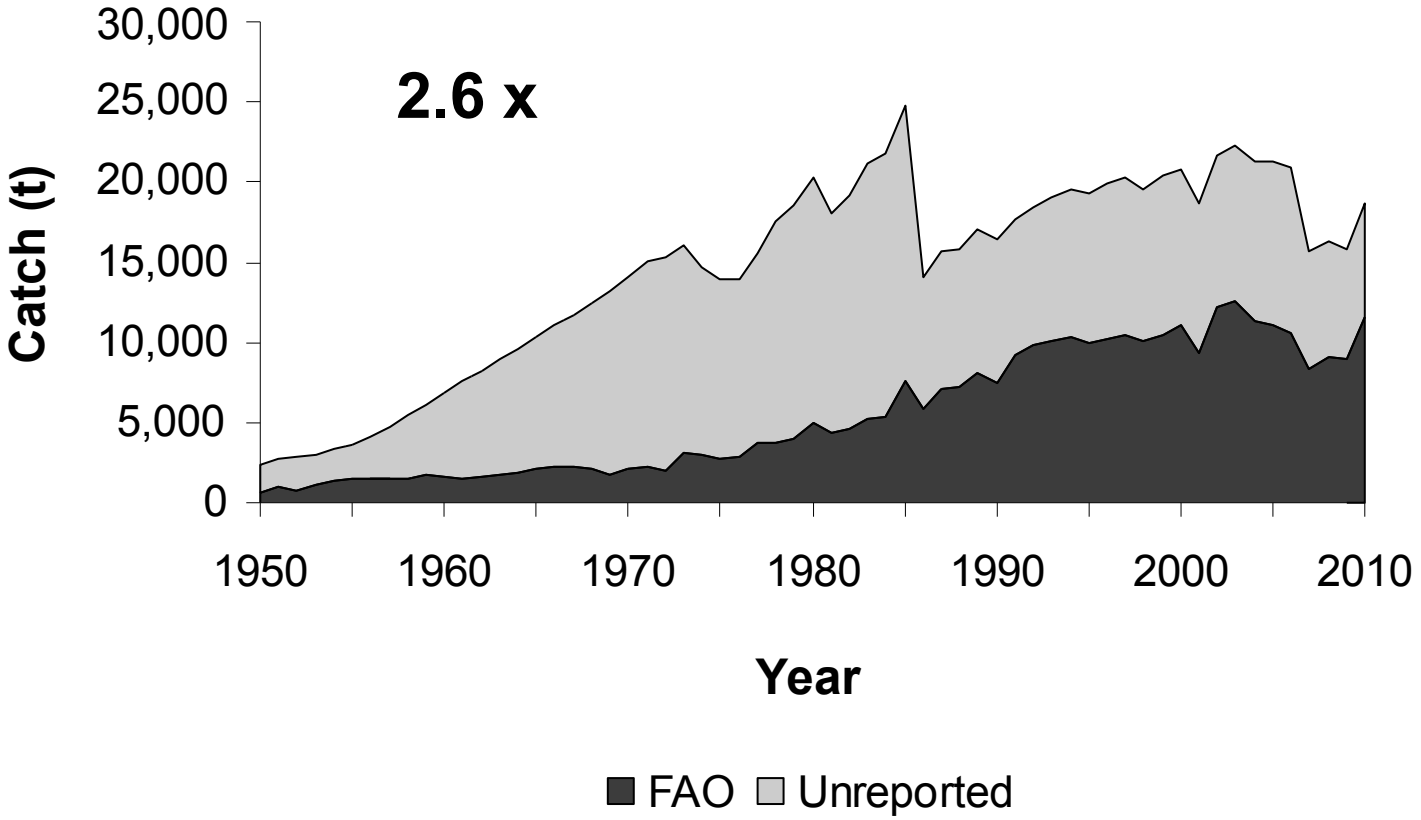
- “But…. there are no data…!” fallacy
  - Historical studies (literature archives)
  - Grey literature (Gov. & NGO reports)
  - Household, health & nutrition surveys
  - Stock assessment reports (ICES)
  - Media stories…
  - Local language (-> local collaborators)
- → ‘shadow’ that no one looks at: > 4000 publications used, i.e., approx. 35 source per country (excl. online). Also: >300 collaborators over the whole worl..

Bahamas



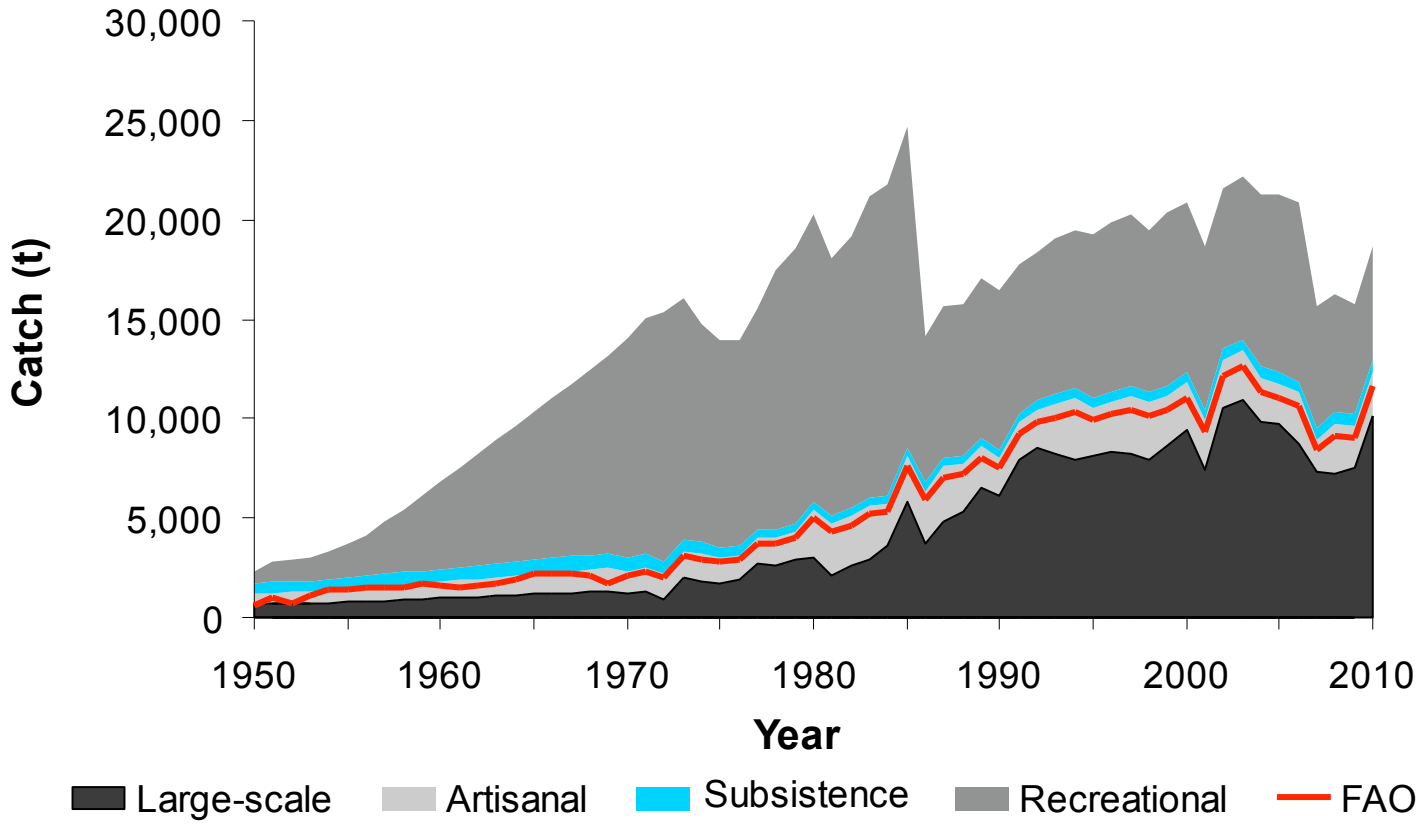
Smith and Zeller (2013), FCRR (unpublished)

Bahamas



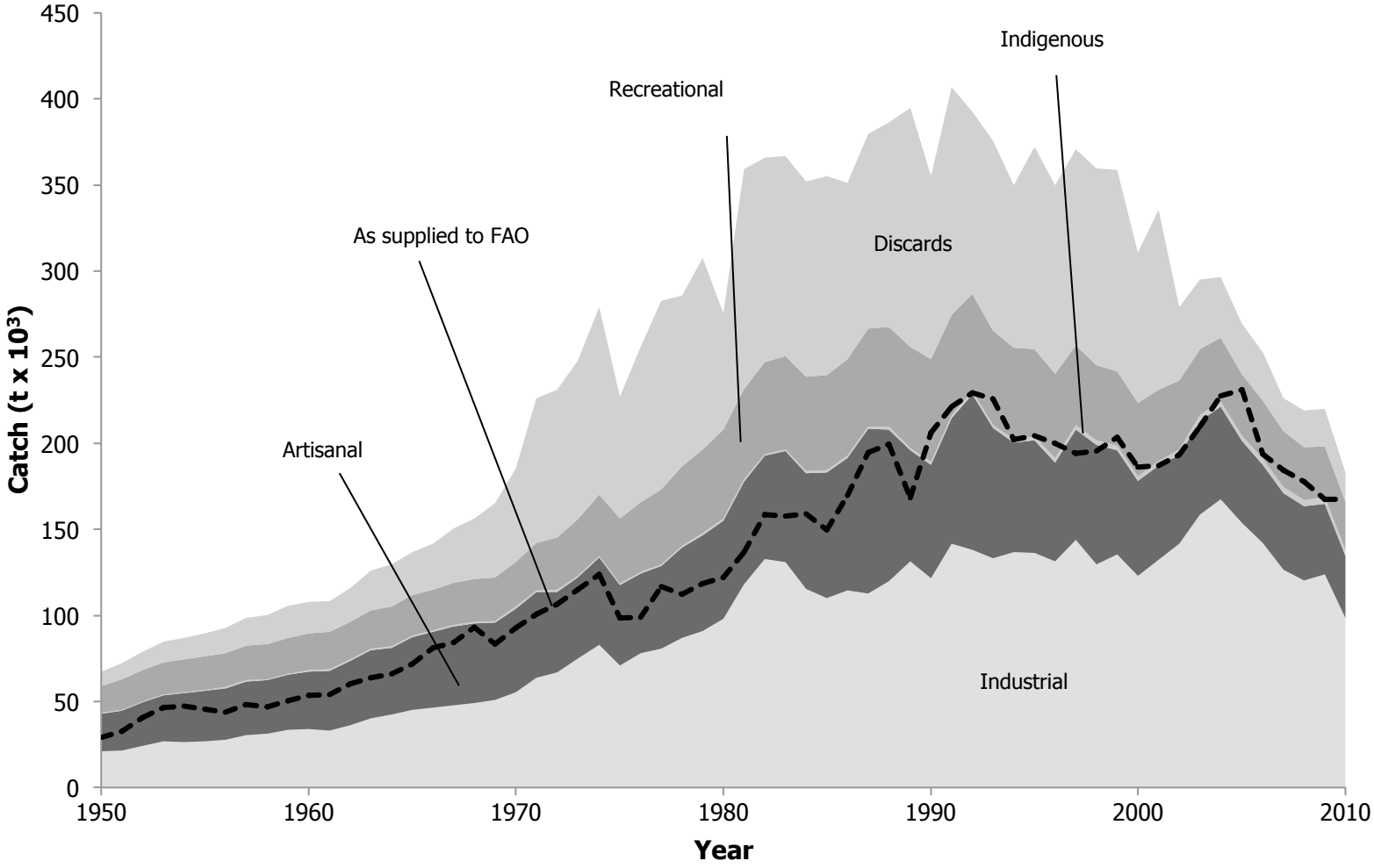
Smith and Zeller (2013), FCRR (unpublished) …. **Now by sector**

Bahamas

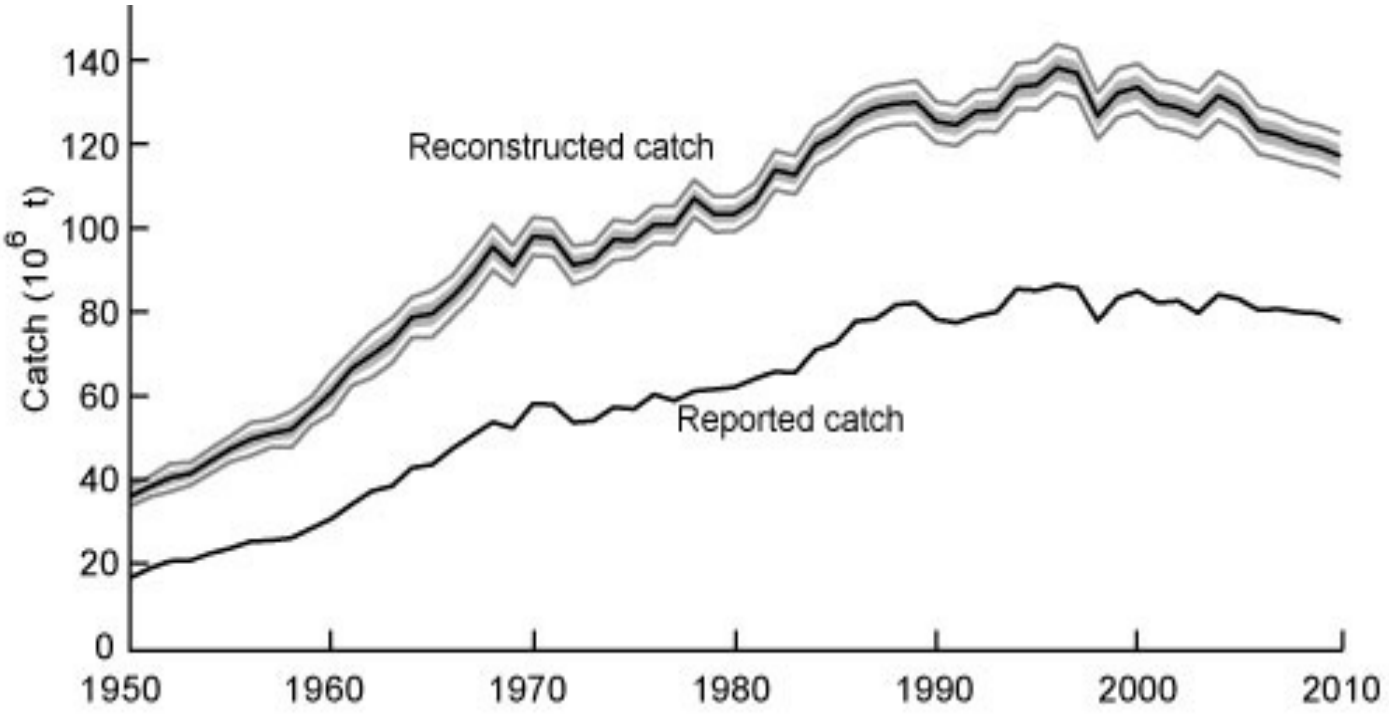


Smith and Zeller (2013), FCRR (unpublished)

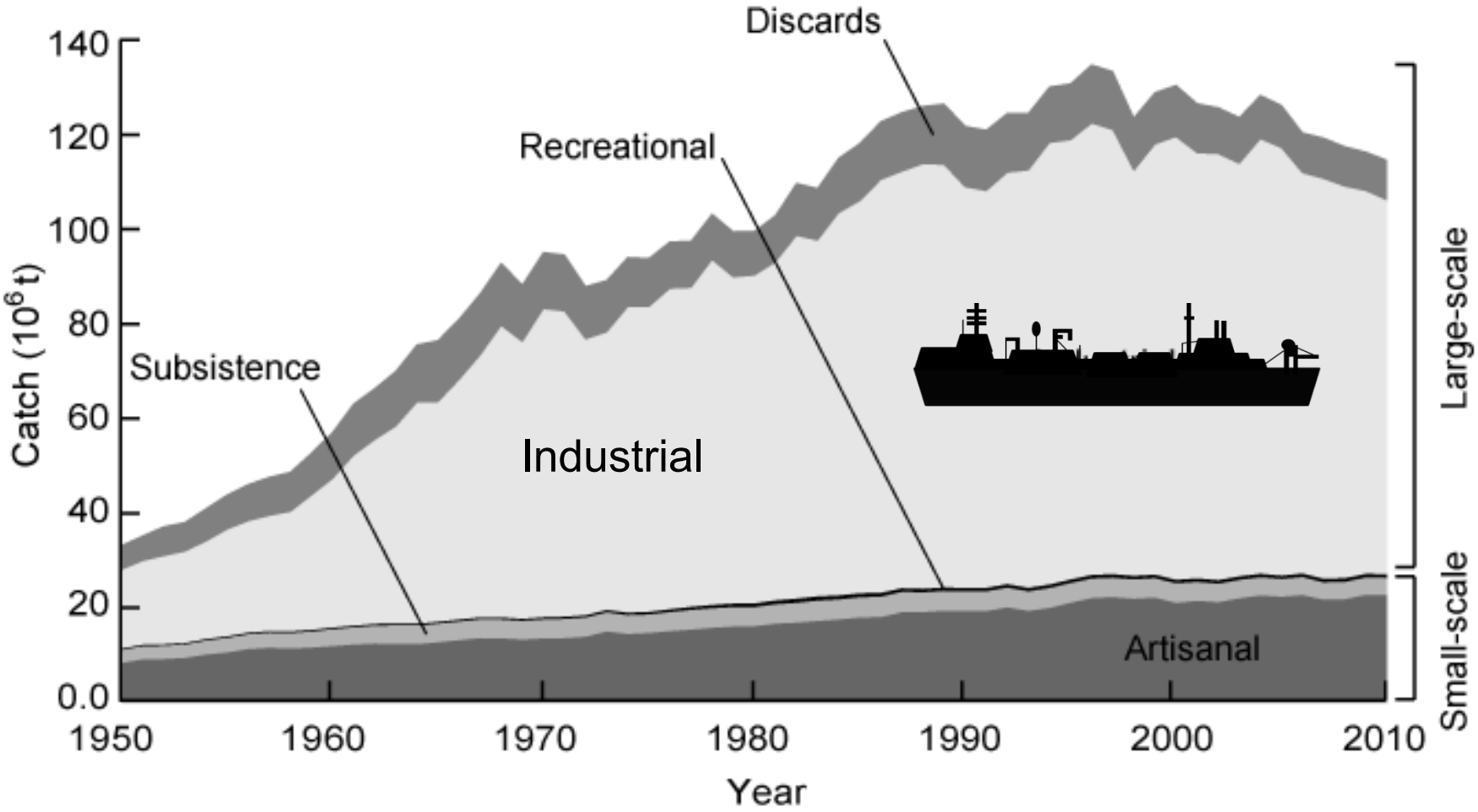
Here is a typical reconstruction for a developed country - Australia



When added up, the country catch reconstructions confirm that the world catch has been declining for the last 2 decades. Important is also that trend is more marked than in the officially reported catch.

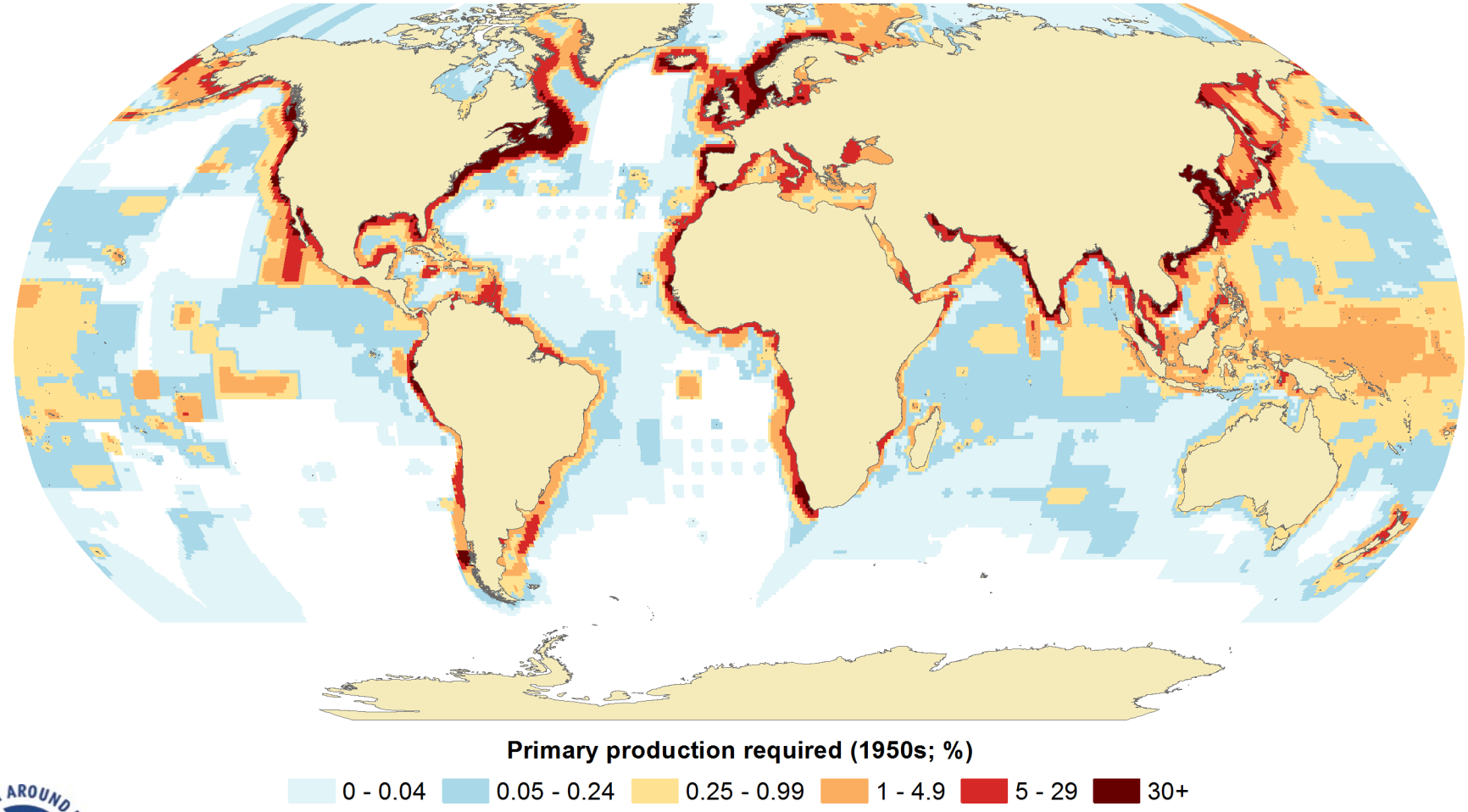


Pauly and Zeller (2016, *Nature Communications*)



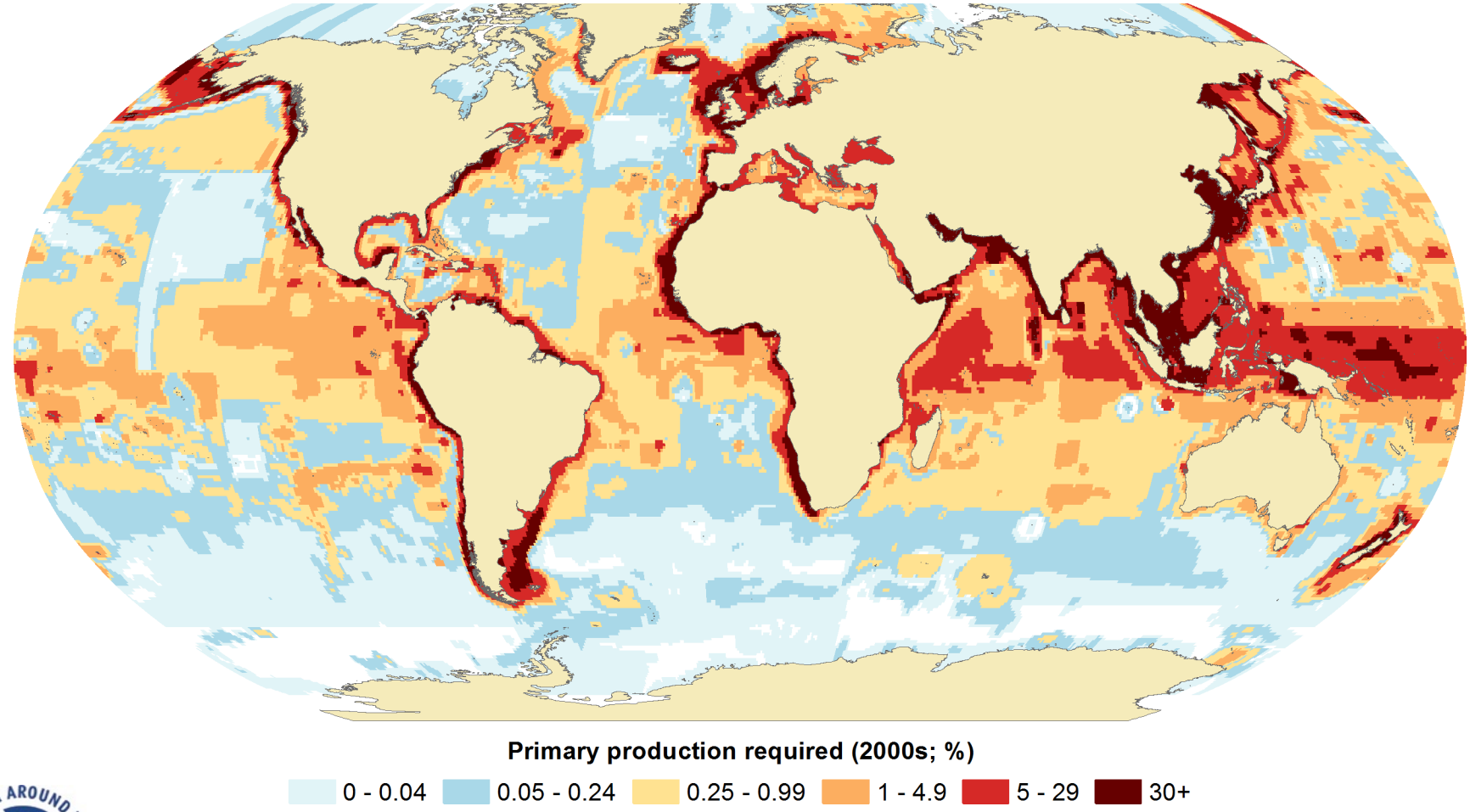
Pauly and Zeller (2016, *Nature Communications*)

We can also map the footprint (or ‘seafoodprint’) of reconstructed catches, here for the 1950s…



see www.searoundus.org

…and in the 2000s…

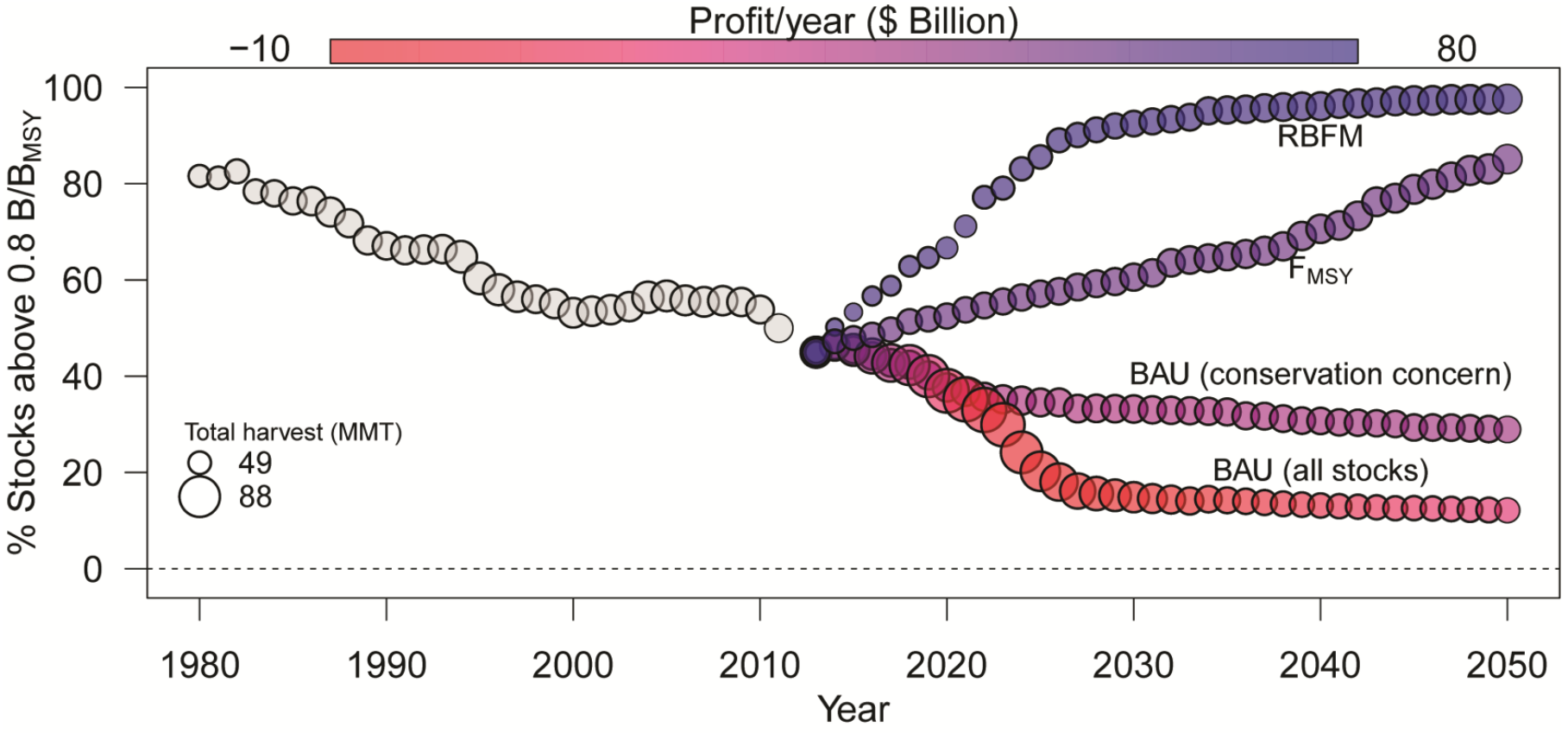


see www.searoundus.org

www.pnas.org/cgi/doi/10.1073/pnas.1520420113 PNAS Early Edition

Global fishery prospects under contrasting management regimes

Christopher Costello[a,1], Daniel Ovando[a], Tyler Clavelle[a], C. Kent Strauss[b], Ray Hilborn[c], Michael C. Melnychuk[c], Trevor A. Branch[c], Steven D. Gaines[a], Cody S. Szuwalski[a], Reniel B. Cabral[a], Douglas N. Rader[b], and Amanda Leland[b]



Which of the scenarios will be realized?

Quotas: a good idea which can easily be turned into a bad idea

1) It is a good idea to limit the catch of a fishery;

2) Then you give exclusive access to a community;

3) Then you individualize the TAC; call them ‘shares’;

4) Then you give them away to your political friends;

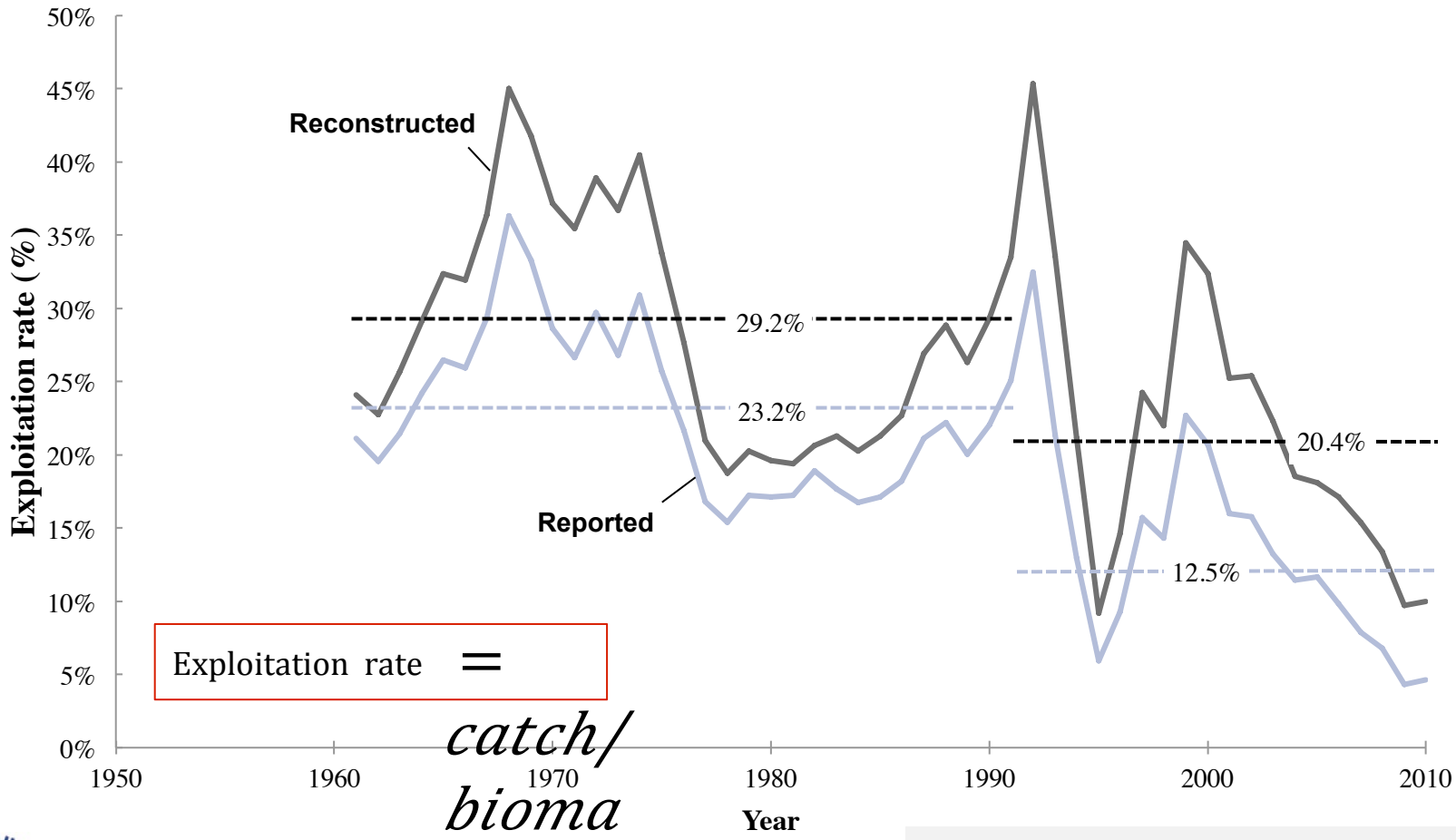
5) And you give them away in perpetuity – really!

6) And you make them transferable, as in ITQ…

7) Now Wall Street has exclusive access to the fishery resources of your country. You are now managed!

The biomass of cod in Eastern Canada is, in the 2000s, between 10 and 15 times lower than in the 1950s/1960s.

Exploitation rate of cod in Eastern Canada



A final point:

This graph highlights the crucial role of small-scale fisheries, so far neglected. Indeed, we would achieve most stated aims of fisheries management plans (particularly their social aims) by dedicated access arrangement for small-scale fisheries.

Fisheries benefits	Large-scale	Small-scale
Annual landings for human consumption	about 60 million tonnes	about 27 million tonnes
Annual catch discarded at sea	10 million tonnes	Almost none
Annual catch for industrial reduction to fishmeal and oil, etc.	26 million tonnes	Almost none
Fuel used per tonne of fish for human consumption	5-20 tonnes	2-5 tonnes
Number of fishers employed	about 1/2 million	about 12 million
Government subsidies (billions of USD)	$$$$$ 25-30 billion USD	$ 5-7 billion USD

Acknowledgements…

- Thanks to The Pew Charitable Trusts and the Paul G. Allen Family Foundation for support

THE PEW CHARITABLE TRUSTS

THE PAUL G. ALLEN FAMILY FOUNDATION

- Thanks to other funding sources: FAO, US Western Pacific Fisheries Management Council, EU-Parliament, UNEP, BOBLME, MAVA Foundation, Rockefeller Foundation, WWF
- Thanks to all members of the *Sea Around Us,* past and present…

… sorry, I ran out of pictures….

and thanks to many other colleagues

visit us at **www.seaaroundus.org**

SEA AROUND US