Estimating global fish biomass

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Four general approaches

- Scaling up density estimates
- Energetic approaches
- Size-based models
- Stock assessment data

Scaling up densities

- Get an areal density estimate – multiply it by area

Trawl survey

Hydroacoustic survey

Scaling up densities

From siphonophores to deep scattering layers: uncertainty ranges for the estimation of global mesopelagic fish biomass

Roland Proud[1]*, Nils Olav Handegard[2], Rudy J. Kloser[3], Martin J. Cox[4], and Andrew S. Brierley[1]

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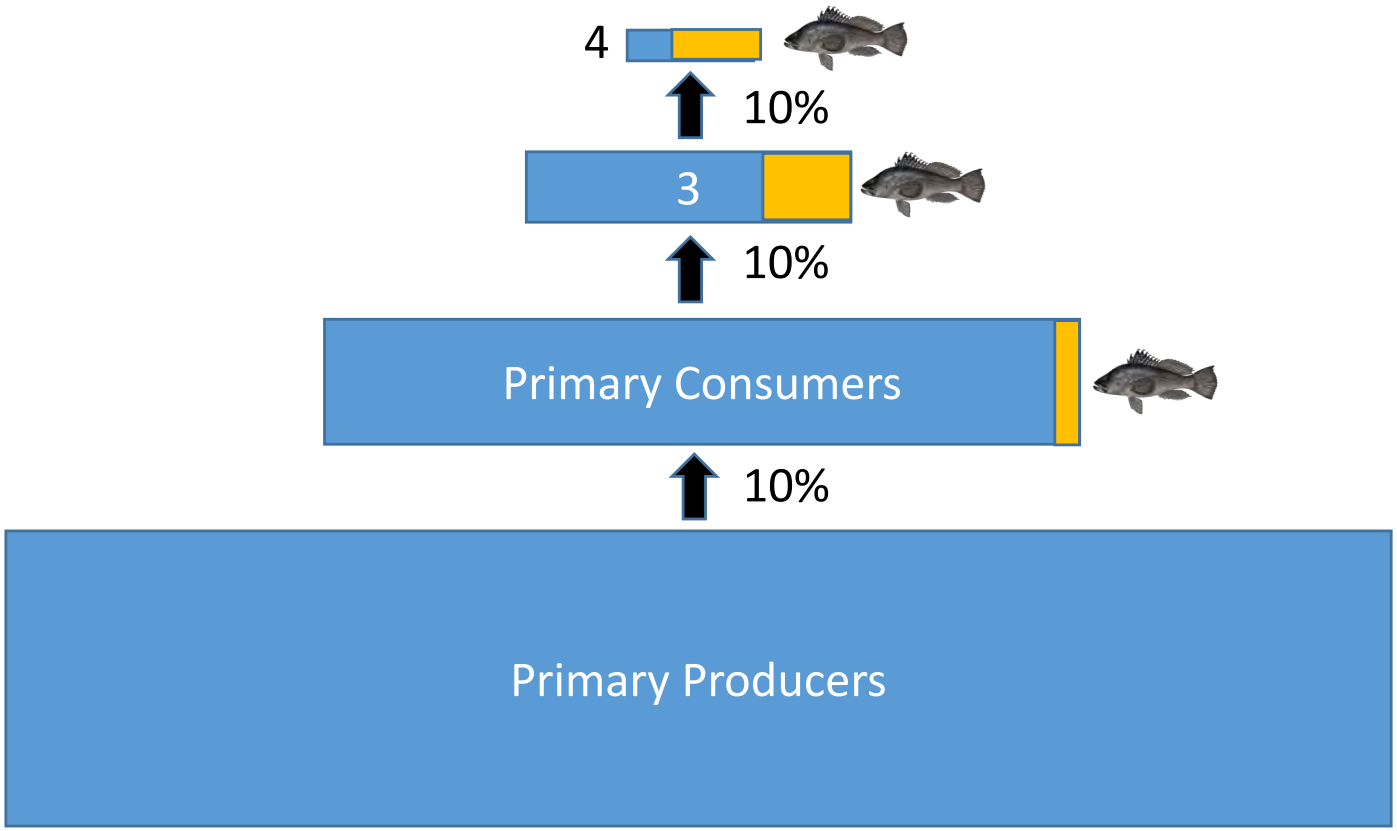
Proud, R., Handegard, N. O., Kloser, R. J., Cox, M. J., and Brierley, A. S. From siphonophores to deep scattering layers: uncertainty ranges for the estimation of global mesopelagic fish biomass. – ICES Journal of Marine Science, doi:10.1093/icesjms/fsy037.

"Estimates of global mesopelagic fish biomass vary substantially (between 1 and 20 Gt)."

Energetic approaches



Energetic approaches

Photosynthesis and Fish Production in the Sea

The production of organic matter and its conversion to higher forms of life vary throughout the world ocean.

John H. Ryther

Primary production required to sustain global fisheries

D. Pauly* & V. Christensen

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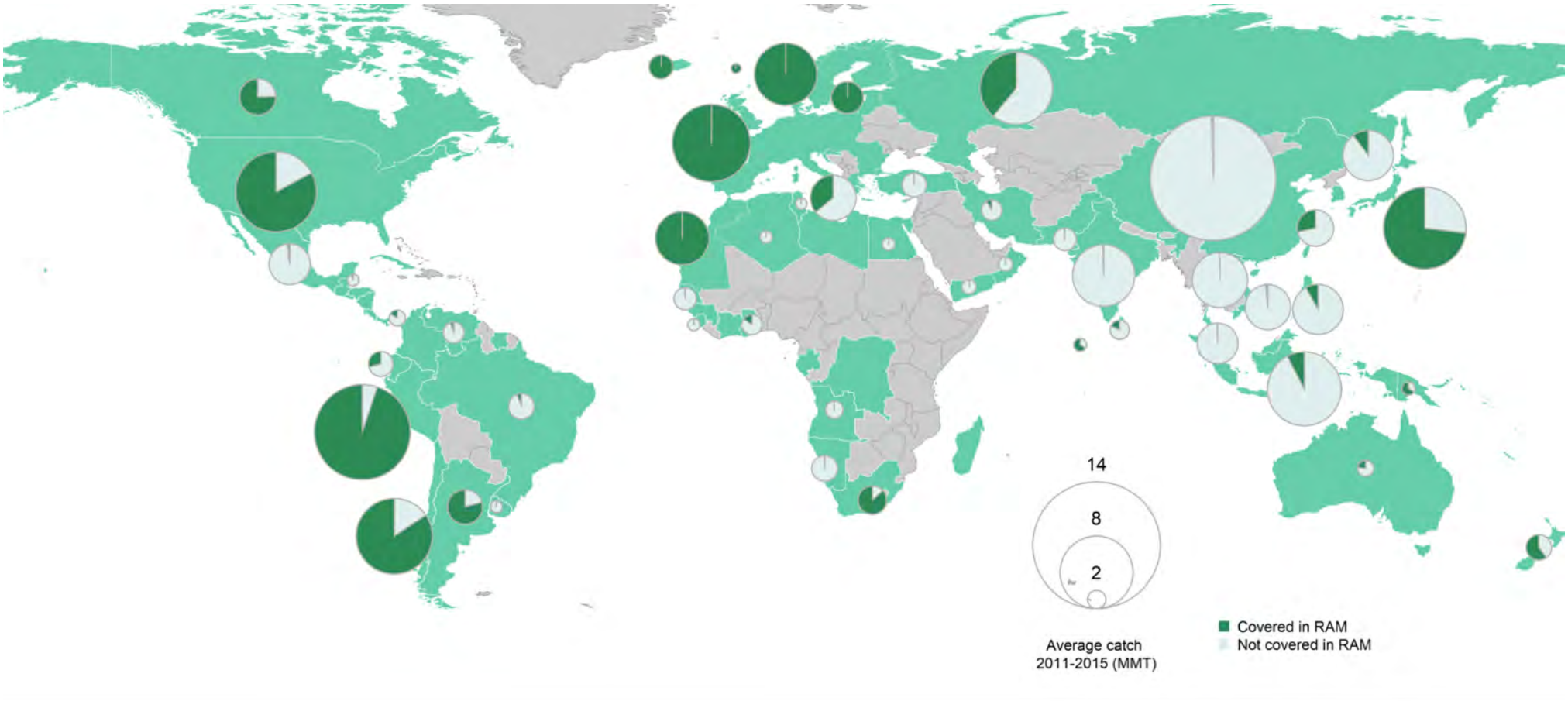
THE mean of reported annual world fisheries catches for 1988–1991 (94.3 million t) was split into 39 species groups, to which fractional trophic levels, ranging from 1.0 (edible algae) to 4.2 (tunas), were assigned, based on 48 published trophic models, providing a global coverage of six major aquatic ecosystem types. The primary production required to sustain each group of species was then computed based on a mean energy transfer efficiency between trophic levels of 10%, a value that was re-estimated rather than assumed. The primary production required to sustain the reported catches, plus 27 million t of discarded bycatch, amounted to 8.0% of global aquatic primary production, nearly four times the previous estimate. By ecosystem type, the requirements were only 2% for open ocean systems, but ranged from 24 to 35% in fresh water, upwelling and shelf systems, justifying current concerns for sustainability and biodiversity.

Size-based models

- Size structures food webs
- The slope of the size spectrum is predictable
- The proportion of fish at each size in the size spectrum can be estimated

Stock assessment data

Stock assessment data



Stock assessment data

Status and Solutions for the World's Unassessed Fisheries

Christopher Costello,[1]* Daniel Ovando,[1] Ray Hilborn,[2] Steven D. Gaines,[1]
Olivier Deschenes,[3] Sarah E. Lester[1,4]

Applying a New Ensemble Approach to Estimating Stock Status of Marine Fisheries around the World

Andrew A. Rosenberg[1], Kristin M. Kleisner[2], Jamie Afflerbach[3], Sean C. Anderson[4], Mark Dickey-Collas[5,6], Andrew B. Cooper[7], Michael J. Fogarty[8], Elizabeth A. Fulton[9,10], Nicolás L. Gutiérrez[11], Kimberly J.W. Hyde[12], Ernesto Jardim[13], Olaf P. Jensen[14], Trond Kristiansen[15], Catherine Longo[16], Carolina V. Minte-Vera[17], Cóilín Minto[18], Iago Mosqueira[13], Giacomo Chato Osio[13], Daniel Ovando[19], Elizabeth R. Selig[20,21], James T. Thorson[22], Jessica C. Walsh[7], & Yimin Ye[11]

Suggestions

- Still much debate about the best method and different methods yield very different estimates
- Expanding your focus from fish to “consumers” or large “consumers” could reduce one source of uncertainty: the fraction of biomass at a given trophic level or size that is made up of fish
- Use different existing estimates to bound the problem