



Nutrient Access from Aquatic Foods

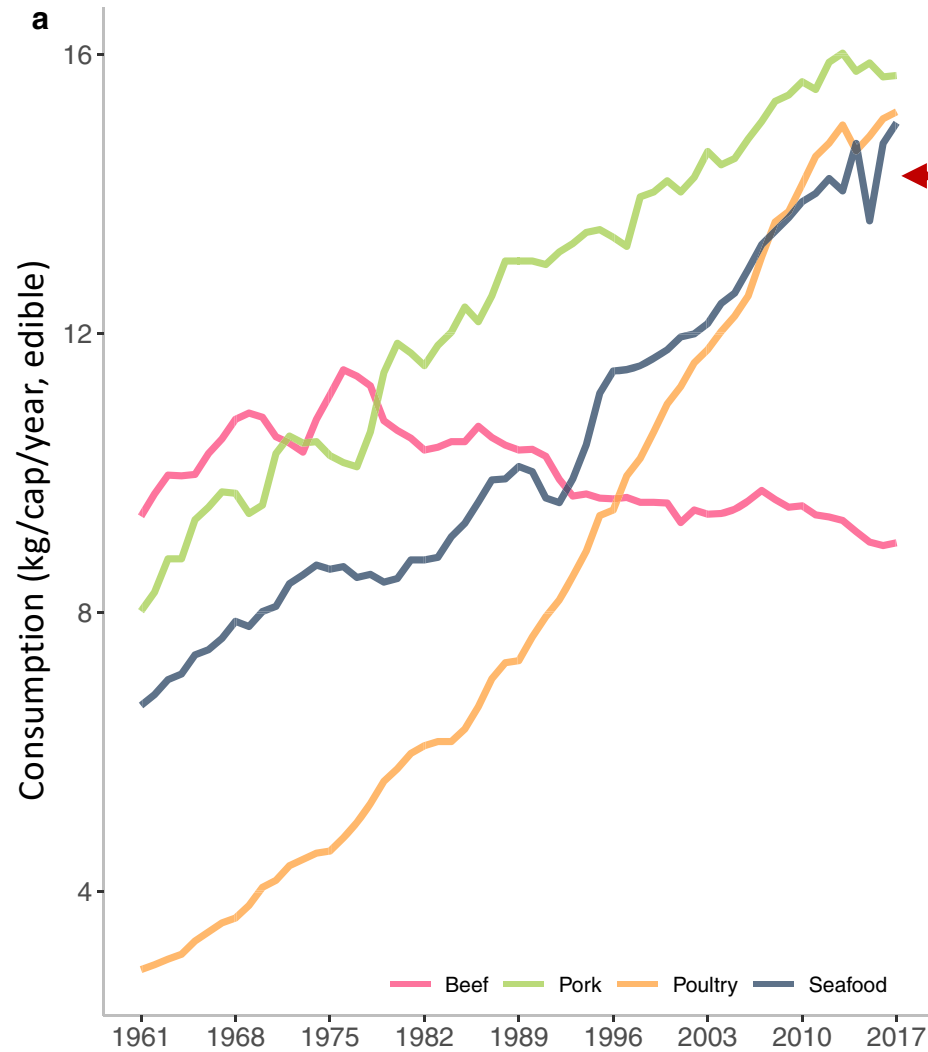
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Aquatic food
consumption
is growing



Graph of increases in per capita animal source food consumption

Naylor et al. 2021 Blue food demand across geographic and temporal scales.

Sources of fish production

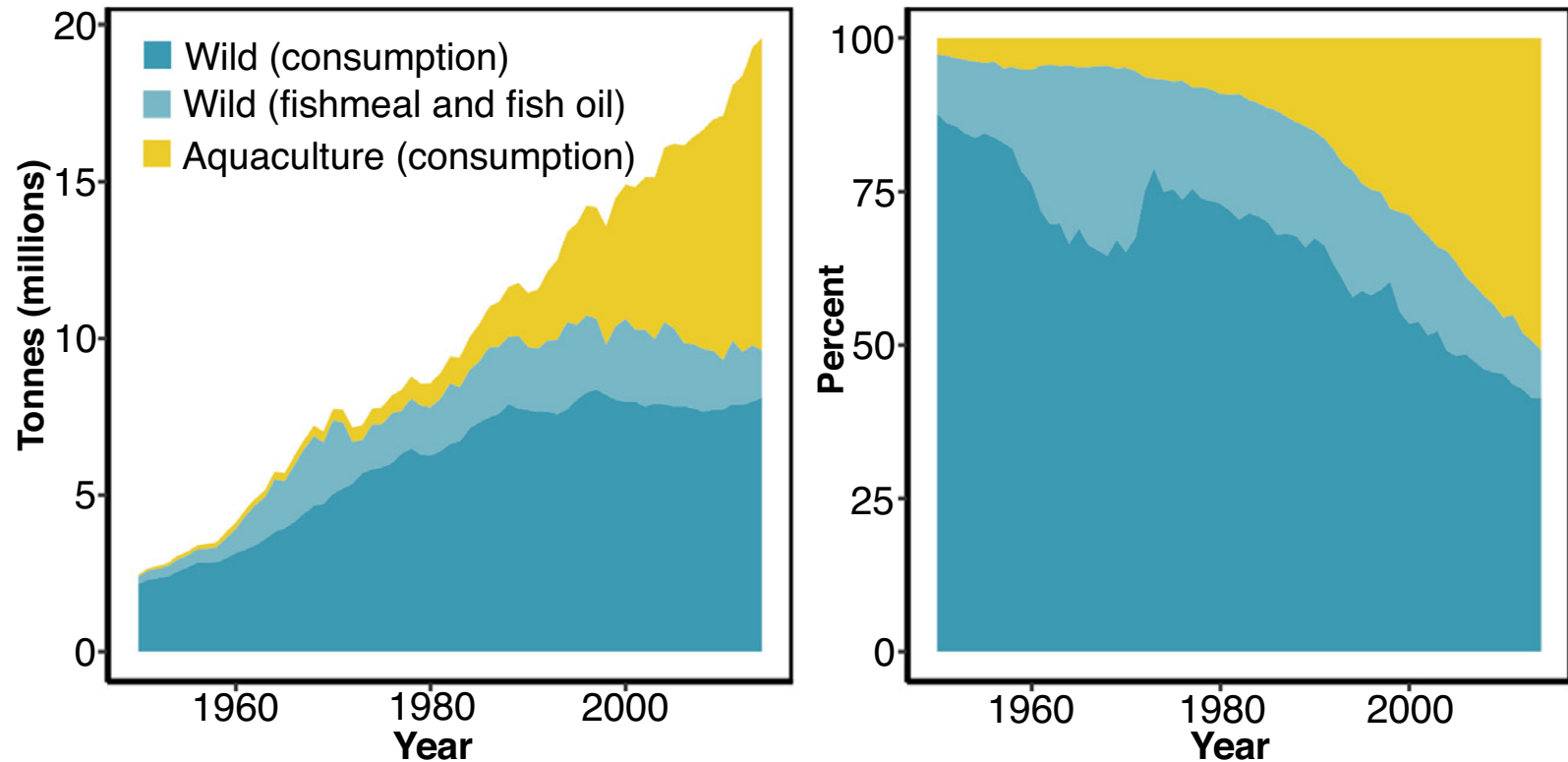


Figure source: Fiorella, KJ, Okronipa, H, Baker, K, Heilpern, S. 2021. Contemporary aquaculture: implications for human nutrition. *Current Opinion in Biotechnology*. 70.

Data source: FAO. FishStat.

Graphs of fish global fish production from wild fisheries and aquaculture

US Aquaculture: Catfish production, Mississippi



Photos: Eric Teplitz

Kenyan aquaculture

Cage culture



Recirculating aquaculture system (RAS)



Photos: Eric Teplitz

Kenyan aquaculture

Cage culture



Recirculating aquaculture system (RAS)



Small-scale cage culture

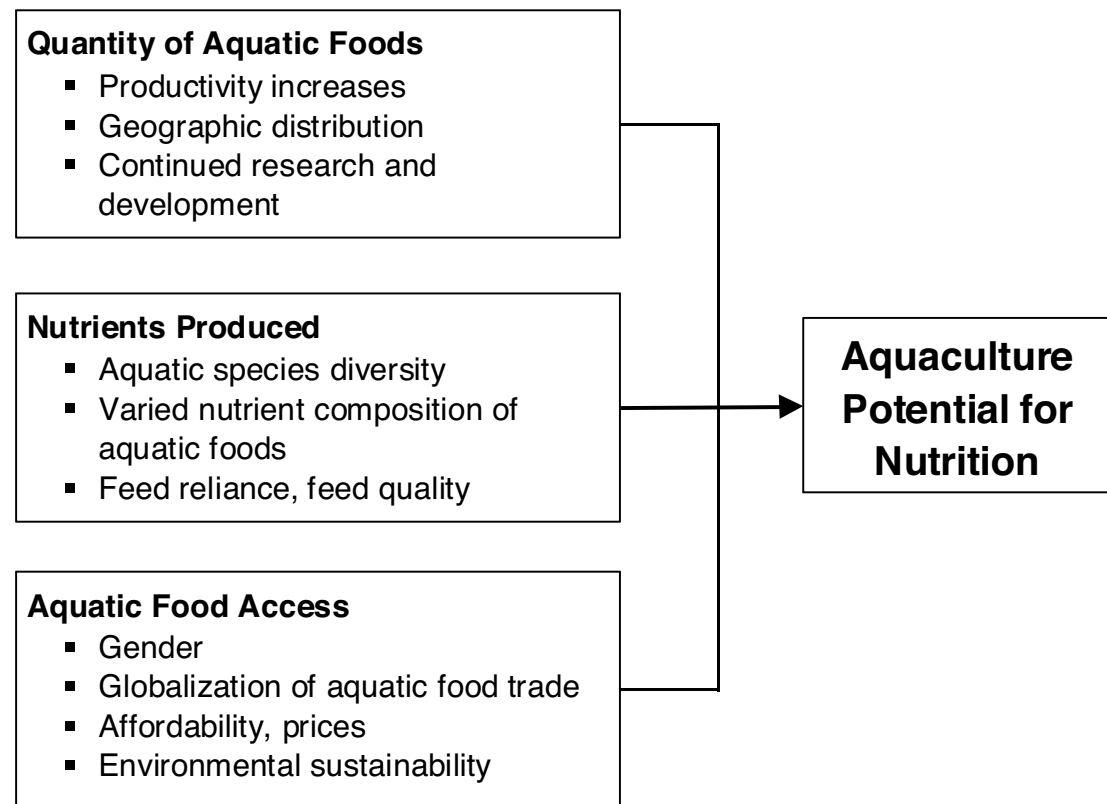


Integrated poultry



Photos: Eric Teplitz

Nutrient availability from aquatic foods



Fiorella, KJ, Okronipa, H, Baker, K, Heilpern, S. 2021. Contemporary aquaculture: implications for human nutrition. *Current Opinion in Biotechnology*. 70.

Environmental impacts shape nutrient access



Quantity of Aquatic Foods

- Productivity increases
- Geographic distribution
- Continued research and development

Nutrients Produced

- Aquatic species diversity
- Varied nutrient composition of aquatic foods
- Feed reliance, feed quality

Aquatic Food Access

- Gender
- Globalization of aquatic food trade
- Affordability, prices
- Environmental sustainability

**Aquaculture
Potential for
Nutrition**

Fiorella, KJ, Okronipa, H, Baker, K, Heilpern, S. 2021. Contemporary aquaculture: implications for human nutrition. *Current Opinion in Biotechnology*. 70.

Access to small, nutrient-rich fish



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Aquaculture Potential for Nutrition

Fiorella, KJ, Okronipa, H, Baker, K, Heilpern, S. 2021. Contemporary aquaculture: implications for human nutrition. *Current Opinion in Biotechnology*. 70.

Low value fish are a vital food source



Public Health Nutrition: page 1 of 8

doi:10.1017/S1368980017003147

Short Communication

Quantity and species of fish consumed shape breast-milk fatty acid concentrations around Lake Victoria, Kenya

Kathryn J Fiorella^{1,2,*}, Erin M Milner³, Elizabeth Bukusi⁴ and Lia CH Fernald³

¹Atkinson Center for a Sustainable Future, Cornell University, 340J Warren Hall, Ithaca, NY 14853, USA:

²Environmental Science, Policy & Management, University of California–Berkeley, Berkeley, CA, USA: ³School of Public Health, University of California–Berkeley, Berkeley, CA, USA: ⁴Centre for Microbiology Research, Kenya Medical Research Institute, Kisumu, Kenya

Food Sec. (2014) 6:851–860
DOI 10.1007/s12571-014-0393-x

ORIGINAL PAPER

Fishing for food? Analyzing links between fishing livelihoods and food security around Lake Victoria, Kenya

Kathryn J. Fiorella • Matthew D. Hickey • Charles R. Salmen • Jason M. Nagata •
Brian Mattah • Richard Magerenge • Craig R. Cohen • Elizabeth A. Bukusi •
Justin S. Brashares • Lia H. Fernald

Low value fish are a vital food source

Public Health Nutrition: 24(3), 476–486

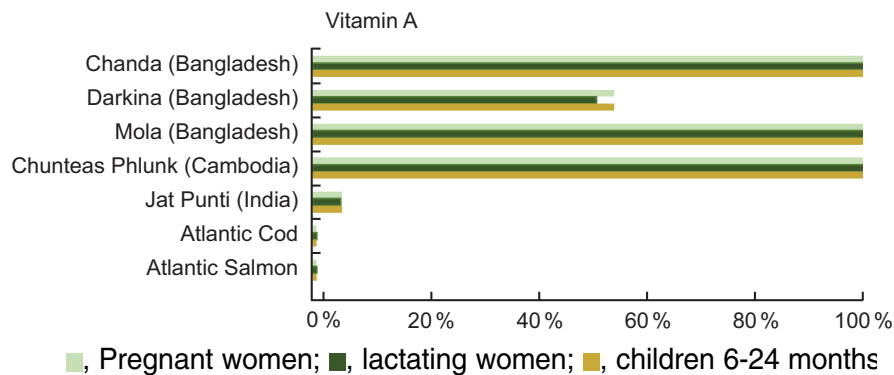
doi:10.1017/S1368980020003857

Review Article

Fish nutrient composition: a review of global data from poorly assessed inland and marine species

Kendra A Byrd¹ , Shakuntala H Thilsted¹ and Kathryn J Fiorella^{2,*} 

¹WorldFish, Penang, Malaysia; ²Master of Public Health Program, Department of Population Medicine and Diagnostic, Cornell University, S2-004 Shurman Hall, Ithaca, NY 14853, USA



Low value fish are a vital food source

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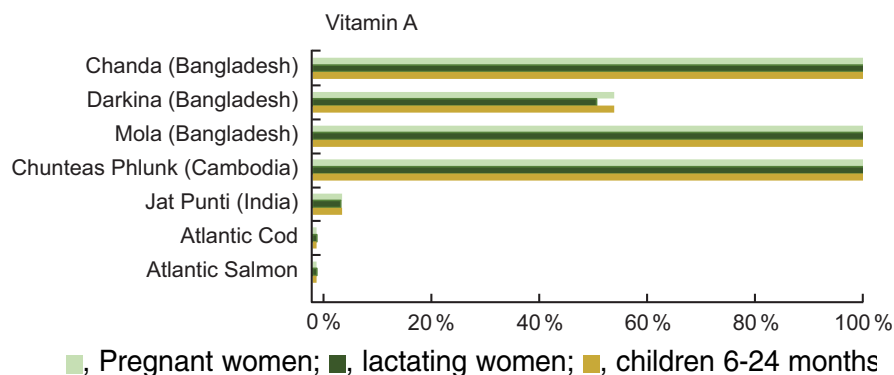
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nature food

Analysis

<https://doi.org/10.1038/s43016-022-00643-3>

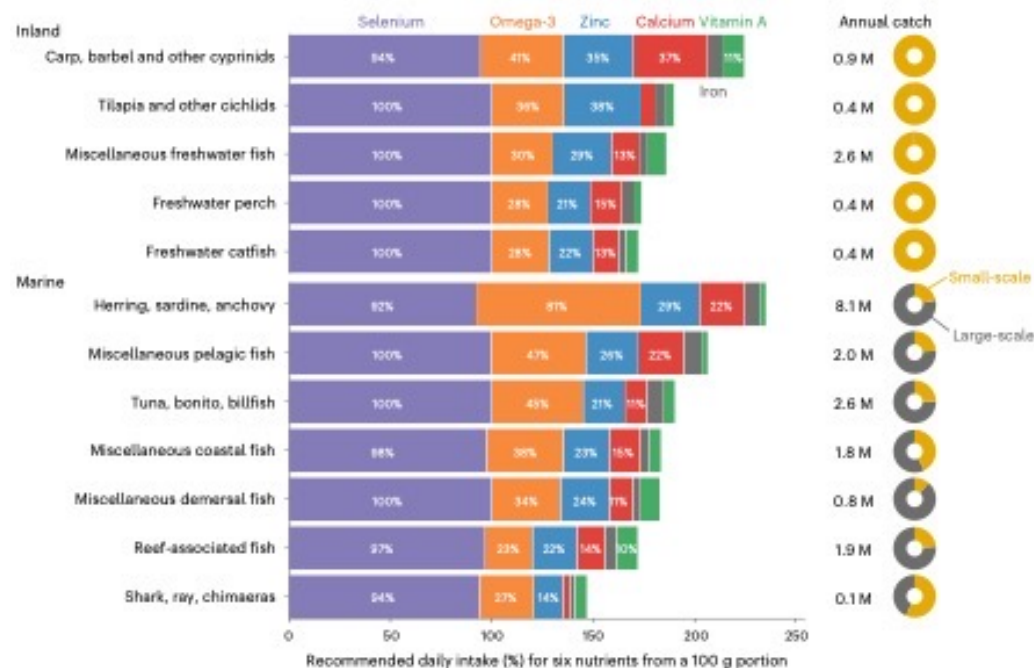
Small pelagic fish supply abundant and affordable micronutrients to low- and middle-income countries

Received: 9 May 2022

Accepted: 20 October 2022

Published online: 01 December 2022

James P. W. Robinson¹ , David J. Mills^{2,3}, Godfred Ameyaw Asiedu⁴, Kendra Byrd^{2,5}, Maria del Mar Mancha Cisneros^{6,7}, Philippa J. Cohen^{2,8}, Kathryn J. Fiorella⁹, Nicholas A. J. Graham¹, M. Aaron MacNeil¹⁰, Eva Maire¹, Emmanuel K. Mbari¹¹, Gianluigi Nico¹², Johnstone O. Omukoto¹¹, Fiona Simmance² & Christina C. Hicks¹



Aquaculture feed innovation

ATLANTIC SALMON | BIOTECHNOLOGY | FEED INGREDIENTS +9 more

19 October 2023, at 10:07am

Omega-3 GM Camelina hits new commercialisation milestone

Yield10 Bioscience has signed a deal that will give it the exclusive licence to sell Omega-3 oils from the genetically modified *Camelina sativa* that has been developed by Rothamsted Research.



GM camelina has proved reliable when grown in different conditions on the UK, Canada and the US.

GM camelina offers 'stable and robust' alternative omega-3 source

Field trials of a plant genetically modified to produce omega-3 normally sourced from fish oil have shown that it can be successfully grown in the UK, Canada and the United States.

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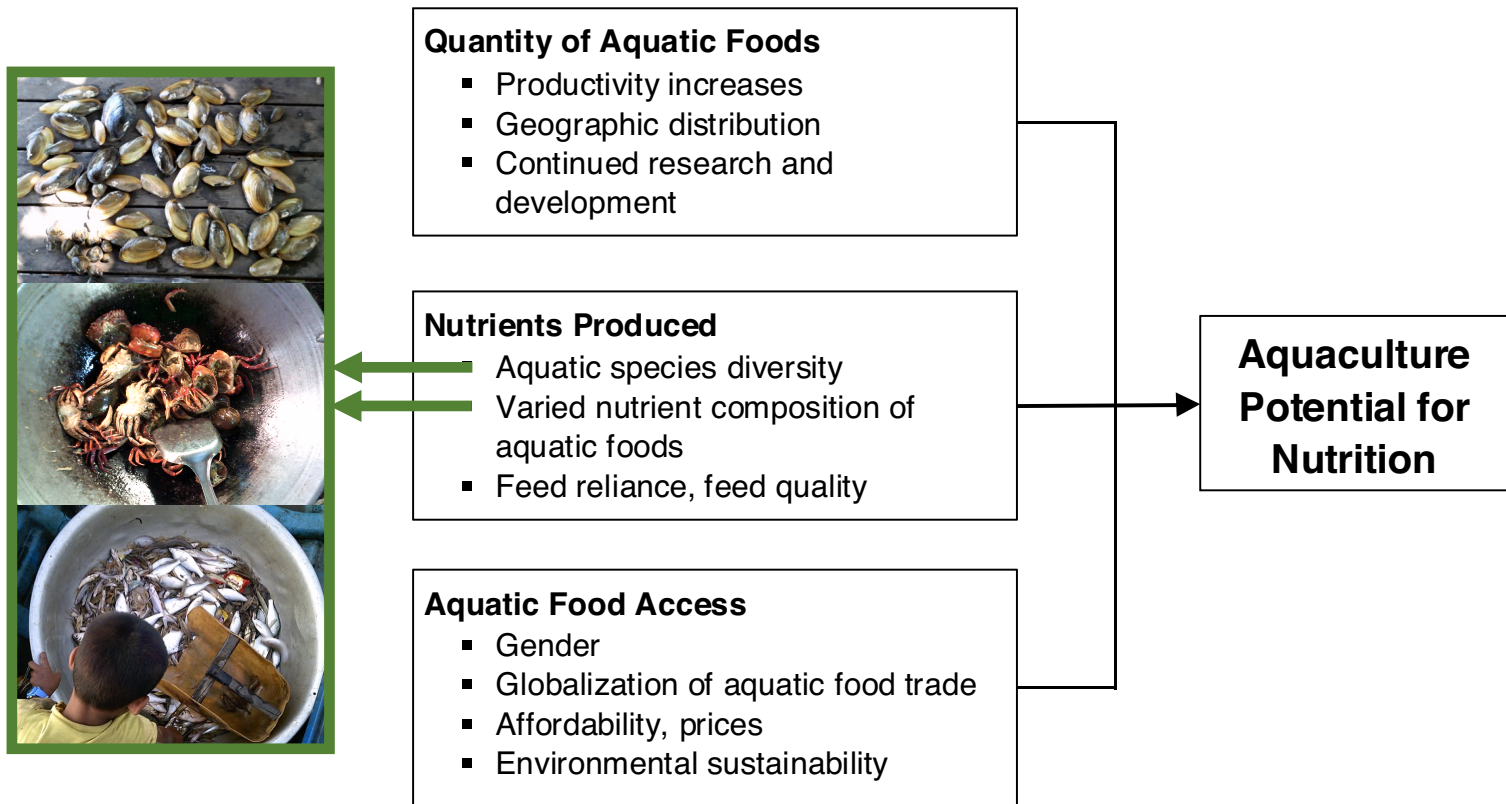
Field trials of a plant genetically modified to produce omega-3 normally sourced from fish oil have shown that it can be successfully grown in the UK, Canada and the United States.

Black soldier fly larvae co-benefits—

- Improved sanitation
- Diverted nutrients
- Reduced methane emissions
- Aquaculture constraint



Access to small, nutrient-rich fish



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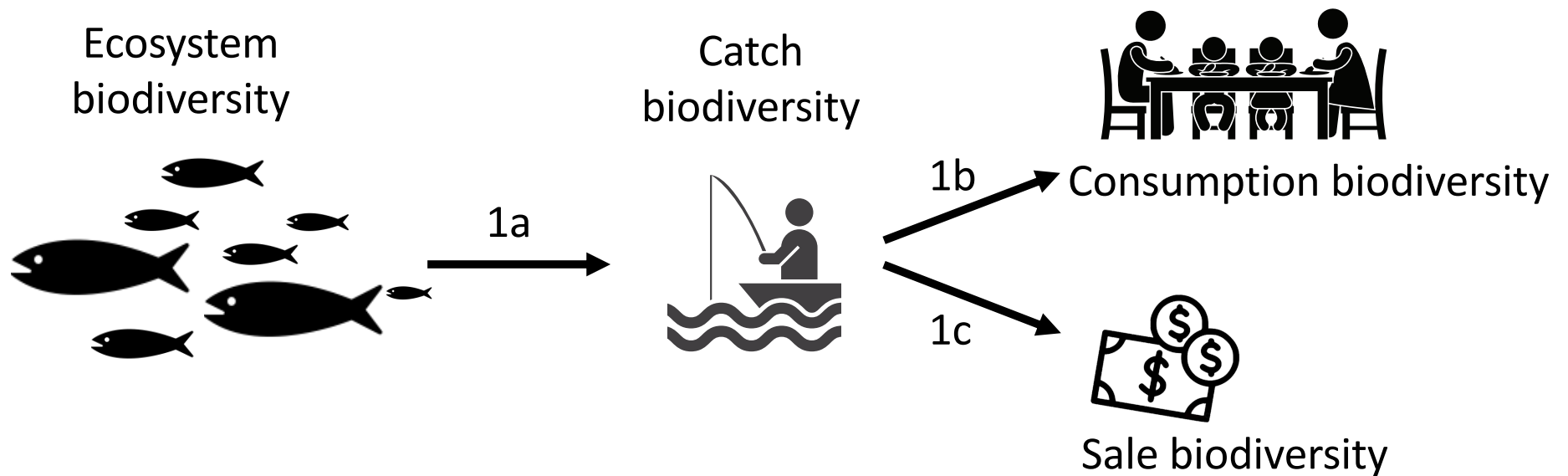
Photovoice: Aquatic foods in Cambodia



Fiorella, KJ, Magnuson, H, Finney Stable, A, Sim, C, Phan, V, Fox, EL. 2023. Environmental change and resource access in aquatic food systems: a Photovoice case study of Cambodian fisheries. *Ecology and Society*. 28(4).

Wang, Q, Byrd, K, Thilsted, S, Navin, C, Kim, M, Fiorella, K. 2023. Nutrition and Food Safety of a Locally-Processed Fish Product in Cambodia. *Aquatic Ecosystem Health and Management*. 25(3).

Species diversity filters through the food system



Fiorella, KJ, Bageant, ER, Thilsted, SH, Heilpern, S. Commercially traded fish portfolios mask household utilization of biodiversity in wild food systems. *In review*.

Substitution of wild fisheries

ARTICLES

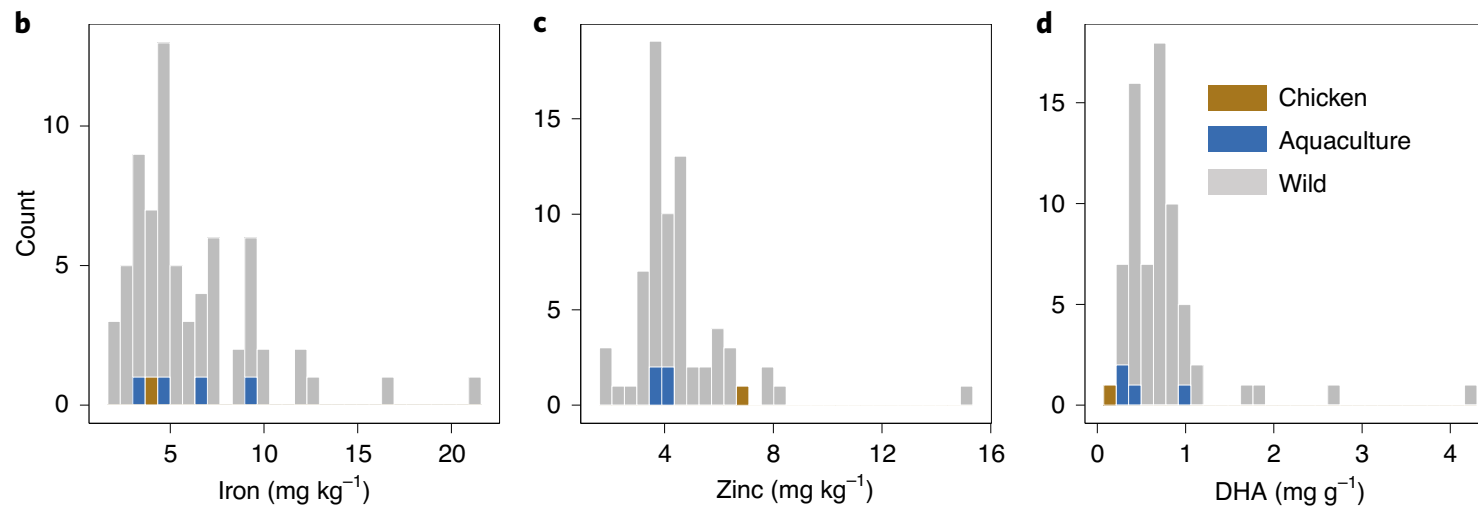
<https://doi.org/10.1038/s43016-021-00242-8>

nature
food

Check for updates

Substitution of inland fisheries with aquaculture and chicken undermines human nutrition in the Peruvian Amazon

Sebastian A. Heilpern^{1,2}✉, Kathryn Fiorella³, Carlos Cañas⁴, Alexander S. Flecker⁵, Luis Moya⁶, Shahid Naeem¹, Suresh A. Sethi⁷, Maria Uriarte¹ and Ruth DeFries¹



Research priorities

- Integrate environmental sustainability and health outcomes
 - Strategies to prioritize nutritional output of whole food system
 - Fish health and antimicrobial resistance management
 - Environmental impact of production systems
 - Risk-benefit trade-offs; pollutants and contamination – e.g., heavy metals, algal toxins
- International examples where aquaculture systems are developing fast
 - E.g., cage culture systems rapidly expanding in Lake Victoria (East Africa) largely prohibited in the US Great Lakes
- Circularity
 - Circular use of nutrients from aquaculture systems – RAS systems, integration with other production systems
 - Feed innovation
- Species selection, for cultivation and feed
 - Wide differences in nutritional composition of fish species
- Access to aquatic foods, participation in aquatic food value chains
 - Aquatic food access for vulnerable groups
 - Cultural importance of aquatic foods a leverage point

Thank you!



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