



InFish

A cross-sectoral
inland fisheries
community of
practice

Abigail J. Lynch, National Climate Adaptation Science Center,



Inland waters:

Lakes, rivers, streams, canals, reservoirs, and other land-locked waters (can include salt!)

Inland fisheries:

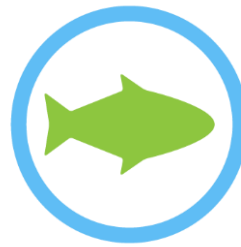
Both capture fisheries and aquaculture of inland fish species for food, income, or recreation.

Inland fish:

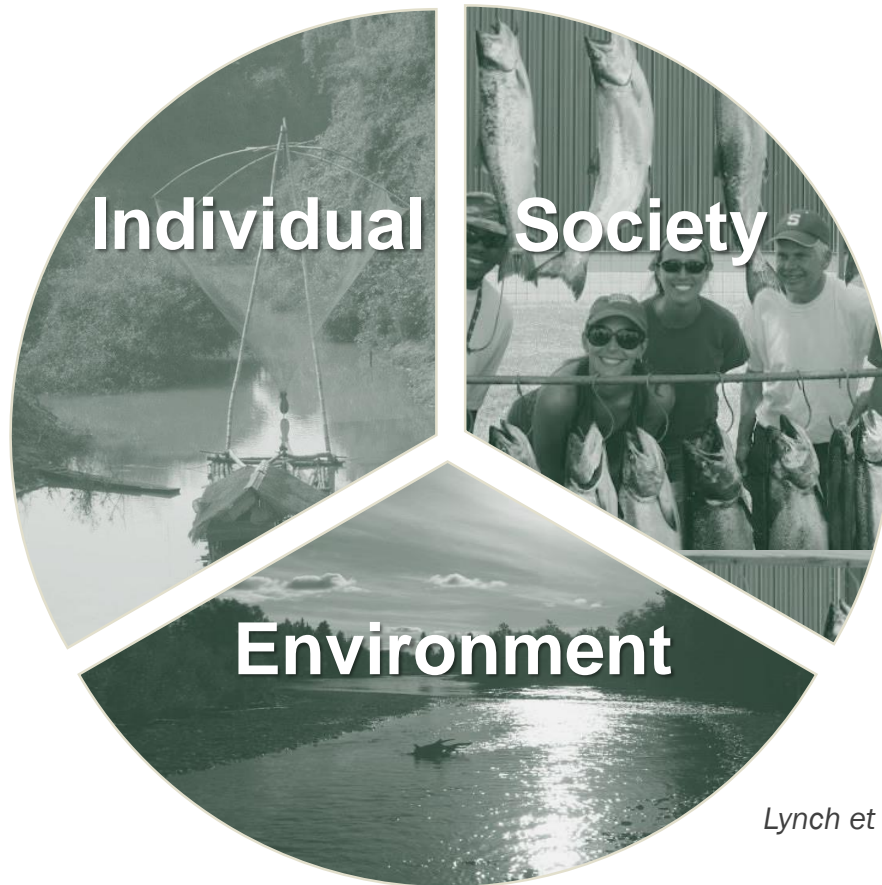
Fish in inland waters, including anadromous; 40% of all fish species and 20% of all vertebrate species.



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- 1. Food security
- 2. Economic security
- 3. Empowerment



- 4. Cultural services
- 5. Recreational services
- 6. Human health and well-being
- 7. Knowledge transfer and capacity building

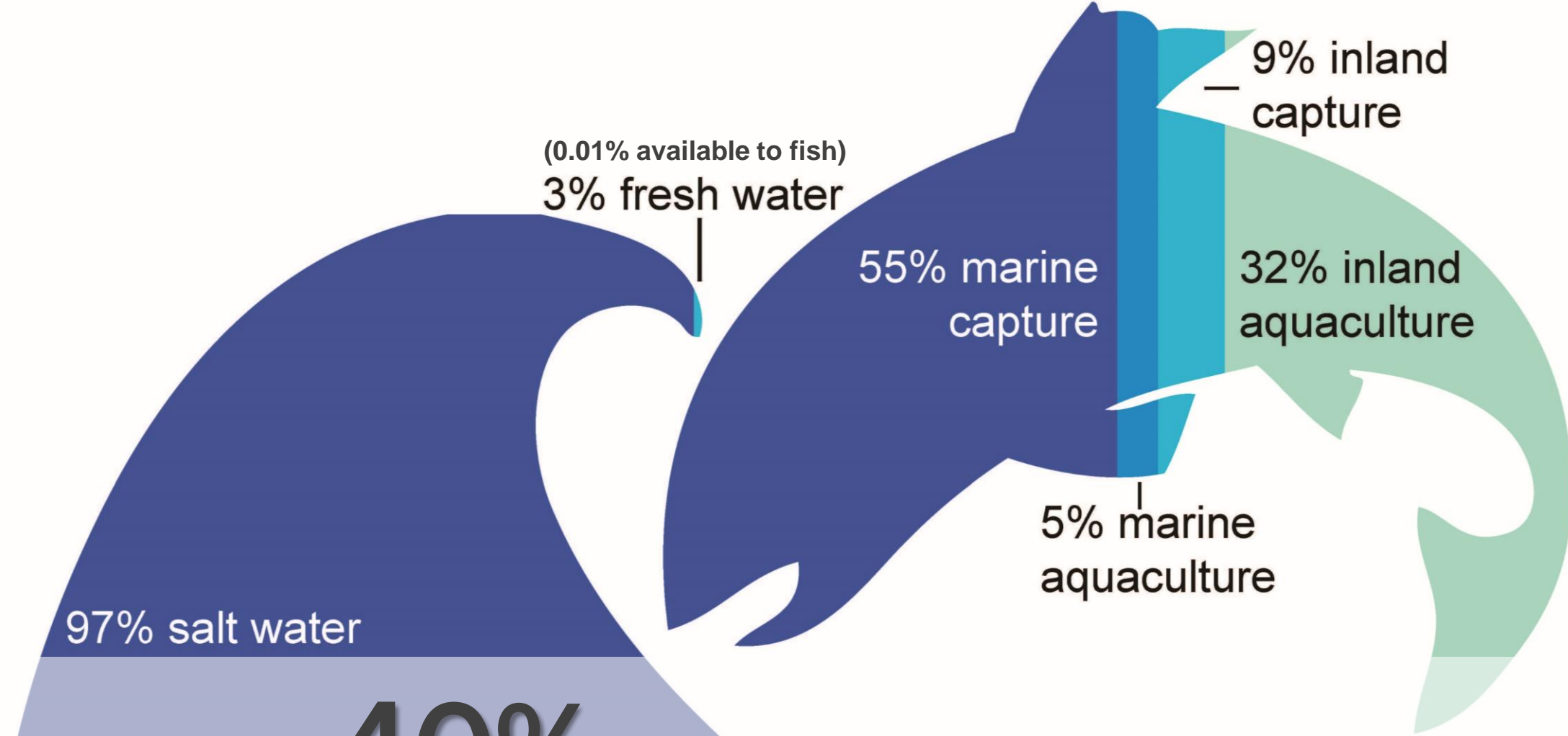
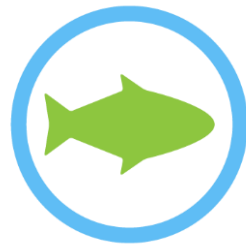
Lynch et al. 2016

- 8. Ecosystem function and biodiversity
- 9. Aquatic “canaries”
- 10. “Green food”



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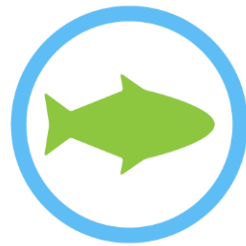
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More than **40%** of the world's finfish production comes from less than **.01%** of the total volume of water on earth.

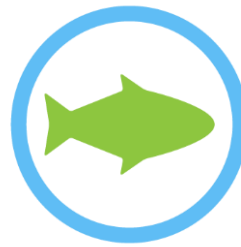
A vibrant indoor fish market scene. In the foreground, a man in a green vest and white shirt is smiling while handling fish on a large metal tray. To his right, another man in a striped shirt is laughing and pointing towards him. In the background, a woman in a colorful sari is working with fish on a scale. The market is filled with large trays and baskets of fresh fish, and other people are visible in the background, creating a bustling atmosphere.

Inland fisheries provide food for **billions**
and livelihoods for **millions** of people worldwide.



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WEAK GOVERNANCE

FISHERS WEAKLY REPRESENTED IN DECISION MAKING

WEAK INSTITUTIONAL SUPPORT FOR FISHERIES MGMT

ECONOMIC SUPREMACY OF WATER SECTOR DEVELOPMENT

CORRUPTION

POLITICAL, ECONOMIC INVISIBILITY

DEARTH OF HIGH PROFILE SCIENTISTS WORKING IN FISHERIES DEVELOPMENT

SYSTEMIC AND UNDOCUMENTED LOSS OF INLAND FISHERIES

POOR ECONOMIC STATUS OF FISHERS, DETERIORATING RESOURCE



SUSTAINABILITY OF INLAND FISHERIES

AGRICULTURAL SECTOR DOMINATES FOOD PRODUCTION SECTOR

MARINE FISHERIES HAVE HIGHER PUBLIC PROFILE

AQUACULTURE SEEN AS VIABLE, PROFITABLE ALTERNATIVE

RESOURCE INVISIBILITY

POOR ASSESSMENT AND REPORTING

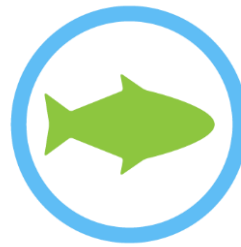
FISHERIES OVERLOOKED IN FOOD SECURITY AND NUTRITION

HIGHLY DISPERSED, PRIMARILY RURAL

LOW PERCEIVED VALUE



GENERAL PROCEDURE OF FISH STOCK ASSESSMENT



INPUT: FISHERIES DATA (+ ASSUMPTIONS)



PROCESS: Analyses of historical data



OUTPUT: ESTIMATED GROWTH AND MORTALITY PARAMETERS

INPUT:



PROCESS: Predictions of yield for a range of alternative exploitation levels



OUTPUT: OPTIMUM FISHING LEVEL
MAXIMUM SUSTAINABLE YIELD

DOES NOT WORK!

FAO 1998



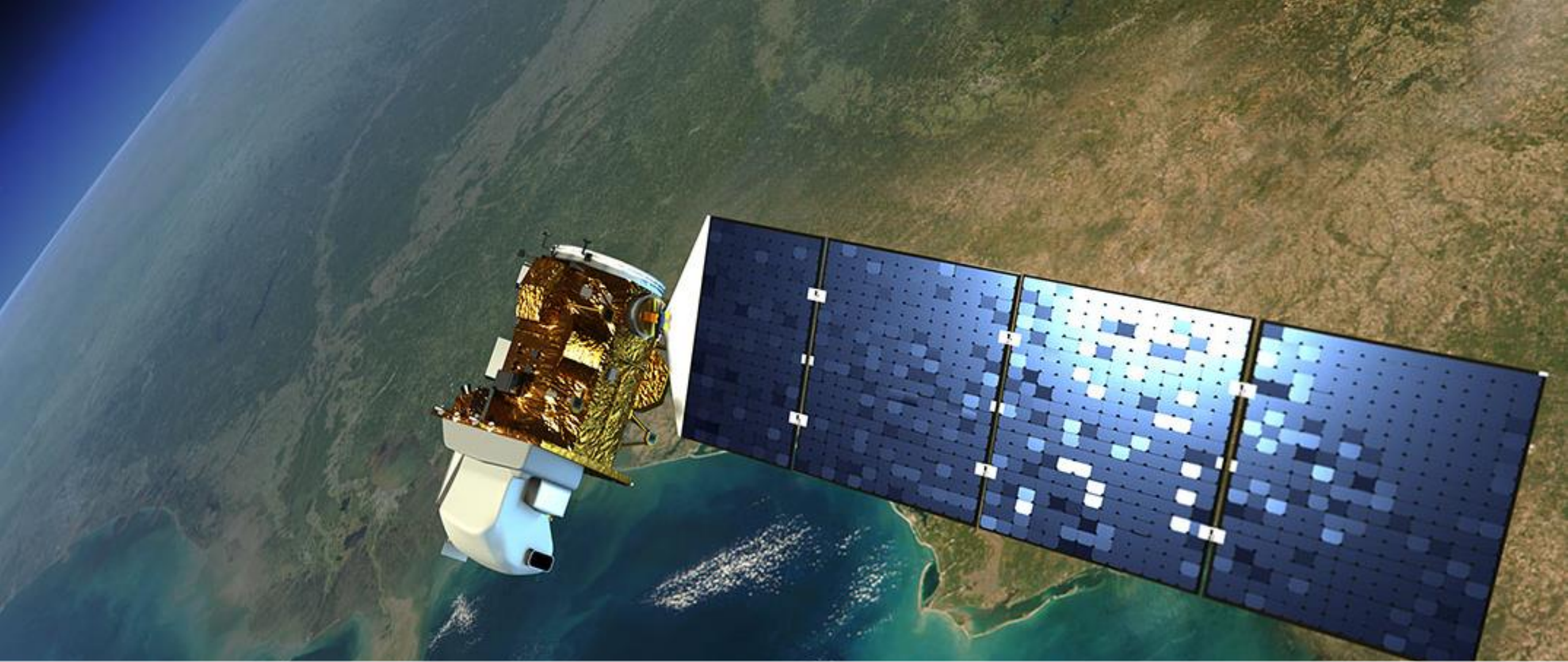
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Most inland fisheries are

highly dispersed, small-scale,
and have limited integration into market systems.





Novel assessment techniques are necessary.



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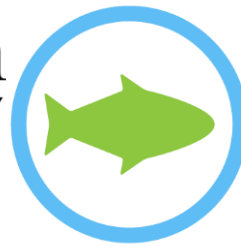


Collaborative opportunities: research, synthesis, networking, outreach.



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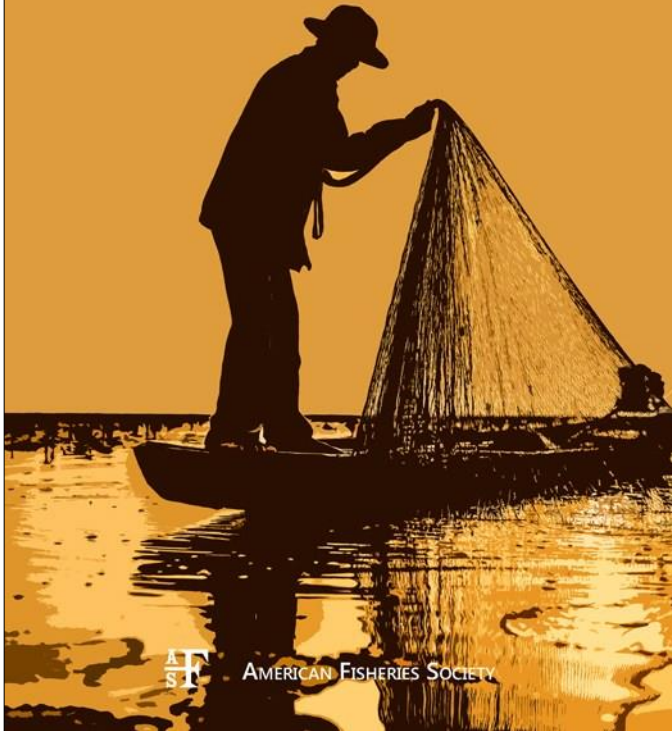
More than **85** members, from more than **40** organizations, based in **19** countries...and counting!



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FRESHWATER, FISH AND THE FUTURE
Proceedings of the Global Cross-Sectoral Conference



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REVIEW

The social, economic, and environmental importance of inland fish and fisheries

Abigail J. Lynch, Steven J. Cooke, Andrew M. Deines, Shannon D. Bower, David B. Bunnell, Ian G. Cowx, Vivian M. Nguyen, Joel Nohner, Kaviphone Phouthavong, Betsy Riley, Mark W. Rogers, William W. Taylor, Whitney Woelmer, So-Jung Youn, and T. Douglas Beard, Jr.

Abstract: Though reported capture fisheries are dominated by marine production, inland fish and fisheries make substantial contributions to meeting the challenges faced by individuals, society, and the environment in a changing global landscape. Inland capture fisheries and aquaculture contribute over 40% to the world's reported finfish production from less than 0.01% of the total volume of water on earth. These fisheries provide food for billions and livelihoods for millions of people worldwide. Herein, using supporting evidence from the literature, we review 10 reasons why inland fish and fisheries are important to the individual (food security, economic security, empowerment), to society (cultural services, recreational services, human health and well-being, knowledge transfer and capacity building), and to the environment (ecosystem function and biodiversity, as aquatic "canaries", the "green food" movement). However, the current limitations to valuing the services provided by inland fish and fisheries make comparison with other water resource users extremely difficult. This list can serve to demonstrate the importance of inland fish and fisheries, a necessary first step to better incorporating them into agriculture, land-use, and water resource planning, where they are currently often underappreciated or ignored.

Key word: food security, freshwater ecosystems, importance of fish, inland fisheries.

Résumé: Bien que la capture de poissons rapportée par les pêcheries soit dominée par la production marine, les poissons et les pêcheries de l'intérieur des terres apportent des contributions substantielles pour rencontrer les défis rencontrés par les individus, les sociétés et l'environnement dans un paysage en changement global. Les captures des pêcheries de l'intérieur et l'aquaculture contribuent à la hauteur de 40 % à la production mondiale rapportée pour les poissons à nageoires, à partir de moins de 0,01 % du volume total de l'eau sur terre. Ces pêcheries fournissent de la nourriture pour des milliards et un moyen de subsistance pour des millions de gens, partout au monde. Dans cette revue, en utilisant des preuves venant de la littérature, les auteurs examinent 10 raisons pour lesquelles, les pêcheries et les poissons de l'intérieur sont importants pour les individus (sécurité alimentaire, sécurité économique, l'autonomisation), pour la société (services culturels, services récréatifs, santé humaine et bien-être, transfert de connaissances et capacité à construire) et pour l'environnement (fonction écosystémique et biodiversité, comme « canaris » aquatiques, pour le mouvement « aliments verts »). Cependant, les limitations actuelles pour évaluer les services fournis par les poissons et les pêcheries intérieures rendent les comparaisons avec les autres utilisateurs de la ressource en eau extrêmement difficile. Cette liste peut servir à démontrer l'importance des poissons et des pêcheries de l'intérieur, une première étape essentielle pour mieux les incorporer avec l'agriculture, l'utilisation du territoire et la planification des ressources en eau, où elles sont actuellement sous-estimées, voire totalement ignorées. [Traduit par la Rédaction]

Mots-clés : sécurité alimentaire, écosystèmes d'eau douce, importance des poissons, pêcheries de l'intérieur.

Introduction

Inland waters are defined by the Food and Agriculture Organization of the United Nations (FAO) as lakes, rivers, streams, canals, reservoirs, and other land-locked waters (FAO 2014a). While inland is generally synonymous with freshwater, inland waters do include land-locked saline water bodies such as the Caspian Sea (FAO 2014a). Inland waters comprise approximately 0.01% of the total volume of water on earth (Stiassny 1996). Inland fishes reside in these waters. They comprise approximately 40% of all fish species and 20% of all vertebrate species

(Helfman et al. 2009). However, the difficulty in assessing aquatic biodiversity, particularly in developing countries and remote areas, suggests that inland fishes are more diverse than the reported estimates (Cooke et al. 2012). Additionally, 65% of inland habitat is classified as moderately or highly threatened by anthropogenic stressors (Voronyy et al. 2010), so populations may be extirpated even before they are documented.

Inland fisheries are both capture fisheries and aquaculture of inland fish species for food, income, or recreation. In discussions of global capture fisheries, inland fisheries are often overwhelmed

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Ambio
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PERSPECTIVE

On the sustainability of inland fisheries: Finding a future for the forgotten

Steven J. Cooke, Edward H. Allison, T. Douglas Beard, Jr., Robert Arlinghaus, Angela H. Arthington, Devin M. Bartley, Ian G. Cowx, Carlos Fuentesilla, Nancy J. Leonard, Kai Lorenzen, Abigail J. Lynch, Vivian M. Nguyen, So-Jung Youn, William W. Taylor, Robin L. Welcomme

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Abstract At present, inland fisheries are not often a national or regional governance priority and as a result, inland capture fisheries are undervalued and largely overlooked. As such they are threatened in both developing and developed countries. Indeed, due to lack of reliable data, inland fisheries have never been part of any high profile global fisheries assessment and are notably absent from the Sustainable Development Goals. The general public and policy makers are largely ignorant of the plight of freshwater ecosystems and the fish they support, as well as the ecosystem services generated by inland fisheries. This ignorance is particularly salient given that the current emphasis on the food-water-energy nexus often fails to include the important role that inland fish and fisheries play in food security and supporting livelihoods in low-income food deficit countries. Developing countries in Africa and Asia produce about 11 million tonnes of inland fish annually, 90 % of the global total. The role of inland fisheries goes beyond just kilocalories; fish provide important micronutrients and essentially fatty acids. In some regions, inland recreational fisheries are important, generating much wealth and supporting livelihoods. The following three key recommendations are necessary for action if inland fisheries are to become a part of the food-water-energy discussion: invest in improved valuation and assessment methods, build better methods to effectively govern inland fisheries (requires capacity building and incentives), and develop approaches to managing waters across sectors and scales. Moreover, if inland fisheries are recognized as important to food security, livelihoods, and human well-being, they can be more easily incorporated in regional, national, and global policies and agreements on water issues. Through these approaches, inland fisheries can be better evaluated and be more fully recognized in broader water resource and aquatic ecosystem planning and

decision-making frameworks, enhancing their value and sustainability for the future.

Keywords Inland fisheries · Sustainability · Governance · Integrated water resources management · Food-water-energy nexus

THE FORGOTTEN FISHERIES

Inland fisheries¹ contribute over 40 % of the world's reported finfish fisheries and aquaculture production (excluding plants, mammals, crustaceans, echinoderms, and mollusks; Lynch et al. 2016). Inland capture fisheries comprise under 10 % of this reported total but the actual fish harvest is likely substantially higher (Welcomme et al. 2010). Despite this indisputable importance, due to lack of reliable data, inland fisheries have never been part of any high profile global fisheries assessment. Moreover, the apparent low proportion of fish provided by inland capture fisheries globally does not reflect the importance of inland capture fisheries in today's society (Bartley et al. 2015). Indeed, the general public and policy makers are largely ignorant of the plight of freshwater ecosystems and the fish they support, as well as the ecosystem services generated by inland fisheries (Cooke et al. 2013; Lynch et al. 2016).

Despite mounting evidence of the immense value of inland capture fisheries for food security in the developing world (Welcomme 2011; FAO 2014), inland fisheries rarely form part of high level policy documents and form dealing

Peer-Field review: 16 June 2016

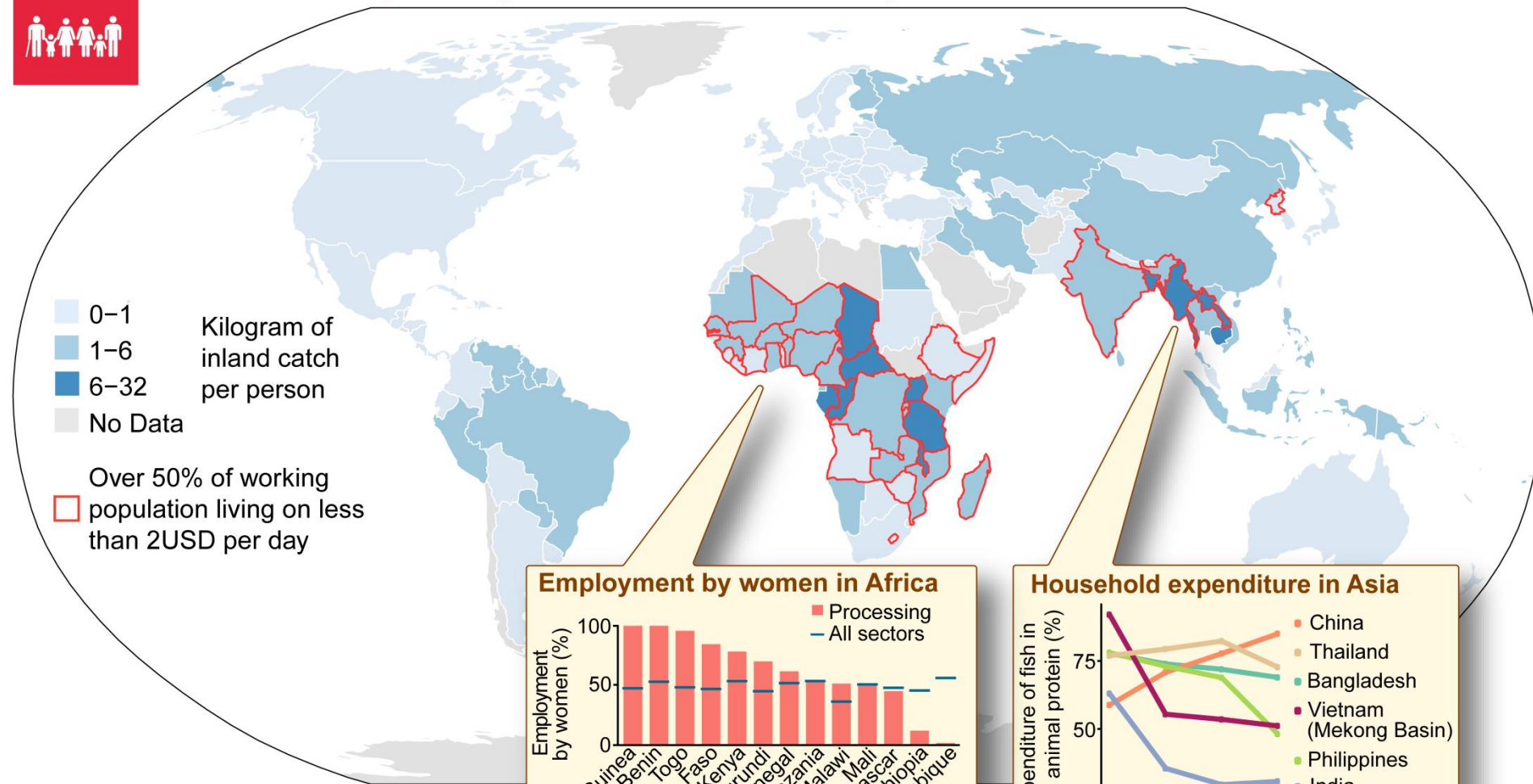
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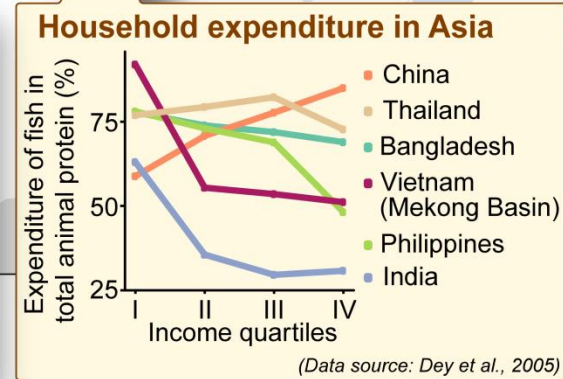
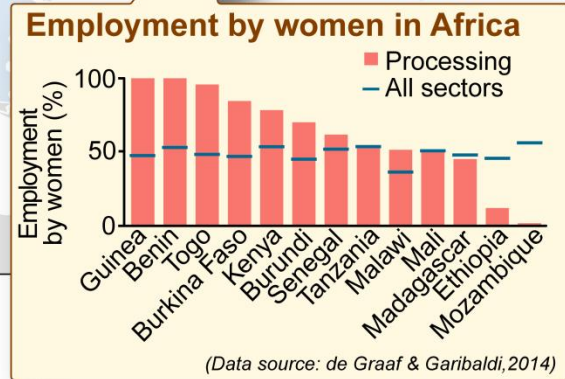
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Goal 1: End poverty in all its forms everywhere



(Data source for map: National inland fish catch and population from FAO (2016), FishStatJ and FAOSTAT respectively. Population percentage living below poverty line from the World Development Indicators (World Bank).



Lynch et al. 2017



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Using **interdisciplinary** methods and **novel** approaches.





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Estimating and projecting fish harvest from lakes with remote sensing



USGS science for a changing world



NASA

Global assessment of river fish production with global change implications



USGS science for a changing world



UNIVERSITY OF Hull


Estimating total harvest of commercial and recreational inland fisheries in the U.S.



USGS science for a changing world



Developing adaptation strategies and replacement costs for recreational and tribal fisheries



USGS science for a changing world



Gretchen Hansen

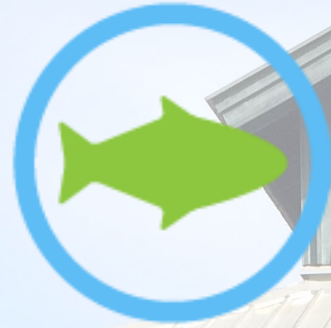


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Thank you!

Ten Steps to
Responsible Inland
Fisheries

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The Rome Declaration: Ten steps to Responsible Inland Fisheries synthesizes the results of a 2015 international conference...

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