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## Climate change and inland aquaculture: impacts, adaptation and adaptation barriers

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Aquaculture will continue to depend more on land than sea

<u>Wenbo Zhang</u> <sup>™</sup>, <u>Ben Belton, Peter Edwards, Patrik J. G. Henriksson, David C. Little, Richard Newton</u> & <u>Max</u> <u>Troell</u>

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## Vulnerability of blue foods to human-induced environmental change

Ling Cao II, Benjamin S. Halpern, Max Troell, Rebecca Short, Cong Zeng, Ziyu Jiang, Yue Liu, Chengxuan Zou, Chunyu Liu, Shurong Liu, Xiangwei Liu, William W. L. Cheung, Richard S. Cottrell, Fabrice DeClerck, Stefan Gelcich, Jessica A. Gephart, Dakoury Godo-Solo, Jessie Ihilani Kaull, Fiorenza Micheli, Rosamond L. Navlor, Hanna J. Payne, Elizabeth R. Selig, U. Rashid Sumaila & Michelle Tigchelaar

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Compound climate risks threaten aquatic food system benefits

# Climate change and inland aquaculture

- Aquatic foods are critical to the nutrition and food security for billions worldwide, yet climate-related hazards are jeopardizing their ability to provide these vital benefits.
- Inland (freshwater) aquaculture, has become the major contributor of edible aquatic food, particularly in the Global South, where around 80% are small- and medium scale aquaculture.
- Climate change and extremes might exacerbate food insecurity in these areas, where small-scale fish farmers have a relatively low buffering capacity and are relatively sensitive to climate-related shocks and variability.

#### WANT BETTER PONDS

#### Bungoma fish farmers incur losses after heavy rains

Chemeseng says he lost fish worth Sh42,000.

#### In Summary

• Kororia Chemeseng, who started fish farming in 2002, told the Star on Sunday they usually incur heavy losses when it rains heavily.

• He said it rained on Monday last week and 1,000 fish were washed away after the pond walls were destroyed by floods.

- □ Inland aquaculture has been at risk from a combination of climatic variabilities and changes, including cyclones, drought, floods, rising temperatures and heat extremes, rainfall variation, and salinity intrusion.
- Inland aquaculture adaptation to climate change is understudied compared to marine and coastal aquaculture. Although a growing literature has shown how climate change and extremes affect aquatic food systems, major gaps remain for inland aquaculture including:
- a systematic understanding of impacts;
- corresponding adaptation measures;
- barriers to adaptation.

Understanding the impact and adaptation pathways is the first step and is paramount important to predict possible devastating effects and to adopt wellinformed strategies for adaptation and mitigation.

#### News | Climate Crisis

## More Kenyans hit by climate change count on fish farming

An increasing number of farmers are surviving drought and downpours by supplementing their income by raising fish.



Fish farmers lament loss of N100 billion to flood



Above 2,000 acres of private fish farms submerged due to Bago floods

🕚 October 20, 2023 🏖 Global New Light of Myanmar 🥥 123



Workers are seen netting fish in a fish breeding pond.



## Generalized aquaculture value chain



### Impact and adaptation pathways on off-farm aquaculture value chain segments

**Rice bran** 

151 Raw rice

**Rice millini** 

Rice bran



### Impact and adaptation pathways on on-farm aquaculture value chain segments



## *Temperature increase-Fishpond-*

Increase in water temperature-Dissolved oxygen decrease-Enhance water

## *"*exchange



Aeration and water circulation

### Impact and adaptation pathways on on-farm aquaculture value chain segments



Flood-Fishpond-Pond dike damages-Fish escape from pond-pond dike reinforcement

Sudden Flood inundation

Construction of tall and wide dyke for protection of pond from flood

## Adaptation classification

	Time	Cost	Benefit	Form	Scale
No-regret reactions	Short	Low	Medium	Technical	Farm
Low-regret tactics	Short	Medium	Medium	Technical	Farm
Up-front strategies	Mid	High	Medium	Infrastructural	Farm Community
Future-benefit strategies	Long	Medium	High	Technical Informational Institutional Financial	Farm Community Nation
Easier early strategies	Short	Low	High	Informational Institutional	Farm Community Nation





## Conceptual framework of adaptation in aquaculture to climate change



- The straightforward and visualized pathways can further be designed in the local context as materials for training or extension education in future interventions to improve farmers' knowledge and capacity about the impacts and adaptations of climate change and extremes.
- This study provides an inventory of adaptation solutions that could be used to address the relevant impacts of climate change and extremes, which constitutes an important knowledge base for future planning and climate change adaptation.

## Foster the environment for inland aquaculture for adaptation to climate change...

- > Incorporate climate change in the food agenda in international, national, and local policies.
- Development of information-sharing platforms to enhance access to timely information by aquaculture producers. Information and communication technologies (ICTs) can be used to support adaptation by enabling access to critical information for decision-making.
- Increase financial investment for sustainable climate-resilient aquatic food system transformation. Less than 30% of countries dependent on aquatic food production have sought adaptation finance, which becomes one of the critical challenges faced in accessing resources to bolster climate resilience.

## Future research should...

- Assess the magnitude of impacts and the effectiveness of adaptation solutions. Only a quarter of reviewed studies conduct household surveys, and only one study assessed the impacts on aquaculture production and economic outcome quantitatively. More community engagements will be needed to understand better the impacts and adaptation on the ground.
- Conduct research on other value chain segments to understand the impacts of climate change on aquaculture. Compared to production, there is a dearth of knowledge regarding the impact and adaptation pathways on other aquaculture value chain (off-farm segment). Multidisciplinary/interdisciplinary research will be needed to unpack the impact and adaptation pathway to climate change in the whole aquaculture value chain.



## Thank you

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