Modelling fish production in Lake Kariba to assess impacts of climate change: A case study on the vulnerability of fish stocks

Mzime R. Ndebele-Murisa

Adaptation
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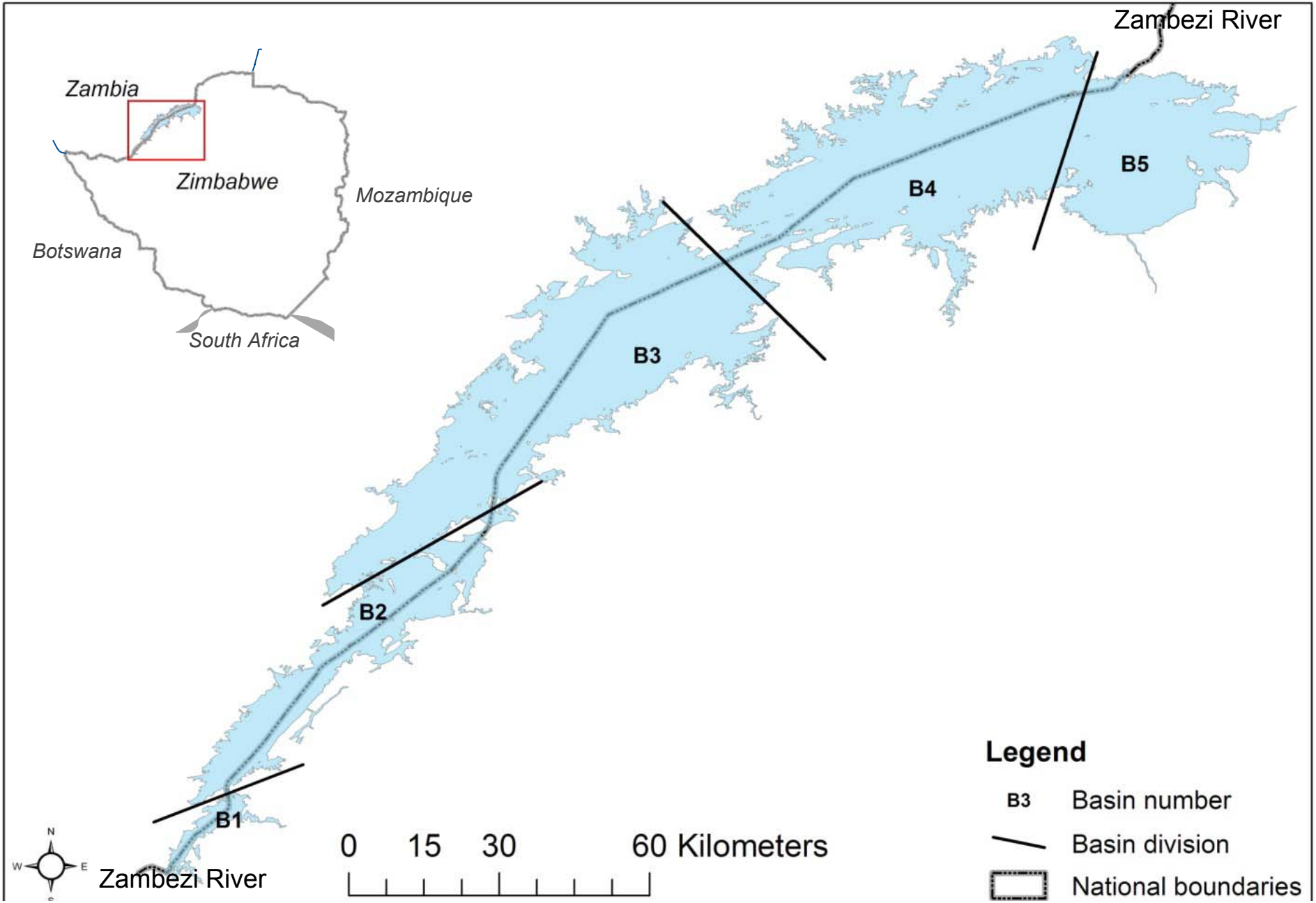
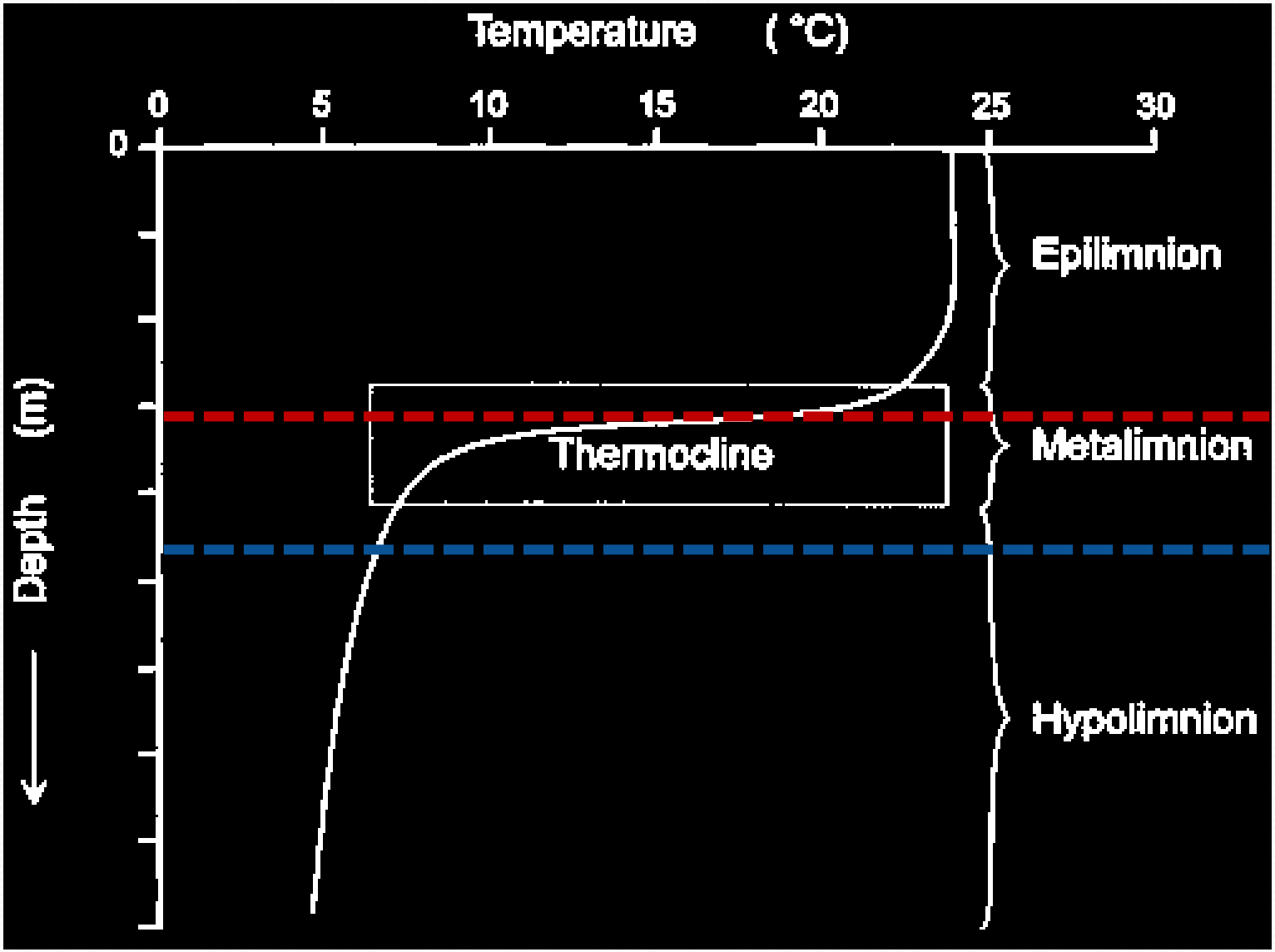
Outline

- Lake Kariba background
- Development of Kapenta fish industry
- Major research findings and interpretation
- Application of research in other disciplines
- Acknowledgements

Lake Kariba history and background



The dilemma of changing ecosystems

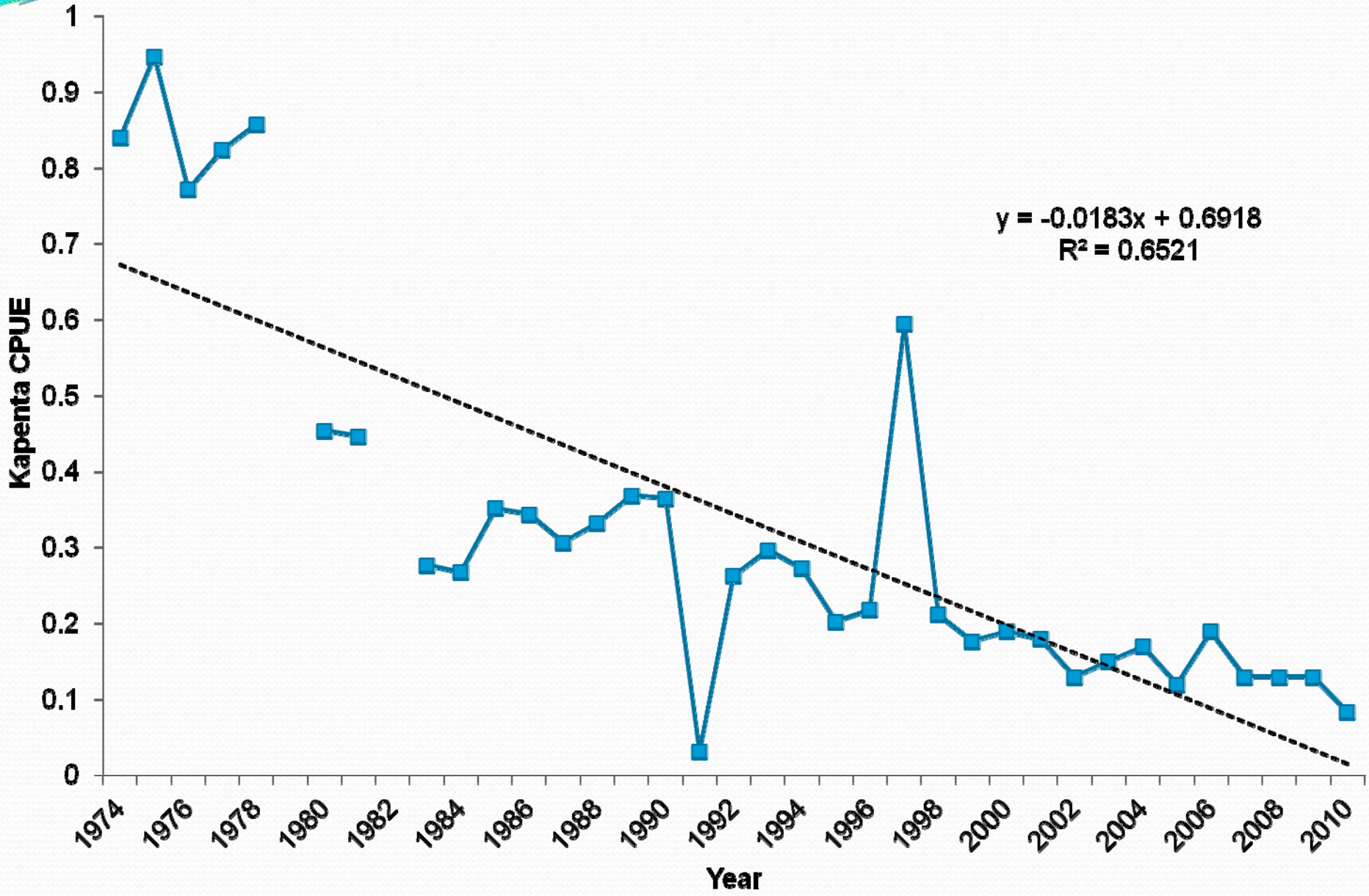


Development of Kapenta fish industry

- 1968/69: Introduced into Lake Kariba
- 1974: Successfully colonizes pelagic zone
  Forms viable commercial industry
- 1974-1990s: Increased production and catches
- Mid 1980s to date: Unprecedented declines

Question is why??????

Results: Kapenta time series



Results: Kapenta fish production

- ~60% decrease in Kapenta fish stocks and size
- Decrease has been unprecedented since 1986-1990
- Decrease in fishing levels (50%) so overfishing ruled out as influential factor on fish production
- Kapenta catch per unit effort (CPUE) corresponds strongly with climatic variables: rainfall, air temperature and lake water levels

Results: Climate change explains Kapenta declines

✓ 3.5°C increase in air temperature since 1963
✓1.9°C in upper waters since 1965

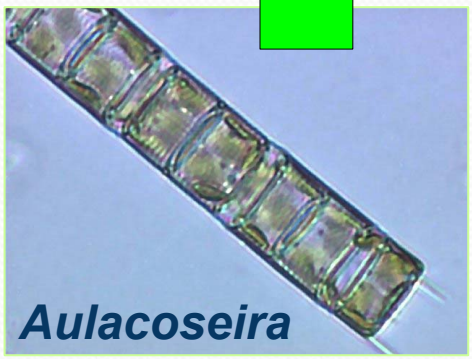
✓60%upward migration of thermocline since 1965 and therefore more stable stratification

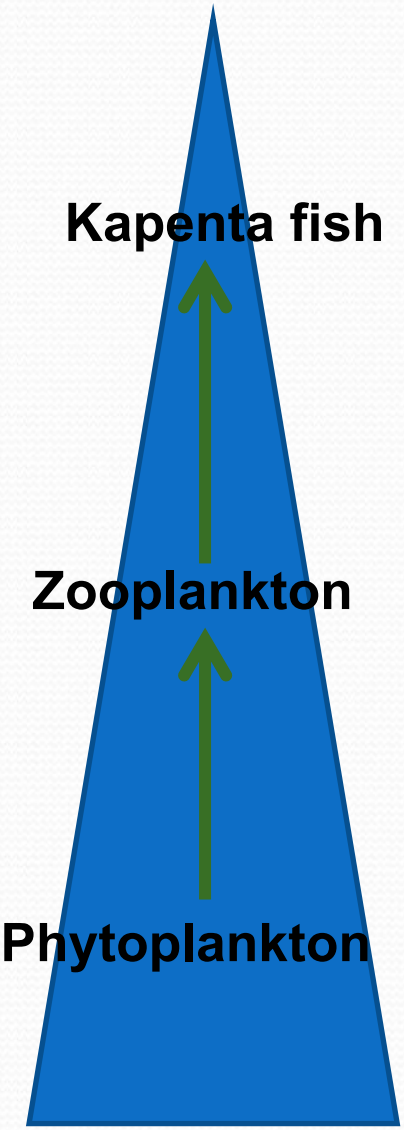
✓Up to 12m decrease in lake water levels mostly from 1985
✓50% decrease in lake nutrients esp nitrogen since 1965
✓57% decrease in phytoplankton biomass and 80% decrease in primary production since 1982

✓Proliferation of smaller-sized species at primary and secondary levels (Cyanobacteria and Rotifera) since 1980s

✓ Lower efficiency of food chain and decrease in primary production cascading up trophic level to Kapenta and other fish

Food web structure and nutrient dynamics





Lower efficiency of food chain and decrease in biological production at primary level cascading up trophic level to zooplankton, Kapenta and other fish

Application of research work

- **UNFCCC/IGBP Least Developed Countries (LDCs) synthesis:** Informing a policy framework for effective fisheries management for environmental policy (Zambia/Zimbabwe)
- **Advanced research:** Developing a bio-economic model for Kapenta fisheries management and in adaptation to current and projected climate changes in and around the lake
- **CORDEX impacts and vulnerability Group:** i) RCMs validation, Climate Change Portal (CIP), University of Cape Town's CSAG, ii) bridging the gap between modelers and end users of climate information by facilitating good science communication between these groups
- **Promotion of small-scale fish farming (aquaculture) in rural Zimbabwe** in order to boost fish production and as an adaptation strategy against climate change and the resultant declining fish stocks in Lake Kariba
- **East African Great Lakes Observatory (EAGLO)**

Acknowledgements

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Thank you!

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