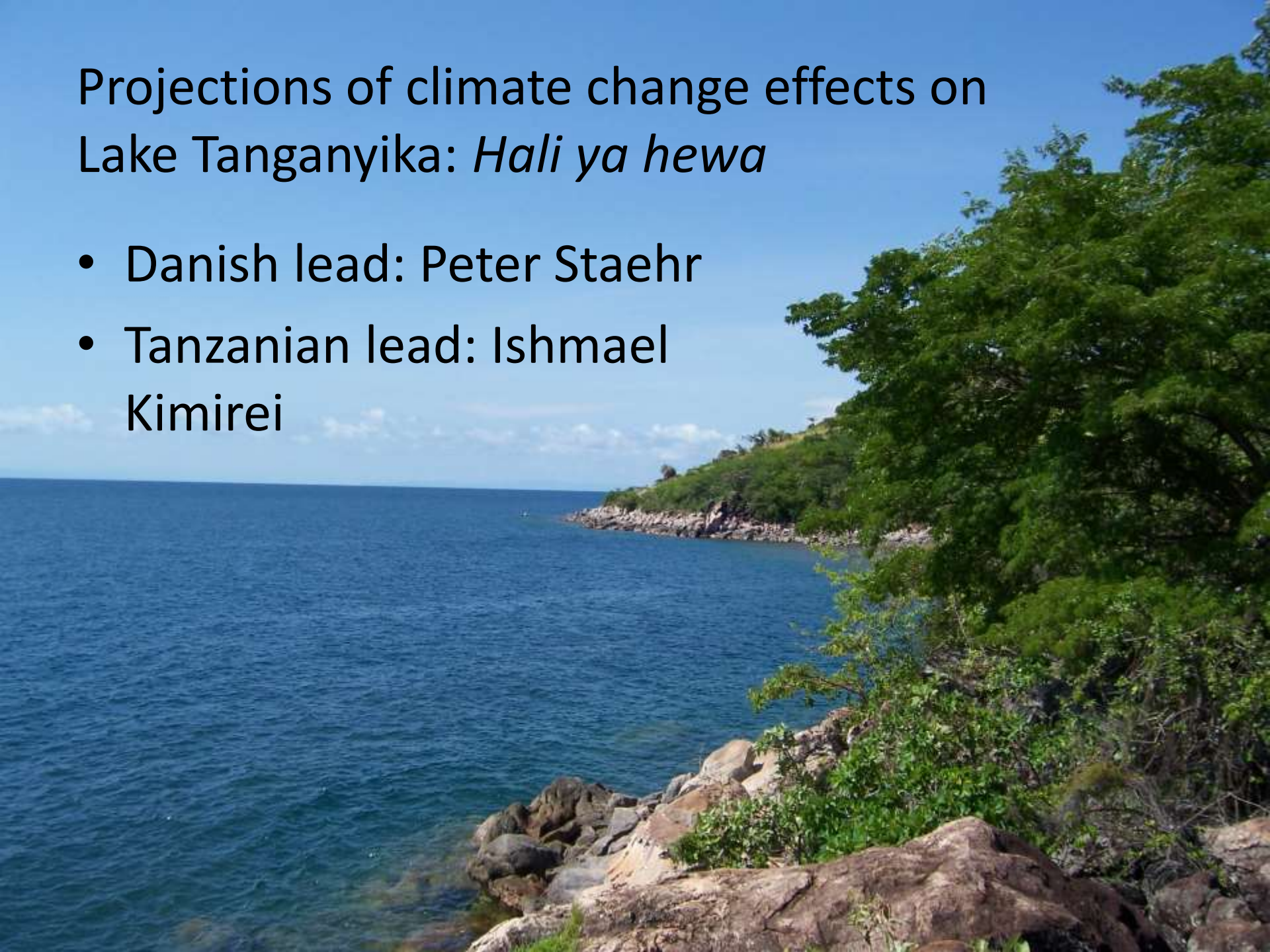
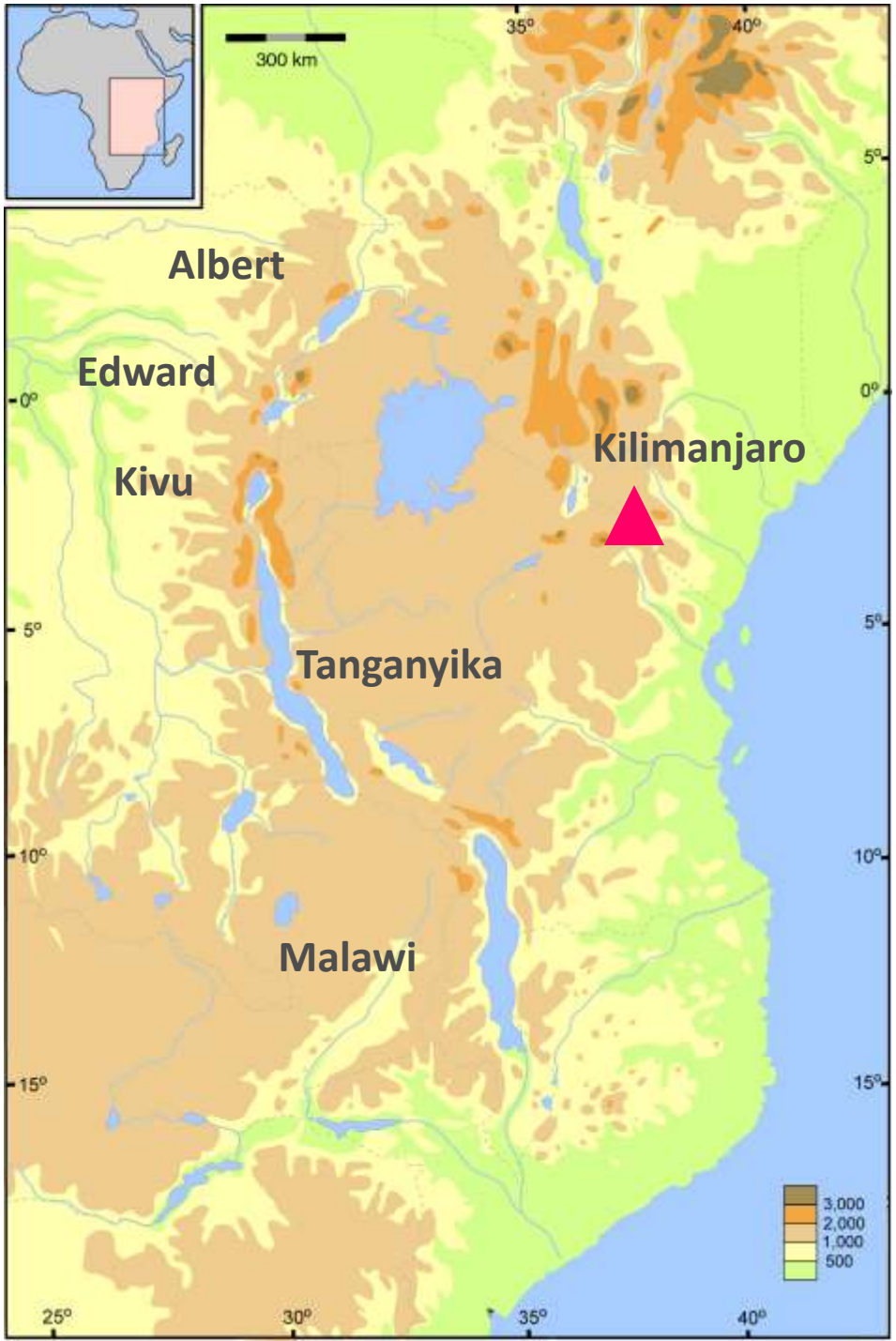


Projections of climate change effects on Lake Tanganyika: *Hali ya hewa*

- Danish lead: Peter Staehr
- Tanzanian lead: Ishmael Kimirei



East African Rift Valley lakes:

- Tropical
- Large volume of the earth's water
- High freshwater biodiversity
- High fish yields
- High human population growth


NASA International Space Station









Projections of climate change effects on Lake Tanganyika

AARHUS UNIVERSITY

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Project abstract

In this poster we present a new five year project which will train Tanzanian scientists and students in sampling, analyzing and interpreting data on physical, chemical and biological conditions in Lake Tanganyika, Tanzania. By combining novel research and capacity building of regional researchers, lake managers and key stakeholders of the lake, we aim to set the grounds for an improved and informed long-term sustainable environmental management of natural resources in Lake Tanganyika in an era of climate change and rapid human population growth.

The overall aim is to improve regional knowledge about changes in water quality and fisheries in Lake Tanganyika. This will allow Tanzania and the Lake Tanganyika Authority to develop and manage sustainable fisheries and continue studies of the effects of climate change.

Lake monitoring by the Tanzanian Fisheries Research Institute (TAFIRI) shows that Lake Tanganyika still has relatively high water quality, and hosts a highly diverse fish community. The larger predator fish feed on the sardines in the lake. A lake temperature change of around 1 degrees Celsius in the last 100 years is believed to be responsible for a 20 percent reduction in biological productivity in the lake. Photos by C. O'Reilly.

Background:

Climate change will disproportionately affect developing countries. Our project will provide fundamental information regarding the extent to which climate-driven changes are influencing the dwindling pelagic fish catches in Lake Tanganyika. While some studies have indicated a strong interaction between climate and fish yields, others have disputed this relationship. However, systematic collection of data on lake physics, primary production and fisheries and application of novel lake models that account for interactions between climate and fish yields will provide a powerful way to obtain valuable new insight that may resolve the current dispute. Our study incorporates all possible drivers of both ecosystem change and fisheries variability and is therefore of high relevance for Tanzania as well as the other riparian countries in the Lake Tanganyika basin. This is particularly important as informed, proper and sound management of the fishery resources in the lake hinges on a solid data foundation.

Specific objectives:

- Build regional capacity in lake quality monitoring and sustainable management of fisheries
- Improve our understanding of climate-driven changes in lake functioning and fisheries productivity of Lake Tanganyika
- Gather essential data A) to develop lake ecosystem models and B) to inform local citizens, especially small-scale fishermen, of lake conditions to promote sustainable fisheries

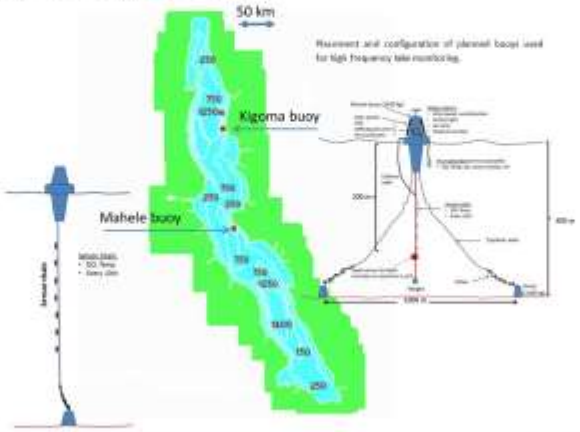
Lake Tanganyika and its basin

Lake Tanganyika is an African Great Lake. It is estimated to be the second largest freshwater lake in the world by volume, and the second deepest, in both cases, after only Lake Baikal in Siberia, it is also the world's longest freshwater lake. The lake is divided among four countries – Tanzania, the Democratic Republic of the Congo, Burundi, and Zambia, with Tanzania (46%) and the DRC (40%) possessing the majority of the lake. The water flows into the Congo River system and ultimately into the Atlantic Ocean.

Catchment area	231,000 km^2
Max. length	673 km
Max. width	72 km
Surface area	32,900 km^2
Average depth	**570 m**
Max. depth	1,470 m
Water volume	18,900 km^3
Residence time	5500 years
Shore length	1,828 km
Surface elevation	773 m

Lake monitoring

A unique dataset on the physical, chemical and biological properties of Lake Tanganyika will be collected using standard ship-based sampling and buoy systems. High frequency data from the buoys will allow us to calculate thermal stability of the water column and determine the frequency and magnitude of upwelling events. We will assess changes in nutrient concentrations from water samples and nutrient limitation using plankton stoichiometry. We will calculate lake-wide algal biomass and primary production using metabolism calculated from buoy data and chlorophyll measured weekly by scaling to the full lake using remote sensing. We will compare our values and findings with those obtained in previous studies to determine the response to climate change.

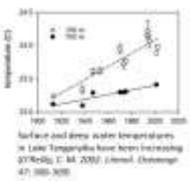


Placement and configuration of planned buoys used for high frequency lake monitoring.

Methodology

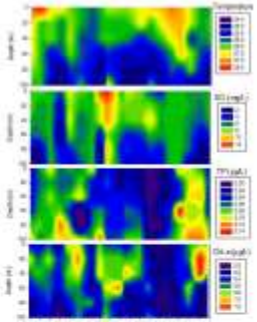
Our project includes a total of 5 work packages. WP1-4 are to provide knowledge on lake ecosystem functioning, climate forcing and fisheries through a combination of lake monitoring, remote sensing, historical data and modelling. Tanzanian scientists and local fishermen will be actively engaged in and responsible for many of these activities. In WP5 the obtained knowledge will be communicated locally via training schools, workshops, leaflets, reports, websites and phone applications and to a wider international community at network meetings and conferences and via scientific papers and, finally, a synthesis book.

Limnological conditions



Surface and deep water temperatures in Lake Tanganyika have been increasing (O'Reilly, C. M. 2003. Limnol. Oceanogr. 47: 305-309)

Hourly meteorological data sampled near Kigoma shows that the region is characterised by low winds, stable air temperatures and low but intense rains.



Profiles of water column conditions sampled biweekly near Kigoma by a Chinese program (Prof. Zhang Lu, Beijing Climate center). High surface temperatures are associated with low TP and low phytoplankton biomass (Chl a).

Platform used by TAFIRI to deploy a thermistor chain close to Kigoma. Photos by Ismael Kimirei.

High frequency water temperature profiles sampled close to Kigoma. Large daily variability near the surface is reduced at 20m depth. Fluctuations at intermediate depths and stable conditions below 80m suggest mixing related to internal waves is a prevailing phenomenon.

Other project partners: University of Dar Es Salaam - Dept. of Aquatic Sciences and Fisheries; Enavigo Consult a/s

Funding: The Danish Ministry of Foreign Affairs – Danida Fellowship Centre

International collaboration: Global Lake Ecological Observatory Network (GLEON), Networking Lake Observatories in Europe (NETLAKE), the East African Great Lakes Observatory (EAGLONet) Global Observatory of Lake Responses to Environmental Change (GloboLakes) and the Too Big To Ignore Global Partnership for Small-scale Fisheries Research (TBTI)