



Project Title: Environmental Flows for enhanced Biodiversity and Poverty alleviation in the deltas of Mozambique(EFlows-Moz)

*7th WIOSAP PROJECT STEERING COMMITTEE
DARES SALAAM, TANZANIA
29TH JANUARY 2025*

Name of IP: *Faculty of Engineering of Eduardo Mondlane University*

Coordinator: Professor Dinis Juízo

Why the Project

- **Objective:**

- **Design environmental flows** that would **maintain and enhance biodiversity values** and the **functioning** of the estuarine and deltaic ecosystems of the Lower Incomati several **optimise the delivery** of key **ecosystem services** to a range of stakeholders and with the **well-being of vulnerable user groups a priority**.
- **Testing of the WIOSAP EFA guidelines**, and their adaptation to the **Mozambican context**.
- **Fostering of local multidisciplinary team** working to interface natural and social sciences.



- **Where:**

- Incomati River Estuary, Mozambique

- **Partners:**



Canada

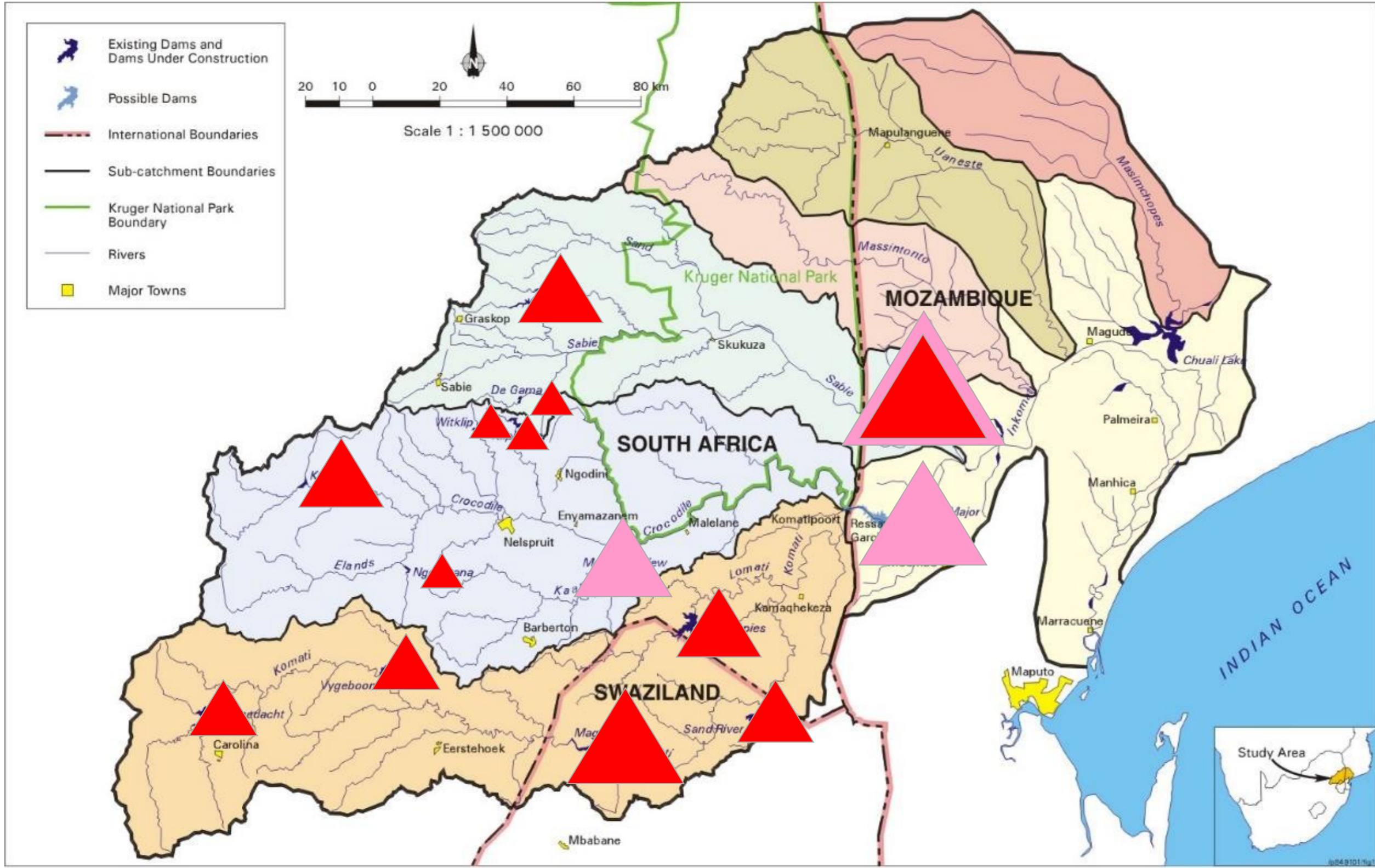


Secretariat of the French Facility for Global Environment



Methods

Study Site

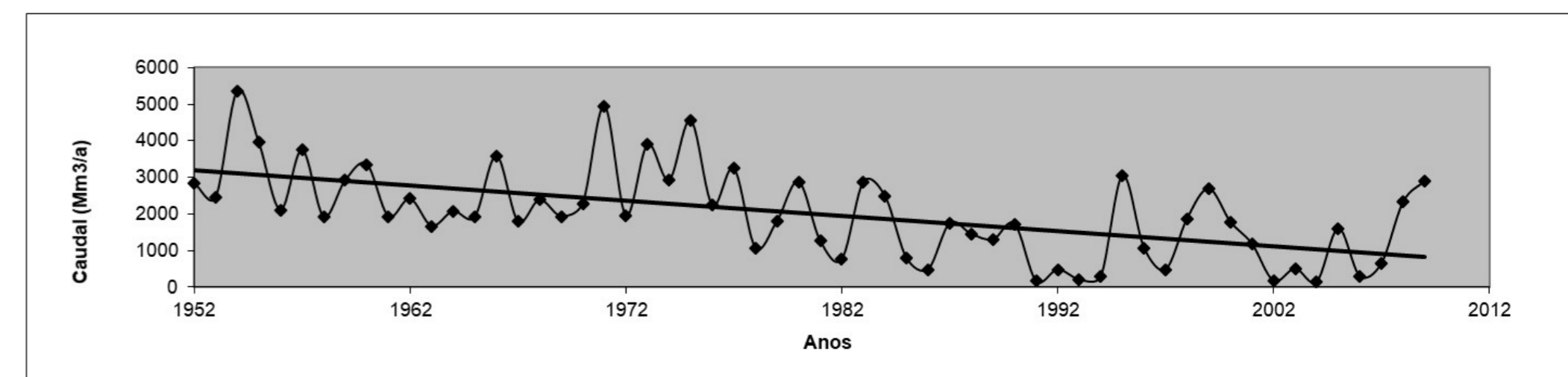
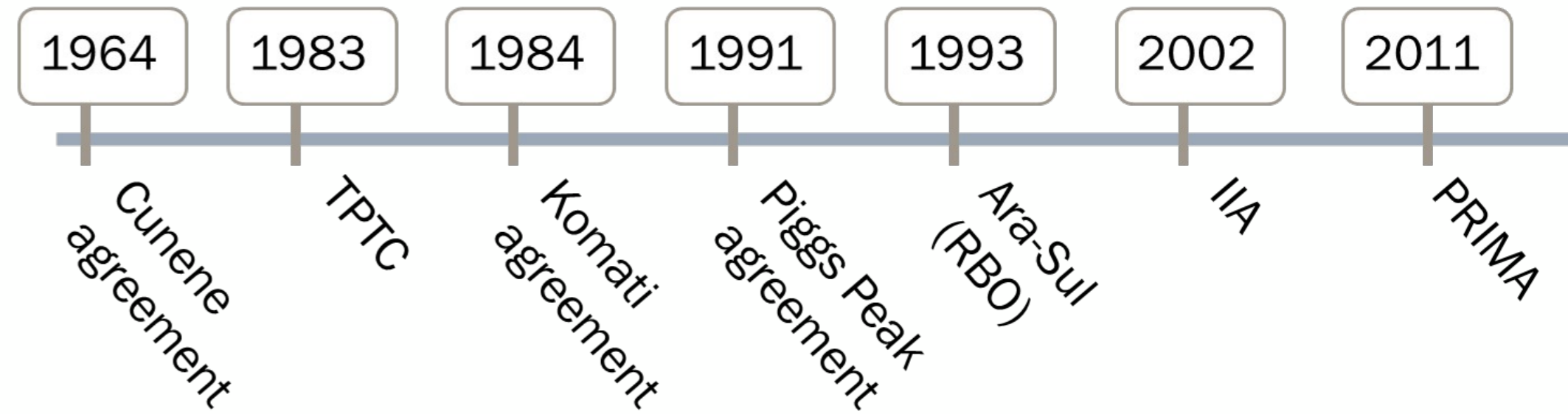


A large shared basin 68% of the watershed in RSA and Eswatini = 96% of the flow

1950 had an average of 200 m³/s

1991 Piggs Peak agreement: cross border flow 2m³/s in free days,

- Significant reduction in flux: **Where is the missing Water?**



RESEARCH FRAMEWORK FOR INCOMATI ESTUARY

Physical & Chemical	Biological	Social & Economic
Hydrology	Vegetation	Subsistence needs
Hydraulic	Macroinvertebrates	Public health
Sediments	Fish	Livestock health
Geomorphology	Birds	Culture recreation
Water quality	Macrophytes	Fisheries requirements
Tides and salinity	Microalgae	Management aspects

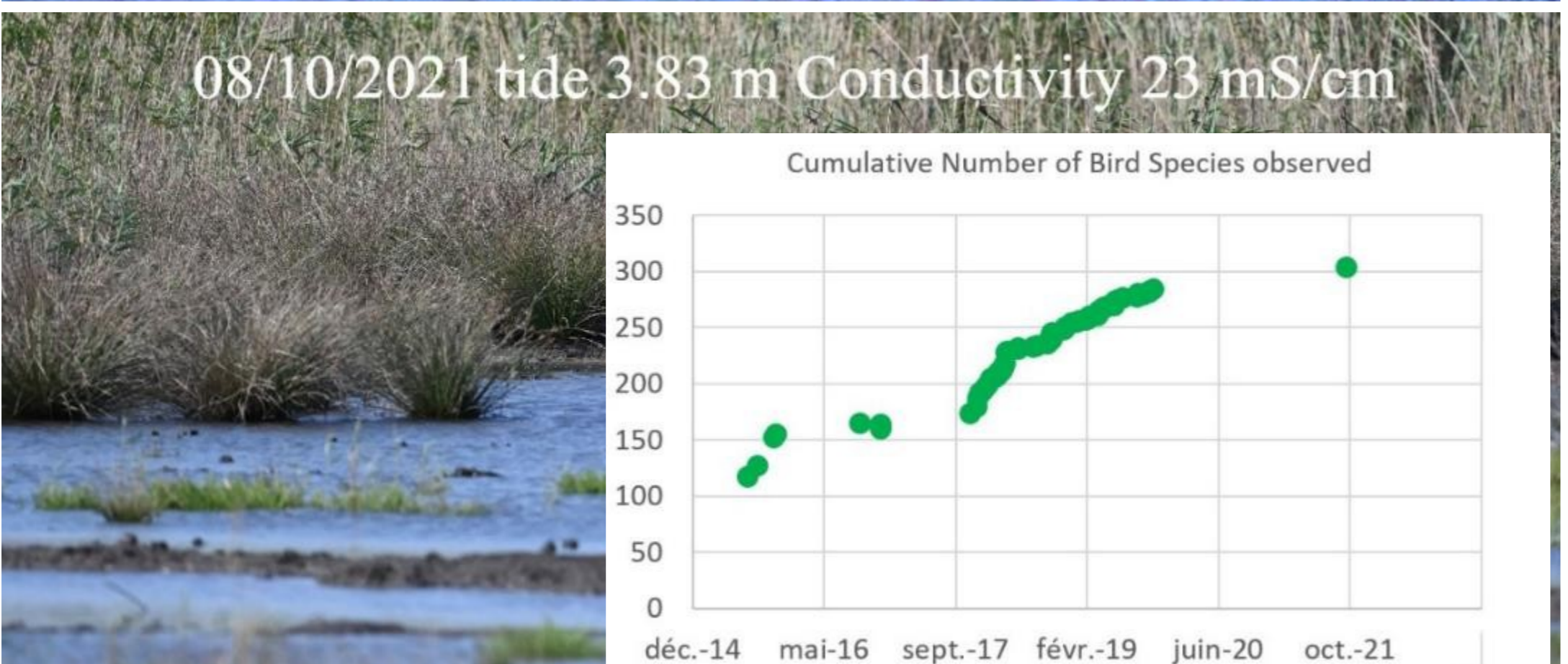


Salinity-Waterbirds



In wet season, the main high water roost had some 20 piscivorous waterbirds, i.e. a consumption of 2 kg of fish

In dry season, on a similar tide, but with salinity 8 times higher there were no piscivorous waterbirds, only some crab and benthic invertebrate feeders



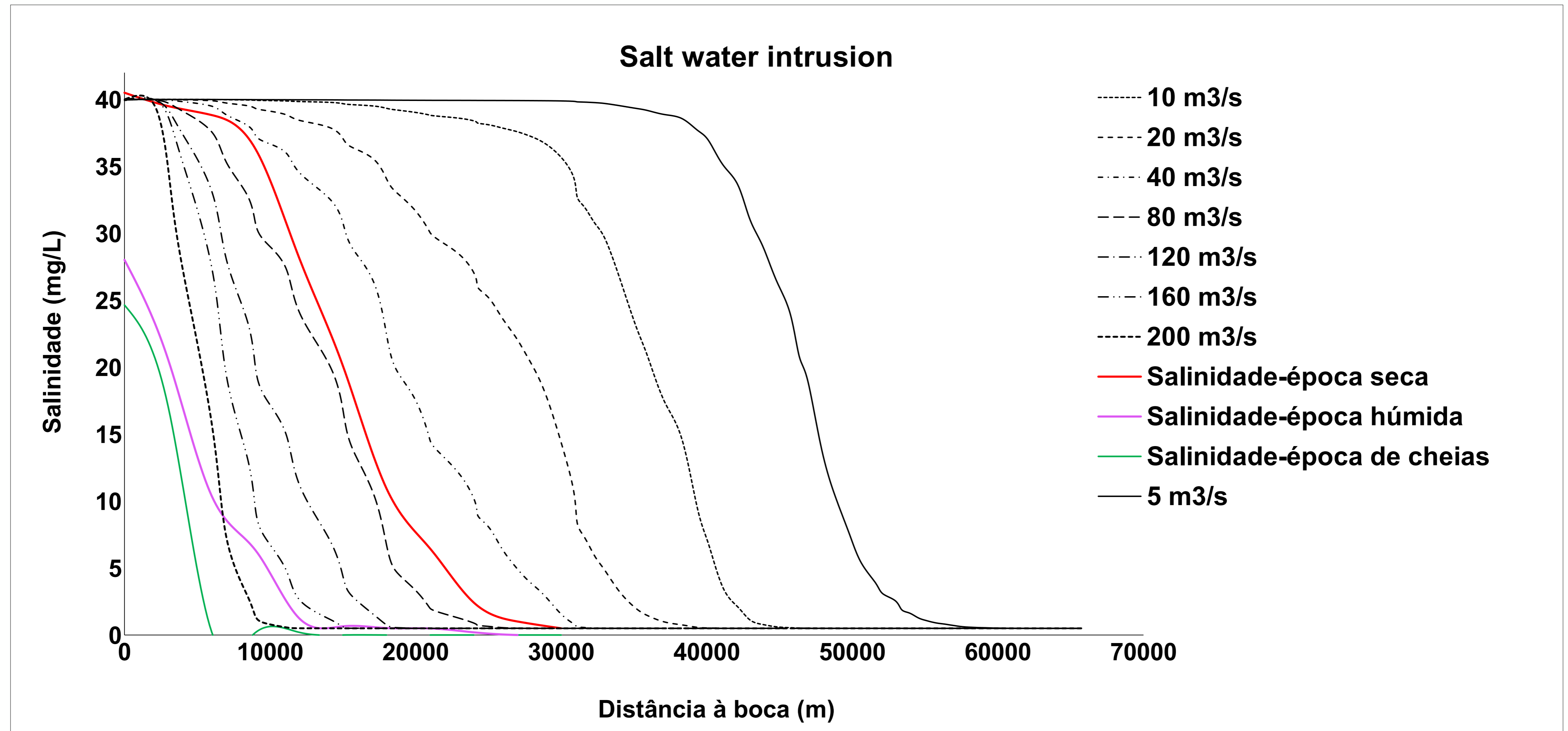
The piscivorous birds had moved North to areas with lower salinity that still have a lot of fish

In principle, with bird counts/salinity measurements were able to establish correlations between salinity and bird trophic group presence and then extrapolate



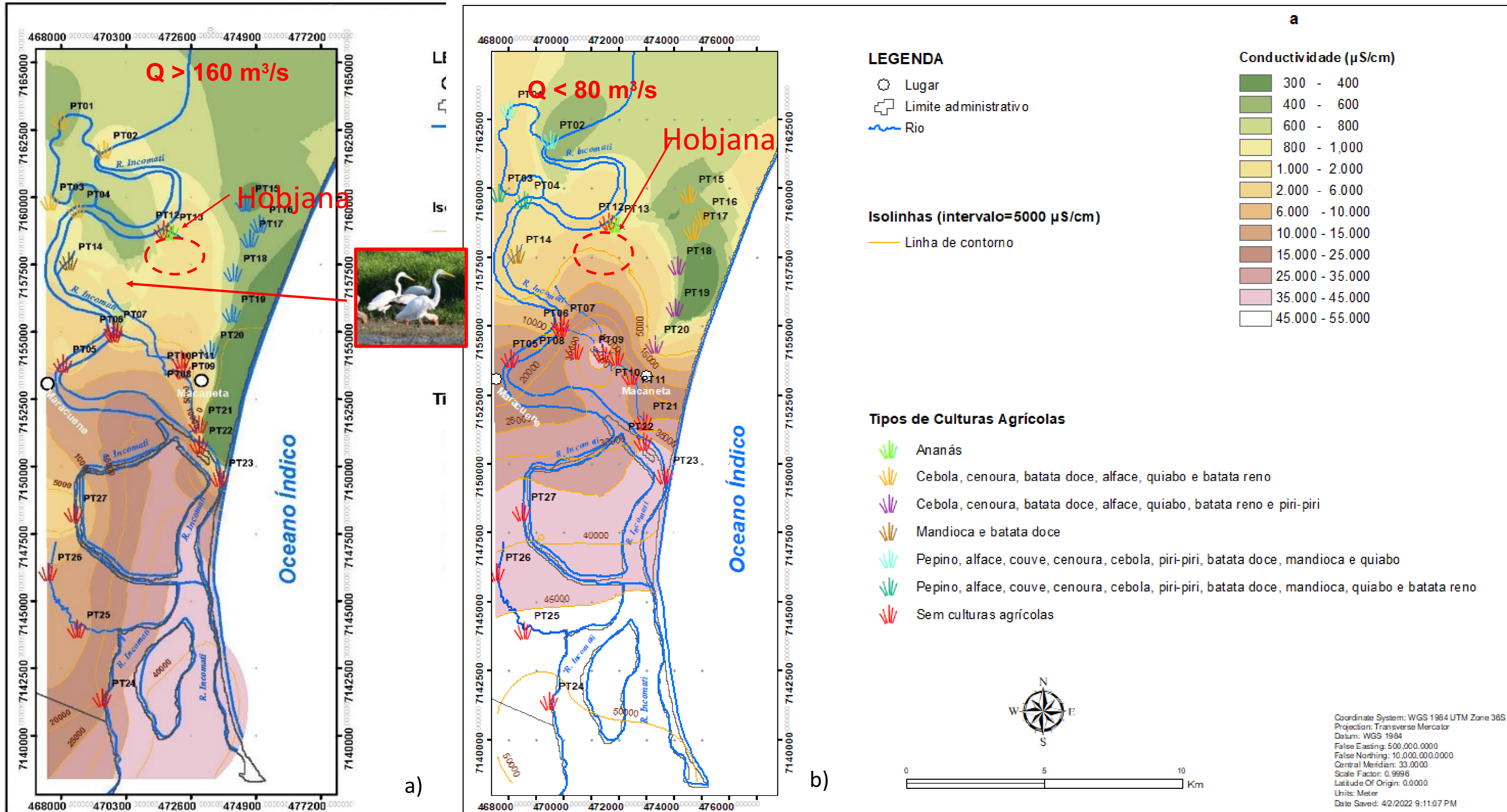
Key Achievements

Hydrology and Water Quality Modelling



Key Achievements

Discussion – Ecology vs Socioeconomic



Key Achievements

Students trained: Bachelor, Master and PhD Students

- **Anária Joaquim Nhangumbo** - Characterization of Macrofauna along the Secondary Channels of the Incomati River Estuary Subject to Tidal Flooding and the Hydrological Regime of the River – Bachelor Student - Department of Biology EMU;
- **Sílvio Cesar Caetano** - Characterization of phytoplankton in the Incomati River estuary, along the salt gradient - Bachelor Student - Department of Biology EMU;
- **Mery Shirima** - Importance of Watershed Conservation in the Preservation of Ecosystem Services - Bachelor Student – Faculty of Engineering, EMU;
- **Yolanda Mate** - Seasonal characterization of zooplankton along the saline gradient of the Incomati estuary - Bachelor Student - Department of Biology EMU;
- **António Saine Chirico Júnior** - Modelling of saline intrusion in the wetlands of Macaneta and analysis of the influence of upwelling on the conservation of ecosystem services - Bachelor Student – Faculty of Engineering, EMU;
- **Zubaida da Conceicao Esperanca** - Estimation of environmental flow in the Incomati River estuary - Bachelor Student – Faculty of Engineering, EMU;
- **Vânia Saúl** - Salinity in the Macaneta wetlands - Bachelor Student – Faculty of Engineering, EMU;
- **Juliana Mazive** - Mapping and quantification of groundwater contribution in the wetlands of Macaneta - Bachelor Student – Faculty of Engineering, EMU;
- **Gelio Muqueio** - Application of the hec-ras model in the assessment of the flood of the Baixo Incomati, including the effect of climate change- Bachelor Student – Faculty of Engineering, EMU;
- **Vilma Machava António** - Socioeconomic survey on Estuarine Area – PhD Student
- **Dércio Alberto** - Práticas e estratégias dos actores locais em relação à salinização do estuário PhD Student



Key Achievements

Conference Publications

Esperança, Z., Nhantumbo, C., Duvail, S., Hamerlynck, O., Juízo, D; (2024) Framework for Estimating Environmental Flow for Incomati River Estuary - Challenges and Opportunities, WaterNet Symposium

Juízo, D., Nhantumbo, C., Macie, A., Bandeira, S., Duvail, S., Hamerlynck, O; (2023) Approach for estimating the environmental flow for Incomati River Basin Estuarine, WaterNet Symposium

Esperança, Z., Nhantumbo, C., Macie, A., Bandeira, S., Duvail, S., Hamerlynck, O., Juízo, D., (2023) Elements to estimate environmental flow for the Incomati River estuary using the holistic method, Conferência Científica da Universidade Eduardo Mondlane

Nhantumbo, C., Juízo, D., Saúl, V., Paluluane, N., Shirima, M., (2022) - Modelling saltwater intrusion in Incomati River as a contribution to the determination of Dynamic Environmental Flow, WIOMSA Symposium;

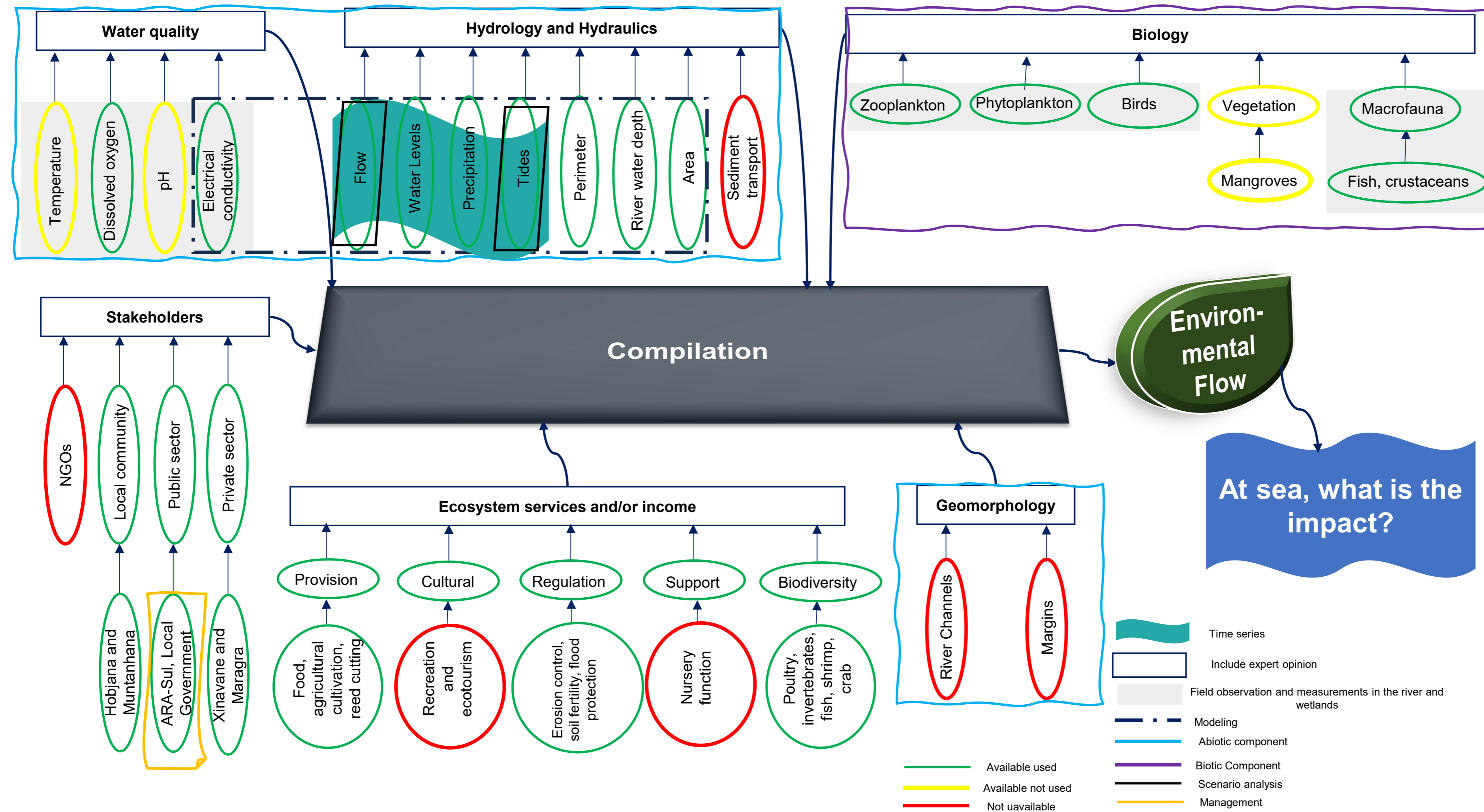
Manuscript

Esperança Z., Mata, Y., Nhanumbe, A., Caetano, S., Saul, V., Shirima, M., Mazive, J., Chirico, A. Jr, Machava, V., Dosse, M., Joaquim, D., Paluluane, N., Taimo, T., Duvail, S., Hamerlynck, O., Macie, A., Bandeira, S., Nhantumbo, C., Juizo, D. - Environmental Flows for enhanced Biodiversity and Poverty alleviation in the Incomati River Estuarine



Key Lessons Learnt

Ecosystem modeling in the river and the impact on the sea



Project Sustainability

- Multidisciplinary research team built (National and international experts)
- DiDEM co-funding extended project activities to date.
- One student received scholarship for PhD studies on Environmental Flow in Incomati River Basin integrating the Source-to-Sea.



Research team

Hydrology



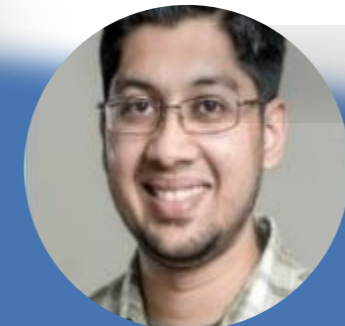
Dinis Juizo



Clemencio Nhantumbo



Vania Covell



Omar Khan



Gelito Muqueio



Antonio Chirico Jr.



Zubaida Esperança

Governance



Stéphanie Duvail
(Geography)



Dercio Alberto
(History)



Catherine Prost
(Anthropology)



Nicia Giva
(Agronomy)



Mary Shirima

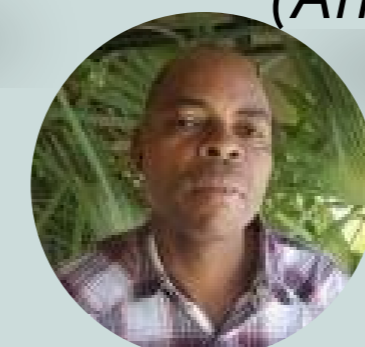
Ecology



Adriano Macia



Olivier Hamerlynck



Salomon Bandeira



Vilma Machava



Taimo Torres



Anária

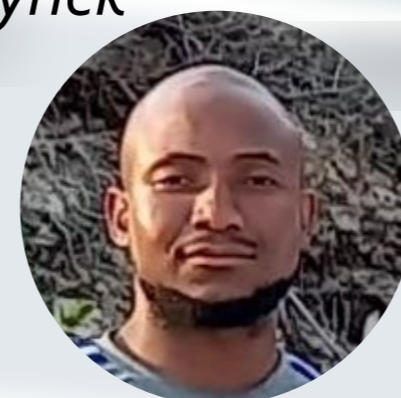


Yolanda

GIS and remote sensing



Paolo Paron
(Geomorphology)



Nordino Paluluane



Leovigildo Custódio



Eric Delaitre



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- GEF support through WIOSAP
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Thank you