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THE INFLUENCE OF OCEANOGRAPHIC FACTORS ON THE TIMING AND LOCATION OF SPAWNING OF TUNA AND TUNA-LIKE SPECIES IN THE TANZANIAN WATERS (ON THE NORTHERN MARINE TANZANIAN WATERS): CONTRIBUTION TO THE SUSTAINABLE MANAGAMENT OF TUNA AND TUNA LIKE SPECIES

UNIVERSITY OF DAR ES SALAAM (INSTITUTE OF MARINE SCIENCES)

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## INTRODUCTION

- Marine resources, especially fish stands to be among the most important socio-economic resource bases (ASCLME, 2012).
- The coastal fisheries are concentrated in the nearshore waters where small vessels and simple fishing gears are deployed.
- The most productive fishing grounds are found proximal to the coral reefs, seagrass and mangrove habitats.
- These areas are experiencing heavy fishing pressure (ASCLME, 2012), over-exploitation of some of the fish species and degradation of the fish supporting habitats (Shaghude et al., 2018).
- Currently, the tuna fishery is undertaken within the inshore waters by local fishermen with small boats.
- In Tanzania, DFSA is responsible for the management and development of deep sea tuna fisheries resources.



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- The project was initiated with the aim of delivering best practices in coastal resource management of the seascape along the northern coast of Tanzania in relation to tuna and tuna like fisheries.
- It contributes to the overall objective of achieving effective long-term ecosystem management in the Western Indian Ocean LMEs in line with the SAP as endorsed by the participating countries with the support of partnerships at national and regional levels.



- The research aimed at determining the oceanographic variables that influence the timing and location of spawning of tuna and tuna-like species in the Tanzanian northern inshore marine waters.
- The following key project activities were formulated:
  - i. Analyse and synthesize oceanographic data from previous cruises (Agulhas II cruise data)
  - ii. Undertake field campaigns during both the NE and SE monsoon periods on the critical habitats of the seascape between Tanzania Mainland and the Zanzibar islands
  - iii. Produce manuscripts on mainstreaming of oceanographic data in management
  - iv. Producing police briefs on mainstreaming of oceanographic data.



## OCEANOGRAPHIC DATA FROM PREVIOUS CRUISES

- Meaningful expeditions over the Tanzanian waters are:
  - RV Algoa in 2004
  - RV Meteor in 2008
  - Second Indian Ocean Expedition by the RS Agulhas in November 2017 and June 2018
  - RV Dr Fridtjof Nansen which crossed the area in 2019.
- Data from the first three cruises were accessed and make the first baseline data.



- The Republic of South African cruises provided high frequency CTD and ADCP data from the surface to the deepest part of the ocean. The cruises potentially provide important baseline data for characterization of coastal and marine waters from the surface to the deepest waters.
- The first dataset consists of CTD casts with ADCP records acquired in 2004 (by a south African research vessel, RV Algoa), 2017 and 2018 (by a South African research vessel, RV Agulhas II) and additionally in 2008 (by a German ship RV Meteor).



## FIELD CAMPAIGNS

- Field dataset was acquired in 2020 over the Pemba Channel to complement the dataset from the previous expeditions.
- Consisted of repeated insitu CTD measurements and other water quality parameters including: chlorophyll-a, suspended solids, salinity, dissolved oxygen (DO) and pH.
- Field campaigns were undertaken in the NE (Feb - Ap 2020) and SE (Jul - Oct 2020) monsoons, along three pre-determined transects across the Pemba Channel.



- The instrument deployment campaign included CTD casts, water sampling and ADCP deployment.
- Water samples were for near surface oceanographic variables from the surface, 15 and 30 m water depths.
- Water samples were collected using a Naskin bottle at the same geographical location as CTD casts.





## RESULTS

- Repeated CTD casts (SA expeditions) show that:
  - the vertical profiles of temperature and salinity during June and August are similar, showing uniform temperature (which is highest) and salinity (which is lowest) on the upper surface waters, followed by a progressive decrease of temperature over the deeper waters and a relatively higher saline water below the 100 m depth.
  - By contrast, the temperature and salinity pattern in November are both characterized by uniform and relatively higher values on the upper 100 m followed by progressive decrease of temperature and salinity at greater depths. This rather unexpected trend needs further investigation.



- In the Pemba Channel, temperature tends to decrease with depth while the salinity is lowest on the surface and increase progressively with depth to a maximum from where again it decreases with depth.

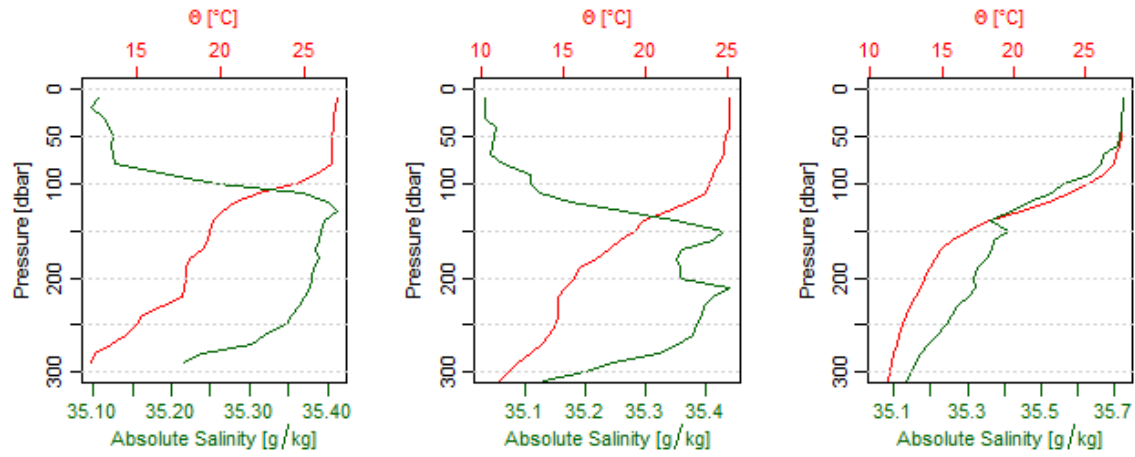


Figure 2: Profile of temperature and salinity off Kimbiji in June 2018 (Left panel), August 2004 (Middle panel) and November 2017 (Right panel).

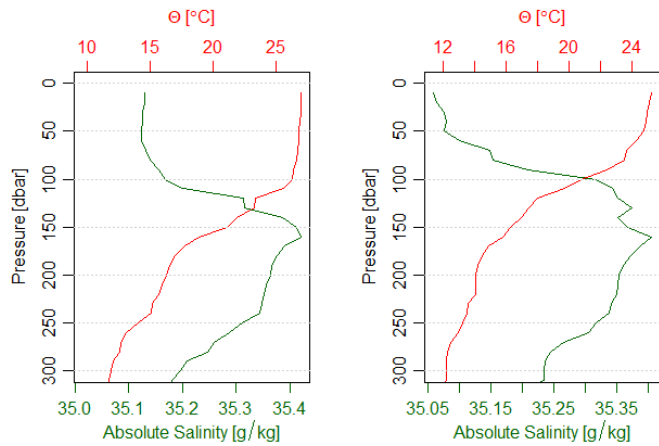
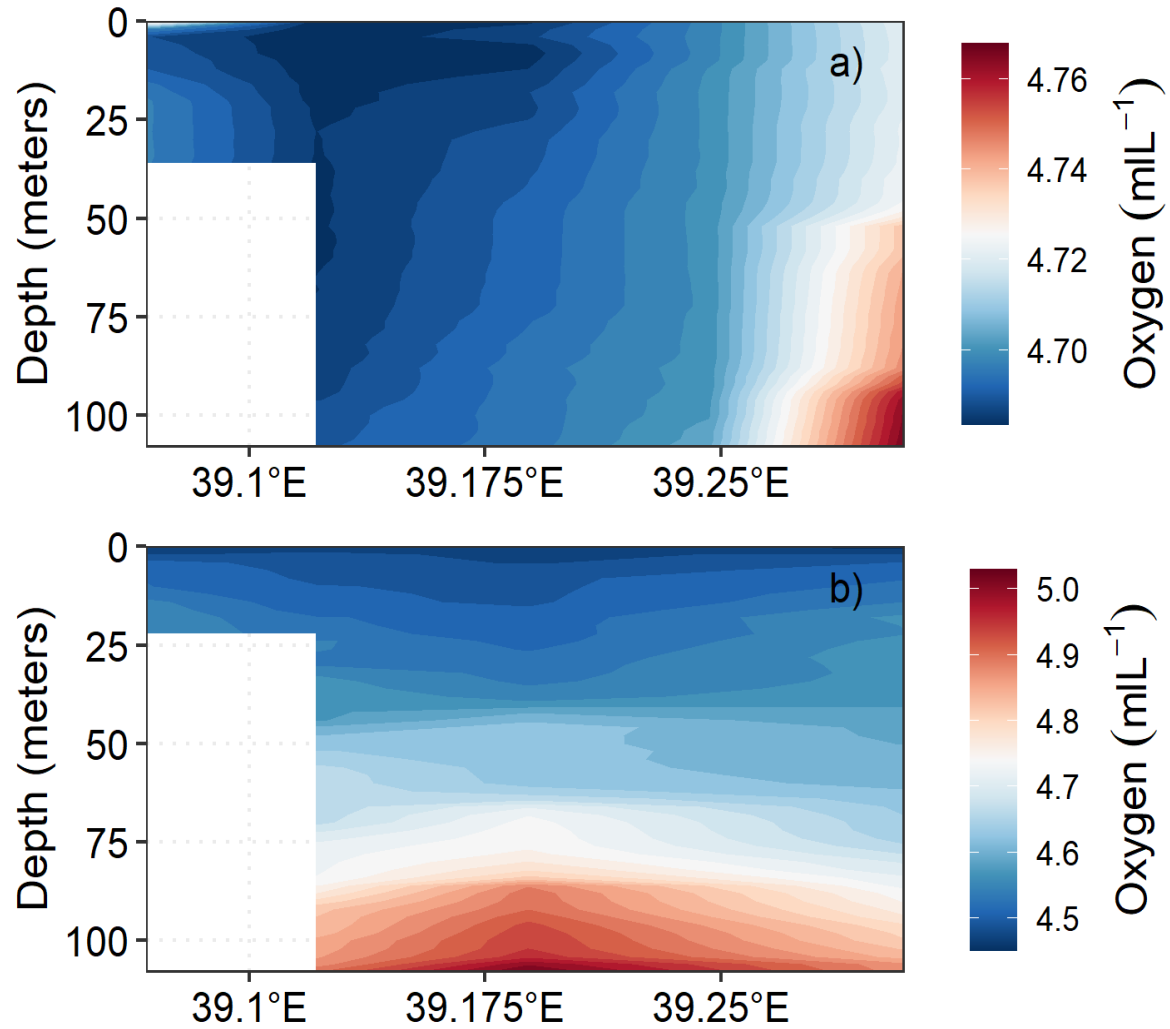
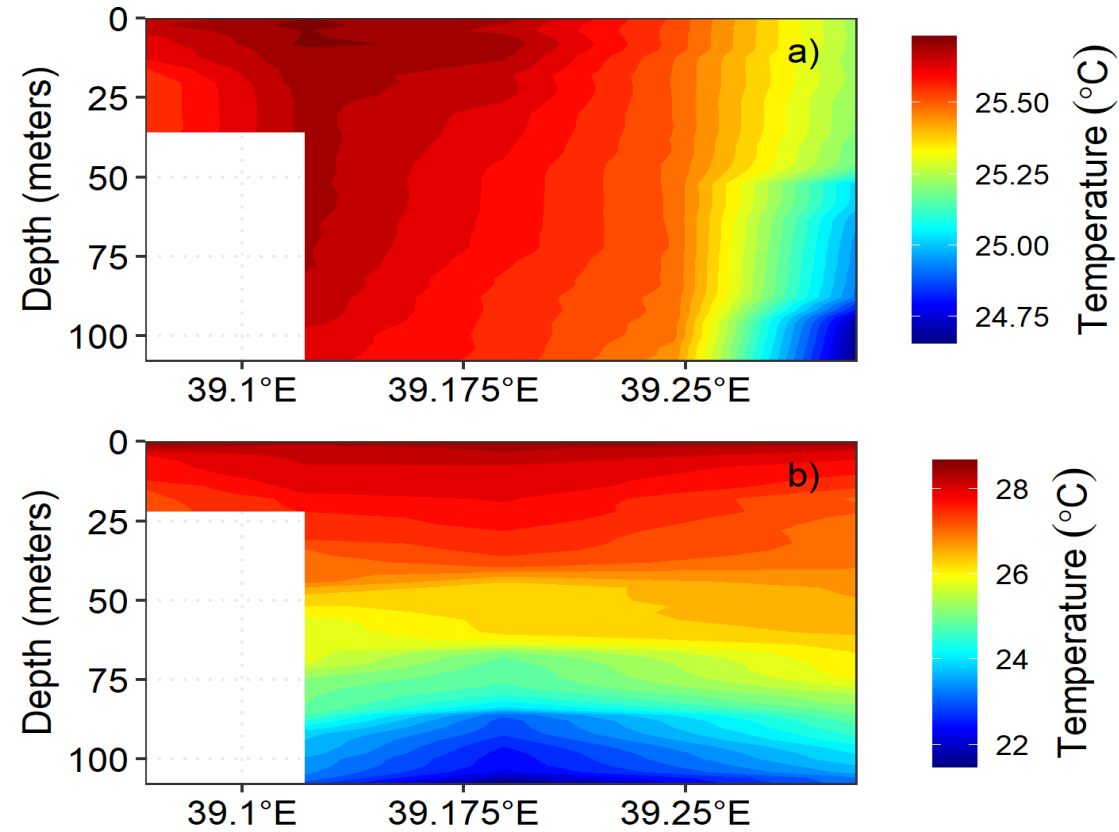


Figure 3: Profiles of temperature and salinity in the Pemba Channel in June 2018 (Left panel) and August 2004 (Right panel).



Vertical structure of dissolved Oxygen in the Pemba Channel (a) SE monsoon and (b) NE monsoon



Vertical temperature structure in the Pemba Channel (a) SE monsoon and (b) NE monsoon



## CONCLUSION

- The SAPPHIRE study conducted in the Pemba Channel and along the Tanzanian coastal waters shows that:
  - There is a great amount of oceanographic data that can be used to establish the first Database along with field campaign data.
  - The sea water temperatures which ranged from 25-26 °C during the SE monsoon season and 22-28°C during the NE monsoon season are within the tolerable RANGE (also favourable) to various tuna species.



- Dissolved Oxygen levels which ranged from 4.70 – 4.76 ml/L during the SE monsoon season and 4.5 – 5.0 ml/L during the NE monsoon season shows the ocean waters is not below the lethal limit.
- The ocean waters are enriched with riverine nutrients (Nitrate and Phosphate) which supports primary productivity and in turn secondary productivity and hence lives of apex predators like tuna.



**THANK YOU**