ABAGOLD™

Forecasting model for Harmful Algal Blooms in South Africa

Background

The South African company, Abagold (https://www.abagold.com/) is one of the abalone farms in the coastal town of Hermanus that has been severely affected by Harmful Algal Blooms (HABs) or red tide. A red tide event can have, serious impacts on the farm (Horstman *et al*. 1991; Botes *et al*. 2003a; Pitcher *et al.* 2018); not only does it result in a decrease in water quality and animal growth rates, it also causes increased risk of mortality and in some cases contamination of abalone (Pitcher *et al.* 2001). Most recently in February-April 2019, the area experienced a severe red-tide event with blooms of predominantly *Lingulodinium polyedrum*. HABs are considered the most significant threat to commercial scale abalone farming along the South-African coastline and require continuous monitoring. To monitor HABs, farms like Abagold currently require labor intensive manual water sampling and phytoplankton analysis.

Purpose and Applications

The main purpose of developing a forecasting model for HABs in South Africa would be to give farms like Abagold an early warning of upcoming blooms. A tool that can assign a risk category with a level of prediction, will enable action to be taken by the farm to minimize negative impacts of blooms. A system such as this will safeguard the aquaculture industry in South Africa, particularly in the Walker Bay region, where Abagold is based.

Early prediction of HABs will ensure a reduction in animal mortality, hence improving economic turnover for the aquaculture sector. Some species causing HABs are also poisonous to humans. Hence, early detection links directly to health and food security in more than one way. There is a confirmed correlation between monitoring parameters like Chlorophyll and Turbidity with phytoplankton count. In seeking solutions to the above-mentioned challenges associated with tackling the prevailing water quality contamination in aquaculture industry, more research must be done in areas of effectiveness, efficiency, prediction accuracy, reliability and usability of the existing water quality prediction models and management methodologies in the precision aquaculture ecosystem.

Abagold is a member of Abalone Farmers Association of South Africa (AFASA) which represents the abalone farmers in South Africa (of which there are 14), an industry which provides employment for some 2000 individuals. There is the opportunity to disseminate the work completed here through this Association to deliver broader impacts across the sector and region. The model could additionally have further applications in the future, including in the mussel, oyster and finfish aquaculture industry in South Africa, as well as applications for recreational coastal users.

Development of the model

Algal biomass dynamics are non-linear and non-stationary due to the complex interaction of physical, chemical, and biological parameters affecting the growth and accumulation of biomass and this is a universal problem so various models have been developed for its prediction. Last year, the University of Strathclyde hosted the Global HAB Prediction Modelling workshop, organized by Neil Banas. (https://habmodelworkshop.sccoos.org/). Most of the prevalent systems are based on remote monitoring but satellite data-based modelling (e.g. https://marine.copernicus.eu/services/use-cases/harmful-algae-bloom-monitoring-aquaculture-farms-spain and https://ocims-dev.dhcp.meraka.csir.co.za/fisheries-and-aquaculture-tool/) comes with a major drawback that there is no data if there are clouds, which are quite prevalent in the summer which is HAB peak time. Hence the intention here is to use data from in-situ sensors for parameters like Chlorophyll and Turbidity to develop a forecasting model for HABs. This modelling will be based on time series data analysis of the measured parameters.

What will we provide?

Following data collected at SeaView farm at Abagold:

- Data collected at farm for Chlorophyll a, Phycoerythrin and Turbidity (November 2022 and March 2023)
- Manual daily (except for weekends) Phytoplankton Count with possible separation into HAB species (2017 – present)
- Data collected at farm for Dissolved Oxygen, pH, Conductivity, Temperature (January 2021-present)

Key Assumptions

Data measured by the sensors represent true value of the parameters
There are no errors in manual phytoplankton counts

References:

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