INCOIS study helps monitoring nutrient stress and trend of phytoplankton bloom in the Bay of Bengal

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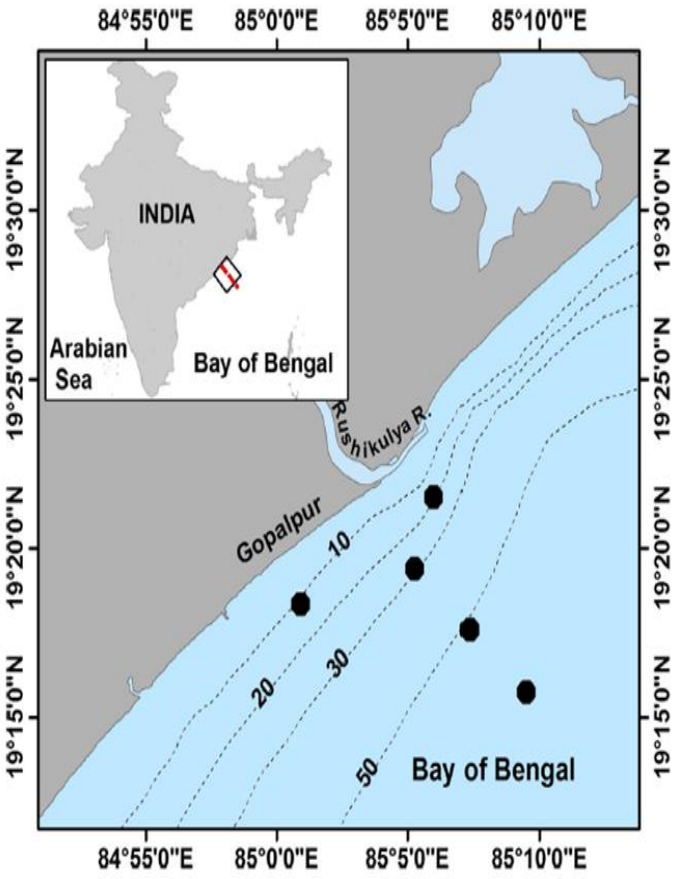
Phytoplankton, which are tiny ocean plants are important ecological indicators of the ocean that helps to regulate our atmosphere and the health of our oceans. Analysis of the concentration of chlorophyll a (chl-a), which is a dominant pigment in phytoplankton cell can tell the scientists the amount of phytoplankton biomass in a particular area of the oceanic waters. While phytoplankton contributes half of the oxygen generated by all the plants on Earth, they also can soften the impacts of climate change by absorbing carbon dioxide, a heat-trapping greenhouse gas. In addition to these, phytoplankton serve as the base of the ocean food chain. Their abundance determines the overall health of ocean ecosystems.

Given their importance, a team of scientists from INCOIS closely tracked the trends of chlorophyll a (chl-a) increase at the northwestern Bay of Bengal (BoB). They also studied the factors that affected the increase pattern of chlorophyll a (chl-a) which is reported in the journal of the Environmental Science and Pollution Research. During the in situ and satellite data based study spanning over last 15 year, they observed significant increase of chlorophyll a (chl-a) during pre-southwest monsoon seasons along with increase in total suspended matter (TSM) and color dissolved organic matter (CDOM) during the southwest monsoon period in the northwestern Bay of Bengal (BoB) coastal water. It was observed that there were two peaks of chlorophyll-a (chl-a) taking place -- the Primary Peak occurred during the pre-southwest monsoons due to the recurring phytoplankton bloom in nearshore water. Whereas, the secondary peak occurred during the end of the southwest monsoons, spreading to far offshore areas.

Apart from phytoplankton bloom contributing to this increase of chlorophyll-a (chl-a) in nearshore water, the study found that upwelling, wind-induced vertical mixing, convective overturn and local circulation pattern also contributed to chlorophyll a (chl-a) peaks which is associated with the distribution and availability of high amount of dissolved chemical inputs from several sources as runoff through the course of the river to the Bay of Bengal coast. Such information on marine environmental parameters is

becoming increasingly important as it describes key parameters for monitoring climate change, river discharge, and the impact of pollution in the ocean.



In this long-term observation from January 2003 to December 2018, INCOIS scientists started collecting data for the trend analysis of the chlorophyll-a (chl-a) increase using NASA's Sea-viewing Wide Field-of-view (SeaWiFS) Data Analysis System Satellites which detected chlorophyll pigment in the ocean. From SeaWiFS (which was functional till 2010), NASA switched to MODIS (Moderate Resolution Imaging Spectroradiometer) technique with sensors aboard two satellites namely Terra (originally known as EOS AM-1) and Aqua (originally known as EOS PM-1) acquiring data in 36 spectral bands. The team of researchers from INCOIS found that the result of statistical analysis of the data collected through NASA's MODISA sensors provided the most accurate information on chlorophyll-a concentration within the study areas of Bay of Bengal. Therefore, finally MODISA method was used for measurement of chlorophyll-a concentrations in the ocean by the research team.

It was observed that the study area also experienced maximum spatial variability during pre-southwest monsoon with salinity, and nutrients which were the major controlling factors for the abundance and distribution of phytoplankton. The study said that though these trends could indicate an overall improved health status of the ecosystems as a whole; they could at the same time may become detrimental to the ocean health resulting from nutrient stress. Nutrient stress can occur due to land run-off that deposits excess of nutrients from agricultural fertilizer run-off which facilitates growth of harmful algal blooms at large scale. These harmful algal bloom due to nutrient stress can deplete oxygen from water disrupting the ocean ecosystem and ocean ecofriendly phytoplankton growth may be adversely affected due to oxygen deprivation caused by harmful algal bloom.

As the growth of phytoplankton is largely dependent on the amount of nutrients, light, temperature and the level of dissolved oxygen that leads to enhancement in the concentration of ecofriendly chlorophyll-a (chl-a) in the water column resulting in bloom, continuous monitoring of the ocean ecosystem is the need of the hour to devise mitigating system to counter disruption caused by nutrient stress.

Led by Aneesh Anandrao Lotliker, the research team comprised of Sanjiba Kumar Baliarsingh, Tummala Srinivasa Kumar of INCOIS, Hyderabad, Ministry of Earth Sciences, and Kali Charan Sahu of Department of Marine Sciences, Berhampur University, Odisha**.**

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