Recognizing Green Noctiluca miliaris Blooms in the Arabian Sea Using NASA Satellite Images

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The Arabian Sea is characterized by winter and summer algal blooms associated with the seasonal monsoons and traditionally predominated by diatoms. However, since 2001, the winter blooms have been dominated by the mixotrophic (both consuming prey and photosynthesizing) dinoflagellate *Noctiluca miliaris*, replacing the short lived diatoms which are consumed rapidly by *Noctiluca*. Consistent sampling over a 9 year period now indicates that *Noctiluca* is becoming a serious threat to the Arabian Sea ecosystem by changing the biodiversity of the area, short-circuiting the food-chain, and creating oxygen depleted "dead zones." In order to better understand the spatial and temporal bloom patterns of *Noctiluca*, it is important to be able to identify blooms easily and find trends relating them to ecological factors such as sea surface temperature (SST) and nutrient concentrations. In order to accomplish this goal, we examined ocean color satellite images, hoping to exploit the remote sensing reflectance data that they provide in several channels in order to determine ways of identifying *Noctiluca* from diatoms and other groups of organisms. Because we had sample evidence indicating that *Noctiluca* bloom appears later in the season (Feb-Mar) than diatoms (Dec-Jan) and at higher latitudes, we had a basis of comparison for chlorophyll *a* levels which allowed us to identify which chlorophyll *a* peaks were due to *Noctiluca* and which were due to diatoms. By using that chlorophyll *a* data as an indicator of bloom composition and comparing it to other satellite products, we found that the satellites are capable of detecting subtle differences in sea surface temperature, remote sensing reflectance values, and NASA Ocean Biogeochemistry Model nitrate concentrations that correlate with our previous understanding of algal blooms. These correlations allowed us to more definitively categorize certain blooms as *Noctiluca* or diatoms, and provide a method of determining the compositions of future blooms.