Discrimination of green *Noctiluca scintillans* in the upper Gulf of Thailand using remote sensing techniques

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Green *Noctiluca scintillans*, the peculiar single cellular heterotrophic organism containing green algae called *Pedinomonas noctilucae*, frequently causes harmful algal bloom (HAB) in the upper Gulf of Thailand (uGoT). The high density of green *Noctiluca* discolors the water to deep milky green, and it has the potential to generate low dissolved oxygen (hypoxia) in the water column resulting in massive fish mortality. The co-occurrence of green Noctiluca and other phytoplankton species (e.g., *Ceratium furca* and diatoms) was often reported. Heretofore, the behavior of red tides has not been clarified. In this study, we, therefore, focus on investigating the dominant spectral characteristics of each HAB species and developing an algorithm to discriminate green *Noctiluca* from the other harmful species. The ship observations (2017 –2018) were conducted to obtain the apparent and inherent optical properties as well as the pigment information of green *Noctiluca* blooms. Fortunately, the super green *Noctiluca* blooms (>1,500,000 cell L^{-1}) occurred near the west coast of the uGoT in July 2017. The remote sensing reflectance spectra measured by using the RAMSES hyperspectral radiometer (320 nm –950 nm) revealed the crucial features of green *Noctiluca* in near-infrared wavelengths. The different characteristics of green *Noctiluca* and other HAB species were also found in visible wavelengths. The investigated features were used in the discrimination method to detect the green *Noctiluca* bloom using satellite observation in the near future.

Keywords: green Noctiluca, the upper Gulf of Thailand, remote sensing