

Direct mapping of *Undaria pinnatifida* habitat range in the nearshore ocean with satellite remote sensing

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Undaria pinnatifida, wakame in trade name, is among the list of “100 of the World’s Worst Invasive Alien Species” [1]. This seaweed native to Asia settled in Europe from 1970s by ballast water [2], spread all over the world. Field survey and remote sensing have been performed to identify the habitat of *Undaria pinnatifida*. The former has high costs and limited study area, while the conventional latter utilizes the sea temperature to outline its blurry range [3]. Based on in-situ spectral measurement this study proposes a new remote sensing method to obtain the range of *Undaria pinnatifida* directly. The spectra of *Undaria pinnatifida* in seawater were observed at 380-1050nm with our homemade small spectrometer. The reflectance of *Undaria pinnatifida* is almost vanished below 680 nm, sudden rising from 680nm to 750nm, which enables us to establish new index for Sentinel-2 satellite bands to specify brown range: (Red band – Red-Edge band)/ (Red band + Red-Edge band). Here visible red and red-edge band has the centre wavelength 665 and 705 nm, respectively. Our in-situ measurement achieved to specify *Undaria pinnatifida* up to 3 m in depth. *Undaria pinnatifida* is annual plants, in spring growing most whereas other blown algae in the nearshore ocean are perennial. By using this difference, we can distinguish the *Undaria pinnatifida* from others. Our new method will be applied to South French coast [4] as well as to Funakoshi-bey in Japan.

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