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Possible Use of Blue Light in *Undaria Pinnatifida* Aquaculture

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Abstract

Latest studies have shown that blue light promotes the growth of both gametophytes and sporophytes of laminarian kelps (Xu *et al*., 2005; Wang *et al*., 2010; Murase *et al*., 2014). On the contrary, insects and some other invertebrate animals are negatively affected by the blue light emission (Hori *et al*., 2014; Xiaolong *et al*., 2015). Therefore, we aimed to promote the growth of cultured *Undaria pinnatifida* and also to deter the herbivorous grazing isopod *Cymodoce japonica* by the emission of blue light. *Cymodoce japonica* grazes on the young sporophytes of cultured *U. pinnatifida* and often causes great loss of its production (Yamaguchi and Nishioka, 1998; Kiriyama, 2007). Water-proof blue LED light capable of emitting in every night time for more than two months was developed and employed underwater for the growth experiment of *U. pinnatifida* in the field from January to April 2018. In the laboratory, alternative selection experiments from four conditions: red, green and blue LED lights and dark were conducted in a container for 30 individuals of *C. japonica*. The nocturnal blue light emission in the field promoted the growth of *U. pinnatifida*. In the laboratory choice experiments, *Cymodoce japonica* apparently avoided blue light. Therefore, the blue light emission to young sporophytes will largely contribute to the rise of *U. pinnatifida* production through the promotion of growth and the exclusion of grazers.

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References

Hori, M., K. Shibuya, M. Sato and Y. Saito (2014) Lethal effect of short-wavelength visible light on insects. *Scientific reports*, 4: 7383.

Kiriyama, T. (2007) Survey on the grazing damages for *Undaria pinnatifida* along the coast of Shimabara Peninsula. *Nagasaki Fisheries Research Center Annual Report for FY2006*, pp. 93-94. (in Japanese only, and title translated by the author)

Murase, N., M. Abe, M. Noda and Y. Suda (2014) Growth and maturation of gametophyte in *Eisenia bicyclis* under different light quality from light emitting diodes (LEDs). *Journal of National Fisheries University*, 62: 147-152. (in Japanese with English abstract)

Wang, W. J., X. T. Sun and F. J. Wang (2010) Effect of blue light on early sporophyte development of *Saccharina japonica* (Phaeophyta). *Marine Biology*, 157: 1811-1817.

Xiaolong, G., Z. Mo, L. Xian, S. Ce, S. Changbin and L. Ying (2016) Effects of LED light quality on the growth, metabolism, and energy budgets of *Haliotis discus discus*. *Aquaculture*, 453: 31-39.

Xu, Z., L. Dapeng, H. Hanhua and T. Tianwei (2005) Growth promotion of vegetative gametophytes of *Undaria pinnatifida* by blue light. *Biotechnology Letters*, 27: 1467-1475.

Yamaguchi, M. and T. Nishioka (1998) Study on the pests of *Undaria pinnatifida*. *Iwate Fisheries Technology Center Annual Report for FY 1998*, pp. 150-151. (in Japanese only, and title translated by the author)