

Scientific Paper:

Limnol. Oceanogr.: Methods, 2025

## **A novel in situ benthic photorespirometer for estimating photosynthesis rates of benthic primary producers**

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### **Abstract:**

We developed a novel benthic photorespirometer (BP) to overcome limitations of existing benthic incubation chambers for in situ photosynthesis–irradiance (P–I) curve analysis, including prolonged measurement times, uneven light distribution, and poor sealing. The BP integrates an artificial light source, an oxygen optode sensor, and a neoprene skirt to enable rapid P–I curve construction through 2-h incubations. Field tests at four coastal sites in Korea validated uniform light delivery and thermal stability during incubation, which are essential for reliable measurements. The compact and rigid design allowed single-operator deployment with minimal habitat disturbance, while the neoprene skirt ensured effective sealing across diverse substrates, including uneven rocky bottoms. Single deployments yielded reproducible oxygen responses and community-specific P–I curves under uniform light conditions, reflecting distinct photosynthetic characteristics among benthic algal communities and demonstrating the BP's capability to assess benthic photosynthesis. These results validate the BP as a reliable, field-deployable tool for high-resolution assessment of benthic primary production in coastal ecosystems.

**Keywords:** photorespirometer, benthic incubation chamber, in-situ photosynthesis-irradiance curve analysis, oxygen response, benthic algal communities, benthic primary producers