Marine Conservation Enhancement Fund (MCEF)

Final Report

(01/07/2023-30/06/2025)

Project No.	MCEF22005
Project Title	Exploring Fluorescence Spectroscopic characterisation of algal organic matter and its implication on early warning of harmful algal blooms in the fish culture zones of Hong Kong
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(i) Executive Summary

Coastal fish culture zones in Hong Kong are increasingly vulnerable to red tides, harmful algal blooms that release potent toxins and can devastate aquaculture, fisheries and marine ecosystems. Rapid detection and assessment of these events are crucial for protecting public health and reducing economic losses, yet conventional monitoring methods like microscopic cell counts, toxin bioassays and chemical analyses are laborious, expensive and too slow to provide timely data. Fluorescence spectroscopy of algal organic matter (AOM) offers a promising alternative: each algal species exhibits distinctive excitation–emission matrix (EEM) signatures that evolve predictably through growth stages, enabling in situ identification of community composition, biomass estimation and toxin risk. In this project, we measured the optical properties of typical phytoplankton toxin in the coastal water. Meanwhile, we collected monthly field samples of dissolved organic matter from 29 fish culture zones around Hong Kong, measured their EEM spectra and recorded associated environmental variables such as water temperature, nutrient concentrations, salinity and chlorophyll a. Also, to identify the contribution from different water habitat, we investigated over 400 sites around Hong Kong including endmember from river, groundwater, storm water and sewage. All laboratory and field data were integrated into a unified database. Using multivariate statistical techniques and machine learning algorithms, we have developed a model in predicting chlorophyll a in coastal water, which has been published in Marine Environmental Research (doi.org/10.1016/j.marenvres.2025.107170). Building on this work, we aim to further develop a predictive model that leverages real-time fluorescence measurements and environmental parameters to estimate algal biomass and toxin potential. The anticipated deliverables include a robust, fluorescence-based diagnostic tool for early warning of harmful blooms, an accessible optical property database linked to specific algal taxa and growth stages, and enhanced

forecasting capacity to support proactive management of Hong Kong's aquaculture zones, ultimately minimizing ecological impacts and economic losses associated with red tide events.