

Executive Summary of the Project

The funded project (MCEF21003) produced a high-value manuscript entitled “*Pollution and Anthropogenic Stressors Are Associated with Cetacean Vulnerability in Coastal Waters: Fine-Scale Diagnostics from eDNA and Multispecies Modeling.*” The manuscript is currently available as a preprint and has undergone several rounds of revision at the *Journal of Hazardous Materials (impact factor: 11.3)*. It is now awaiting a final editorial decision.

Pre-print version: Nimalrathna, T., Guibert, I., Si, Z., Yeung, K.K.L., Chan, T.Y. and Seymour, M., 2026. Pollution and Anthropogenic Stressors Are Associate with Cetacean Vulnerability in Coastal Waters: Fine-Scale Diagnostics from eDNA and Multispecies Modeling. *bioRxiv*, pp.2026-04.

The project successfully applied an integrated eDNA metabarcoding and Joint Species Distribution Modelling framework to assess cetacean and fish biodiversity across the waters surrounding Lantau Island to generate a substantial eDNA dataset, including cetacean and fish metabarcoding libraries, environmental variables, water-quality data, and vessel/fishing-pressure indicators. Overall, the project has achieved its core objective of developing and applying a scalable, non-invasive monitoring and modelling framework for marine conservation. It has generated new biodiversity data, identified species-specific environmental vulnerabilities, clarified the relative importance of pollution and anthropogenic pressures, and provided evidence that current uniform conservation approaches may be insufficient for protecting Hong Kong’s resident cetaceans. The project also demonstrates the value of integrating eDNA monitoring with advanced ecological models to support adaptive marine spatial planning, particularly in data-limited and disturbance-prone coastal ecosystems.

The findings have direct implications for conservation management. For *S. chinensis*, priority actions should include reducing vessel disturbance, managing vessel routes and speeds, strengthening protection of western and southwestern Lantau waters, and minimizing further habitat degradation in turbid estuarine habitats. For *N. phocaenoides*, management should focus more strongly on improving water quality, reducing nutrient and microbial pollution, and monitoring pollution-sensitive habitats in southern and southeastern waters. For both species, conservation planning should move beyond simply expanding protected areas and instead ensure that protected areas are placed, managed, and adapted according to species-specific ecological needs and threat profiles.

Way Forward Following Completion of the Funded Project

Following completion of the funded project, the next step is to translate the scientific findings into practical conservation and management actions. First, the eDNA–JSDM framework developed in this project should be incorporated into long-term marine biodiversity monitoring in Hong Kong. Repeated seasonal sampling would allow managers to track changes in cetacean occurrence, fish communities, water quality, and anthropogenic pressure over time, providing an early-warning system for habitat deterioration and emerging conservation risks.

Second, the project findings should be used to inform adaptive marine protected area planning. Current protected areas should be reassessed in relation to the fine-scale habitat-use patterns identified for *S. chinensis* and *N. phocaenoides*. In particular, management attention should be directed towards western and southwestern Lantau waters for *S. chinensis* and southern to southeastern waters for *N. phocaenoides*. Future conservation planning should consider dynamic or threat-based management measures, including vessel-speed restrictions, vessel-routing adjustments, seasonal protection of key habitats, and stricter control of activities that degrade water quality.

Figures

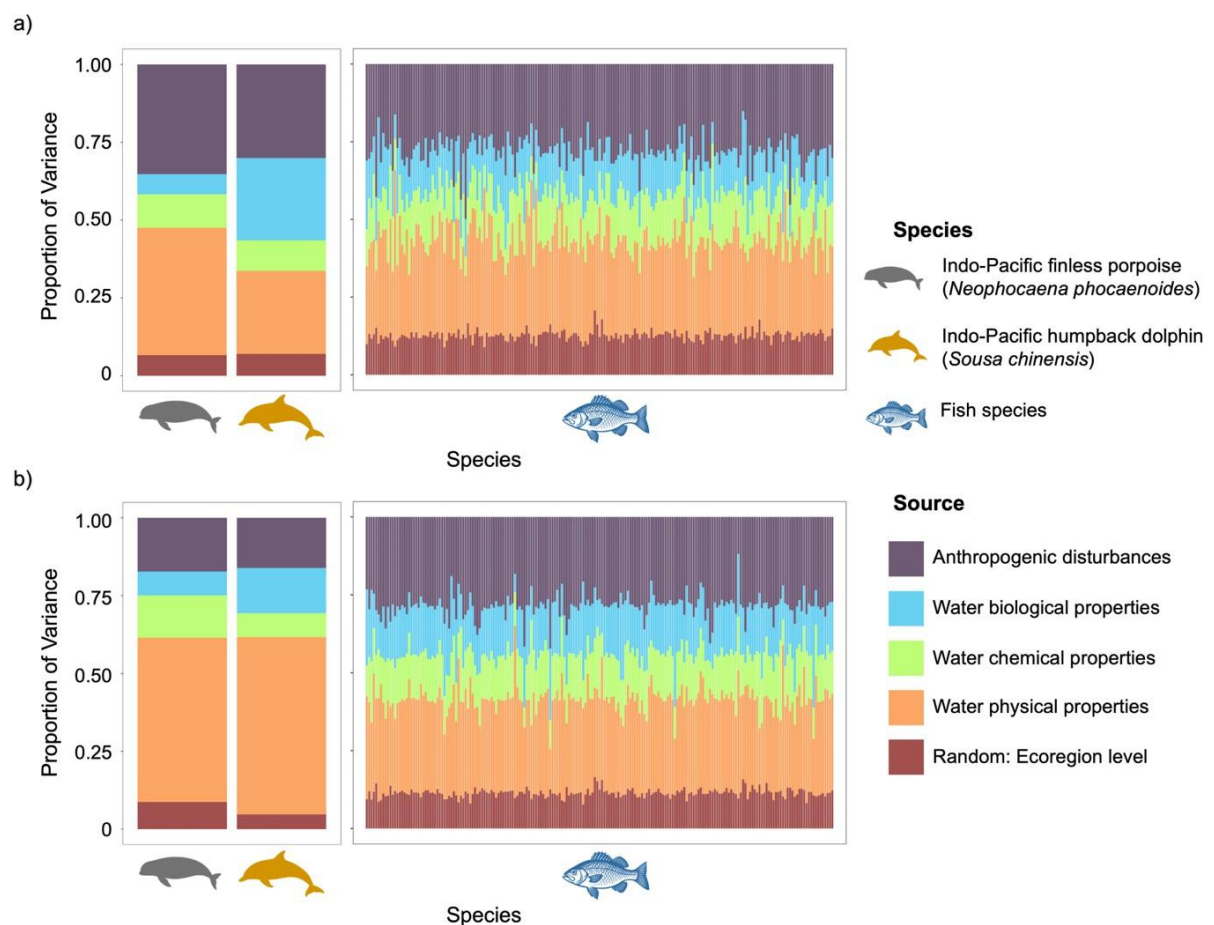


Figure 1. Variance partitioning of environmental drivers of community structure. Proportion of variance explained by environmental covariates and ecoregion-level random effects for (a) occurrence and (b) relative abundance data. Bars show the proportion of variance explained by grouped environmental variables from both binomial models.