DETERMINATION OF INVASION THREAT SCORES OF NON-INDIGENOUS SPECIES IN PORTS OF MANILA, PHILIPPINES

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ABSTRACT

Considered as one of the major gateways in the Philippines and in Asia, Manila Bay has been one of the entry points for marine non-indigenous species in the country. Port monitoring for biological invasion has been done using different methodologies including the use of a fouler collector created by the North Pacific Marine Sciences Organization (PICES). In this study, ecological approaches using PICES collectors and morphological taxonomy, and eDNA metabarcoding technology were used to detect non-indigenous species in Manila Bay for years 2021 and 2022. In terms of species detected, morphological taxonomy or the traditional identification method identified 29843 individuals belonging to 44 taxa for both 2021 and 2022 while eDNA technology detected 877 species. In determining the Invasion Threat Scores of the NIS, the habitat suitability of the NIS in Manila Bay, NIS' invasion history and maritime traffic score were computed and summed up. The highest ITS among the NIS was *Mytella strigata* (99.4%) followed by *Arcuatula senhousia* (95.3%). Other NIS that have more than 70% ITS were *Polydora websteri* (85.5%), *Mytilopsis sallei* (82.7%), *Pinctada imbricata* (73.5%) and *Mytilopsis leucophaeata* (71.0%). NIS with lower than 30% were *Upogebia africa* (25.9%), *Pinna rudis* (24.3%) and *Luidia foliolata* (22.8%). In assessing the distribution of the NIS in the Ports of Manila, presence-absence of the NIS in the Manila Bay for years 2021 and 2022 were considered. The non-indigenous species are clustered together by sampling sites and year they were collected. However, appearing to be slightly distant from the other sampling points and for both years was

the presence of the samples detected in Manila International Container Terminal last 2021. In comparing the species identified using the PICES collector and the eDNA metabarcoding, only one species, *Amphibalanus amphitrite* was detected using both approaches. This suggests that these techniques can work complementary with one another in order to detect more species that could be overlooked by both techniques because of their limitations. On the probability of detecting NIS, Using the information on the habitat suitability, eDNA can only on average detect a probability of 44.2% possible establishment of IAS. Meanwhile, employing DNA plus morphological taxonomy using PICES collector will detect a 54.3% chance. Using the ITS, on average, eDNA can detect a 40.05% probability of the possible establishment of IAS. And, with morphological taxonomy, eDNA technology can detect 59.99% of NIS establishments. In conclusion, ecological approach can work in complement with the eDNA metabarcoding. The probability of detecting NIS increases with the combination of both ecological approach and eDNA technique. This study also explains the invasion of *Mytella strigata* in Manila Bay which has 99.4% ITS because of its high habitat suitability in Manila, successful invasion history and presence in the FAO areas where there is high maritime traffic to Ports of Manila. Species with more than 70% NIS-ITS should be focused on and studies further and efforts to address the impact of these “target species” will be crucial for the successful management of biological invasions in Manila Bay.