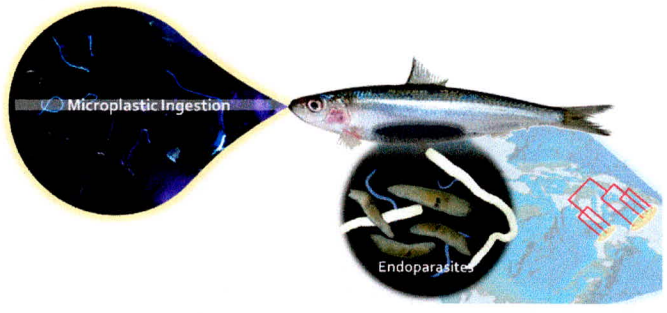
Susceptibility of *Sardinella lemuru* to microplastic pollution and delineation of stock structure in northern Mindanao using endoparasites as biological tag.



ABSTRACT

Sardinella lemuru is a pelagic fish mostly harvested in northern Mindanao, consumed locally, and exported worldwide as bottled or canned sardine products. While overfishing activities remain a constant threat to its survival, it is likely vulnerable as well to the emerging microplastic pollution that has been contaminating across levels of marine food chain at a global scale. Moreover, this sardine is also commonly infected with numerous parasites of ecological importance. Some of these parasites have been successfully used as biological tags for stock identification of some economically important marine fishes in various regions except in the Philippines. In this study, the impact of microplastics was investigated on *S. lemuru* and its stock structure was explored and delineated using parasite data of local sardine populations from Patawag, Sindangan, Dipolog, Iligan, Macajalar, Gingioog, and Butuan Bays.

The stomach contents of 600 sardines were examined visually under a microscope, stained with Rose Bengal, and tested with hot needle to identify ingested microplastics. These anthropogenic particles were measured and physically classified into fibers, fragments, and films. Results of this study showed that 85% of *S. lemuru* were already contaminated with 3.74 ± 3.92 # of microplastics even before being processed into various sardine products. These microplastics ranged from 0.12 to 21.30 mm and 80 % were mostly < 2.5 mm size class. The dominant microplastics were 97.94 % in the form of fibers while 1.52 % and 0.54 % were respectively classified into fragments and films. In the laboratory, a 100% recovery efficiency was determined from isolating microplastics in spiked samples (n=30) performed in 3 retrieval attempts. While results from Canonical Correspondence Analysis of ingested microplastic data had shown no relationship with the standard lengths of the sardine and the masses of ingested food materials at 20, 64, 100, 250, and > 500 size classes, we found that the total number of ingested microplastics from 2014 to 2016 directly correlated (r^2=0.91, p=0.003) with the human population at each landing site located along the coastline of Northern Mindanao.

Endoparasites were isolated from 225 sardine stomachs and intestines while undertaking dietary study. A total of 103 parasites were recovered from the 23.1% of all the surveyed sardines. Three parasites belonging to Phyla Nematoda, Acanthocephala, and Platyhelminthes were enumerated microscopically with the latter 2 as new records. The parasitic prevalence showed discontinued geographic distribution patterns between 11% and 12% infected respectively with anisakid in Northern Zamboanga Peninsula (NZP) and with acanthocephalan in Bohol Sea System (BSS). Two-way Cluster Analysis of the parasitic intensity data also showed similar geographic discontinuity between NZP and BSS at 75% remaining information of the dendrogram. Thus, we hypothesized that the sardine stock in Northern Mindanao may be divided into NZP and BSS stocks. We tested this hypothesis using One-way ANOVA and compared the mean standard lengths of sardines in NZP and BSS stocks and found a marked difference (p=0.00). Therefore, the use of anisakid and acanthocephalan parasites as biological tags were successful enough to delineate the sardine stocks in NZP and BSS. These results further support the idea of NZP as a justified management unit to implement sardine fishing ban.

Joseph Dominic H. Palermo
PhD Candidate
UP IESM