Microdebris Ingestion by *Sargassum*-associated Fishes in the Northern Gulf of Mexico

Ingestion de Micro-residuos por Peces Asociados con Sargazo en el Norte del Golfo de Mejico

Ingestion de Micro-débris par les Poissons Associés aux Sargasses dans le Nord du Golfe du Mexique

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EXTENDED ABSTRACT

Pelagic *Sargassum (S. natans* and *S. fluitans*) is a macroalgal complex found in surface waters of the Western-Central Atlantic Ocean, and more recently high *Sargassum* biomass has been observed in the Caribbean (Wang and Hu 2016). Because *Sargassum* is a neustonic habitat, it is subject to oceanographic processes that aggregate floating objects, including marine debris. Indeed, the first mention of microplastics in the marine environment was reported from the Sargasso Sea in association with floating *Sargassum* (Carpenter and Smith 1972). Many early life stages of fishes use *Sargassum* as nursery areas (Rooker et al. 2006), but little is known about the impacts of marine debris or microplastics within *Sargassum* communities. Here we present results from a pilot study examining the frequency of microdebris occurrence in the stomachs of *Sargassum*-associated fishes.

Sargassum and associated fishes were collected with a neuston net (0.5 x 1 m mouth opening; 505 μm mesh) and a plankton purse seine (3 x 10 m; 1000 μm mesh) during surveys in the northern Gulf of Mexico off the coast of Alabama in 2010, 2011, 2014 and 2015. Marine debris was present in all *Sargassum* collections, and ranged from relatively large items (e.g., plastic bottles) to smaller particles (e.g., microplastics, monofilament threads). Juvenile fishes were sorted and identified to the lowest possible taxonomic level. Prior to dissection, work surfaces, petri dishes, dissection tools were cleaned to avoid lab-based contamination. To minimize potential biases related to net feeding, only the stomach was removed and examined for the presence of microdebris (esophagus and intestines were excluded). Stomach contents (natural prey and debris) were sorted, enumerated and identified under a dissecting microscope. Microplastics were categorized as either fibers, fragments, flakes or spheres, following the classification of Li et al. (2016). The frequency of occurrence of ingested microplastics was calculated for dominant taxa.

In our sample collections, the juvenile *Sargassum*-associated fish community was dominated by relatively few taxa, including Planehead Filefish (*Stephanolepis hispidus*), pipefishes (*Syngnathus* spp.), Sargassumfish (*Histrio histrio*), Blue Runner (*Caranx crysos*) and Bermuda Chub (*Kyphosus sectatrix*), which collectively comprised approximately 70% of the total catch. In total, 860 fishes representing 34 taxonomic groupings were dissected and analyzed, and approximately 10% contained microdebris in their stomachs. No evidence of microplastic ingestion was observed for 19 taxonomic groups, including jacks (*Caranx* spp.), Atlantic Bumper (*Chloroscombrus chrysurus*), and Rainbow Runner (*Elagatis bipinnulata*). In the remaining 15 taxonomic groups, microdebris frequency of occurrence varied by taxon, with some of the highest frequencies observed in Pygmy Filefish (*Stephanolepis setifer*: 22%), Sergeant Major (*Abudefduf saxatilis*; 18%), Bermuda Chub (16%), and Tripletail (*Lobotes surinamensis*; 14%). Nearly all ingested microdebris particles were fibers (~87%), followed by fragments (~10%) and flakes (~3%); no spheres were identified in fish stomachs.

Our initial observations suggest that some fishes associated with *Sargassum* may have a greater probability of consuming microdebris than others, which may be related to feeding morphology or behaviors. The microplastic frequency of occurrence in fish stomachs observed in our study is similar to values reported for marine fishes in Texas estuaries (~10%; Phillip and Bonner 2015), and mesopelagic fishes in the Northeast Atlantic (~11%; Lusher et al. 2015) and North Pacific (~9%; Davison and Asch 2011), however much higher values (>35%) have been reported in other studies (e.g., Boerger et al. 2010, Lusher et al. 2013). Because the community of fishes associated with *Sargassum* is relatively unique, we were unable to compare microplastic ingestion by species collected both within and outside of *Sargassum* habitats. Such comparisons would require intensive sampling (particularly in non-*Sargassum*, open water habitats) to collect enough specimens for statistical analysis, but would be useful in determining if *Sargassum*-associated fishes, which are presumably using *Sargassum* as "nursery habitat", are at greater risk of consuming microplastics. Further, we suggest that future studies include toxicological analyses to determine if microplastics serve as vectors for potentially harmful environmental pollutants, and if so, what (if any) deleterious impacts to fishes (e.g., impaired growth) may result.

KEYWORDS: *Sargassum*, microplastics, Gulf of Mexico, marine debris, juvenile fishes

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