Heavy metals in the Atlantic Goliath Grouper in Trinidad

Metales pesados en el mero Goliath del Atlántico en Trinidad

Métaux lourds dans l'Atlantique Goliath Grouper à Trinidad

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EXTENDED ABSTRACT

Atlantic Goliath Grouper (*Epinephelus itajara*) is one of the largest species of grouper found in the Atlantic Ocean, with a life span of up to 37 years (Koenigetal.2007). As larvae, the *Epinephelus itajara* settles in both coastal and estuarine areas, where it remains until maturity. It then migrates to deeper continental shelf areas where there are large natural or artificial structures (Koenigetal.2007). The Atlantic Goliath Grouper, *Epinephelus itajara*, is threatened by pollution due to its shallow, coastal distribution. This pollution is a result of anthropogenic activity in coastal areas, leading to the discharge of heavy metals. Heavy metals also called trace metals, are naturally occurring in the environment and in living organisms where they play a crucial role. Despite its importance to the environment heavy metals can become highly toxic when they accumulate in high concentrations in humans as well as the Atlantic Goliath Grouper, its prey and predators, humans.

This research investigated the concentration levels of seven heavy metals: Iron, Manganese, Zinc, Lead, Copper, Nickel and Cadmium, in the liver, dorsal fin tissue and stomach contents of Atlantic Goliath Groupers caught in the waters of Trinidad. Grouper samples were collected opportunistically around Trinidad from landing sites, fish markets or directly from fishermen between the years 2016 and 2020. Samples that were collected were separated into 17 liver samples, 25 dorsal fin samples and 26 samples of stomach contents. The 25 samples from the dorsal fin and the 17 samples from the liver were cut into small pieces with the use of a ceramic knife, all samples were weighed and rinsed in distilled water and then stored in 5ml plastic vials.

The stomachs that were collected were all cut open with a ceramic knife and then scraped with a plastic fork so that the contents inside the stomach could be removed. Any undigested material found during this process was identified and then stored in 5ml plastic vials. All samples were then dried in an oven at 105°C for 24 hours Canoplat and Calta(2003). The dried samples were then weighed and placed in nitric acid in a 50ml beaker on a hot plate of 100°C for 6 hours Malinowski (2019) and Moselhy et al. (2014).

The digested material was then run in the Atomic Absorption Spectrometer, where the concentration levels were obtained. The results obtained showed that in the liver, Iron, Zinc, Copper and Cadmium had the highest average levels, with no detectable levels of lead in any of the samples. The muscle from the dorsal fin showed detectable levels of lead in 36% of the samples. It was noted however 2 of the samples were over the international thresholds at 0.32 and 0.42 ppm. The juvenile groupers had high levels of lead, a similar pattern was seen for Cadmium, whereas 2 of the samples detected iron and 3 detected manganese.

In the stomach contents there was the highest level of concentration of Nickel and Manganese; manganese was detected in most of the samples, with only 3 samples showing high amounts, lead was detected in 3 samples, the highest being a spine, most of the samples regardless of the type showed elevated amounts of CD, NI, and Cu which was nearing the threshold level for safe consumption. The concentration of Cd has a significant negative relationship ($p=0.013$), when the relationship between the fish length and dorsal fin tissue was observed. Pb, having had a near significant relationship ($p=0.053$), indicating there may be higher levels of heavy metals in the juvenile's habitat or its prey. High levels of lead were also found in the muscle tissue of the Goliath grouper, which is very concerning as this is the area consumed by humans and juvenile goliath grouper are most often the ones caught.

For several of the heavy metals smaller individuals had higher levels than larger ones; no patterns in concentrations were seen across years. Lastly even though manganese was shown to have a significant positive relationship with length ($p=0.007$), this may have been due to bioaccumulation or there being limited amount during the groupers' juvenile stage.

This research has shown the elevated levels of lead in some of the dorsal fin tissue samples is concerning for the health of the humans, however, by most international standards the Atlantic Goliath grouper tissues were below threshold in the heavy metals which were tested for, because the sample size was small, further research should be done looking at the relationship between length of groupers and their concentration levels using larger individuals.

Testing for other pollutants and heavy metals, such as mercury and petrochemicals, should be undertaken, continued monitoring is recommended.

KEYWORDS: pollutant concentrations, human health, bioaccumulation, stomach contents

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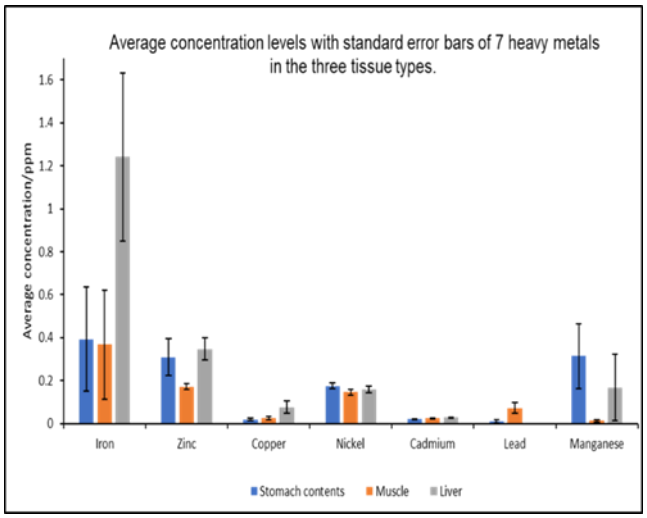

Figure 1. Average concentration levels with standard errors bars of 7 heavy metals in the three tissue types

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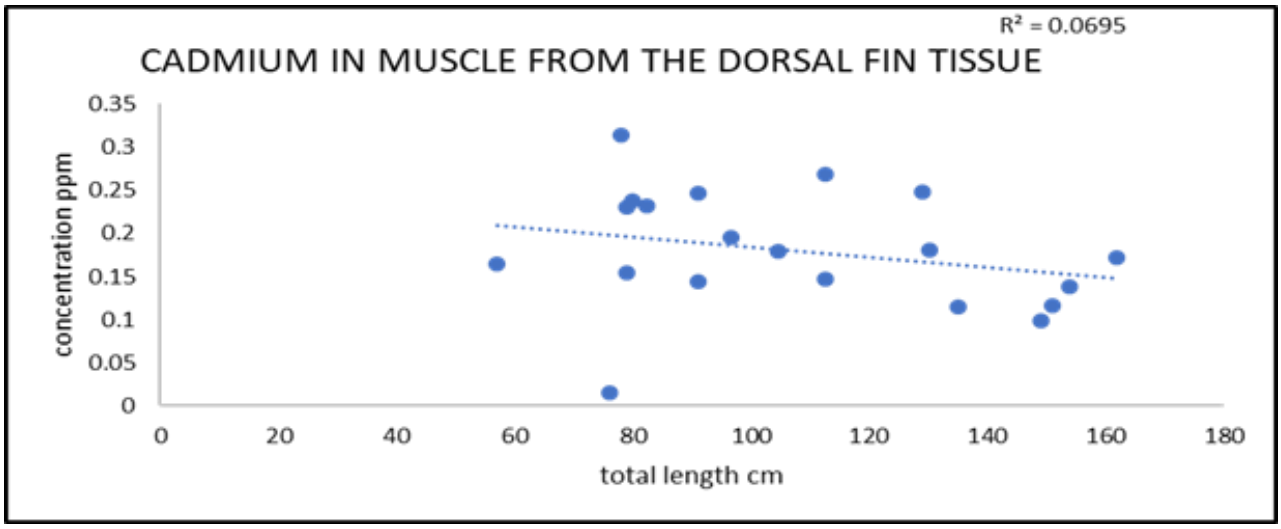

Figure 2. Cadmium in muscle from the dorsal fin tissue