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Case Report

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Ingestion of a Large Plastic Fragment by a Gilthead Seabream, *Sparus aurata*

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Abstract

In this report, a farmed seabream, *Sparus aurata*, weighing 209 grams and measuring 300 mm in total length was found to have ingested a transparent plastic fragment > 150 mm long, lodged within its intestine. Both the affected and unaffected regions of the intestinal wall exhibited physical and pathological damage. In conclusion, farmed seabream fish can ingest large plastic fragments which leads to gut blockage and/or sever intestinal damage

Keywords: *Sparus aurata,* Water pollution, Macroplastics, Mariculture, UAE

Introduction

During the last decades, marine contamination with the plastics with a consequent ingestion by marine fish species has been a topic of increasing research interest [1]. Some studies reported that pelagic fish species have a higher number of plastic particles per individual fish [2-3], while others showed that demersal species have a higher rate of plastic ingestion [4]. Plastic ingestion can be found either in large fragments, macroplastic, or in small fragments, microplastics or mesoplastics [5]. Most studies on plastic ingestion in fish have primarily focused on the effects of microplastics, which are more common and have been shown to cause various pathophysiological and physical adverse effects [6]. Ingestion of macroplastics was reported in some studies where plastic debris >25 mm was detected in the digestive tract of some large-sized demersal and pelagic wild fish species [3, 7]. Gilthead seabream (*Sparus aurata*) is demersal carnivore of the family Sparidae, is widely cultured in temperate and tropical waters around the world. In the current case study, a cultured sea bream fish was found to have ingested a large plastic fragment, which became lodged in the anterior intestine and was associated with several physical and pathological damages

Materials and Methods

A farmed seabream fish of 209 g weight and 300 mm total length was collected during a bi-weekly fish health sampling from an open sea fish cage at Omega Fish Farm, Dibba, Fujairah, UAE. In the laboratory, the fish was dissected, and the entire intestine was then carefully removed and immediately placed in a 50 ml Falcon tube containing 10% neutral buffered formalin. Several sections were taken from the anterior intestine where the plastic was found, and another from the lower intestine, which appeared free of plastic. The samples were processed following standard histopathological methods. Briefly, the tissues were dehydrated in a series of ethanol concentrations, cleared in xylene, and embedded in paraffin. Intestinal sections were then cut at 10 µm using a microtome, stained with routine Hematoxylin and Eosin (H & E), and examined under a microscope.

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Results

The anterior and the upper part of the middle intestine were swollen and hard in texture (Fig. 1). Upon opening the intestinal lumen, a convoluted transparent plastic fragment, measuring >150 mm in length, was found lodged inside. The wall of this affected intestinal region was very thin and showed clear signs of a physical damage. The remaining middle and lower intestinal sections, located beyond the plastic obstruction, were hemorrhagic, and filled with a fluid of a foul odor, indicating a case of intestinal obstruction. Histopathological examination of the affected anterior and middle intestinal segments revealed a significant loss, and damages of intestinal villi, submucosa, and mucosa layers (Fig. 2) compared to the posterior intestinal section (Fig. 2). The muscularis mucosa and submucosa layers of both intestinal sections exhibited pronounced ectasia and congestion of the blood vessels, along with extensive leukocytic infiltration (Fig. 2). Additionally, increase in rodlet cells (Crypt cell loss) and massive de-epithelization were observed in the lower intestinal section (Fig. 2).

Figure 1: A Record of a transparent macroplastic fragment in the intestine of seabream fish. AI: anterior intestine; MI: middle intestine; PI: posterior intestine; P: plastic fragment; S: stomach

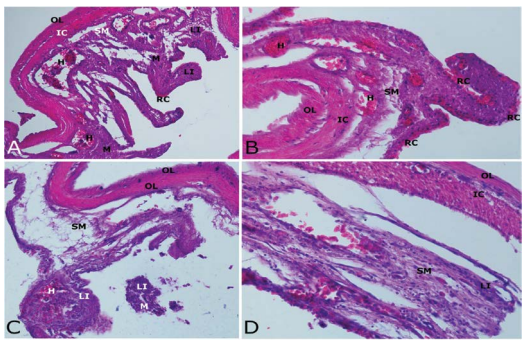

Figure: 2 Transverse sections of the intestine of a seabream fish showing several alterations (H & E) A & B: Affected posterior intestine; C&D: Anterior intestine (A & C - 10X; B & D - 20X). M: mucosa; SM: submucosa; IC: inner circular muscularis; OL: outer longitudinal muscularis; H: Hyperemia; LI: Leukocytic infiltrations; RC: Rodlet cells with de-epithelization.

Discussion

To our knowledge, this is the first documented case of a cultured seabream of 300 mm in total length had ingested a clear plastic fragment with a length of > 150 mm. The upper and part of the middle intestinal segments were nearly occluded and severely damaged. The consumption of such a large plastic fragment suggests that this was either an accidental ingestion or the fish exhibited behavior indicative of linear foreign body ingestion. While the duration of the plastic's presence in the intestine is unknown, it likely had not been there for long, as the observed intestinal obstruction, though significant, but it might be incomplete. Obstruction of digestive tract might lead to a false feeling of satisfaction which ends with starvation and death [8]. Most previous studies investigating plastic ingestion in demersal and pelagic fish species classified the ingested plastics as microplastics or macroplastics. However, these studies either did not specify the dimensions of the macroplastics [9], or with a length of >25 mm [7, 10], which are considerably much smaller compared to the size of the plastic sheet (>150mm) ingested by the fish in our case study with only a total body length of 300mm. The severe damage observed in the intestinal villi, submucosa, and mucosa of the anterior intestinal region in the current study is likely attributable mainly to the physical injury. In general, the ingestion of plastics, particularly microplastics, has numerous detrimental effects on fish. These include increased mortality, reduced predatory performance, neurotoxicity and oxidative stress [1], and severe intestinal damage with reduced food intake, or complete loss of appetite [11-12]. The inflammatory conditions observed in the intestine, characterized by extensive de-epithelization, blood vessel ectasia, and congestion, along with widespread leukocyte infiltration, have been previously documented in laboratory studies over a long period of ingestion. For example, European sea bass (*Dicentrarchus labrax*) showed these symptoms after being fed microplastics for 60-90 days [11]. Similarly, zebrafish (*Danio rerio*) and intertidal fish (*Girella laevifrons*) exhibited similar inflammatory responses after 10, and 45 days, respectively, of microplastic exposure [12, 13].

Conclusion

Ingestion of large plastic fragments by gilthead seabream fish is possible and can be associated with gut blockage and/or sever intestinal damage.

Declaration of competing interest

The authors declare that there is no conflict of interest.

Authors' contributions

SA, NM, and AI: Methodology, investigations, conceptualization, statistical analysis, writing, review, and editing.

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