Bioaccumulation of microplastic fibres in the gut of Sardinella longiceps (Valenciennes, 1847) collected from Sassoon dock, west coast of Maharashtra.

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Abstract - Due to anthropogenic activities the marine environment is disturbed and so the organisms living in that habitat. One of the most critical and persistent pollution nowadays is plastic pollution in aquatic ecosystem. Plastic being flexible, durable and inexpensive to produce, utilization of it has become unavoidable which led us in “plastic cage”. Present study was conducted to investigate presence of microplastic fibre in the gut of the Sardinella longiceps collected from Sassoon dock, Mumbai. Stereomicroscopy was done for screening and visual inspection of different microplastic fibre from completely digested gut tissue. Identification of found microplastic fibres were done using ATR-FTIR method. Present study provides evidence of presence of microplastic fibres in the gut of the said fish polymers found were polyamide (PA), polyethylene (PE), polypropylene (PP), Polystyrene (PS), & Polycaprolactum (PA-6). Polyamide was found more in number than other type of polymer in gut tissue of studied fish.

Keywords: Microplastic, Sardinella longiceps, Sassoon dock, FTIR.

1. INTRODUCTION
Microplastic pollution is increasing globally and it is one of the great concern today. Plastic being ubiquitous in nature its quantity is enormously growing in environment of marine ecosystem (Ganesan, M, et al,2019; Gao, F et al,2019; Barnes, D. K. A et al,2009). Anthropogenic activities as industrial effluents, disposal of waste, domestic waste all these leads microplastic entry in the marine ecosystem (Liu et al. 2021; Sutton et al. 2016). Particles varying in size from 0.1 to 5000 μm comes under microplastic category (Alexander et al., 2016). These plastic waste in the environment all together form plastic litter in the environment (Katare et al., 2022). With respect to surface mass area ratio, microplastics may be present in many forms as fragments, pellets, fibres, films or granules (Koelmans et al. 2019). Fish have shown presence of microplastic collected from fresh water as well as marine or estuaries water or even if bought from local markets (Rochman et al. 2015; Wootton et al. 2021b; Wu et al. 2020). Sardinella longiceps is a pelagic clupeid, commercially valuable fish which is found globally. Sardinella longiceps fish is rich in lipid content (Priti Singh & Leena Muralidharan, 2022). Being most natural and traditional food item, fish is consumed all over the world in all communities. Fish is found to have most protein and other essential vitamins and minerals which is required for better growth and development of living organisms (Kumar et al., 2020). Fish rich diet can reduce the risk of cardiovascular disease (Raatz S.K., et al, 2013; Torris C, et al 2018). Present study is undertaken to investigate presence of microplastic fibre in the gut of Sardinella longiceps which is collected from Mumbai’s one of the famous dock, Sassoon dock.

2. MATERIALS AND METHOD:
2.1 Sample collection
Fresh fish samples of Sardinella longiceps (Valecienes, 1847) were collected from the sampling site, Sassoon dock, Mumbai (Fig. 1). With the help of local fisherman fishes of 18-21 cm in length and 75 to 95 gms in weight were taken and kept in ice box transported to the lab for microplastic examination. Sassoon dock is one of the famous dock in Mumbai which is located between latitude 18°54'37.692” N and longitude 72°49'2.172”E from where fresh fishes and other sea food items are exported in all part of Mumbai and to other part of world.

2.2 Extraction of microplastic
Fishes were dissected in sterile condition taking care to avoid any false reading. Gut of the fish were removed carefully after dissection and digested completely with the help of 10% KOH solution (Rochman, C., et al. 2015). Tissue to chemical solution volume was kept 1:3 and it is kept at 60 °C overnight for effective digestion. After complete digestion tissue filtrate is filtered on whatman filter paper with pore size of 11 micron meter and it was oven dried. After complete digestion of organic and inorganic material the filter paper is inspected in stereomicroscope for microplastic morphology and characteristic feature. The microplastic fibre found on stereomicroscope is then analysed on ATR-FTIR (Fig.2) and with the help of inbuilt library type of microplastic fibres were identified.

2.3 Contamination control
To minimize false positive result from airborne plastic, the whole experiment was done under sterile condition wearing 100% cotton lab coat, nitrile gloves cleaning surface area with 70 % alcohol and taking precautionary measures. All glassware in used was wash with distilled water and oven dried prior to use every time.

3. RESULT AND DISCUSSION:
Present work showed varying size, shape and colour of microplastic fibre in the gut of Sardinella longiceps. The size of microplastic found was 0.1 mm to 2.5 mm. It has been found that most frequent size found in marine organism is 100-1000 micronmeter (Rochman et al., 2015; Vendel et al., 2017; Pazos et al., 2017; Barboza et al., 2020; Bessa et al., 2018; Abbasi et al., 2018). Shape found in our research varied from slender body to comma shape to curve of different angle. The different shape of microplastic fibre may be due to rejection capacity of body tissue to expel it out. The impact of microplastic to the biological system is affected by the varying size of microplastic (Hamed et al., 2022). In our study we found polyamide(PA), polyethylene(PE), polypropylene(PP), Polystyrene(PS), & Polycaprolactum (PA-6) as microplastic fibre under ATR-FTIR spectroscopy.
Polyamide was found more frequently (Fig.4). Our findings of microplastic fibre is in concordance with earlier studies as they also got polystyrene, polypropylene, and polyethylene from gut of their studied organism (Kezia James et al.,2022; Mohammad Javad Nematollahi et al.,2021; Cassola et al., 2019). Blue, green, red, yellow, brown, black colour of different fibre were present in studied fish (Fig.3). It has been shown in studies that blue and black colours are more frequently present in marine organisms (Morgana et al., 2018; Wieczorek et al., 2018; de Vries et al., 2020). Microplastic fibre has high specific surface area and it has prevalence in sludge and agricultural soil due to this it is one of the important category of microplastic (H. Frost et al.,2022).

4. CONCLUSION:
The present study showed bioaccumulation of microplastic fibre in the gut of commonly edible commercial fish sardinella longiceps collected from Sassoon dock, Mumbai. Microplastic found more frequently were blue and red in colour and size was 0.1mm-2.5
mm. The shape and size of polymer found was not similar in each fish and capacity of ingestion of microplastic fibre also varies. Our study will add evidence on microplastic ingestion in experimental fish suggesting urge of plastic waste management for betterment of our future as plastic ingestion could be potentially hazardous to living organisms. This work is done to add on data to fill the gap of plastic knowledge in marine environment. The knowledge gap in plastics is available to plastics researchers.

5. ACKNOWLEDGEMENT:
We are greatful to our principal Dr.Himanshu Dawda sir for providing ATR-FIR laboratory facility and motivating us throughout the experimental period.

REFERENCES: