Identification of anthropogenic debris in the stomach and intestines of giant freshwater prawns from the Trang River in southern Thailand

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Abstract

Background: Anthropogenic waste, especially microplastics, is becoming more prevalent in the environment and marine ecosystems, where it has the potential to spread through food chains and be consumed by humans. Southeast Asian countries are home to giant freshwater prawns, a common freshwater species that is eaten around the world. Microplastic pollution in river water, sediment, and commercially significant aquatic species such as fish and mollusks has been observed, yet few studies have been conducted on giant freshwater prawns in the rivers of southern Thailand, where microplastics may contaminate prawns via the food they ingest. The purpose of this research was to investigate the accumulation of anthropogenic material in the organs of river prawns (*Macrobrachium rosenbergii*).

Methods: Microplastics in the stomachs and intestines of giant freshwater prawns were the focus of this study. Samples were digested with 30 ml of 10% potassium hydroxide (KOH), heated for 5 minutes at 60°C, and then digested at room temperature. The quantity, color, and appearance of microplastics were assessed using a stereomicroscope after 12 hours. Furthermore, polymers were examined using a Fourier transform infrared spectrophotometer (FTIR). Microplastic counts were compared between sexes. A T-test was used to compare male and female microplastic counts in the stomach and intestine, and the Pearson correlation was used to compare the association between microplastic counts in the stomach and intestine and carapace length (CL), length of abdomen (LA), and body weight (BW) of male and female giant freshwater prawns. The threshold of significance was fixed at $p < 0.05$.

Results: Based on the study results, a total of 370 pieces of anthropogenic debris were discovered in the stomachs and intestines of both female and male prawns. The average number of microplastics per individual was 4.87 ± 0.72 in female stomachs and 3.03 ± 0.58 in male stomachs, and 1.73 ± 0.36 in female intestines and 2.70 ± 0.57 in male intestines. The majority of microplastics found in females were within the <100 μm range, while males contained microplastics in the range of 100–500 μm. Both male and

41 female prawns contained fibers (72.70%) and fragments (27.30%). Various polymers were identified,
42 including cotton, rayon, and polyvinyl chloride (PVC). The study also explored the relationship between
43 carapace length, length of abdomen, body weight, stomach weight, and the number of microplastics. The
44 findings reveal a significant association between the number of microplastics and stomach weight in male
45 prawns (R = 0.495; p = 0.005). These findings provide alarming evidence of anthropogenic debris ingestion
46 in prawns and raise concerns about the future effects of anthropogenic pollution on giant freshwater
47 prawns.
48
49 **Introduction**
50 The world is well aware of the devastating effect that plastic waste has on the ecosphere. Plastics are a
51 popular material used to make a variety of goods (Plastics Europe, 2018). They are a form of synthetic
52 polymer that has been widely employed due to their light weight, strength, durability, and low cost, as
53 well as their ability to be molded into various shapes and sizes using contemporary manufacturing
54 processes (Bogusz and Oleszczuk, 2017). Thailand is among the top six nations that dump the most plastic
55 into the sea (Jambeck et al., 2015).
56   Microplastics are microscopic plastic particles that are produced as a byproduct of commercial
57 product manufacturing due to the breakdown of larger plastics by physical, chemical, and biological
58 processes (Arthur et al., 2009). These processes produce macroplastic (more than 25 mm), mesoplastic (5–
59 25 mm), and microplastic (less than 5 mm) particles (Desforges et al., 2014), which are derived from
60 primary sources of microplastics such as plastic beads from plastic manufacturers, microbeads in
61 cosmetics, and fishing net fibers, as well as secondary sources of microplastics (GESAMP, 2016).
62 Microplastic pollution in the environment causes microplastics to infiltrate the food chain, where they can
63 directly impact organisms and ecosystems (Lusher et al., 2017). It can now be detected in a variety of ways.
64 It has been documented that many forms of microplastics have been ingested by zooplankton, shrimp, and
65 animals living in alluvium or mangrove soil (Pradit et al., 2021; Abbasi et al., 2018; Devriese et al., 2015;
66 Moore et al., 2001; Murray and Cowie, 2011). Several studies have shown that consuming too much
67 microplastic-contaminated food on a regular basis increases the likelihood of acquiring allergies (Pironti et
68 al., 2021). Microplastics can obstruct the activity of organs in the body, such as the circulatory system,
69 because they are small enough to enter the bloodstream, causing pain and irritation to internal organs.
70 They can also enter the digestive system where they can cause gastric cancer. The most dangerous effect
71 of microplastics on the body is genetic mutation (Thushari et al., 2017).
72   South and Southeast Asia, in addition to some parts of the Pacific Islands, are home to giant
73 freshwater prawns (Petchjun and Sirisawat 2016). Giant freshwater prawns are large shrimp that live in
74 freshwater waterways along rivers and canals, and are usually observed in regions where the water is
75 flowing and clean. They are commonly consumed both locally and internationally because the flesh is
76 excellent and has a high nutritional value. Because of their high price, the species is popular among
77 fishermen (Thongchai et al., 2022). Fertilized female giant freshwater prawns move to the river mouth or
78 brackish water to spawn during the breeding season before moving back to fresh water. The feeding
79 habitats of prawns involve consuming a wide variety of organic material (Sitthi, 2011). Microplastics are
80 abundant in river water and soil, and aquatic species such as prawns may absorb them while feeding.
81 Microplastic consumption has been researched in different shrimp species, such as *Paratya australiensis*,
82 and were found in 36% of the shrimp, with an average of 0.52 ± 0.55 items/ind (24 ± 31 items/g) (Nan et al,
83 2020.). The gut of *Nephrops norvegicus* was investigated, and 83% of the animals analyzed had plastics
84 (mostly filaments) in their stomachs (Murray and Cowie, 2011). There has been little academic research on
85 this topic in Thailand, and there have been no reports of microplastic buildup in the Trang River. This

86 study investigates the presence of anthropogenic waste, such as microplastic-like debris, in the
87 gastrointestinal tracts of giant freshwater prawns.
88
Materials & methods
1. Sample collection and preparation
91 In September of 2022, a total of 6 kg of giant freshwater prawns (*M. rosenbergii*) was purchased randomly
92 from coastal fishermen who operate on the Trang River in the Trang province (Figure 1). To conduct a
93 microplastic analysis, a total of 60 giant freshwater prawns were randomly selected, with 30 males and 30
94 females. Male and female characteristics of giant freshwater prawns are shown in Figure 2. The sample
95 size used in this investigation is consistent with previous studies conducted by Cole et al. (2013), Pradit et
96 al. (2020), and Jitkaew et al. (2023). It is important to note that this species is commonly consumed in
97 Thailand. To preserve the giant freshwater prawn samples, they were carefully wrapped in aluminum foil
98 and stored in a freezer at a temperature of −20℃ in preparation for further analysis.
99
2. Prevention of microplastic contamination
101 A blank test was performed using a 250-ml beaker filled with distilled water and placed in a laboratory.
102 After 24 hours, the distilled water in the beaker was filtered using filter paper, oven-dried, and examined
103 under a microscope to ensure the absence of microplastics. The experiment took place in a clean room
104 with a fume hood, and no disturbances such as wind were present in the laboratory. The researcher wore
105 gloves, a gown, and a surgical cap throughout the experiment. During the lab analysis, aluminum foil was
106 placed over the glass beaker containing the dissected sample (Pradit et al., 2023). To minimize the impact
107 of exogenous microplastics, no plastic instruments were used on the samples during the experiment (Pan
108 et al., 2021). All materials were cleaned and rinsed with distilled water before use.
109
3. Anthropogenic debris identification
111 The frozen giant freshwater prawn samples (*M. rosenbergii*) were defrosted at room temperature. Carapace
112 length (CL) and length of abdomen (LA) were measured in centimeters (Figure 3), and body weight (BW)
113 was measured in grams, in accordance with Food and Agriculture Organization of the United Nations
114 (FAO) guidelines. The description from Dehauts et al. (2016) served as the basis for the sample analysis
115 procedure. The samples' intestines and stomachs (Figure 2) were removed using thin forceps, cut into small
116 pieces, and placed in a beaker. The alkaline technique was applied to digest the dissected stomachs and
117 digestive tracts of the samples (Cole et al., 2014; Ding Jin-Feng et al., 2018). The samples were then placed
118 in 30 ml of 10% potassium hydroxide (KOH) solution, stirred continuously for 1 minute with a stirring rod,
119 covered with aluminum foil to prevent foreign matter contamination from the air, heated to 60℃ for 5
120 minutes, and left to degrade for another 12 hours at room temperature. The samples were then filtered
121 with a 20-micron filter cloth. The filter cloth (new, made of nylon) was dried in a hot air oven at 50℃ for 5
122 hours. Studies conducted after digestion can benefit from density separation. The primary aim is to
123 separate microplastics from sediment or other inorganic material that was not dissolved during enzymatic
124 or chemical digestion (Stock et al., 2019), and when there is a significant amount of inorganic material
125 present (Lusher et al., 2016). Because there was no organic or inorganic material left (such as sand or
126 chitin) after digestion with KOH (10%) in our investigation, the density separation step was skipped. The
127 method of using alkaline digestion was adapted for the dissolution of the biota of invertebrates and fish
128 and has proven largely efficacious in removing biogenic material (Lusher, et al., 2016). In the absence of

129 debris, organic matter, shells, or cartilage, which can prevent the identification of microplastics on the
130 filter, an alkaline digestion was deemed to be efficient (Dehaut et al., 2016).
131   The microplastic samples on the filter cloth were carefully counted and their sizes measured.
132 Additionally, their characteristics and color were observed using an Olympus SZ61 three-dimensional
133 viewing system equipped with a light-emitting diode. The microplastics were counted as individual pieces.
134 The size of the microplastics was categorized into four classes: <100 μm; 101–500 μm; 501–1000 μm; and
135 >1000 μm. Furthermore, the types of microplastics were classified into two categories: fibers and
136 fragments. Randomly selected microplastics longer than 100 μm were analyzed on a Fourier transform
137 infrared spectrophotometer (FTIR), using the Attenuated Total Reflectance mode to identify their
138 composition; Spectrum Two; Perkin Elmer Spectrum IR version 10.6.2, spotlight 200i, UK. In the study,
139 the wavelength spanned from 4000 cm^{-1} to 400 cm^{-1}. The acquired spectrum was compared to the standard
140 library spectrum.
141
142 **4. Data analysis**
143 Descriptive data on the number, size, color, and shape of microplastics was collected in Microsoft Excel
144 (Office Professional Plus 2019). Data was presented in the form of a mean standard error. The t-test was
145 used to compare the number of microplastics found in the intestines and stomachs of male and female
146 giant freshwater prawns. The relationship between the number of microplastics in the intestines, stomachs,
147 carapace length, length of the abdomen, and body weight between male and female giant freshwater
148 prawns was measured using the Pearson correlation. The significance level was set at $p < 0.05$.
149

150 # Results
151 **Abundance of anthropogenic debris in the stomach and intestine of giant freshwater**
152 **prawns**
153 60 giant freshwater prawns (30 females and 30 males) were tested. Each giant freshwater prawn was
154 measured for CL, BW, LA, and SW before the analysis was conducted (Table 1). The number of
155 microplastics in the stomachs and intestines of female and male giant freshwater prawns were 4.87 ± 0.72
156 items/individual, 1.73 ± 0.36 items/individual, 3.03 ± 0.58 items/individual and 2.70 ± 0.57 items/individual,
157 respectively (Table 2). The number of microplastics in the stomachs of female giant freshwater prawns and
158 male giant freshwater prawns (p = 0.866) and intestines (p = 0.171) was not statistically different.
159
160
161 **Anthropogenic debris: size**
162 In the stomachs of female giant freshwater prawns, the most common size of microplastics found was
163 <100 μm whereas in the stomachs of male giant freshwater prawns, the most common size of
164 microplastics found was 100–500 μm. In the intestines of female and male giant freshwater prawns, the
165 most common size of microplastics found was 100–500 μm. See more details in Figure 4.
166
167 **Anthropogenic debris: type, color, and polymer**
168 The intestines of male giant freshwater prawns included 91.36% fiber-type microplastics, followed by the
169 stomachs (85.71%) of male giant freshwater prawns and the intestines (69.23%) and stomachs (55.48) of
170 female giant freshwater prawns. Fragment-type microplastics were found in 44.52% of female giant
171 freshwater prawn stomachs, followed by female giant freshwater prawn intestines (30.77%), and male giant

172 freshwater prawn stomachs (14.25%) and intestines (8.64%) (Table 3). The forms and sizes of the
173 microplastics differed.
174   Blue (61.35%), black (32.70%), red (5.68%), and yellow (0.27%) microplastics were found. Blue was the
175 most prevalent hue discovered in the stomach and intestines of both female and male giant freshwater
176 prawns, followed by black, red, and yellow. Yellow microplastics were not found in the stomachs and
177 intestines of female giant freshwater prawns nor male giant freshwater prawns (Table 3). Cotton (70.37%),
178 rayon (25.93%), and polyvinyl chloride (PVC) (3.70%) were the polymer types found in *M. rosenbergii*
179 (Figure 5).
180
181 **Correlation between the size of giant freshwater prawns and anthropogenic debris in the**
182 **stomach and intestines**
183 The study examined the relationship between CL, LA, BW, and stomach weight, and the number of
184 microplastics. The findings revealed a significant association between the number of microplastics and
185 stomach weight in male prawns (R = 0.495; p = 0.005) (Table 4).
186

Discussion

188 This study confirmed that microplastics were detected in the stomach and intestines of female and male
189 giant freshwater prawns. More microplastics were found in the stomach than in the intestines in both
190 female and male giant freshwater prawns; 4.87 ± 0.72 items/individual, 1.73 ± 0.36 items/individual, 3.03 ±
191 0.58 items/individual, 2.70 ± 0.57 items/individual, respectively. There was no significant difference in the
192 accumulation of microplastic particles in the stomachs (p = 0.866) and intestines (p = 0.171) of female and
193 male giant freshwater prawns. This is consistent with a study conducted in shrimp, *Crangon crangon*, that
194 found microplastics were most common in the gastrointestinal tract (Devriese et al., 2015). The number of
195 microplastics found in each type of prawn and shrimp depends on the environment where the prawn
196 samples are selected, such as rivers, aquaculture ponds, lakes, and seas. When comparing the present
197 study with other studies (Table 5), the number of microplastics detected in this study varied by location.
198 The amount of microplastics found in this study is similar to the results obtained by Goh et al. (2022), but
199 less than other studies in Thailand (Jitkaew et al., 2023; Reunura and Prommi, 2022; Pradit et al., 2021).
200 This could be because there are fewer sources of microplastics in the aquatic environment from this study
201 (south-west Thailand) than in the areas from other studies (south-east Thailand). The most common size of
202 microplastics found in this research was 100–500 µm (44.05%), followed by <100 µm (38.11 %), >1000 µm
203 (9.46 %), and 501–1000 µm (8.38%), respectively. The size of the microplastics found is likely related to their
204 toxicity. Smaller microplastics can better absorb hydrophobic materials from a production process or from
205 the environment, resulting in humans being at a greater risk of exposure to toxic chemicals (Lusher et al.,
206 2017). Microplastics can absorb the additional chemicals (plastic additives) used in the manufacturing
207 process that give plastic products their color and characteristics (Pradit et al., 2020). The results of
208 interactions between selected microplastics and heavy metals strongly support the hypothesis that
209 microplastics can absorb heavy metals and act as a vector for heavy metal ion distribution in the marine
210 ecosystem (Goh et al., 2022). As a result, microplastics appear to be poison transporters for aquatic
211 creatures that consume microplastics. Heavy metals can accumulate in marine creatures, increasing in
212 concentration over time. This concentration provides a record of the availability of metal species in the
213 environment (Rainbow, 2002).
214   The most abundant category of microplastics found was fibers, followed by fragments, which is
215 consistent with the findings of several studies (Pradit et al., 2021; Goh et al., 2021; Gurjar et al., 2021;

216 Hossain et al., 2020; Devriese et al., 2015). According to Weinstein et al. (2016), it was reported that
217 polymer fibers can float on water for a long time due to their low density, while fragments with rough
218 surfaces are broken down by natural forces. The fibers found in this study likely originated from floating
219 fibers in river water, and the fiber strands of polymer most likely came from fishing nets and clothing lint
220 (De Witte et al., 2014).

221   The microplastics found in both male and female giant freshwater prawns were blue, black, and red,
222 while yellow microplastics were only found in the intestines of male giant freshwater prawns. This is
223 similar to the results of previous studies (Jitkaew et al., 2023; Reunura and Prommi, 2022; Pradit et al.,
224 2021; Goh et al. 2021; Gurjar et al. 2021; Nan et al., 2020). It was also found that plastics with a long
225 lifespan and darker colors are more likely to be contaminated with other chemical substances than long-
226 lived lighter-colored plastics (De Witte et al., 2014). Wright et al. (2013) reported that living organisms
227 choose to eat plastics that look similar to their regular food, causing them to acquire microplastics in their
228 gastrointestinal tract. According to Sitthi, (2011), giant freshwater prawns eat all types of food, both living
229 and nonliving, including fish, seedlings, and other prawns.

230   In this study, three polymer types were found in giant freshwater prawns. The results reveal that
231 natural polymer cotton was the most abundant, followed by semi-synthetic polymer (rayon) and synthetic
232 polymer (PVC), respectively. The use of detergent in laundering likely results in increased microfibers
233 (Zambrano et al., 2019) which are then suspended and accumulate in bottom sediment or in water currents
234 (Henry et al., 2019). This study found polyvinyl chloride (PVC) in the stomachs of male giant freshwater
235 prawns, similar to a study on *Litopenaeus vannamei* in the Korean Sea (Yoon et al., 2022), which found
236 that the PVC likely came from food packaging and fishing equipment. The study of the correlation
237 between microplastic content and CL, LA, BW, and stomach weight found that there was no correlation
238 between female giant freshwater prawns and microplastic content in the stomach and intestines, while
239 there was a significant correlation between male giant freshwater prawns and intestinal microplastic
240 content and stomach weight at the level of $R = 0.495$; $p = 0.005$. This indicates that the high gastric weight
241 of giant freshwater prawns may result in an increase in intestinal microplastic content in proportion to the
242 stomach. CL, LA, and BW were not associated with the number of microplastics in female and male giant
243 freshwater prawns.

244   It is projected that the problem of plastic waste will worsen due to the excessive use and
245 consumption of single-use plastics (Silva et al., 2021) as well as an increase in the demand for personal
246 protective equipment (PPE) such as masks, and rubber gloves, which will lead to an increase in PPE waste
247 (Okuku et al., 2021). A public awareness campaign aimed at changing people's attitudes regarding the
248 environment is critical (Sornplang et al., 2021). Diffusion can occur when microplastics are smaller than 5
249 mm, causing widespread pollution of the environment. If an organism is exposed to this environment for a
250 prolonged period of time, there is a greater chance that the exposure will have negative effects. These
251 effects could include obstructions in the gastrointestinal tract of organisms, increased mortality rates,
252 decreased ability to reproduce, and inhibition of metabolism. However, depending on the size, shape, and
253 type of contaminated plastic in the environment, as well as the quantity and concentration discovered
254 (Cole et al.,2013; Zhang et al., 2017), other hazardous additive contaminants may be released which could
255 serve as an intermediary to other pollutants, further harming aquatic animals and humans.

256

Conclusions

In this study, anthropogenic waste was discovered in the stomachs and intestines of giant freshwater prawns (*M. rosenbergii*). This discovery indicates that microplastic pollution, which is caused by a range of human activities, is harmful because microplastics can enter the food chain. Fibers were the most prevalent category of microplastic found in prawn organs. Blue, black, and red microplastics were identified in the intestines of both male and female giant freshwater prawns, whereas yellow microplastics were found in the intestines of male giant freshwater prawns. Cotton, rayon, and PVC were also discovered in these giant freshwater prawns. Although microplastics are evacuated with waste, some persist in the tissue. Consequently, to reduce plastic pollution in the seas in the future, people need to be informed of the government's management and act immediately to remedy issues with waste disposal.

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401

402   Legends:

403   Figure 1:

404   The study area of the Trang River, Trang Province, Thailand.

405

406   Figure 2:

407   Male and female characteristics of giant freshwater prawns.

408

409   Figure 3:

410   Carapace length and length of the abdomen of a giant freshwater prawn.

411

412   Figure 4:

413   Size of anthropogenic debris in female and male giant freshwater prawns.

414

415   Figure 5:

416   Polymer found in giant freshwater prawns.

417

418   Table 1:

419   Carapace length (cm), weight (g), length of abdomen (cm), and stomach (g) of giant freshwater

420   prawns.

421

422   Table 2:

423   Anthropogenic debris abundance in giant freshwater prawns.

424

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426   Anthropogenic debris type and color in female and male giant freshwater prawns.

427

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429   The relationship between the size of giant freshwater prawns and the amount of anthropogenic

430   debris in the stomach (ST) and the intestines (IN).

431

432   Table 5:

433   Microplastic accumulation in shrimps form various studies.

Figure 1

The study area of the Trang River, Trang Province, Thailand.

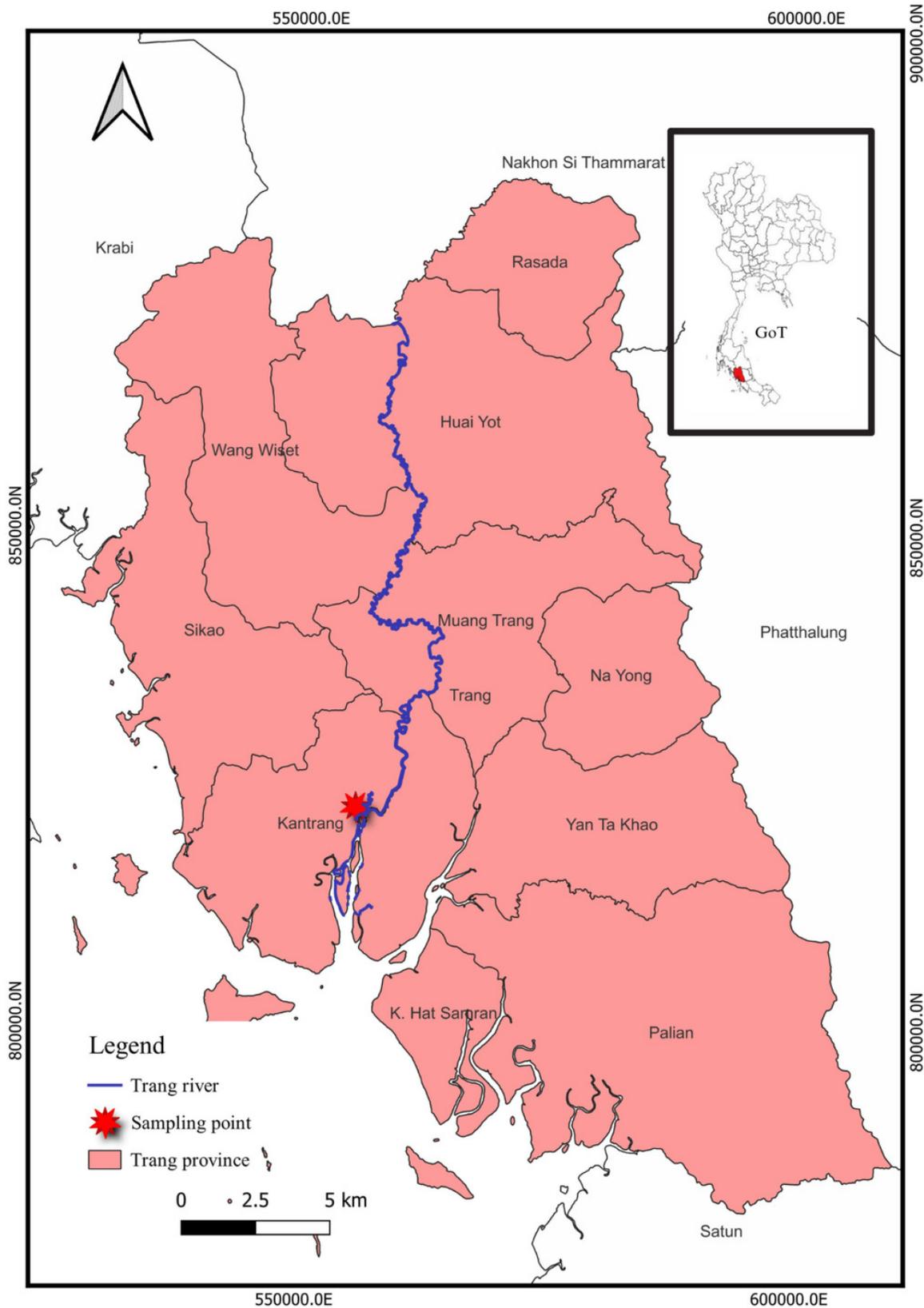



Figure 2

Male and female characteristics of giant freshwater prawns.

Stomach

Intestine

♂ ♀

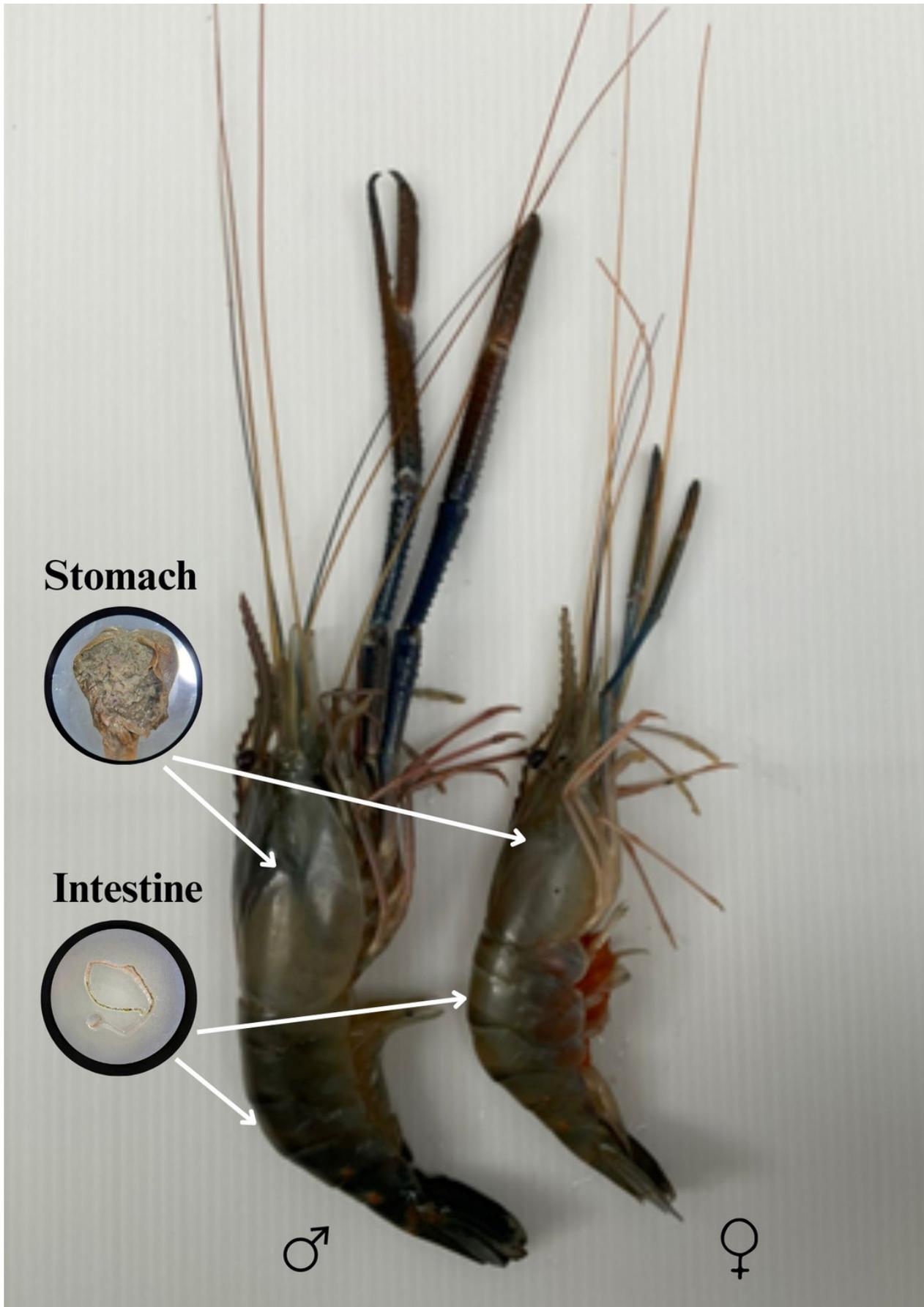



Figure 3

Carapace length and length of the abdomen of a giant freshwater prawn.

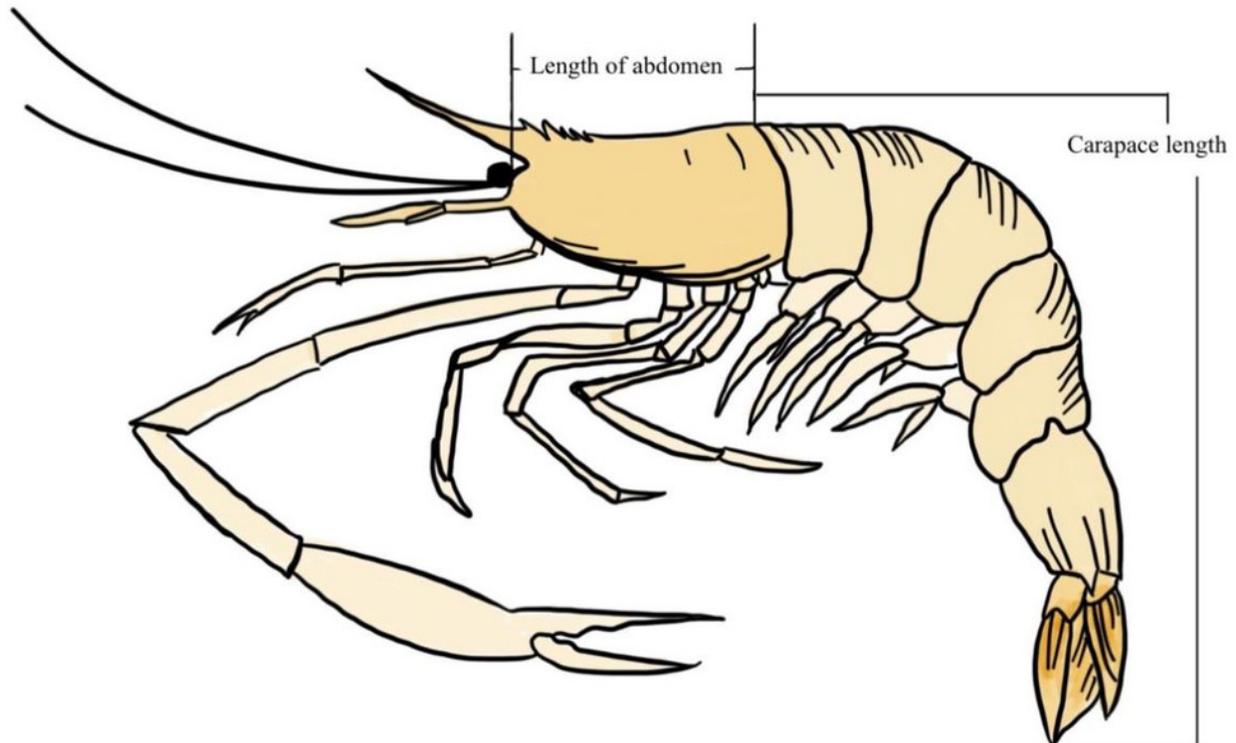



Figure 4

Size of anthropogenic debris in female and male giant freshwater prawns.

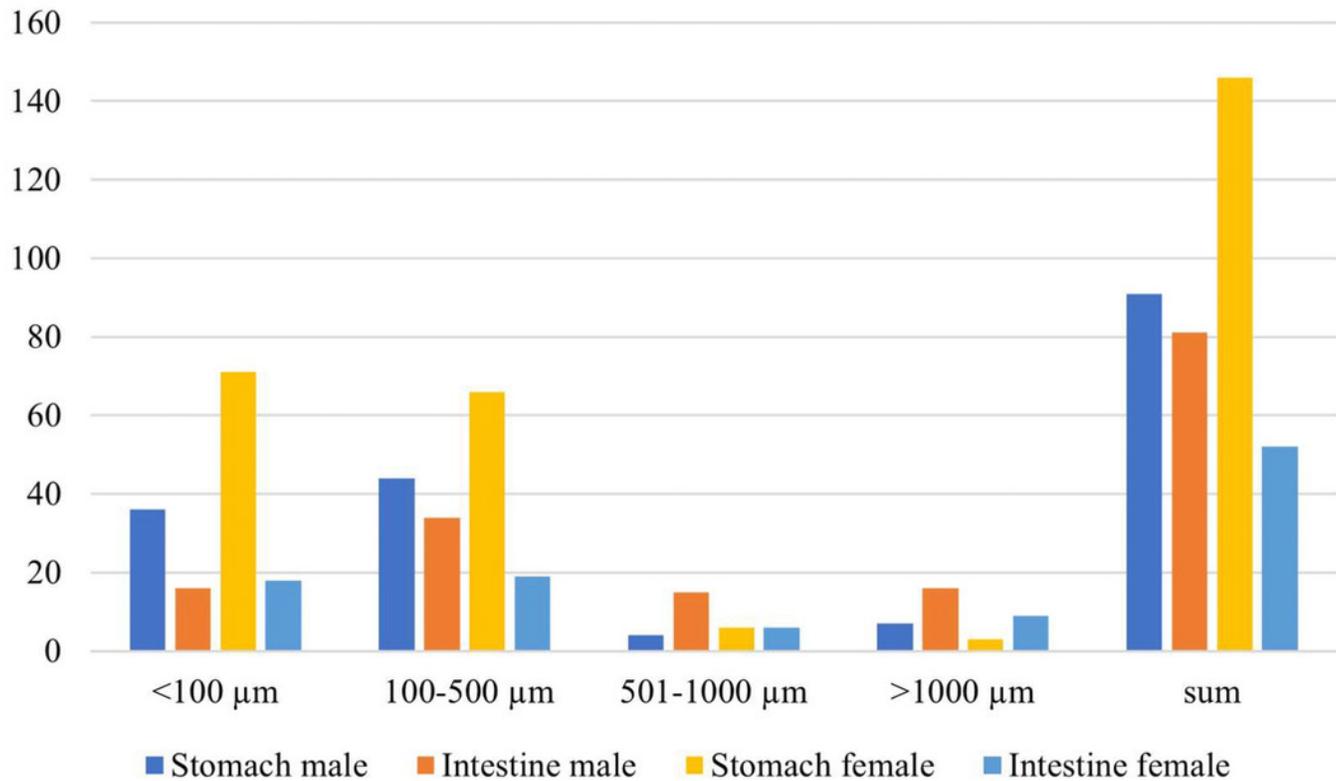
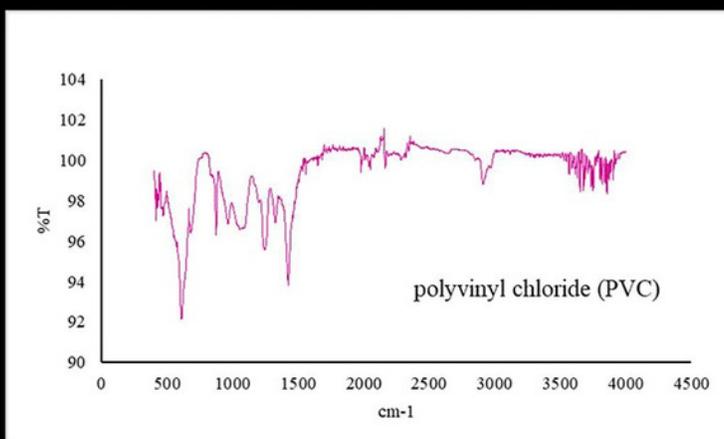
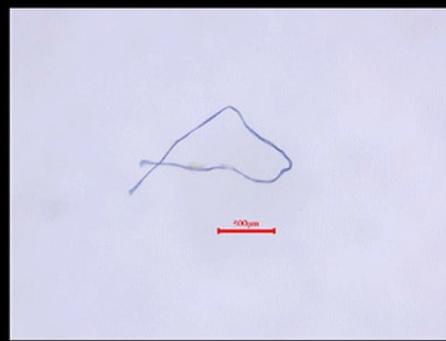
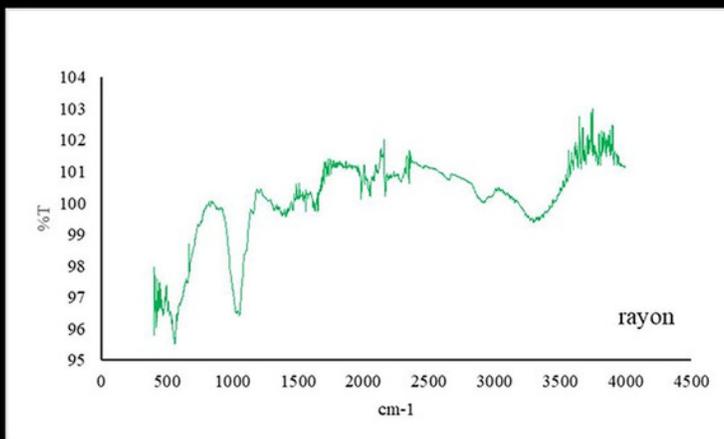
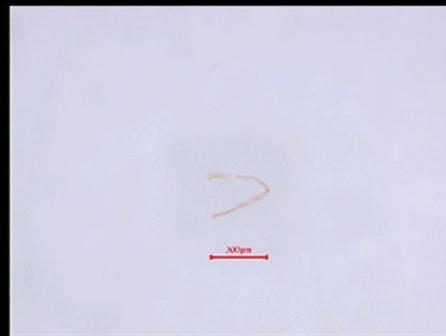
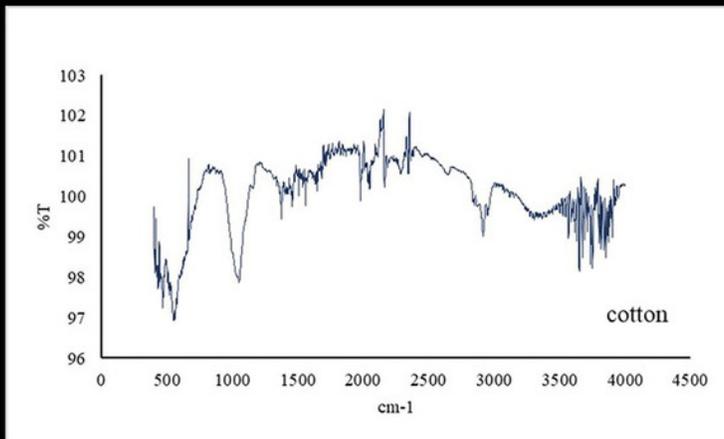



Figure 5

Polymer found in giant freshwater prawns.

Carapace length (cm), weight (g), length of abdomen (cm), and stomach (g) of giant
freshwater prawns.

1 **Table 1**.

2 **Carapace length (cm), weight (g), length of abdomen (cm), and stomach (g) in giant**

3 **freshwater prawns.**

Sex	Carapace length (cm)			Weight (g)			Length of abdomen (cm)			Stomach (g)		
	max	min	mean±SE	max	min	mean±SE	max	min	mean±SE	max	min	mean±SE
Female (n=30)	5.40	3.40	4.41±0.08	99.11	28.94	54.83±2.96	10.00	7.00	8.49±0.13	1.28	0.22	0.56±0.04
Male (n=30)	7.00	3.60	5.15±0.17	175.61	33.06	89.07±8.07	11.40	7.00	9.26±0.19	6.33	0.30	1.39±0.24

Anthropogenic debris abundance in giant freshwater prawns.

1 **Table 2**.

2 **Microplastic abundance in giant freshwater prawns.**

Sex	Body	Microplastics item	
		Total Microplastics	Average item /individual
Female	Stomach	146	4.87±0.72
	Intestine	52	1.73±0.36
Male	Stomach	91	3.03±0.58
	Intestine	81	2.70±0.57

Anthropogenic debris type and color in female and male in giant freshwater prawns.

<p>PeerJ</p>

1 **Table 3**.

2 **Microplastic type and color in female and male in giant freshwater prawns.**

Category of microplastics		*Macrobrachium rosenbergii*			
		Female		Male	
		Stomach	Intestine	Stomach	Intestine
Type (%)	Fiber	55.48	69.23	85.71	91.36
	Fragment	44.52	30.77	14.29	8.64
Color (%)	Black	37.67	16.00	27.18	44.44
	Blue	57.53	78.00	67.03	50.62
	Red	4.79	6.00	8.79	3.70
	Yellow	0.00	0.00	0.00	1.23

The relationship between the size of giant freshwater prawns and the amount of anthropogenic debris in the stomach (ST) and the intestines (IN).

1 **Table 4**.

2 **The relationship between size of giant freshwater prawns and the amount of anthropogenic**

3 **debris in stomach (ST) and the intestines(IN).**

		CL (cm)	AL (cm)	SW (g)	BW (g)	ST (items)	IN (items)
Macrobrachium rosenbergii (female)	CL (cm)	1	.805**	.385*	.840**	.292	-.176
	AL (cm)		1	.468**	.894**	-.062	-.122
	SW (g)			1	.321	.109	-.074
	BW (g)				1	.222	-.178
	ST (items)					1	.083
	IN (items)						1
Macrobrachium rosenbergii (male)	CL (cm)	1	.912**	.371*	.932**	.029	-.045
	AL (cm)		1	.352	.903**	.121	-.145
	SW (g)			1	.407*	.241	.495**
	BW (g)				1	.085	-.119
	ST (items)					1	.144
	IN (items)						1

Microplastic accumulation in shrimps form various studies.

1 **Table 5**.

2 **Microplastic accumulation in shrimps form various studies**

Shrimp	Location	Method	Abundance of microplastics	Color	Shape	Size	Polymer	References
Metapenaeus moyebi (n=17) *Macrobrachium rosenbergii* (n=17)	Khlong U-Taphao, Songkhla	H_2O_2 30%	14.76±1.98 items/individual 11.24±1.74 items/individual	blue, black, other	fiber, fragment	less than 100 µm larger than 1000 µm	rayon, polyester, PET, PP, Poly (Ethylene:Propylene)	*Jitkaew et al., 2023*
Litopenaeus vannamei (n=150) *Macrobrachium rosenbergii* (n=300)	Thailand	HCO_2K 99%	11.00±4.60 items/individual 33.43±19.07 items/individual (male) 33.31±19.42 items/individual (female)	black, red, white, blue, yellow, green	fiber, fragment, film, spheres	500-1000 µm	PE, polycaprolactone, polyvinyl alcohol, acrylonitrile butadiene styrene	*Reunura & Prommi 2022*
Parapenaeopsis hardwickii (n=18) *Metapenaeus brevicornis* (n=18)	Songkhla Lake, Southern Thailand	KOH 10%	4.11±1.12 pieces/stomach 3.78±0.48 pieces/stomach	black, red blue, white	fiber	500-1500 µm 500-5000 µm	rayon, polyester, polyvinyl alcohol, PE, paint	*Pradit et al., 2021*
Metapenaeus elegans (n=20) *Fenneropenaeus indicus* (n=20)	Songkhla Province, Southern Thailand	KOH 10%	3.70±1.12 number of MPs/individual 3.45±0.04n/individual	black, red blue, gray, transparent	fiber	150-3800 µm	PE	*Goh et al., 2021*
Metapenaeus monoceros (n=60) *Parapeneopsis stylifera* (n= 50) *Penaeus indicus* (n=70)	North Eastern Arabian sea	HNO_3 69%	7.23±2.63 items/individual 78.48±48.37 MPs/gram of the gut material 5.36±2.81 items/individual 64.79±24.58 MPs/gram of the gut material 7.40±2.60 items/individual 47.5±38.0 MPs/gram of the gut material	blue, translucent, black, red	fiber, fragment, pellet, film, beads	< 100 µm, -greater than 1000 µm	PE, PP, PA, nylon, PES, PET	*Gurjar et al., 2021*
P. monodon/ gastrointestinal tract (n=50) *M. monocerous/ gastrointestinal tract* (n=100)	Northern Bay of Bengal	H_2O_2 30%	6.60±2.00 pieces/gram 7.80±2.00 pieces/gram	blue, black, transparent, green, red blue, black, transparent, green	fiber, fragment	250-5000 µm < 250-5000 µm	rayon, polyamide	*Hossain et al., 2020*
Fenneropenaeu	coastal	KOH	0.39±0.60	red, blue,	fiber,	157-2785	polyamide,	*Daniel et al.,*

Shrimp	Location	Method	Abundance of microplastics	Color	Shape	Size	Polymer	References
s indicus (n=330)	waters off Cochin, Kerala, India	10%	microplastics/gram	black, transparent, green	fragment	μm	polyester, polyethene, PP	*2020*
Paratya australiensis (n=100)	Victoria, Australia	NaOH	0.52±0.55 pieces/individual	black, red gray, white blue, green, transparent, yellow	fiber, fragment, film, pellet	36-4668 μm	rayon, polyester, polymide	*Nan et al., 2020*
Crangon crangon (n=165)	North sea	HNO3: HClO4 4:1	1.23±0.99 items/individual	transparent, translucent, orange, yellow-greenish, purple-blue, pink	fiber	200-1000 μm	-	*Devriese et al., 2015*
Macrobrachium rosenbergii (n=60)	Thailand	KOH 10%	female; stomach 4.87±0.72 MPs/individual intestine 1.73±0.36 MPs/individual male; stomach 3.03±0.58 MPs/individual intestine 2.70±0.57 MPs/individual	black, red, blue, yellow	fiber, fragment		cotton, rayon, PVC	*This study*