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Identification of Types and Analysis of Microplastic Content in Fresh Shrimp Marketed in Dumai City

Identifikasi Jenis dan Analisis Kandungan Mikroplastik pada Udang Segar yang Dipasarkan di Kota Dumai

Irene Dwi Rani Br Lingga[1*], Bintal Amin[1], Efriyeldi[1]
[1]Department of Marine Science, Faculty of Fisheries and Marine, Universitas Riau, Pekanbaru 28293 Indonesia
**email: irene.dwi4437@student.unri.ac.id*

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Abstract

Microplastics are plastic particles smaller than 5 mm that are difficult to remove from the ocean. This study aimed to identify the types and levels of microplastics found in vannamei (*Litopenaeus vannamei*) and white shrimp (*Penaeus merguiensis*) marketed in Dumai City, conducted from September to November 2025. The method used was a survey, and the research locations were determined using purposive sampling. Vannamei shrimp samples were collected from Bundaran Market, and white shrimp from Dumai City Fish Landing Site (TPI), and analyzed at the Marine Chemistry Sciences of the Department of Marine Sciences, Faculty of Fisheries and Marine Sciences, Universitas Riau. The results of this study indicate that three types of microplastics were present in both shrimp species: fibres, fragments, and films. Statistical analysis further revealed that the microplastic content in both shrimp species across different sizes did not differ significantly ($p > 0.05$). There were no significant differences in microplastic content between vanamei and white shrimp ($p > 0.05$). The results of linear regression analysis between microplastic content and shrimp morphometric measurements revealed a weak relationship.

Keywords: Microplastics, Content, *Litopenaeus vannamei*, *Penaeus merguiensis*

Abstrak

Mikroplastik adalah partikel palistik yang lebih kecil dari 5 mm yang sulit dikeluarkan dari lautan. Penelitian ini bertujuan untuk mengidentifikasi jenis dan kadar mikroplastik yang terdapat pada vaname (*Litopenaeus vannamei*) dan udang putih (*Penaeus merguiensis*) yang dipasarkan di Kota Dumai, yang dilakukan pada bulan September hingga November 2025. Metode yang digunakan adalah survei, dan lokasi penelitian ditentukan menggunakan purposive sampling. Sampel udang vaname dikumpulkan dari Pasar Bundaran dan udang putih dari Tempat Pendaratan Ikan (TPI) Kota Dumai, dan dianalisis di Ilmu Kimia Kelautan Departemen Ilmu Kelautan Fakultas Perikanan dan Ilmu Kelautan Universitas Riau. Hasil penelitian ini menunjukkan bahwa ada tiga jenis mikroplastik pada kedua spesies udang: serat, fragmen, dan film. Analisis statistik lebih lanjut mengungkapkan bahwa kandungan mikroplastik pada kedua spesies udang dengan ukuran yang berbeda tidak menunjukkan perbedaan yang signifikan ($p > 0,05$). Tidak ada perbedaan yang signifikan dalam kandungan mikroplastik antara udang vanamei dan udang putih ($p > 0,05$). Hasil analisis regresi linier antara kandungan mikroplastik dan pengukuran morfometri udang mengungkapkan hubungan yang lemah.

Kata kunci: Mikroplastik, Konten, *Litopenaeus vannamei*, *Penaeus merguiensis*

1. Introduction

The city of Dumai is located on the coast, with its northern side facing the Malacca Strait, which has driven the city's growth. This growth has encompassed port and maritime transport activities, fisheries, raw material industries, and oil processing. This can contribute to pollution in aquatic environments; one of the pressures affecting water pollution in Dumai is marine debris (Mirad et al., 2020). The influx of marine debris significantly affects water quality and the organisms living within it. Among various pollutants, plastic waste is one of the primary threats (Amin et al., 2023). Plastic waste enters water and breaks down into microplastics.

Microplastics are plastic particles smaller than 5 mm that originate from various sources, including the degradation of larger plastic products (secondary microplastics) and primary microplastics derived from the production of small-sized plastics, such as industrial waste and cosmetic manufacturing. Secondary microplastics, such as films, fragments, and fibers, are the most common types of pollution in the ocean. Microplastics are particularly problematic in the marine environment because plastic is an extremely durable material that resists natural degradation (Amin et al., 2023).

Microplastics dispersed in the ocean tend to settle on the seabed or be transported by ocean currents. The widespread distribution of microplastics, along with their size and color resembling zooplankton and phytoplankton, means they are likely to be ingested and accumulated by various marine organisms (Aulia et al., 2023). The smaller the microplastics, the greater the likelihood of their ingestion by marine organisms (Amin et al., 2021). Two organisms that have the potential to accumulate microplastics through their diet are the vannamei shrimp (*Litopenaeus vannamei*) and the white shrimp *(Penaeus merguiensis*).

Vanamei shrimp are a high-value commodity widely farmed, known for their high productivity and consumer popularity. Microplastics in aquaculture can originate from seawater used in the system, nets, fishing gear, rearing tanks, water pipes, and even commercial feed (Wicaksono, 2022). As filter feeders and deposit feeders, vanamei shrimp have a high potential to accumulate microplastics in their bodies. This feeding behavior increases the likelihood that vanamei shrimp will ingest microplastic particles dispersed in sediments and the water column. White shrimp is a popular fishery commodity rich in protein, carbohydrates, fat, water, and minerals (Selvia et al., 2019). This species is an economically important crustacean widely found in Indo-Pacific waters, including Indonesia, and serves as a major export commodity for the Indonesian fisheries sector. White shrimp are susceptible to microplastic contamination, which can occur through direct exposure to seawater, consumption of contaminated food, or exposure via the gills during respiration.

Vanamei shrimp and white shrimp containing microplastics are likely to have adverse effects on humans who consume them. According to Aulia (2023), microplastic pollutants can cause immune system disorders, neurotoxicity, reproductive disorders, liver and kidney dysfunction, anemia, and an increased risk of cancer in humans. Both types of shrimp are highly popular among the residents of Dumai City and are widely sold. Therefore, information regarding the microplastic content in vanamei and white shrimp sold in Dumai City, Riau Province, needs to be investigated. In addition to providing information on microplastic contamination, this study also aims to assess the safety of seafood consumption, particularly for residents of Dumai City.

2. Material and Method

2.1. Time and Place

This study was conducted from September to November 2025. Shrimp samples were collected from the Dumai City Fish Landing Site (TPI) and the Bundaran Market in Dumai Timur Subdistrict, Dumai City, Riau Province. Analysis of the types and levels of microplastics was conducted at the Marine Chemistry Laboratory, Department of Marine Sciences, Faculty of Fisheries and Marine Sciences, Universitas Riau.

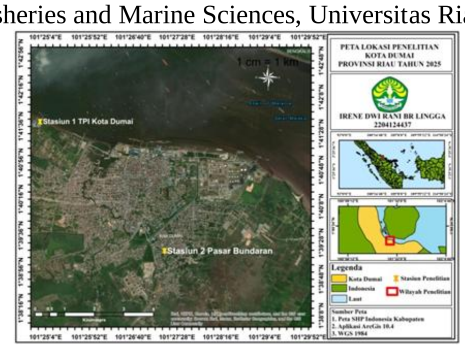

Figure 1. Map of research stations

2.2. Methods

The research locations were determined using purposive sampling, which involves establishing specific criteria for each location. A total of 25 vanamei shrimp samples of varying sizes were collected from the Bundaran

Market. Meanwhile, 25 white shrimp samples of varying sizes were collected from the Dumai City Fish Landing Site (TPI) and transported to the laboratory for further analysis.

2.3. Procedures

The shrimp samples were cleaned in the laboratory using running water and then measured, with lengths found to range from 3 to 15 cm. Five specimens were collected for the small-sized group (3-7cm), five for the medium-sized group (8-11cm), and five for the large-sized group of each shrimp species (12-15cm). Subsequently, their morphology, specifically length, was measured, and their weight was determined using an analytical balance. There are three stages in analyzing microplastics in shrimp, as outlined by the National Oceanic and Atmospheric Administration (NOAA, 2015): sample preparation, sample dissolution, and microscope observation.

After the samples were measured and weighed, the digestive tract was separated from the shrimp meat. The digestive tract was weighed again using an analytical balance. It is then placed in a sample bottle, and 10% KOH solution is added until the sample is submerged to remove organic matter from the shrimp's body, and the sample is left to incubate for 2 weeks at room temperature (20-25 $^{\circ}$C). The sample is then filtered using a vacuum pump with Whatman No. 42 filter paper and examined using an Olympus CX23 microscope. The types of microplastic particles found were identified, and their numbers recorded. Microplastic abundance was then calculated using a formula based on the study by Boerger et al. (2015):

$$K = \frac{\sum Ni}{N}$$

Notes : K : Microplastic content (particle/ind); $\sum$Ni : Number of microplastic particles found (particle); N: Number of shrimp (ind)

3. Result and Discussion

3.1. Types of Microplastic

Based on the observation results, three types of microplastics were found in Vaname shrimp sourced from the Bundaran Market in Dumai City: fiber (the dominant type), fragments, and film (Figure 2). Similarly, white shrimp sourced from the Dumai City Fish Landing Site (TPI) also contained three types of microplastics: fiber (the most abundant type), fragments, and film (the least abundant) (Figure 3).

(a) (b) (c)

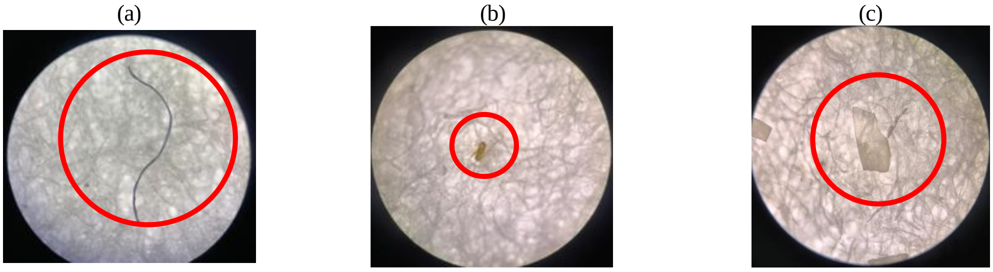

Figure 2. Types of microplastics found in vaname shrimp
Description: (a) Fiber, (b) Fragment, (c) Film

(a) (b) (c)

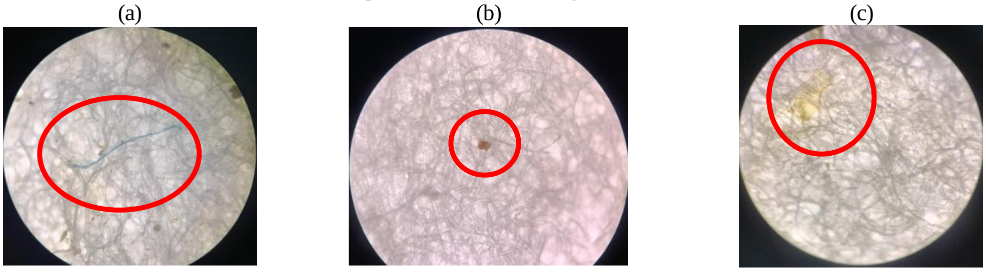

Figure 3. Types of microplastics found in white shrimp
Description: (a) Fiber, (b) Fragment, (c) Film

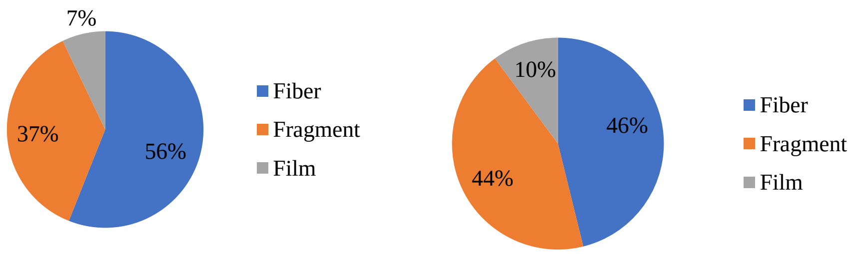

Figure 4. Percentage composition of microplastic types
Notes: (a) Vaname, (b) White Shrimp

Based on the observation results, three types of microplastics were found in Vaname shrimp sourced from the Bundaran Market in Dumai City: fiber (the dominant type), fragments, and film (Figure 2). Similarly, white shrimp sourced from the Dumai City Fish Landing Site (TPI) also contained three types of microplastics: fiber (the most abundant type), fragments, and film (the least abundant) (Figure 3). The results of the microplastic type identification in Vaname shrimp showed that the fiber type had the highest content at 56%, followed by the fragment type at 37%, and the film type at 7%. In white shrimp, the most abundant microplastic type was fiber at 46%, followed by fragments at 44%, and film at 10% (Figure 4).

The high levels of fiber-type microplastics in both shrimp species generally originate from fishing activities, specifically the use of fishing nets, fishing gear, and ship mooring lines that enter the water. This type of microplastic can also originate from domestic waste, such as synthetic fabric and laundry detergent residues. Household waste enters the ocean via river flows. UNEP (2015) states that fibre-type microplastics originate from fishing nets, fishing gear, and synthetic-fabric clothing. Fiber-type microplastics have a form resembling very thin fibers that tend to float in the water column and on the water's surface.

The most common type of microplastic after fibers is the fragment type. This type of microplastic originates from plastic bags, ready-to-eat food packaging, and plastic beverage bottles. According to Faustina et al. (2024), fragment-type microplastics result from the fragmentation of larger pieces of waste caused by currents, UV radiation, and the plastic's own oxidative properties. Another type found in both shrimp species is film. These microplastics originate from single-use plastic bags and food and beverage packaging made of thin, flexible, low-density plastic. The low prevalence of film-type microplastics is likely due to their easier degradation and smaller size, which makes them difficult to detect visually during identification.

3.2. Microplastic Content by Shrimp Type and Size

The types of microplastics found in vanamei shrimp of different sizes showed that fiber-type microplastics were the most prevalent, with an average of 15.2 particles/ind. The least prevalent type was film, with an average of 1.93 particles/ind. The highest microplastic content across the three different sizes was found in large vanamei shrimp, with an average of 30.6 particles/ind. In contrast, the lowest microplastic content was found in small shrimp, with an average of 24.8 particles/ind (Table 1).

Table 1. Types and microplastic content in vaname shrimp based on size

Shrimp Size	Microplastic Content (Particles/ind ± Std. Deviation)			Total (Particles/ind ± Std. Deviation)
	Fiber	Fragments	Film	
Small	11.4±4.77	11.6±7.02	1.8±2.48	24.8±12.3
Medium	14.2 ± 8.78	9.6±2.30	2.4 ± 3.36	26.2±10.7
Large	20 ± 8.63	9 ± 5.24	1.6 ± 2.07	30.6 ± 8.67
Average	15.2±7.97	10 ± 4.97	1.93 ± 2.52	27.2 ± 10.2

Table 2. Types and content of microplastics in white shrimp based on size

Shrimp Size	Microplastic Content (Particles/ind ± Std. Deviation)			Total (Particles/ind ± Std. Deviation)
	Fiber	Fragments	Film	
Small	12.8±7.29	8.4±4.56	2.2±2.48	23.4±7.89
Medium	15.4 ± 8.17	11.8 ± 4.49	3.4 ± 0.89	30.6±12.4
Large	11.4±4.33	17.4 ± 8.08	3.2 ± 3.11	32 ± 11.7
Average	13.2 ± 6.52	12.5 ± 6.71	2.9 ± 2.25	28.6±10.7

The high content of fiber-type microplastics in the digestive tract of vanamei shrimp is attributed to the water used in the ponds, which originates from waters in Dumai City contaminated by waste from fishing, household, and tourism activities (Mirad et al., 2020). The location of the ponds near residential areas also leads to laundry wastewater entering the water. The microplastic fragments in vanamei shrimp originate from plastic pieces used as pond liners and plastic film, as well as from plastic bag waste around the ponds, which the shrimp can ingest. The results of the One-Way ANOVA test yielded a p-value (0.679) > 0.05. Fiber-type microplastics in white shrimp had the highest average concentration, with an average of 13.2 particles/individual. In contrast, film-type microplastics had the lowest concentration found, with an average of 2.9 particles/individual. Microplastic content across three sizes showed that large white shrimp had the highest content, averaging 32 particles/ind. In contrast, the lowest content was found in small shrimp with an average of 23.4 particles/ind (Table 2).

The high microplastic content in white shrimp stems from high human activity in coastal areas and an inadequate waste disposal system, leading to microplastic contamination in the shrimp (Dewi et al., 2015). High levels of fiber-type microplastics originate from fishing gear waste such as nets, traps, and fishing lines used by fishermen, as well as household waste specifically the washing of synthetic fabrics which can cause synthetic fibers to enter the water. The long distribution route from the shrimp's habitat to where the shrimp are marketed, coupled with unhygienic handling, is also a contributing factor to the high levels of microplastic contamination in shrimp. The results of the One-Way ANOVA test indicate that the p-value (0.431) is> 0.05. This value indicates that there is no significant difference in microplastic levels among white shrimp of different sizes.

3.3. Differences in Microplastic Content between Vaname and White Shrimp

The highest microplastic content was found in white shrimp with a value of 28.6 particles/ind, and the lowest microplastic content was found in vanamei shrimp with a value of 27.2 particles/ind (Table 3).

Table 3. Microplastic content in vanamei and white shrimp

Shrimp Species	Microplastic Content (Particles/ind ± Std. Deviation)			Total (Particles/ind ± Std. Deviation)
	Fiber	Fragments	Film	
Vaname Shrimp	15.2±7.97	10±4.97	1.93±2.52	27.2±10.2
White Shrimp	13.2±6.52	12.5±6.71	2.9 ± 2.25	28.6±10.7

The results of the independent-samples t-test showed no significant difference in microplastic content between vanamei and white shrimp. The significance value of 0.951 ($p > 0.05$) indicates that there is no significant difference in microplastic accumulation between the two shrimp species. This lack of difference may be since the water source used in the ponds as habitat for vanamei shrimp originates from the same waters as those used for white shrimp.

3.4. Relationship between Microplastic Content and Body Length and Weight in Vaname and White Shrimp

The average body length of vanamei shrimp was 11.9 cm, with the shortest being 9 cm and the longest 14.9 cm; the average body weight was 8.9 g, with the lightest being 4.26 g and the heaviest 12.75 g. The results of the linear regression analysis between microplastic content and the body length and weight of vanamei shrimp showed a positive relationship with a correlation coefficient of $r = 0.341$ and a coefficient of determination $R^2= 0.116$, with the regression equation $y = 2.073 + 3.370x$ for the relationship between microplastic content and body length (Figure 5), and a positive relationship with a correlation coefficient of $r = 0.260$ and a coefficient of determination $R^2= 0.067$, with the regression equation $y = 1.023 + 18.022x$ for the relationship between microplastic content and body weight, indicating that the length and weight of the shrimp does not influence microplastic content (Figure 6).

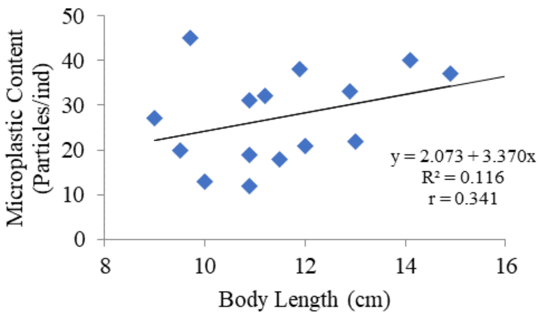

Figure 5. The relationship between microplastic content in vaname shrimp and body length

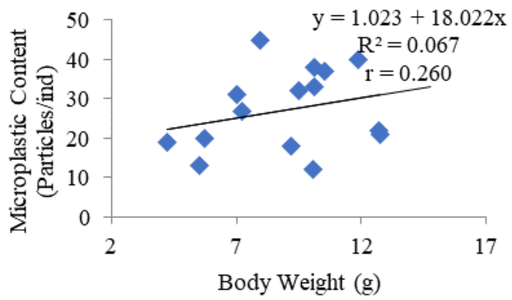

Figure 6. The relationship between microplastic content in vaname shrimp and body weight

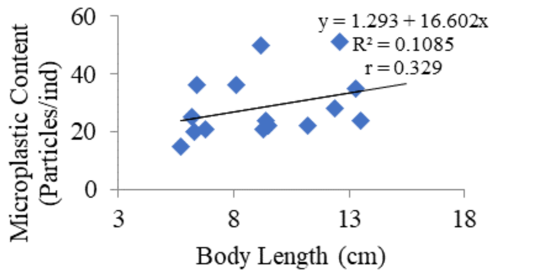

Figure 7. The relationship between microplastic content in white shrimp and body length

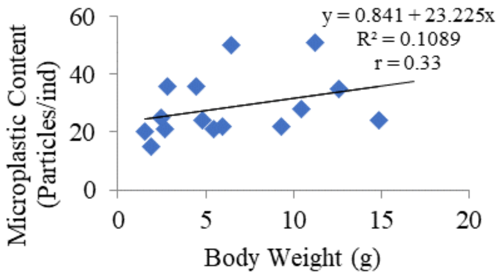

Figure 8. The relationship between microplastic content in white shrimp and body weight

The average body length of white shrimp was 9.3 cm, with the shortest body length being 5.7 cm and the longest 13.5 cm, and the average body weight was 6.46 g, with the smallest body weight being 1.57 g and the largest 14.82 g. The results of the linear regression test between microplastic content and the body length and weight of white shrimp showed a positive correlation with a correlation coefficient (r) of 0.329 and a coefficient of determination $^{R^2}$of 0.1085, with the regression equation $y = 1.293 + 16.602x$ for the relationship between microplastic content and body length, and a correlation coefficient (r) of 0.33 and a coefficient of determination ($R^2= 0.1089$ with the regression equation $y = 0.841 + 23.225x$ for the relationship between microplastic content and body weight of white shrimp, indicating that the shrimp's morphometric measurements do not influence microplastic content (Figure 7).

The results of the linear regression analysis between microplastic content and white shrimp body weight are shown in Figure 8. According to Foekema et al. (2013), the size of marine organisms does not show a clear relationship with microplastic particles; nearly every sample examined contained a variety of microplastic particles. Microplastics that are too small are not thought to provide a sense of fullness to marine organisms, which could cause blockages in the digestive tract, particularly in the intestines. Therefore, it is likely that microplastics do not affect the observed marine organisms. This aligns with research by Nan et al. (2020), which found no significant correlation between the total length and weight of shrimp and their microplastic content. The differing behaviors and habitats of each shrimp species contribute to the diversity of microplastics found within their bodies.

4. Conclusions

The types of microplastics found in vanamei and white shrimp sold in Dumai City include fibers, fragments, and films. In both shrimp species, the highest microplastic content was found in large shrimp, while the lowest microplastic content was found in small shrimp. The microplastic content in vanamei shrimp and white shrimp of three different sizes showed no significant differences ($p > 0.05$). The microplastic content between vanamei shrimp and did not show a significant difference ($p > 0.05$). Furthermore, there was no significant relationship between length, weight, and microplastic content in vanamei and white shrimp.

5. References

[UNEP] United Nations Environment Programme. (2015). *Plastic in cosmetics: Are we polluting the environment through our personal care, plastic ingredients that contribute to marine microplastic litter*. Universitas Brawijaya, Malang.

Amin, B., Nedi, S., Nurrachmi, I., & Nurdiansyah, N. (2023). Abundance, distribution and correlation of microplastics in Tuapejat Coastal Water, Mentawai Islands, Indonesia. *BIO Web of Conferences*, *74*.

Amin, B., Rukim, M., & Nurrachmi, I. (2021). Presence of microplastics in sea cucumber *Paracaudina* sp from Karimun Island, Kepulauan Riau, Indonesia. *IOP Conference Series: Earth and Environmental Science*, 934(1).

Aulia, A., Azizah, R., Sulistyorini, L., & Rizaldi, M.A. (2023). Literature review: Dampak mikroplastik terhadap lingkungan pesisir, biota laut dan potensi risiko kesehatan. *Jurnal Kesehatan Lingkungan Indonesia*, 22(3): 328–341.

Boerger, T., Pietro, B., Peda, C., Consoli, P., Andaloro, F., & Fossi, M.C. (2015). First evidence of presence of plastic debris in stomach of large pelagic fish in the Mediterranean Sea. *Marine Pollution Bulletin*, 10(10): 8-16.

Dewi, I.S., Budiarsa, A.A., & Ritonga, I.R. (2015). Distribution of microplastic at sediment in the Muara Badak Subdistrict, Kutai Kartanegara Regency. *Depik*, 4(3): 121-131.

Faustina, A.M., Nauli, L., Toruan, L., Tallo, I., & Saraswati, A.S. (2024). Jenis-jenis mikroplastik pada sedimen sungai di Kota Kupang. *Jurnal Bahari Papadak*, 5(2): 62–73.

Foekema, E.M., De Gruijter, C., Mergia, M.T., Van Franeker, J.A., Murk, A.J., & Koelmans, A.A. (2013). Plastic in North Sea Fish. *Environmental Science & Technology*, 47(15): 8818-8824.

Mirad, A., Yoswaty, D., & Thamrin. (2020). Identification microplastic waste in seawater and the digestive organs of Senangin Fish (*E. tetradactylum*) at Dumai City Sea Waters. *Asian Journal of Aquatic Sciences*, 3(3): 248–259.

Nan, B., Su, L., Kellar, C., Craig, N.J., Keough, M.J., & Pettigrove, V. (2020). Identification of microplastics in surface water and Australian Freshwater Shrimp *Paratya australiensis* in Victoria, Australia. *Environmental Pollution*, 259: 113865.

NOAA. (2015). Laboratory methods for the analysis of microplastics in the marine environment: Recommendations for quantifying synthetic particles in waters and sediments. NOAA.

Selvia, I.D., Lestari, F., & Susiana, S. (2019). Kajian stok udang putih (*Penaeus merguiensis*) di Perairan Senggarang Kota Tanjungpinang. *Jurnal Akuatiklestari*, 2(2): 20–30.

Wicaksono, E.A. (2022). Threats of microplastic pollution on aquaculture activities in Indonesia. *Torani Journal of Fisheries and Marine Science*, 5(6): 77–91