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SHORT COMMUNICATION

Endoparasite worms infestation on Skipjack tuna *Katsuwonus pelamis* from Sibolga waters, Indonesia

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ABSTRACT

Skipjack tuna *Katsuwonus pelamis* is one of the commercial species of fishes in Indonesia frequently caught by fishermen in Sibolga waters, North Sumatra Province. There is, however, presently no study conducted on the endoparasites infestation in these fishes. Therefore, the objectives of the present study were to identify endoparasitic worms and examine the intensity level in skipjack tuna *K. pelamis* from Sibolga waters. Sampling was conducted in Debora Private Fishing Port, Sibolga from 4th to 18th June 2019 and a total of 20 fish samples with weight ranged between 740 g and 1.200 g and length from 37.2 cm to 41.4 cm were analyzed in the study. The identification of the worm was conducted in the laboratory using a stereo microscope. The results showed seven species or genera of worms were found in the intestine and stomach of the fish with varying level of intensity and incidence. For example, *Echinorhynchus* sp. was found with 100% intestinal and 10% stomach incidences at a total intensity of 8.5; *Acanthocephalus* sp. with 25% intestinal incidence and 1.6 intensity, *Rhadinorhynchus* sp. with 25% intestinal and 5% stomach incidences, and 1.5 intensity; *Leptorhynchoides* sp. with 25% intestinal incidences, and 1 intensity; *Neoechinorhynchus* sp. with 25% intestinal incidences, and 1.4 intensity; *Pomphorhynchus* sp. with 10% intestinal incidence, and 1.5 intensity; and *Apororhynchus* sp. with 10% intestinal incidences and 1 intensity. *Echinorhynchus* sp. was concluded to have the highest incidence and intensity.

Keywords: Endo-parasites, *Echinorhynchus* sp., Prevalence, Intensity, Commercial marine fish

INTRODUCTION

Skipjack tuna *Katsuwonus pelamis* is one of the commercial pelagic fishes in Indonesian waters and widely distributed in the Indian Ocean, Banda Sea, Java Sea, Bali, and Flores Sea (Firdaus, 2018; Uktolseja, 1989). This species is one of the main targets for fishing by local fishers of Sibolga in North Sumatra, Indonesia, and therefore, and has experienced intensive exploitation (Pulungan and Fadhilah, 2018). Several studies have been reported by several researchers, for example, Azwir *et al.* (2004) studied the feeding habit of *K. pelamis* from Aceh waters, and Skipjack tuna was found to be carnivorous feeding on anchovy and shrimp. Moreover, studies on the parasitic infestation in the Oman Sea and Batangas Sea have been reported by Sattari *et al.* (2014) and Briones *et al.* (2015), respectively. Besides, Amin *et al.* (2019) also reported on worm infestation in the Pacific Coast of Vietnam. However, the study on the infection of the parasite on skipjack tuna in Indonesia waters is very limited with only three reports by Sabariah *et al.* (2018), and Yani and Susianti (2017), and Diba and Rahmad (2018) on the endo-parasitic worms' infection from Manokwari waters and Makassar Strait available.

It has been discovered that parasites are commonly transmitted from foods, especially those not processed adequately. One of the possible transmitters is fish due to its susceptibility, especially

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from unhealthy waters (Muchlisin *et al*., 2014; Muchlisin *et al*., 2015; Muchlisin *et al*., 2018). Apart from the detrimental effect of these parasites to human, their presence can cause an unexpected impact on fish populations leading to huge losses to the fisheries and aquaculture industries (Palm *et al*., 2008; Taufik *et al*., 2014). According to Hidayati *et al*. (2016), the presence may also reduce consumption, diminish quality in aquaculture, decrease ingestion of fish body weight, and consumer rejection due to abnormal morphology or body shape. However, Rahayu (1986) stated that diseases are caused by several factors such as environmental changes, genetic or the presence of microorganisms and parasites. Hence, the objectives of this research were to identify endo-parasitic worms and examine their intensity level in skipjack tuna K. *pelamis*.

MATERIALS AND METHODS

Site and Time

This research was conducted in 4th to 18th June 2019 with samples collected from Debora Fishing Port, Sibolga, Indonesia. Endoparasite worms were identified in the Aquatic Environmental Laboratory, Major of Aquatic Resource Management, University of North Sumatera, Medan, Indonesia.

Tools and Materials

The main equipment used includes a surgical instrument, cool box (Marina Cooler 18S), ruler 30 cm, manual scale, sample bottles (100 ml), Petri dishes (100 mm x 15 mm), object glass (25.4 x 76.2 mm), cover glass (22 x 22 mm), microscope (Olympus CX22), drop pipette, paper labels, Erlenmeyer (500 ml), measuring glass (500 ml), and stationaries. Moreover, the primary material used was skipjack tuna (K. *pelamis*) with bodyweight ranged between 740–1,200 g and total length between 37.2–41.4 cm while the other materials include neutral buffered formalin to preserve the samples, distillates water, alcohol at 70%, 80%, and 95%, acidic alcohol (alcohol 70% + HCL), alkaline alcohol (alcohol 70% + NaHCO3), aceto-carmine solvent, xylol, and entellan.

Research Procedure

A total of 20 fish samples were randomly purchased from local fishers in Debora Fishing Port based on length. They were measured for total length (cm) and total body weight (g) and later dissected. The digestive tract including intestine and stomach were removed and placed in the sample bottle, fixed with neutral buffered formalin. The samples were further stored in an icebox (Marina Cooler 18S) at 4oC and transported to the laboratory for further analysis.

In the laboratory, the intestine and stomach were opened using a scissor, and their contents placed in a glass plate. The worms found were stained with a carmine solution and dehydrated with multilevel alcohol and the worm-resistant preparation was identified by observing the head to the tail using a stereomicroscope (Olympus CX22).

Data Analysis

The data obtained on parasite species, prevalence and intensity were analyzed descriptively. The prevalence (incidence) was calculated using the formula according to Bush *et al.* (1997):

$$\text{Prevalence} = \frac{\sum \text{Fish infected}}{\sum \text{Fish examined}} \times 100$$

and the intensity calculated using the formula according to Caspers (1962):

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$$\text{Intensity} = \frac{\sum \text{Parasite Found}}{\sum \text{Fish infected}}$$

While the respective levels were calculated based on William and William (1996) as presented in Tables 1 and Table 2.

Table 1. Category of incidence of endo-parasitic worms (Williams and Williams, 1996)

Infection Category	Range of Values (%)
Almost never	<0.01
Very rarely	<0.1–0.01
Rarely	<1–0.1
Occasionally	1–9
Often	10–29
Commonly	30–49
Frequently	50–60
Usually	70–89
Almost always	90–98
Always	99–100

Table 2. Intensity parasite category (Williams and Williams, 1996)

Intensity (ind/sample)	Information
<1	Very low
1–5	Low
6–55	Medium
56–100	Severe
>100	Very severe
>1,000	Super infection

RESULTS

The results indicated all fish samples were infected by five families of endoparasitic worms belonging to seven genera including *Echinorhynchus* sp., *Acanthocephalus* sp., *Pomphorhynchus* sp., *Leptorhynchoides* sp., *Rhadinorhynchus* sp., *Neoechinorhynchus* sp., and *Apororhynchus* sp. as shown in Figures 1 to 7. Moreover, *Echinorhynchus* was found to be predominant with 168 individuals followed by *Rhadinorhynchus* and *Acanthocephalus* with 9 and 8 individuals, respectively as shown in Table 3. Highest intensity was also recorded for *Echinorhynchus* at an average of 8.4 individual/fish sample, and the lowest observed in *Leptorhynchoides* and *Apororhynchus* as shown in Table 4. All species of the worms were found in the intestine with only two, *Echinorhynchus* sp. and *Rhadinorhynchus* sp., infested the stomach, and no infection was found in the kidney.

The study also showed *Echinorhynchus* sp. has the highest incidence rate with 100% in the intestine and 10% in the stomach followed by *Rhadinorhynchus* sp. with 25% and 5%, respectively. Based on intensity, *Rhadinorhynchus* sp., *Acanthocephalus* sp., *Leptorhynchoides* sp., *Neoechinorhynchus* sp., *Pomphorhynchus* sp., and *Apororhynchus* sp. were categorized at low-level while *Echinorhynchus* sp. was

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in the medium category. Moreover, with respect to infection, *Echinorhynchus* sp. was always found in the intestine, but often found in the stomach.

Table 3. Identification of endoparasitic worms found in the skipjack tuna

Class	Order	Family	Genus	Total individual
Palaecanthocephala	Echinorhynchida	Echinorhynchidae	*Echinorhynchus*	168
			Acanthocephalus	8
		Pomphorhynchidae	*Pomphorhynchus*	3
		Rhadinorhynchidae	*Leptorhynchoides*	5
			Rhadinorhynchus	9
Eocanthocephala	Neoechinorhynchida	Neoechinorhynchidae	*Neoechinorynchus*	7
Archiacanthocephala	Apororhynchida	Apororhynchidae	*Apororhynchus*	2

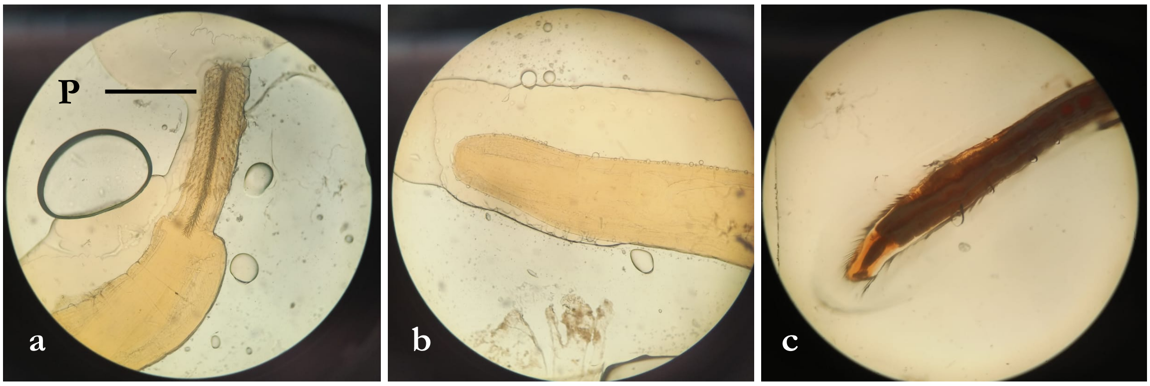

Figure 1. *Echinorhynchus* sp. (a. Anterior, b. Female Posterior, c. Male Posterior, P: Proboscis) 40x (c) and 100x magnification (a, b)

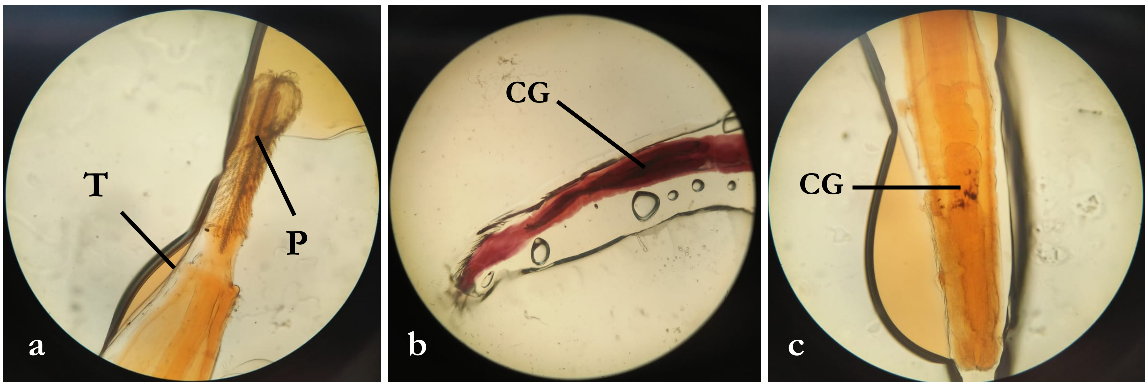

Figure 2. *Rhadinorhynchus* sp. (a. Anterior, b. Female Posterior, c. Male Posterior, P: Proboscis, CG: Cement Gland, T: Thorn) 40x (b) and 100x magnification (a, c)

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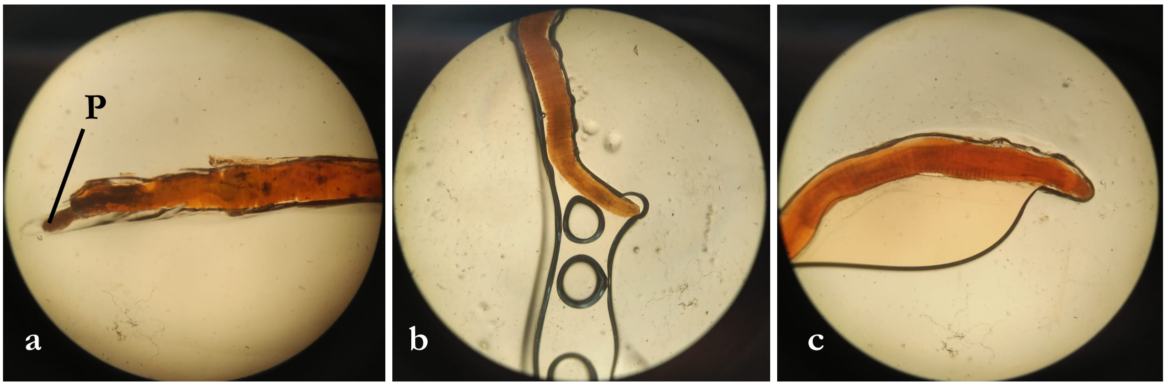

Figure 3. *Acanthocephalus* sp. (a. Anterior, b. Female Posterior, c. Male Posterior, P: Proboscis) 40x magnification

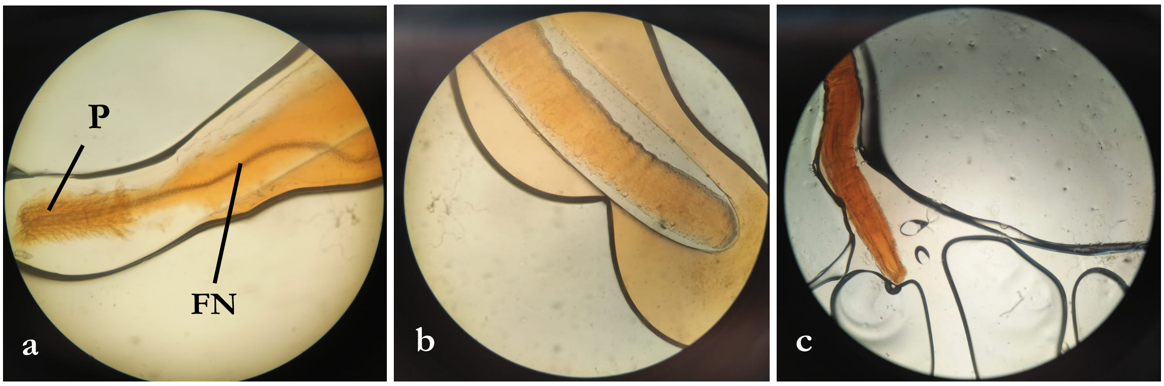

Figure 4. *Pomphorhynchus* sp. (a. Anterior, b. Female Posterior, c. Male Posterior, P: Proboscis, FN: False Neck) 40x (c) and 100x magnification (a, b)

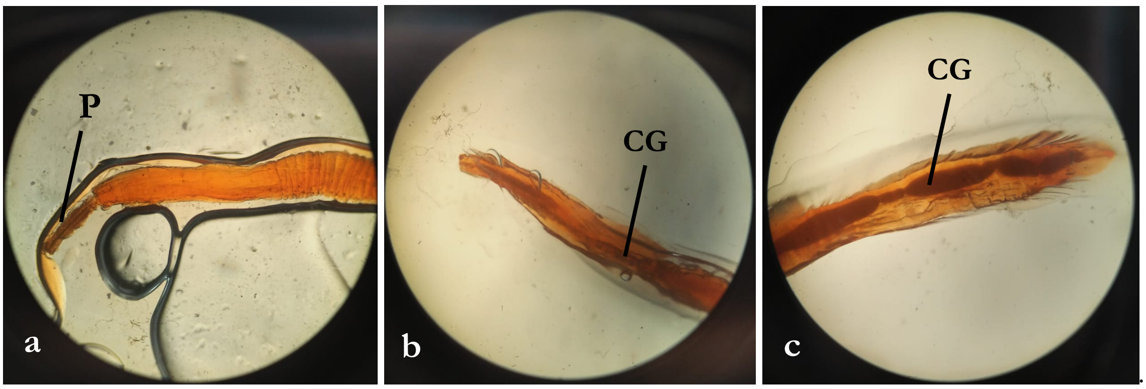

Figure 5. *Leptorhynchoides* sp. (a. Anterior, b. Female Posterior, c. Male Posterior, P: Proboscis, CG: Cement Gland) 40x magnification

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Figure 6. *Neoechinorhynchus* sp. (a. Anterior, b. Female Posterior, c. Male Posterior, P: Proboscis) 40x (b) and 100x magnification (a, c)

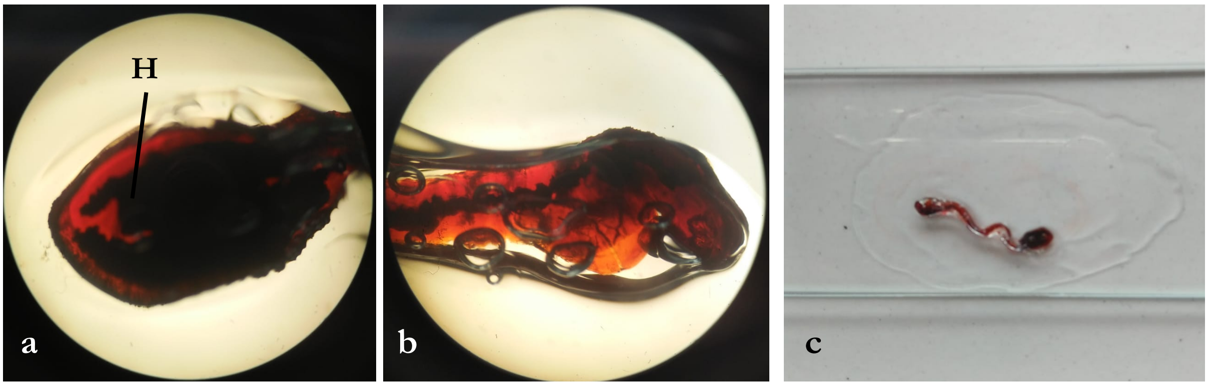

Figure 7. *Apororhynchus* sp. (a. Anterior, b. Posterior, c. A whole of the body, H: Head) 100x magnification (a, b)

Table 4. Intensity and prevalence of endoparasitic worms

Total of Fish Examined	Total of Fish Infected	Parasite found	Incidence (%)			Intensity (ind. of worm/ fish sample
			Intestine	Stomach	Kidney	
20	20	*Echinorhynchus* sp.	100	10	0	8.4
	5	*Acanthocephalus* sp.	25	0	0	1.6
	2	*Pomphorhynchus* sp.	10	0	0	1.5
	5	*Leptorhynchoides* sp.	25	0	0	1
	6	*Rhadinorhynchus* sp.	25	5	0	1.5
	5	*Neoechinorynchus* sp.	25	0	0	1.4
	2	*Apororhynchus* sp.	10	0	0	1

DISCUSSION

A total of seven species of parasitic worms were found during the analysis and they include *Echinorhynchus* sp., *Rhadinorhynchus* sp., *Acanthocephalus* sp., *Leptorhynchoides* sp., *Neoechinorhynchus* sp., *Pomphorhynchus* sp., and *Apororhynchus* sp. belonging to Acanthocephalans which is characterized by 'thorny' or 'spiny headed'. The *Echinorhynchus* sp. infected all the fish samples as found sticking on the inside wall of 20 intestines and the outer wall of 3 stomachs. The *Rhadinorhynchus* sp., *Acanthocephalus* sp., *Leptorhynchoides* sp., and *Neoechinorhynchus* sp., were found to have infected the intestines of five fishes and the *Rhadinorhynchus* sp. was also found in the stomach of one fish. Furthermore, *Pomphorhynchus* sp. and *Apororhynchus* sp. were discovered to have infected the intestine of two fish samples.

The presence of these Acanthocephalans in the gastrointestinal of fishes may be due to the intermediary hosts such as arthropods eaten by them. Skipjack tuna is carnivorous feeding on small fishes, shrimp, or marine arthropods (Azwir *et al.*, 2004). However, in general, the intensity of the worms is discovered to be low and safe for human if the fish is cooked properly.

It was also observed that the proboscis of *Echinorhynchus* sp. was attached to the inner wall of the intestine and outer wall of the stomach of the fish sample. This worm is characterized by a short cylindrical proboscis shape, and short neck (Arai, 1989). Contrastingly, the *Acanthocephalus* sp. has a long neck and swollen proboscis while *Pomphorhynchus* sp. has a very long proboscis and neck (> 1 mm) which is also known as pseudo neck (Arai, 1989). It attached to the inside of the intestinal wall. *Apororhynchus* sp. has an incidence rate of 10% classified under the frequently found category and it has a finer, bigger, and fuller head compared to other worms found in this study.

Rhadinorhynchus sp. has a small body, curved backward, rotating forward in two planes separated by a thornless zone but with a wider upper part and equipped with spines. Its proboscis is much longer and connected to the head near its center (Amin and Heckman, 2017; Amin *et al.*, 2019). This worm is somewhat similar to *Leptrhynchoides* sp but according to Arai (1989), it has thorny stems and two cement glands, while the *Leptrhynchoides* sp. has a thornless stem with eight cement glands. Moreover, *Neoechinorhynchus* sp. has a small proboscis, rounded shape (Briones et al., 2015), short body with three circles, each having six hooks (Arai, 1989). The infection level of *Rhadinorhynchus* sp., *Leptrhynchoides* sp., and *Neoechinorhynchus* sp., are categorized as "often found" in skipjack.

It was also discovered that Acanthocephala infection caused a severe effect on the host fish. Jithendran and Kannappan (2010) stated that fish heavily infected by Acanthocephalans may have their stomach perforated causing considerable severe damage and local inflammatory reaction. In the last decades, the attention of ecologists and environmental toxicology to this parasite has been increasing significantly due to its ability to accumulate heavy metals in higher concentrations. These are further transmitted into the definitive host like skipjack causing harm to human that consumed the infected fish (Sures *et al.*, 1999). However, due to its ability to absorb heavy metals, acanthocephalans are used as bioindicators for heavy metal pollution in waters (Hassanie *et al.* 2019); Sures *et al.*, 2017).

CONCLUSIONS

The skipjack tuna from Sibolga waters were found to be infested by seven species of Acanthocephala worms including *Echinorhynchus* sp., *Rhadinorhynchus* sp., *Acanthocephalus* sp., *Leptorhynchoides* sp., *Neoechinorhynchus* sp., *Pomphorhynchus* sp., and *Apororhynchus* sp. The *Echinorhynchus* sp. and *Rhadinorhynchus* sp. were found to affect both the intestine and stomach of the fish samples and the *Echinorhynchus* sp. had a higher intensity and always found in the intestine but seldom in the stomach.

REFERENCES

Amin, O.M., R.A. Heckmann. 2017. *Rhadinorhynchus oligospinosus* sp. (Acanthocephala, Rhadinorhynchidae) from mackerels in the Pacific Ocean off Peru and related rhadinorhynchids in the Pacific, with notes on metal analysis. Parasite, 24(19): 1-12.

Amin, O.M., R.A. Heckmann, S. Dallares, M. Constenla, N.V. Ha. 2019. Morphological and molecular description of *Rhadinorhynchus laterospinosus* Amin, Heckmann & Ha, 2011 (Acanthocephala, Rhadinorhynchidae) from marine fish off the Pacific coast of Vietnam. Parasite, 26(14): 1-20.

Arai, H.P. 1989. Acanthocephala. In: Margolis, L. and Z. Kabata (Ed.), Guide to the parasites of fishes of canada. Part III. Publie Par, Ottawa, pp. 107-95.

Azwir, A., Z.A. Muchlisin, I. Ramadhani. 2004. Study of the stomach of skipjack tuna (*Katsuwonus pelamis*) and mackerel tuna (*Auxis thazard*). Jurnal Natural, 4(2): 20-23.

Briones, J.C.A., R.D.S. Papa, G.A. Cauyan, M. Urabe. 2015. The first report of three Acanthocephalan parasite species isolated from Philippine fishes. Helminthologia, 52(4): 384-389.

Bush, A.O, K.D Lafferty, J.M. Lotz, A.W. Shostak. 1997. Parasitology meets ecology on its own terms: Margolis et al. Revisited.The Journal of Parasitologi, 83: 75–83.

Caspers, H. 1962. Parasitology of Fishes. In: Dogiel, V. A., Petrushevski, G. K., Polyanski, Yu. I. (Ed.), T.F.H. Publ. ncl. Ltd., Hongkong. p: 384

Diba, D.F., W.E. Rahman. 2018. Description of histopathology of liver, stomach and intestine of skipjack tuna (*Katsuwonus pelamis*) infested with parasitic worms. Octopus, 7(2): 24-30.

Firdaus, M. 2018. The profile of tuna and cakalang fishery in Indonesia. Marina, 4(1): 23-32.

Hassanie, R.M.E., Z.M. Al-Hasawi, M.S. Hariri, H.E. Touliabah. 2019. *Sclerocollum saudii* Al-Jahdali, 2010 (Acanthocephala: Cavisomidae) as a sentinel for heavy-metal pollution in the Red Sea. Journal of Helminthology, 93(2): 177-186.

Hidayati, N., M. Bakri, Rusli, Y. Fahrimal, M. Hambal, R. Daud. 2016. Identification of parasites in mackerel tuna (*Euthynnus affinis*) at Lhoknga Fish Auction Site, Aceh Besar Fish. Jurnal Medika Veterinaria, 10(1): 5–8.

Jinthendran, K.P., S. Kannappan. 2010. A short note on heavy infection of Acanthocephalan worm (*Neoechinorhynchus agilis*) in grey mullet, *Mugil cephalus*. Journal of Parasitic Diseases, 34(2): 99-101.

Muchlisin, Z.A., A.M. Munazir, Z. Fuady, W. Winaruddin, S. Sugianto, M. Adlim, N. Fadli, A. Hendri. 2014. Prevalence of ectoparasites on mahseer sh (*Tor tambra* Valenciennes, 1842) from aquaculture ponds and wild population of Nagan Raya District, Indonesia. HVM Bioflux, 6(3): 148-152.

Muchlisin, Z.A., B. Lubis, A.S. Batubara, I. Dewiyanti, M. Affan, M. Sidqi. 2018. Nematode infestation in the Indonesian shortfin eel (*Anguilla Bicolor*) (Actinopterygii: Anguilliformes: Anguillidae) harvested from Aceh waters, Indonesia. Philippines Journal of Veterinary Medicine, 55(1): 59-64.

Muchlisin, Z.A., Z. Fuadi, A.M. Munazir, N. Fadli, W. Winaruddin, C.N. Defira, A. Hendri. 2015. First report on Asian fish tapeworm (*Bothriocephalus acheilognathi*) infection of indigenous mahseer (*Tor tambra*)

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Printed ISSN 2502-9568 Electronic ISSN 2622-8734

from Nagan Raya district, Aceh province, Indonesia. Bulgarian Journal of Veterinary Medicine, 18(4) 361-366.

Palm, H.W., I.M. Damriyasa, Linda, I.B.M. Oka. 2008. Molecular genotyping of *Anisakis dujardin*, 1845 (Nematoda: Ascaridoidea: Anisakidae) larvae from marine fish of Balinese and Javanese waters, Indonesia. Helminthologia, 4(1): 3–12.

Pulungan, A., A. Fadhilah. 2018. Analysis of production factors of skipjack tuna (*Katsuwonus pelamis*) catch results in the Sibolga archipelago port. University of North Sumatera, 1-9.

Rahayu, A. 1986. Disesases of sea fish. Oseana, 11(3): 101-110.

Sabariah, V., D.M. Rettob, H. Kopalit. 2018. Skipjack (*Katsuwonus pelamis*) and yellow tail tuna (*Thunnus albacore*) parasite in Manokwari waters. Proceedings of the Eighth National Fish Seminar, 333-338.

Sattari, A., R. Kheiradish, S.R. Nourollahi-Fard, B.S. Omrani, I. Sharifpour. 2014. Infection of skipjack tuna *Katsuwonus pelamis* (Linnaeus 1758) of Oman Sea with cestode *Trypanorhyncha* (Diesing 1863). Iranian Journal of Fisheries Sciences, 13(2): 469-476.

Sures, B., M. Nachev, C. Selbach, D.J. Marcogliese. 2017. Parasite responses to pollution: what we know pand where we go in "environmental parasitology". Parasite and Vectors, 10(65): 1-19.

Sures, B., R. Siddall, H. Taraschewski. 1999. Parasites as accumulation indicators of heavy metal pollution. The Journal of Parasitolologi, 15: 16-21.

Taufik, S., Mulyana, F.S. Mumpuni. 2014. Inventory of parasites in mackerel tuna (*Auxis thazard*) in the waters of Teluk Muara Baru, North Jakarta. Journal of Agriculture, 5(2): 73-77.

Uktolseja, J.C.B., B. Gafa, S. Bahar, E. Mulyadi. 1989. Potential and distribution of Indonesian marine fish resource. Directorate General of Fisheries, Jakarta.

Williams, E.H., L.B. Williams. 1996. Parasites of offshore big game fishes of Puerto Rico and The Western Atlantic. Univerity of Puerto Rico, San Juan. p: 382.

Yani, F.I., W. Susaniati. 2017. Infection of anisakis parasites in tuna and skipjack fish in Makassar strait waters. Journal of Galung Tropika, 6(3): 198-205.