Iraqi Journal of Veterinary Sciences

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Detection of endoparasites in mackerel tuna (*Euthynnus affinis*) in north Sumatra province, Indonesia

E. Yusni[1], C. Frantika[1] and A.S. Batubara[2]

[1]Department of Aquatic Resources Management, Faculty of Agriculture, University of Sumatera, Utara, [2]Faculty of Mathematics and Natural Sciences, University of Negeri, Medan, Indonesia

Article information

Article history:
Received June 30, 2021
Accepted November 11, 2021
Available online March 15, 2022

Keywords:
Endoparasite
Prevalence
Intensity
Tuna

Correspondence:
E. Yusni
eriyusni@hotmail.com

Abstract

The purpose of this study was to determine the species and the prevalence value of endoparasites that infect male and female mackerel tuna (Euthynnus affinis) in Tanjung Balai Port, North Sumatra Province. This research was conducted from August to September 2020. Research on endoparasite identification was carried out at the Laboratory of the Technical Implementation Unit for the Implementation of Fishery Product Quality (UPT PMHP), Medan. The method used in this study is a survey method with direct collection at the research location. The sample was taken using random sampling techniques. Endoparasite research was conducted on 30 fish samples, divided into 15 samples of male mackerel tuna with an average size of 26.92 cm and an average weight of 258.451 g, and 15 samples of female mackerel tuna with an average size of 29.50 cm and an average weight of 352.249 g. Four genera of endoparasites were found that infect male and female mackerel tuna, namely Rhadinorhynchus sp., Echinorhynchus sp., Acanthocephalus sp., and Neoechinorhynchus sp. with the highest prevalence value, namely the type of Rhadinorhynchus sp. 6.66% in the stomach and 76.66% in the intestine, the type of Echinorhynchus sp. 3.33% in the stomach and 33.33% in the intestine, as well as Acanthocephalus sp 26.66% and Neoechinorhynchus sp 13.33% only in the intestine.

DOI: 10.33899/ijvs.2021.130703.1867,

Introduction

Tanjung Balai Asahan Port has two port locations. The first is better known as Teluk Nibung Port, on the outer threshold of the Asahan River. The following location leading to the estuary is Bagan Asahan Port. The mainstay commodity exported through this port is fresh fish (1).

The production of pelagic fish, which is the primary commodity in North Sumatra Province, namely skipjack tuna (*Katsuwonus pelamis*), reached 25140 tons, mackerel tuna (*Euthynnus affinis*) reached 10398 tons, and yellowfin tuna (*Thunnus albacares*) reached 7545 tons in one year (2).

Mackerel tuna is a fish with high potential and has a high economic value, distributing this fish in the canned form widely throughout the world (3,4). Mackerel tuna has high protein content and is very rich in omega-three fatty acids (5). This taxon is another tribe of the Scombridae family which is also classified as tuna (6).

Parasites are often encountered in developing the fishing industry, where fish are potential hosts for various parasites (7,8). Parasitic infections that attack fish are usually associated with an unfavorable environment. High temperature and salinity are often the cause of weak immune systems in fish (9). According to Juniardi *et al.* (10), worms are parasites often found in fish, which have a significant role in human health. The effect of parasites can affect humans who consume raw or undercooked fish infected by parasites so that if consumed, it can cause ulcers in the intestines (11).

Furthermore, information on the inventory and prevalence of fish endoparasites in Indonesia is limited, especially in mackerel tuna. Therefore, this research is necessary to be done in male and female *E. affinis*. This

research was conducted in Tanjung Balai Port, North Sumatra Province, where at this location, the mackerel tuna is permanently anchored.

Materials and methods

Time and place of research

This research was conducted from August to September 2020. Fish samples were taken from traditional fishers at Tanjung Balai Port, North Sumatra Province. Research on endoparasite identification was carried out at the Laboratory of the Technical Implementation Unit for the Implementation of Fishery Product Quality (UPT PMHP), Medan.

Research procedure

The method used in this study is a survey method with direct collection at the research location. The sample was taken using random sampling techniques. Tuna samples that have been taken then measured the length and weight. Endoparasite research was conducted on 30 fish samples, divided into 15 samples of male mackerel tuna with an average size of 26.92 cm and an average weight of 258.451 g, and 15 samples of female mackerel tuna with an average size of 29.50 cm and an average weight of 352.249 g.

Procedures or techniques used for examining fish refer to Al-Niaeemi and Dawood (12). The fish was dissected by cutting three parts, namely the lower part of the stomach starting from the front of the anus to the lower operculum passing through the pectoral fin, the front of the anus upward towards the linear lateral, and then the cutting along the linear lateral direction to the operculum and finally the scissors connecting the two parts of the cutout.

Previous, transfer all the internal organs of the fish to a petri dish containing a physiological NaCl solution. The fish organs to be examined are the digestive tract, intestine, and stomach. Then the digestive organs (intestines and stomach) are separated in a petri dish containing a separate physiological NaCl solution.

Furthermore, the digestive organs are opened by cutting. Then scraped using a spatula, then placed on a glass slide and dropped with physiologic NaCl solution, then covered with a cover glass and observed under a microscope with a magnification of 40x. The digestive organs walls are examined again to take parasitic worms that stick to them and are examined again under a microscope. Endoparasite identification was carried out based on Arai and Smith (13).

Data analysis

The research data are presented in tables and figures and analyzed descriptively based on the identification results of *E. affinis*. Then the fish is calculated using the following formula by Fira *et al*. (14) Prevalence = Total of fish sample/Total of fish infected × 100.

The supporting parameter in this study is the fish size, which includes the fish's length, weight, and sex. This supporting parameter data is used as supplementary data for the main parameters. The infection category is based on prevalence using reference by Syukran *et al.* (15), as shown in table 1.

Table 1: Infection category based on prevalence

Prevalence (%)	Infection	
	Category	Rate
<0.01	Almost Never	Never
<0.1-0.01	Very Rarely	Very Rarely
<1-0.1	Rarely	Rarely
1-9	Sometimes	Sometimes
10-29	Often	Often
30-49	Generally	Generally
50-69	Very Often	Very Often
70-89	Usually	Moderate
90-98	Almost Always	Severe
99-100	Always	Very severe

Results

Species of endoparasites

A total of 30 fish samples, divided into 15 samples of male mackerel tuna with an average size of 26.92 cm and an average weight of 258.451 g, and 15 samples of female mackerel tuna with an average size of 29.50 cm and an average weight of 352.249 g. All fish samples examined were infected by parasites in the digestive tract (intestine), and only a few fish were infected in the stomach. The results were found in four genera of endoparasites that infect male and female *E. affinis* (Table 2).

The results of identifying endoparasites that were found to infect the digestive tract of mackerel tuna were dominated by the phylum Acanthocephala. There are three genera of parasites from the phylum Acanthocephala that belong to the Palaecanthocephala class, namely *Rhadinorhynchus* sp. (Figure 1), *Echinorhynchus* sp. (Figure 2), *Acanthocephalus* sp. (Figure 3), and one genera from the Eocanthocephala class, namely *Neoechinorhynchus* sp. (Figure 4).

Based on table 3 on the intensity average that infects mackerel tuna by gender, male mackerel tuna has an average weight value of 258.451 g, and the average length value is 26.92 cm.

On the other hand, the average intensity value of parasite infection in the stomach of male mackerel tuna is 1.08 and/fish, and the average value of parasite infection in the mackerel tuna intestine is 2.83 and/fish. Whereas female mackerel tuna has an average weight value of 352.24 g, an average length value of 29.50 cm, the average intensity value of parasite infection in the mackerel tuna stomach is 1.06 ind/fish, and in the intestine is 4.06 ind/fish.

Table 2: Identification of endoparasites infect for male (M) and female (F) of mackerel tuna

Phylum	Class	Genus	M	F	Total parasite
Acanthocephala	Palaecantocephala	*Rhadinorhynchus*	21	43	64
		Echinorhynchus	10	13	23
		Acanthocephalus	2	13	15
	Acanthocephala	*Neoechinorhynchus*	3	6	9

Table 3: Mean and standard errors of endoparasites intensity in male and female of mackerel tuna

Sex	Weight (g)	Length (cm)	Stomach	Intestines
Male	258.451 (16.582)	26.92 (0.468)	1.08 (0.83)	2.83 (0.474)
Female	352.249 (20.782)	29.50 (0.466)	1.06 (0.056)	4.06 (0.521)
Mean	314.730 (16.323)	28.47 (0.406)	1.07 (0.046)	3.57 (0.377)

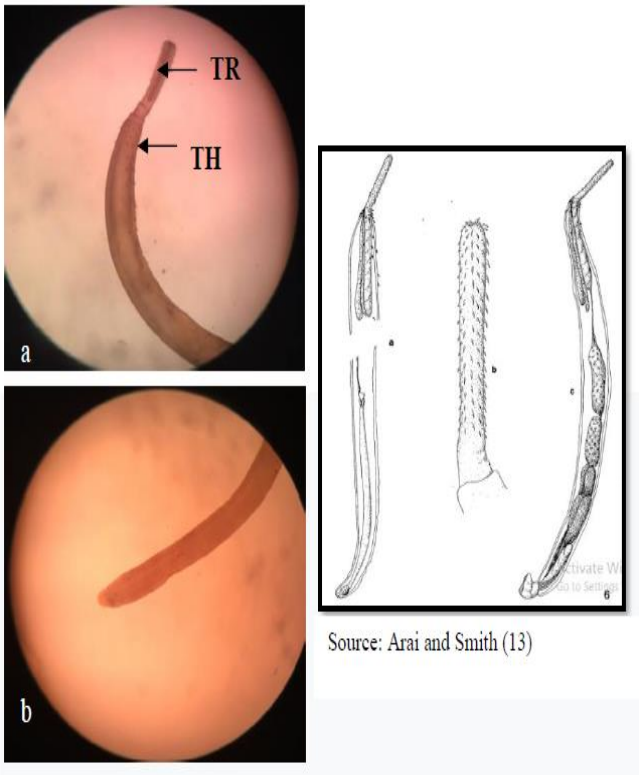

Figure 1: *Rhadinorhynchus* sp. (a. Anterior, b. Posterior, TR: Trunk, TH: Thorns) magnification 40x.

Prevalence of endoparasites

The prevalence of endoparasites found to infect the digestive tract of mackerel tuna has a different value for each genus. Based on the calculation of the prevalence of endoparasites, *Rhadinorhynchus* sp. had a higher prevalence value of 6.66% in the stomach and 76.66% in the intestine. *Echinorhynchus* sp. has a prevalence value of 3.33% in the stomach and 33.33% in the intestine. Then, the endoparasites with the "frequent" infection rate category were *Acanthocephalus* sp. with a prevalence value of 26.66% and *Neochinorhynchus* sp. with a prevalence value of 13.33%. Both types of endoparasites were found to infect only the intestine. This category level of infection means that these two species of endoparasites also frequently attack tuna (Table 4).

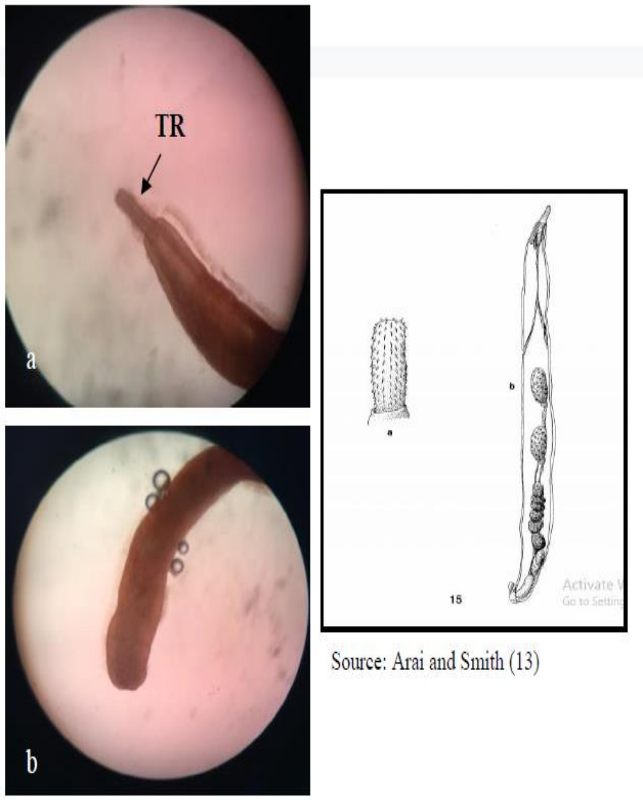

Figure 2: *Echinorhynchus* sp. (a. Anterior, b. Posterior, TR: Trunk) magnification 40x.

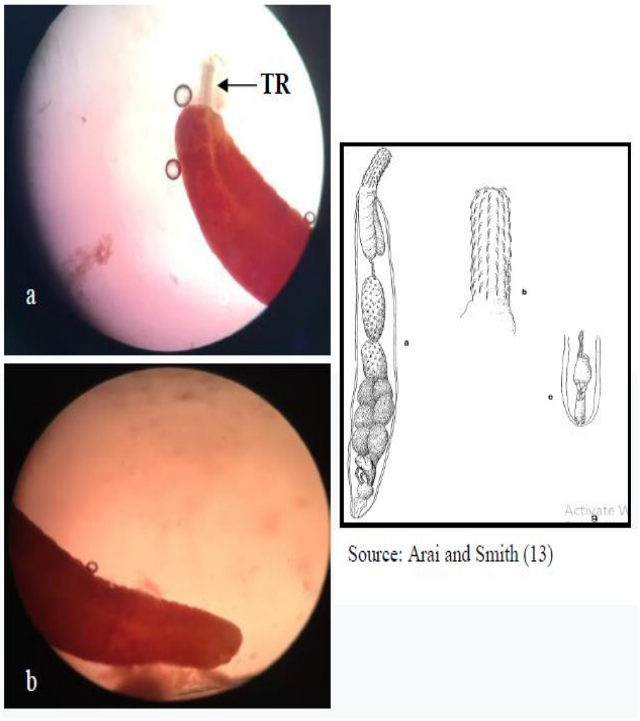

Figure 3: *Acanthocephalus* sp. (a. Anterior, b. Posterior, TR: Trunk) magnification 40x.

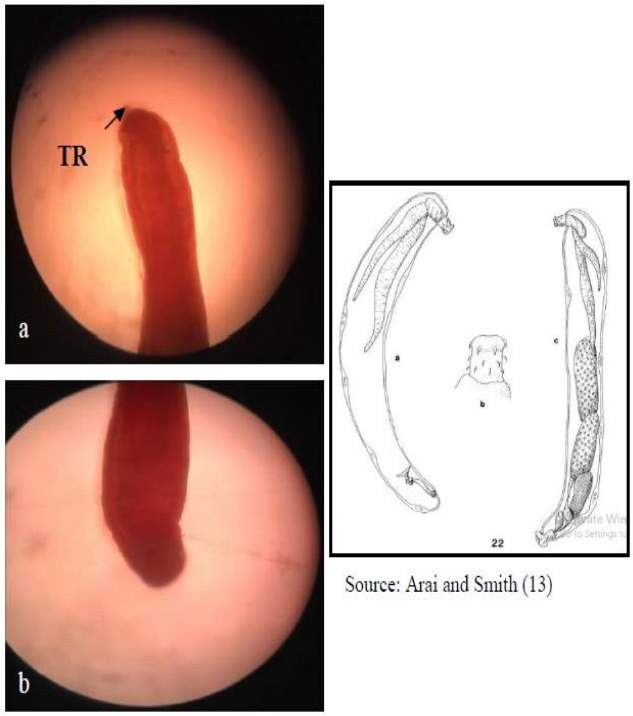

Figure 4: *Neoechinorhynchus* sp. (a. Anterior, b. Posterior, TR: Trunk) magnification 40x.

Table 4: Prevalence of endoparasites that attack the digestive tract of mackerel tuna

Total of fish examined	Total of infected fish	Genus of parasite	Prevalence (%)	
			Stomach	Intestines
30	24	*Rhadinorhynchus* sp.	6.66	76.66
	10	*Echinorhynchus* sp.	3.33	33.33
	8	*Acanthocephala* sp.	0	26.66
	4	*Neoechinorhynchus* sp.	0	13.33

Discussion

Based on the research and identification that has been done, one type of endoparasite that was found to infect the stomach and intestines of male and female mackerel tuna, namely *Rhadinorhynchus* sp., with the characteristics of having a trunk and spines on the anterior. This follows Morsy *et al.* (16), which states that endoparasites of the *Rhadinorhynchus* sp. are usually found in the gastrointestinal tract of fish in the larval and adult stages with spines that spread on the anterior part of the body. Generally, Arai and Smith (13) also state that the endoparasites *Rhadinorhynchus* sp. has a very long trunk equipped with hook thorns. The trunk is relatively small and elongated.

Other types of endoparasites infect male and female mackerel tuna, namely *Echinorhynchus* sp., with the characteristics of also having a trunk on the anterior and having a body that is cylindrical and slender. This is following Wayland *et al.* (17), which states that the type of endoparasite *Echinorhynchus* sp. is a species that attacks marine fish. According to Arai and Smith (13), morphologically, the endoparasites *Echinorhynchus* sp. have ramping and cylindrical bodies, vary in size from small to medium, and sometimes enlarge on the anterior and have a trunk that has a large number of hooks.

Other types of endoparasites that have also been found to infect the digestive tract are *Acanthocephalus* sp. This type of endoparasite has a body that is smaller than other types of endoparasites found. This type of endoparasite has also been found to have a cylindrical trunk and body. According to Rindra *et al.* (18), the type of *Acanthocephalus* sp. has a generally small body and a metasoma located inside the body. In addition, Arai and Smith (13) state that this endoparasite species has a short neck morphology, a relatively long trunk armed with a cylindrical hook.

Meanwhile, the species of *Neoechinorhynchus* sp. was also found to have a smaller trunk than other endoparasites found and has a cylindrical body shape, and slightly widened

at the anterior. According to Amin *et al.* (19), this type of endoparasite has the characteristics of a small trunk and is equipped with a hook. The trunk for the trunk is longer than the trunk and has a cylindrical shape. The torso is slightly wider at the anterior. Sometimes the shape of the back of the body looks like a hump. In addition, Arai and Smith (13) also state that *Neoechinorhynchus* sp. is a type of endoparasite from the Eocanthocephala class. This endoparasite usually has a petite body and a cylindrical body shape, sometimes curved and sometimes straight.

Based on the results of research that has been conducted, it is known that endoparasites infect female mackerel tuna more than male mackerel tuna. This is due to differences in condition factors with indications of biological characteristics of fish such as obesity, suitability of the environment or gonad development, and weight of food contained in the digestive tract of these fish. This study found that female mackerel tuna's average body weight value is higher than male mackerel tuna. According to Gani *et al.* (20), differences in condition factors indicate various biological characteristics of fish such as obesity, suitability of the environment, or development of gonads. The value of the fish condition factor, apart from being influenced by the level of maturity of the gonads, can also be influenced by the weight of the food contained in the digestive tract as well as the size, age of the fish, and the environmental conditions where the fish is located can also affect the value of the fish condition factor.

According to Syukran *et al.* (15), in the endoparasite prevalence category, the endoparasite prevalence value of *Rhadinorhynchus* sp. those found in the stomach are categorized as 'occasional' infections, and those in the intestines are categorized as 'usual' infections. Meanwhile, *Echinorhynchus* sp. found in the stomach is categorized as 'occasional' infection, and in the intestine is categorized as 'general' infection. Williams and Williams (21) stated that if endoparasites are in the 'usually' or 'sometimes' category, these types of parasites are typical parasites or often infect mackerel tuna.

Conclusion

Rhadinorhynchus sp., *Echinorhynchus* sp., *Acanthocephalus* sp., and *Neoechinorhynchus* sp. are endoparasites identified in 30 samples of mackerel tuna (15 samples of female and 15 samples of male). Endoparasites prevalence in female mackerel tuna was the highest compared to males in the stomach and intestine.

Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

References

1. Muda I. The contribution of Teluk Nibung Port of Tanjung Balai Asahan to the local revenue of Tanjung Balai City. J Eko Bis. 2010;9(1):17-28. [available at]
2. BPS North Sumatra. North Sumatra in 2017 figures. Medan: Central Bureau of Statistics of North Sumatra Province; 2018. 661 p.
3. Sadeghi P, Loghmani M, Frokhzad S. Human health risk assessment of heavy metals via consumption of commercial marine fish (*Thunnus albacares*, *Euthynnus affinis*, and *Katsuwonus pelamis*) in Oman Sea. Env Sci Poll Res. 2020;27(13):14944-14952. DOI: 10.1007/s11356-020-07907-0
4. Okyere H, Voegborlo RB, Agorku SE. Human mercury exposure, lead, and cadmium through canned mackerel, tuna, pilchard, and sardine consumption. Food Chem. 2015;179:331-335. DOI: 10.1016/j.foodchem.2015.01.038
5. Harel Z, Riggs S, Vaz R, White L, Menzies G. Omega-3 polyunsaturated fatty acids in adolescents: knowledge and consumption. J Adolescent Hlth 2001;28(1):10-15. DOI: 10.1016/S1054-139X(00)00179-8
6. Taufik S, Mulyana M, Mumpuni FS. Inventory of parasites in tongkol (*Auxis thazard*) in the waters of Muara Baru Bay, North Jakarta. J Pertanian 2014;5(2):73-77. DOI: 10.30997/jp.v5i2.46
7. Poulin R, Guégan JF. Nestedness, anti-nestedness, and the relationship between prevalence and intensity in ectoparasite assemblages of marine fish: a spatial model of species coexistence. Int J Parasitol. 2000;30(11):1147-1152. DOI: 10.1016/S0020-7519(00)00102-8
8. Morand S, Rohde K, Hayward C. Order in ectoparasite communities of marine fish is explained by epidemiological processes. Parasitol. 2002;124(7):57-63. DOI: 0.1017/S0031182002001464
9. Putra EM, Mahasri G, Sari LA. Ectoparasites infestation on *Oreochromis niloticus* maintained by using aquaponic and non-aquaponic system. J Aqua Fish Health 2017;7(1):1-8. [available at]
10. Juniardi E, Mustahal M, Putra AN. Inventory of parasitic worms in milkfish (*Chanos chanos*) in ponds in Ketapang Village, Mauk District, Tangerang Regency, Banten Province. J. Perik Kel. 2014;4(4):251-257. DOI: 10.33512/jpk.v4i4.173
11. Utama FP, Kismiyati K, Mahasri G, Wulansari PD. Identification and prevalence of endoparasitic worms in catfish (*Decapterus macrosomia*) at the Brondong Archipelago Fishery Port, Lamongan. J Akua Rawa Indo. 2018;6(1):77-82. DOI: 10.36706/jari.v6i1.7151
12. Al-Niaeemi BH, Dawood MH. Biomarkers metabolic activities of the tapeworm *Khawia Armeniaca* (Cholodkovsky, 1915) in association to its fish host *Barbus grypus* (Hekle, 1843). Iraqi J Vet Sci. 2021;35(1):169-176. DOI: 10.33899/ijvs.2020.126518.1339
13. Arai, HP, Smith JW. Guide to the parasites of fishes of Canada Part V: Nematoda. Zootol. 2016;4185(1):1-274. DOI: 10.11646/zootaxa.4185.1.1
14. Fira D, Wiradana PA, Ansari A, Susilo RJK, Sabdoningrum E. Ectoparasite incentivization of nilem fish (*Osteochilus hasselti*) fingerlings cultured on ponds in Sukabumi, West Java, Indonesia. Iraqi J Vet Sci. 2021;35(3):605-609. DOI: 10.33899/ijvs.2020.127031.1440
15. Syukran M, Rahimi SAE, Wijaya S. Intensity and prevalence of ectoparasites in ornamental betta fish (*Betta splendens*) in the waters of Aceh Besar District and Banda Aceh City. J Ilm Mahas Kel Per Unsyiah 2017;2(1):221-228. [available at]
16. Morsy K, Ammar KN, Hussein ANA, Mansour A. Light and scanning electron microscopic description of *Rhadinorhynchus bicircum* Hooper 1983 (Acanthocephala) infecting the bayad *Bagrus bajad* (Bagridae), new host and locality records from the River Nile Qena Egypt. J Egypt Soc Parasitol. 2017;47(3):487-492. [available at]
17. Wayland MT, Vainio JK, Gibson DI, Herniou EA, Littlewood DTJ, Vainola R. The systematics of *Echinorhynchus zoega* in Muller 1776 (Acanthocephala, Echinorhynchidae) elucated by nuclear and mitochondrial sequence data from eight European taxa. ZooKeys 2015;484:25-52. DOI: 10.3897/zookeys.484.9132
18. Rindra RIAJ, Sirih HM, Darlian L. Identification of endoparasites in the digestive system of tiger grouper (*Epinephelus fuscoguttatus*) from floating net cages (KJA) in Bajo Indah Village and Lepe Village,

الكشف عن الطفيليات الداخلية في تونة الماكريل (Euthynnus affinis) في مقاطعة سومطرة الشمالية بإندونيسيا

إيري يوسني[١] ، كاهيا فرانتكا[١] و آكونك باتوبارا[٢]

[١] قسم إدارة الموارد المائية ، كلية الزراعة ، جامعة سومطرة ، أوتارا
[٢] كلية الرياضيات والعلوم الطبيعية ، جامعة نيغيري ،ِميدان ، إندونيسيا

الخلاصة

الغرض من هذه الدراسة هو تحديد أنواع الطفيليات الداخلية التي تصيب ذكور وإناث تونة الماكريل (Euthynnus affinis) ومدى انتشارها خلال الفترة من آب إلى أيلول ٢٠٢٠ في ميناء تانجونج بالاي بمقاطعة سومطرة الشمالية. اذ تم إجراء الكشف عن الطفيليات الداخلية في مختبر وحدة التنفيذ الفني لجودة المنتجات السمكية(UPT PMHP) ، ميدان. استخدمت في الدراسة المسحية طريقة الجمع المباشر للعينة وبصورة عشوائية، إذ تم جمع ٣٠ عينة من الأسماك للكشف عن الطفيليات الداخلية، حيث شملت ١٥ عينة من ذكور تونة الماكريل بمتوسط حجم ٢٦,٩٢ سم ومتوسط وزن ٢٥٨,٤٥١ غرام و ١٥ عينة من إناث تونة الماكريل بمتوسط حجم ٢٩,٥٠ سم ومتوسط وزن ٣٥٢,٢٤٩ غرام. تم الكشف على أربعة أجناس من الطفيليات الداخلية تصيب كلا جنسي تونة الماكريل، وهي Rhadinorhynchus sp. و Echinorhynchus sp.و Acanthocephalus sp. و Neoechinorhynchus sp. سجل النوع Rhadinorhynchus sp اعلى نسبة انتشار، اذ بلغت ٧٦,٦٦٪ في عينات الامعاء و ٦,٦٦٪ في عينات المعدة، بينما سجل النوع Echinorhynchus sp نسبة انتشار بلغت ٣,٣٣٪ في عينات المعدة و ٣٣,٣٣٪ في عينات الامعاء، في حين سجل النوع Acanthocephalus sp نسبة ٢٦,٦٦% وسجل النوع Neoechinorhynchus sp نسبة ١٣,٣٣% في عينات الامعاء.

Soropia District, Southeast Sulawesi. AMPIBI: J Alumni Pend Biol. 2016;1(1):50-57. DOI: 10.36709/amphibian.v1i1.5026
19. Amin OM, Heckmann RA, Ha NV. Acanthocephala from fishes and amphibians in Vietnam describe five new species. Parasite 2014;21(53):1-17. DOI: 10.1051/parasite/2014052
20. Gani A, Nilawati J, Rizal A. Study of habitat and food habits of rono lindu fish (*Oryzias sarasinorum* Popta, 1905). J Sains Teknol Tadulako 2015;4(3):9-18. [available at]
21. Williams EH, Williams LB. Parasites of offshore big game fishes of Puerto Rico and the western Atlantic. Puerto Rico: Antillean College Press; 1996.