Journal of Ecosystem Sciences and Eco-Governance (JESEG)
www.jeseg.carsu.edu.ph

Vol. 2, No. 2 | December 2020
PRINT ISSN 2704 4394 | ONLINE ISSN 2782 8522

Anisakid parasite in Scad Fish (*Decapterus* spp.) from Selected Fishing Grounds of Caraga Region, Philippines

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Received: September 23, 2020
Revised: December 5, 2020
Accepted: December 28, 2020

Cite this article: Tiempo, C.T., Reyna, K.C.M., Sulapas, R.R., & Estaño, L.A., (2020). Anisakid parasite in Scad Fish (Decapterus spp.) from Selected Fishing Grounds of Caraga Region, Philippines. *Journal of Ecosystem Science and Eco-Governance*, **2**(2):12-17.

ABSTRACT

This study reported the presence of an anisakid parasite *Anisakis* sp. in commercial fish (*Decapterus* spp.) collected in selected fishing grounds of Caraga Region, Philippines. The collection of the fish was done in a purposive sampling last June- July 2019 in selected fishing ports in three (3) provinces: Buenavista, Agusan del Norte, Placer, Surigao del Norte, Barobo, Cagwait, and Hinatuan of Surigao del Sur. There were 111 collected fish samples and 40 (36%) were infected with the anisakid parasite. Fish samples comprise three (3) species: *Decapterus macrosoma, Decapterus maruadsi,* and *Decapterus tabl.* The infection of anisakid parasite among various sampling sites was significant ($p < 0.05$) with Buenavista as highest (60.9%), followed by Placer (42.9%), Barobo (29.2%), Hinatuan (25%), and lastly, Cagwait (21.7%). The infestation was higher in *D. maruadsi* (39%), followed by *D. macrosoma* (36.4%), while *D. tabl* recorded lowest (29.2%) however, the difference was not significant ($p > 0.05$). Moreover, prevalence between ages was observed highest in the adult samples (49.3%) compared to the juvenile samples (14.3%) which is significant at $p<0.05$. The infection confirms that *Decapterus* spp. in the selected fishing ground in Caraga Region, are carriers of an anisakid parasite. Results of the study provide baseline information on anisakid parasite in *Decapterus* spp. in these areas and its implication in public health and fisheries.

Keywords: *Anisakid, Decapterus, Fish Parasite, Caraga Region*

1 Introduction

Anisakid parasite is a nematode of the family Anisakidae, which used different crustaceans and fish species as intermediate or paratenic hosts while humans are accidental hosts. Human anisakiasis occurs when seafood containing the infective stage (L3) of this parasite was ingested (Aibinu et al. 2019). Anisakiasis is considered an emerging public health risk for humans, manifesting long-lasting sharp epigastric pain, nausea, and vomiting without diarrhea. Due to anisakiasis, the risk of raw fish meat consumption gained approximately 20,000 cases, as reported globally (Valle et al. 2012). With that, the increasing threat of human anisakiasis worldwide is now posing a human health risk for fish and consumers (Castellanos et al. 2018). The World Health Organization has estimated that the number of people infected with fish-borne parasites exceeds 18 million, and many more are at risk (WHO 2004). According to the Food and Agriculture Organization of the United Nations (UN-FAO), fish consumption has been increasing with the Mediterranean diet's introduction in recent years (De Guia and Quiazon 2018). In Southeast Asia, anisakid parasites were prevalent in Indonesia, Thailand, Malaysia, and Brunei, however, the absence of reports in Myanmar, Vietnam, and

Cambodia might be due to a lack of studies in these countries. In the Philippines, this parasite can be seen in several fishes nevertheless, no incidence of disease in humans related to this parasite was reported. (Anshary et al. 2013, Wiwanitkit and Wiwanitkit 2016). The infective stage of *Anisakis* has been found in several economically important fish species, and prevalence may vary between geographical fishing grounds (Aibinu et al. 2019). The parasite already existed in marine fish species in Southeast Asia and the emerging human disease is possible (Quizon et al. 2013). Anisakiasis has been identified as a new focus of interest in tropical coastal medicine at present (Wiwanitkit and Wiwanitkit 2016).

The Philippines has several essential fishing grounds that have enabled the development of industrial and artisanal fishing activities (UN-FAO 2014). In Caraga Region, marine areas in most provinces serve as main fishing grounds that support the abundant fishery resources. The surrounding municipalities within coastal areas rely heavily on their marine resources for food and livelihood (Baclayo et al. 2016). Meanwhile, anisakid infection in fish is essentially used as an indicator of water pollution, global climate changes, anthropogenic impacts, and environmental stresses, fish stock assessment, and general ecosystem health (Sures 2004, Marcogliese 2005, Brooks 2007 and Lloret et al. 2012). Hence, the infection of anisakid parasite in fish remains limited in the Philippines and no study was conducted in Caraga region. This study is sought to determine the presence of anisakid parasites in *Decapterus* fish collected in selected fishing grounds in the Caraga region. Information about this study would help assess the marine ecosystem for its implication in fisheries and public health.

2 Materials and Methods

Study area

The collection of samples was conducted in June-July 2019 and was carried out in a purposive sampling in the mainland provinces of the Caraga Region, Philippines. Selected fishing grounds were identified from three (3) provinces represented by five municipalities: Buenavista, Agusan del Norte, Placer, Surigao del Norte, and three municipalities in Surigao del Sur which include, Barobo, Cagwait, and Hinatuan (Figure 1). Fishes from the said areas are supplied by fishermen according to the availability of the *Decapterus* fish. The samples were placed individually in labeled bags, kept in a box with ice, and transferred to the laboratory. Individual fish was examined immediately afterward, and morphometric measurements on fins length, tail length, body length, total body length, and weights were taken with photographs to assist in determining fish species. The age of fish was allocated to two age classes based on body length. Since *Decapterus* fish vary in size at maturity, the *D. macrosoma* with <17.6 cm was categorized as juvenile age class while individuals >17.6 cm as adults; for *D. tabl* individuals <30 cm were assigned to juvenile age class while individuals >30 cm as adults (Paxton et al. 1989). For *D. maruadsi,* individuals that are <10 cm were categorized as

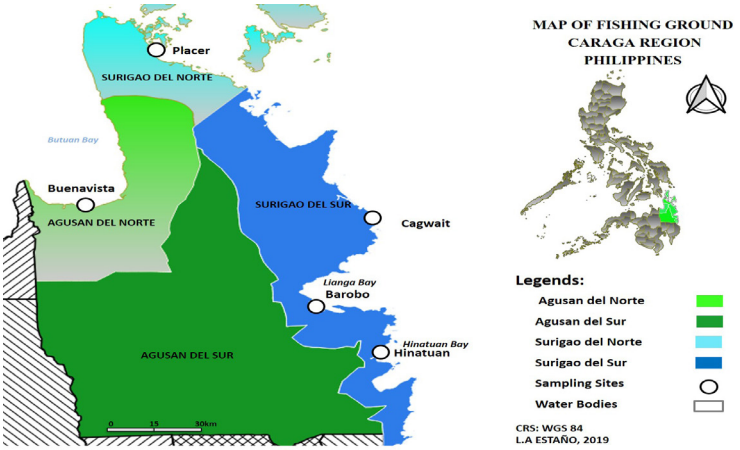

Figure 1. Map showing the selected fishing ground of Caraga region, Philippines

juvenile age class while individuals >10 cm were categorized as adults (Myers 1991).

Dissection and Isolation

The collected fishes were dissected to expose the gastrointestinal tract and other internal organs. The gut region composed of the intestine and caecum was cut open and examined using a dissecting microscope. The isolated nematodes were fixed in warm formalin (4% solution) and immediately washed with alcohol (70% solution) and was fixed further with iodine solution. Only the internal organ of the fish was examined to determine the presence of the anisakid parasite. The nematodes were clarified in gradual solutions of glycerin (20% solution). The anisakid parasite was identified based on morphological characteristics only with images taken at 40x, and 100x magnification (Castellanos et al. 2018).

Data Analyses

The anisakid parasites infection was computed by dividing the total number of infected hosts by the total number of samples multiplied with 100. Moreover, differences in the prevalence rate among age, location sites, and species were analyzed using the Chi-square of independence test. Statistical computations were done using the following software for Windows: Quantitative Parasitology (QP) version 3.0 and SPSS v. 20.0 software (IBM Corp. 2011).

3 Results and Discussion

Of the 111 collected fish samples, only 40 (36%) were infected with an anisakid parasite. This parasite has common features of all nematodes (Figure 2) the vermiform body plan without segmentation (Mattiucci and Nascetti 2006). Parasite infection among sites (fishing grounds) was significantly different (p=0.038) with Buenavista having the highest infection (60.9%) followed by Placer (42.9%), Barobo (29.2%), Hinatuan (25%), and Cagwait (21.7%) (Table 1). Comparison of anisakid infection among species show that *D. muadrasi* were the most infected by the parasite (39%) followed by *D. macrosoma* (36.4 %) and *D. tabl* (29.2 %). However, infection among fish species was not significant (p=0.418).

Infection of the parasite varies in reference to the host's maturity

The parasite infection in adult fish samples (49.3%) was significantly higher compared to juvenile (14.3%) fish samples (p=0.001). This could be explained by the assumption that older hosts have been exposed to parasitic infections longer than younger hosts (De la Cruz et al. 2013). As reported by Munda and Estaño 2020, adult hosts have a higher prevalence due to adult behavior, which has covered a wider area for foraging activity, and acquired the most infective stages of the parasite in the environment. The adult hosts have greater contact with parasites during their lifetime, increasing the chances of infection and parasite loads increases in older hosts (Rascalou and Gourbiere 2015). Moreover, the fish body mass and length had significant effects on the host's number of parasites (Munda and Estaño 2020) .

Anisakid parasite infection in the Philippines was reported by De Guia and Quiazon (2019) in some commercial fishes, including yellowfin

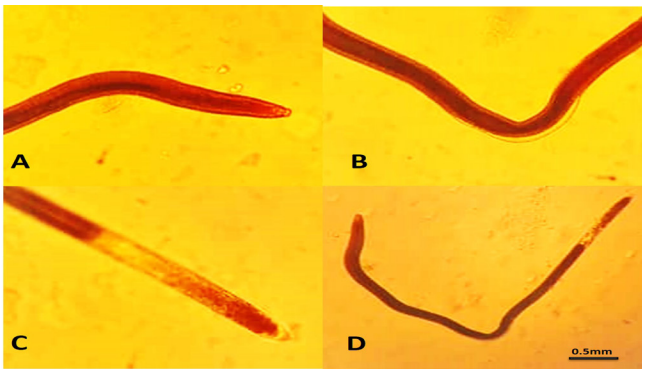

Figure 2. Larva of the Anisakid parasite recovered in *Decapterus* spp. collected in selected fishing ground of Caraga Region, Philippines. **A**. Anterior end view (100x). **B**. Middle view (100x). **C**. Posterior end view (100x). **D**. Whole view (40x)

Table 1. Summary of Infected fish *Decapterus* spp. collected in selected fishing ground of Caraga Region, Philippines.

Sites*	No. of Samples	No. of Infected Samples	Infection rate (%)
Barobo	24	7	29.2
Buenavista	23	14	60.9
Cagwait	23	5	21.7
Hinatuan	20	5	25.0
Placer	21	9	42.9
Species			
D. macrosoma	33	12	36.4
D. muadrasi	54	21	39
D. tabl	24	7	29.2
Age*			
Adult	69	34	49.3
Juvenile	42	6	14.3
Overall	**111**	**40**	**36**

*significant at $p<0.05$

tuna (*Thunnus albacares*), mackerel (*Rastrelliger* sp.), grouper (*Epinephelus* sp.), and round scad (*Decapterus* sp.). These commercial fishes were infected with *Anisakis typica* reported in Palawan, Quezon, Zambales, Davao, General Santos, and Nueva Ecija. This species is not zoonotic unlike *Anisakis simplex* and *Anisakis pegreffii*, which are considered the most pathogenic species in humans. The infection of anisakid parasite in their intermediate host plays an essential role in completing the parasites' life cycle (Aibinu et al. 2019).

The infection of the parasite in *Decapterus* fish suggests that anisakid parasite requires various hosts to complete the life cycle, which passes through several hosts throughout their lives. Eggs hatched in seawater, and the infective larvae are consumed by primary, intermediate host crustaceans, usually euphasids. These crustaceans are subsequently eaten by the secondary intermediate host, such as mollusks or fishes (Nieuwenhuizen et al. 2003, and Montalto et al. 2005). The life cycle is completed when an infected fish is eaten by a marine mammal, such as whales, sea lions, dolphins, seals, and other animals like seabirds and sharks. The parasite exists in the intestine, feeds, grows, mates, and releases eggs into the seawater in the host's feces. Anisakid parasites may infect humans who ingested a raw or semi-raw fish, and since the gut of humans is functionally very similar to marine mammals, the parasites survived (Umehara et al. 2006).

Moreover, anisakid infections in humans have been documented in more than 26 countries on five continents (Mercado et al. 1997, Audicana et al. 2002, Cabrera et al. 2003, and Guardone et al. 2018). Most of the reported cases have occurred in Spain, Japan, and other Asian countries, where epidemiological studies have indicated that anisakid infection is more frequent in coastal populations . The United Nations Food Organization (UN-FAO) and World Health Organization have established regulations and guidelines to minimize and prevent the harmful effects of anisakid parasites on human health (WHO, 2004). The reported anisakid parasite infection in fish in the Philippines is not zoonotic. Findings of Petersen et al. (1993), and De Guia and Quiazon, (2018) indicated that fish infected by anisakid parasite may be safe for human consumption.

4 Conclusion and Recommendations

This study provides preliminary information on anisakid parasite infection in *Decapterus* fish collected in selected fishing grounds of the Caraga Region, Philippines. Results confirm that the fish genus *Decapterus* are carriers of anisakid parasite in these areas. This study recommends survey of anisakid infection in other commercial fish species marketed to provide complete data of anisakid

parasite infection in the area. Long-term monitoring of seasonal changes in relation to parasite infection in fish is also recommended to further exemplify the dynamics of infection. Moreover, identification protocols such as molecular analysis should be employed to further characterize and validate the species of parasite identification to determine if anisakid parasite harbored in *Decapterus* in the area is zoonotic to human. Surveys and case studies on the occurrence of parasitic diseases in humans would also be useful in assessing the impact of the parasites in the area.

5 Acknowledgement

The researchers would like to thank the following: Fisher folks of different municipalities in Caraga Region: Buenavista, Barobo, Cagwait, Hinatuan and Placer for their support during fish collection; Fisheries Technologist J.A Catabay for his expertise in the identification of our fish samples. Department of Biology Laboratory, Caraga State University for allowing the researchers to conduct laboratory analysis; and Butuan City School of Arts and Trades community for financial supports.

Statement of Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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