The correlation between temperature and intensity of 
Zeylanicobdella arugamensis on cantang grouper (E. 
fuscoguttatus × E. lanceolatus) from traditional ponds in the 
Kampung Kerapu Lamongan East Java Indonesia

D D Afifah¹, G Mahasri²* and W H Satyantini²

¹Program Study of Fisheries Science, Faculty of Fisheries And Marine, Universitas Airlangga, Jalan Mulyorejo, Surabaya 60115, East Java, Indonesia
²Department of Fish Health Management and Aquaculture, Faculty of Fisheries And Marine, Universitas Airlangga, Jalan Mulyorejo, Surabaya 60115, East Java, Indonesia

*Corresponding author: mahasritot@gmail.com

Abstract. Grouper fish (Epinephelus sp.) is one of the superior species in the development of marine culture in Indonesia. In the cultivation process, one important factor that must be considered is good water quality. Diseases that attack fish are caused by the interaction between environment, pathogen, and host. One of the pathogenic agents is parasites, and the ectoparasite that infects cantang grouper is Zeylanicobdella arugamensis. This study aims to determine the correlation between temperature and intensity of Zeylanicobdella arugamensis in cantang grouper. The method used in this research is a survey method by measuring pond temperature and calculating the intensity of Zeylanicobdella arugamensis from 50 samples of cantang grouper in cantang grouper at 4 ponds. The results that have been obtained are, temperature: 28°C (pond 1), 29°C (pond 2), 30°C (pond 3), and 31°C (pond 4). While the intensity of Zeylanicobdella arugamensis found were: 18,66 individu / fish (pond 1), 10,7 individu / fish (pond 2), 7,1 individu / fish (pond 3), and 4,6 individu / fish (pond 4). Results of the correlation analysis showed a very close relationship between temperature and the intensity of Zeylanicobdella arugamensis in cantang grouper with negative correlation coefficient value is r = -0.964 (p <0.05).

1. Introduction
Grouper fish (Epinephelus sp.) is one of the superior species in the development of marine culture in Indonesia. One of the factors that can influence the cultivation process is water quality. Environmental carrying capacity has a huge effect on the sustainability of grouper farming. Selection of the proper cultivation locations becomes the biggest factor determining the success or failure of grouper culture activities [1]. Water quality is very important factor for the success of the business of cultivating groupers. Analysis of the suitability of aquatic parameters in the form of fish farming commodities needs to be done so that we get a level of conformity for the commodities that we want to cultivate [2].

Diseases that attack fish are caused by the interaction between environment, pathogen, and host [3]. This incompatibility causes stress on the fish, so that their self-defense becomes weak, thus the disease can easily enter the body and cause disease [4]. One of the pathogenic agents that can cause disease in
fish is parasites. Meanwhile, parasites that infect groupers are ectoparasites known as marine leeches (*Zeylanicobdella arugamensis*). *Zeylanicobdella arugamensis* has been reported as the most dangerous ectoparasite affecting various fish species [5]. According to Kua *et al.* [6] *Zeylanicobdella arugamensis* embryos were studied to develop into juveniles at temperatures below 27°C. Therefore, this study aims to see how the correlation between temperature and the intensity of *Zeylanicobdella arugamensis* in groupers raised in traditional ponds located in Kampung Kerapu, Kentong, Labuhan, Brondong, Lamongan, East Java.

2. **Materials and Method**

This research was conducted using a survey method. Cantang grouper (17-21 cm) was taken from a traditional pond in Kampung Kerapu, Kentong, Labuhan, Brondong, Lamongan, East Java. Sampling was carried out in 4 ponds and each pond was examined for 50 fishes.

Observation of *Zeylanicobdella arugamensis* was carried out on body surfaces, fins and gills with the native method by scraping [7]. The level of infestation was defined as the average number of marine leeches found in every fish sample. Intensity are calculated by the formula:

\[
\text{Intensity (individu/fish)} = \frac{\sum_{i=1}^{n} \text{parasite found}}{\sum_{i=1}^{n} \text{infested fish}} \quad [8]
\]

Intensity of *Zeylanicobdella arugamensis* was grouped by category [9]. In addition, temperature measurements were also carried out with a thermometer to determine the correlation with the intensity of *Zeylanicobdella arugamensis* in cantang groupers.

Data obtained from the results of temperature value and intensity values of *Zeylanicobdella arugamensis* on the cantang grouper (*Epinephelus fuscoguttatus* x *Epinephelus lanceolatus*) from traditional ponds in Kampung Kerapu, Lamongan were analyzed with correlation test on statistical software (SPSS version 20).

3. **Results and Discussion**

3.1 **Results**

The results of measuring the temperature value and the calculation of the intensity of *Zeylanicobdella arugamensis* on 50 samples of cantang grouper maintained from 4 traditional ponds in Kampung Kerapu, Kentong, Labuhan, Brondong, Lamongan, East Java are shown in Table 1.

| Pond | Temperature (°C) | Intensity (individu/fish) | Intensity Category |
|------|------------------|--------------------------|-------------------|
| 1    | 28               | 18.66                    | Medium            |
| 2    | 29               | 10.7                     | Medium            |
| 3    | 30               | 7.1                      | Moderate          |
| 4    | 31               | 4.6                      | Light             |

Results of the correlation analysis showed a very close relationship between temperature and the intensity of *Zeylanicobdella arugamensis* in cantang grouper. The negative correlation coefficient value is \( r = -0.964 \) (\( p < 0.05 \)). The correlation graph can be seen in Figure 1.
Figure 1. Graph of correlation between temperature and intensity of *Zeylanicobdella arugamensis* on cantang grouper

Figure 1 showed the negative correlation between temperature and the intensity of *Zeylanicobdella arugamensis*. This shows that when the temperature increases, the intensity of *Zeylanicobdella arugamensis* on cantang grouper will decrease. Figure 2 shows that *Zeylanicobdella arugamensis* was found attached to the fin and body surface and of cantang grouper.

Figure 2. *Zeylanicobdella arugamensis* attached to the fin and body surface

3.2 Discussion

Marie leech, *Zeylanicobdella arugamensis* found on the body surface, fins, operculum, and eyes of cantang grouper. This is in accordance with the statement [10] which says that the marine ectoparasite was mostly found attached to the body surface, eyes, mouth, ventral fins and dorsal fins. Table 1 shows that there is a negative correlation between temperature and intensity of *Zeylanicobdella arugamensis* in cantang grouper. The highest intensity was found in cantang grouper reared in ponds at a temperature of 28°C.

Temperature can affects the parasitic reproduction process [7]. Kua et al. [6,11] found that the hatching percentage for the cocoon was 60.7% during a study on the life cycle of the marine leech *Z. arugamensis* at 27°C. At the temperature of 28°C–32°C, *Z. arugamensis* took 2 weeks to grow to a mature adult and start producing cocoons [6]. Furthermore, Kua et al. [11] also reported that the highest survival rate in juvenile and adult stages of *Zeylanicobdella arugamensis* was recorded at 25°C. This factor might explain why the intensity of *Z. arugamensis* were higher in cantang grouper cultured in the pond with a water temperature of 28°C.

Juveniles of *Z. arugamensis* were able to hatch at temperatures ranging from 25 to 35 °C but failed at 40°C [10]. The survival periods of adult and juvenile leeches ranged from 11 to 16 days at 25°C,
which was comparatively longer than the periods of 5–13 days and 10 h to 5 days observed at 27–30°C and 35–40°C, respectively [5].

Temperature may also directly modify the contact rate between hosts and water-borne parasite spores. The optimal temperature for the fish, 28°C–32°C [12,13]. This was in accordance with the temperature of the cantang grouper ponds which were examined in Kampung Kerapu, Kentong, Labuhan, Brondong, Lamongan, East Java. Since temperature increases the oxygen demand of the trout and the fish responds to this by increasing gill ventilation and blood flow rates [14,15] spore contact rates with gill epithelium may increase with temperature. This is what led to the discovery of *Z. arugamensis* in the gills or operculum.

Furthermore, one of the major interactions of temperature and disease relates to the activity of the immune response when hosts are confronted with an infection [16]. In many poikilothermic animals, the strength of immune response is positively correlated with temperature, and thus even small changes in ambient temperatures can lead to significantly increased investment in immune function when infected [17]. However, the marine leech *Zeylanicobdella arugamensis* mostly can hatch at temperature of 27°C and this ectoparasites takes 2 weeks to grow into juvenile.

Two different types of mechanisms could explain this finding: either the trigger for the parasite transmission is density-dependent and/or the parasite needs a defined temperature-dependent maturation time to locate in the tubules for being excreted. This further corroborates the suggestion above on the factors limiting parasite intensity in the fish host. Another implication of this interpretation is that the plateau phase of parasite intensity most likely does not reflect a stop of parasite proliferation, but an equilibrium between parasite proliferation and parasite release [13].

4. Conclusion
There is a very close negative correlation between temperature and the intensity of *Zeylanicobdella arugamensis* maintained in traditional ponds in Kampung Kerapu, Kentong, Labuhan, Brondong, Lamongan, East Java.

5. References
[1] Yulianto H, Damai AA, Delis PC, Elisdiana Y 2017 *Turkish J. Fish. and Aquat. Sci.* 17, 1253–1261.
[2] Radiarta A, Saputra and Priono B 2004 *Jurnal Penelitian Perikanan Indonesia* 10, 19–32.
[3] Hartono P, Dewi J and Tusihadi T 2001 *Diseases in Grouper Cultivation* Lampung.
[4] Cahyono P M, Mulia D S and Rochmawati E 2006 *J. Protein* 13, 2 (In Indonesia).
[5] Ravi R and Shariman Y Z 2017 *Asian Pac J of Trop Biomeden*. 7, 5 473–477.
[6] Kua B C, Azmi M A and Hamid N K A 2010 *Aquaculture* 30, 153–157.
[7] Noga E J 2010 *Fish Disease Diagnosis and Treatment* 2nd Edition (USA: Wiley Black Well).
[8] Kabata Z 1985 *Parasites and Diseases of Fish Cultured in the Tropics* (London: Taylor and Francis).
[9] Williams E H and Bunkley-Williams L 1996 *Parasites of offshore big game fishes of Puerto Rico and the western Atlantic* University of Puerto Rico.
[10] Gunanti M, UmI H, Fungky P P, Dicky R, Sri S, Putri D W, and Muhamad A 2020 *J Fish Dis* 1–11.
[11] Kua B C, Choong F C and Leaw Y Y 2014 *J. Fish Dis.* 37, 201–207.
[12] Mursitorini E and Ramdhani P 2013 *Loka Pemeriksaan Penyakit dan Lingkungan* [Press release].
[13] Strepparava N, Segner H, Ros A, Hartikainen H, Schmidt-Posthaus H and Wahl T 2017 *Parasitology* 145, 3 281–291.
[14] Maricondi-Massari M, Kalinin A L, Glass M L and Rantin F T 1998 *J of Thrml Biol.* 23 283–290.
[15] Vornanen M, Haverinen J and Egginton S 2014 *J of Experimental Biol.* 217, 299–309.
[16] Jokinen I E, Salo H M, Markkula E, Rikalainen K, Arts M T and Browman H I 2011 *Fish. Shellfish Immunol.* 30, 102–108.
[17] Bailey C, Segner H, Casanova-Nakayama A and Wahli T 2017 Fish. Shellfish Immunol. 63, 424–437.

6. Acknowledgements
The authors would like to thank the Faculty Fisheries and Marine, Universitas Airlangga