Effect of Salinity and Zinc (Zn) Heavy Metal on Water towards Size Distribution of River Catfish (*Mystus sp.*) at Blanakan River, Subang, West Java

A Oktavina and N D Takarina
Department of Biology, Faculty of Mathematics and Natural Sciences, University of Indonesia
E-mail: noverita.dian@sci.ui.ac.id

Abstract. River Catfish (*Mystus sp.*) is a fish that lives in the estuary area of the Blanakan River and has a high level of physiological adaptation to a wide salinity range. People consume River catfish. The study aims to determine the effect of salinity and Zinc (Zn) heavy metals at the water on the size distribution of river catfish. The fish samples were collected from 2 stations. The salinity was measured directly from water as well as the length and weight of fish. The Zn in water was measured by using AAS (Atomic Absorption Spectroscopy). The results showed that the value of salinity and Zn were 20 ppt - 29 ppt and 0.03mg/l – 0.22 mg/l, respectively. The fish length and weight were ranged 13.2 cm – 13.6 cm and 30.6- 34.7 gr, respectively. Hence we conclude that the salinity and zinc variation has increased weight and length of river catfish.

1. Introduction
In the aquatic environment, salinity is one of the critical factors affecting fish. Salinity can affect the length and weight of fish. Among vertebrates, fishes also are highly dependent on environmental conditions. Among those factors, many studies have reported an influence of water salinity on fish development and growth. Variation of salinity range or treatment positively affects the growth rate of fish [1]. The fish has better growth in salinity ranges from 8 to 20 ppt [2].

*Mystus* *sp.* is a brackish fish that originated from Indonesian water. However, it is only available in a particular area, for example, Sumatra, Java, and Kalimantan water. *Mystus* *sp.* lives in a wide variety of habitats, including fast-flowing rivers and slow-flowing rivers. It also likes to inhabit nearby the streams, where it reportedly feeds on invertebrates or smaller fishes. People have consumed River catfish near the river, considering its high protein content [3].

There are several ways how Zn can contaminate aquatic habitats. The Zn in nature resulted from erosion. Likewise, Zn also resulted from anthropogenic sources, including mining, zinc production facilities, iron and steel production, corrosion, and pesticides. Even though Zn is an essential element for every organism, the excess amount of Zn is toxic for the organism and can cause physiological disorders [4].

In The Blanakan river, the *Mystus sp* is an important commercial commodity for local fishers (Figure 1) [5]. However, information about the *Mystus sp.* with its environmental parameters and metals are still limited. Hence to fulfill this gap, this study aims to estimate the correlation of salinity and Zn in water with the length and weight of *Mystus sp.* that can be used as primary information to support fishery practices of this species.
2. Methods

2.1 Study site
The Blanakan river is located in Subang district, West Java province. The station geocoordinates were from upstream at lat: -6.277444, long: 107.6599 to downstream (river mouth) lat: -6.240083, long: 107.667472 (Figure 2). The width of The Blanakan river is varied from 60 m near the river mouth to 11 m in the upstream. In upstream, the river was surrounded by settlements and paddy field, in midstream was transition area from paddy field to fish pond and downstream was dominated by the fish pond and relegated by mangrove. The Mystus sp. samples were collected in fish ponds in Station 1, 2, and 3 in June 2019.

2.2 Salinity sampling and measurement
Salinity was measured in each sampling station by using a refractometer [6].

2.3 Zn sampling and measurement
Zn was sampled from water by using a bottle sample. The water sample is put in the spectrophotometer, and then the Zn was analyzed by using AAS (Atomic Absorption Spectrophotometry) flame [7]. A spectrophotometer is an instrument that measures the number of
photons (the intensity of light) absorbed after it passes through the sample solution. With the spectrophotometer, the amount of a known chemical substance (concentrations) can also be determined by measuring the intensity of light detected.

2.4 Measurement of catfish length and weight
River catfishes were captured at each sampling station by using nets and were taxonomically identified by using the identification book. The length was measured to the nearest centimeter (cm), and body weight was recorded in the nearest gram (g). The total length of each fish was measured from the tip of the snout to the extended tip of the caudal fin using a measuring board.

3. Result

Table 1. The comparable salinity (ppt) with other locations

| Value/Range | Locations                              |
|-------------|----------------------------------------|
| 20-29       | Blanakan river (this study)            |
| 29.5 – 30.6 | Bengkalis strait [8]                   |
| 33.2-34.1   | Java sea [9]                           |
| 33.5-34.25  | Eastern of Indian ocean[10]            |

In Table 1, we can see that the salinity range in the Blanakan river varies from 20 ppt – 29 ppt in the river and river mouth, respectively. In Table 2, the Zn was ranged from 0.03 to 0.22 mg/l.

Table 2. The comparable Zn (mg/l) with other locations

| Value/Range       | Location                          |
|-------------------|-----------------------------------|
| 0.03-0.22         | Blanakan river (this study)       |
| 0.9973-2.7815     | Kamal coast [11]                  |
| 0.0053-0.0104     | Membramo river [12]               |
| 0.002-0.012       | Pangkajene river[13]              |

Table 3. The comparable length and weight of Mystus sp. with other locations

| Length (cm) | Weight (gr) | Location                        |
|-------------|-------------|---------------------------------|
| 13.2 – 13.6 | 30.6-34.7   | Blanakan river (this study)     |
| 21.0 – 41.0 | Na          | Siak river [14]                 |
| 5.2-10.2    | Na          | Manair river [15]               |

Figure 3 shows the correlation of water salinity with a body length of Mystus sp. As the salinity went lower from 29 in river mouth to 20 in the river, it decreased the length of Mystus sp. from 13.59 to 13.20 cm. However, it also decreased the weight of Mystus sp. from 34.67 to 30.63 gr.
Figure 4. The correlation of Zn with length (left) and weight (right) of Mystus sp.

Figure 4 shows the correlation of Zn contained in water with body weight and length of Mystus sp. As the Zn composition in water decreased from 0.22 to 0.03 mg/l, it decreased the weight of Mystus sp. from 34.67 to 30.63 gr. Furthermore, it also decreased the length of Mystus sp. from 13.59 to 13.20 cm.

4. Discussion

The range of salinity and Zn vary on the locations of sampling stations. The sampling stations in the Blanakan river were located between the river mouth and river. Hence, water salinity is affected by marine water (high salinity) entering the river through the river’s mouth near the sea and freshwater from the river (low salinity). The salinity range in the Blanakan river is low compared to samples from Bengkalis strait, Java sea, and Eastern of Indian ocean (Table 1). Low salinity occurred because the location of the Blanakan river itself was located far from the ocean area; hence the salinity was low.

Heavy metals can also significantly affect the growth rate of fish. It is crucial to monitor all potential contaminations of the ecosystem and its effect on food webs to ensure the fish commodities quality and safety. Even a low concentration of heavy metals may cause fingerling stress that may not kill fish, but cause a decrease in fish size, and body weight. The metals may into the fish’s body by three possible routes: (i) the skin surface/epidermal surface (skin), (ii) the gills (iii) the food tract.

The Zn range in the water of the Blanakan river was found lower in comparison to other similar locations, for example, the Kamal coast (Table 2). In those locations, Zn in water can be several folds than in the Blanakan. However, the Zn range in the water of the Blanakan river was observed higher than the range found in the Membramo river and Pangkaje river.

Mystus sp. in this study has salinity ranged from 20 to 29 (Figure 3). Fish that live in the estuary area have adaptation ability towards a wide salinity range. Hence, this happens because of the osmoregulation mechanism in fishes. This mechanism will keep the body water composition stable despite how high or low water salinity.

The size distribution of Mystus sp. also depends on Zn ranges. In Figure 4, larger Mystus sp. found in the river mouth that has higher Zn. Meanwhile, smaller fishes were found only in a river that has lower Zn. Body size is related to the resistance of Mystus sp. Smaller or younger Mystus sp. is not resistant to Zn exposure than larger fish that may be more tolerant of Zn.

5. Conclusion

The salinity and Zn influence Mystus sp. length and weight. The increase of salinity will increase the length and weight. Likewise, the increase of Zn will increase the length and weight as well.

Acknowledgments

This research was funded by DRPM UI (Directorate for Research and Community Research of the University of Indonesia) with contract number NKB-0029/UN2.R3.1/HKP.05.00/2019.
References

[1] A Yulan, Ida AAP, dan Ariesa A. Gema Putri 2013 Tingkat kelangsungan hidup benih ikan nila gift (*Oreochromis niloticus*) pada salinitas yang berbeda *Jurnal Perikanan (J. Fish. Sci.)* XV 78-82

[2] Boeuf G and Payan P 2001 How should salinity influence fish growth *Comp Biochem Physiol C Toxicol Pharmacol* 130 411-23

[3] Nath, P. and S.C. Dey 2000 Conservation of fish germplasm resources of Arunachal Pradesh. p .49-67. In A.G. Ponniah and U.K. Sarkar eds *Fish biodiversity of north east India* (NBFGR.NATP Publ. 2,228p)

[4] Kumar M, Ratna A, Prashad R, Trivedi SP, Sharma YK, and Shukla AK. Assessment of zinc bioaccumulation in fish channa punctatus exposed chronically *Global Journal of Biotechnology* 4 2015: 347-355

[5] Simanjuntak, J.A.M. 2015 Beberapa aspek biologi ikan lundu macrones gulio gunther, 1864) di perairan majakerta, kecamatan balongan, indramayu (Departemen Manajemen Sumberdaya Perairan, Fakultas Perikanan dan Ilmu Kelautan, Institut Pertanian Bogor)

[6] Takarina ND and Wardhana W. 2019 Relationship between environmental parameters and the Plankton community of the Batuhideung fishing grounds, Pandeglang, Banten, Indonesia. *Journal of Biological Diversity* 20

[7] Permanawati, Yani & Zuraida, Rina & Ibrahim, Andrian 2016 Kandungan logam berat (cu, pb, zn, cd, dan cr) dalam air dan sedimen di perairan teluk Jakarta *Jurnal Geologi Kelautan*. 11 9. 10.32693/jgk.11.1.2013.227.

[8] Anggara, Anja 2012 Studi Biodiversitas dan Distribusi Nekton Berdasarkan Kondisi Fisik dan Kimia Kawasan Daerah Aliran Sungai Ogan serta Pengajarannya di SMAN 1 Rambutan *Prosiding Interdisciplinary Postgraduate Student Conference 2nd*

[9] Amri K, Muchlizar M, and Ma’mun A 2018 Variasi bulanan salinitas, ph, dan oksigen terlarut di perairan estuary bengkalis *Majalah Ilmiah Ilmiah Globê* 20 57-66

[10] Putri AD, Yona D, Handayani M 2016 Kandungan logam beray (cd, cu, zn) pada air dan sedimen perairan pelabuhan kamal, kabupaten bangkalan, madura (Marine Resources Exploration and Management (MEXMA) Research Group, Universitas Brawijaya)

[11] Era, LN Mbay, DW Kusuma, M Trenggono 2012 Analisis suhu, salinitas, dan oksigen terlarut sebagai indikator upwelling di timurlaut samudera india *Jurnal Kelautan Nasional* 7 175-182

[12] Z Tarigan, Edward dan Rozak A 2003 Kandungan Logam Berat Pb, Cd, C, Zn, dan Ni dalam Air Laut dan Sedimen di Muara Sungai Membrano, Papua Dalam Kaitannya dengan Kepentingan Budidaya Perikanan *Makara Journal of Science* 7

[13] I Sunti, A Daud, S Manyullei 2008 *Studi Kandungan Logam Berat Seng (Zn) Dalam Air dan Kerang Baja-baja* (Andonta woodiana) di Sungai Pangkajene Kabupaten Pangkep (Universitas Hasanudin:Makasar)

[14] I.M. Sinaga, Titrawani, Yusfiati 2013 *Analisis Isi Lambung Ikan Baung* (*Mystus nemurus cv*) *di Perairan Sungai Siak Kecamatan Rumbai Pesisir Provinsi Riau* (Fakultas Matematika dan Ilmu Pengetahuan Alam Kampus Binawidya: Pekanbaru)

[15] Rao KR 2017 Food and feeding habits of freshwater cat fishes siluriformes : bagridae : mystus sp.) *Int. J. Life. Sci. Scienti. Res.*, 3 786-791