SEAS (Sustainable Environment Agricultural Science) **E-ISSN 2614-0934**

http://ejournal.warmadewa.ac.id/index.php/seas
Volume 06, Number 01, April 2022, Pages: 34~41 http://dx.doi.org/10.22225/seas.6.1.4918.34-41

The Length-Length Relationships, Growth Pattern and Condition of *Rasbora* sp. in Tamblingan Lake, Bali Island

I Nyoman Y. Parawangsa[1*], Prawira A.R.P. Tampubolon[2] Nyoman Dati Pertami[3]

[1] Program Study of Aquatic Resources Management,
Faculty of Agriculture, Warmadewa University, Denpasar Bali, 80239, Indonesia
[2] Research Institute for Tuna Fisheries,
Ministry of Marine Affairs and Fisheries, Denpasar Bali, 80224, Indonesia
[3] Program Study of Aquatic Resources Management,
Faculty Marine Sciences and Fisheries, Udayana University, Badung, Bali, 80361, Indonesia

*Email: inymyparawangsa@gmail.com

Abstract

Rasbora sp. *is one of native fish species that inhabit in Tamblingan Lake. Several publication that discussed about this species in other ecosystem was published, but very rare information in Tamblingan Lake. The aims of this research ware determine the length-length relationships, growth pattern and condition Rasbora* sp. *in Tamblingan Lake. Fish sampling conducted from January to December 2019 in Tamblingan Lake. The sampling method was purposive sampling which did alternately every month on five sampling station that representing the condition of Tamblingan Lake. The fish sample were captured by experimental gillnet. Every fish sample was measured in length by ruler with an accuracy of 0.1 cm and weighed using a digital scale with 0.01 g accuracy. The result shown, all character of length has strong correlation with body weight of fish, but the total length (TL) was the most accurate measure to estimating the body weight of Rasbora* sp. *The growth pattern of Rasbora* sp. *was isometric and the condition of this fish in good condition.*

Keywords: good condition, isometric, total length

1. Introduction

The fish resources management in an aquatic ecosystem requires a variety of supporting information. Basic information that encouraged the management of a fish species is the length-length relationship, the length-weight relationship and the condition factors [1-3]. The length-length relationship used to determine the most accurate type of length character for estimating fish body weight in the length-weight relationship [4]. The growth pattern of fish expose through the length-weight relationship which also be used to approach the condition factors of fish [5, 6]. The condition factors approach will provide an overview of the compatibility between a fish and their habitat as indicated by the good condition of the fish through the estimated value of the relative condition factor [7].

Tamblingan Lake is one of four lake ecosystem in Bali Island. This lake is located in Buyan-Beratan Caldera Mountage *Rasbora* sp. is one of 7 fish species inhabit in Tamblingan Lake, Bali Island. Various information related to this fish species has been published before. The research of *Rasbora* sp. has been carried out in other aquatic ecosystems. Several research of *Rasbora* sp. discussed about, the food habit in Musi River [8], the population structure in Sekadau River [9], the growth in Jatigede Reservoir [10] and the spawning spot habit in Ngrancah River [11]. This fish species has been studied on a laboratory-scale which discussed about domestication [12], the

induction of gonadal maturation [13] and the spawning induction [14]. Noted, the information of this species in Tamblingan Lake only about the length measurement [15].

Although, the research related to *Rasbora* sp. has been widely published before, but the information on this fish species in Tamblingan Lake is still rare. The deficiency of information on *Rasbora* sp. in Tamblingan Lake will cause difficulties in managing the resources of this fish species in Tamblingan Lake. The research that provides basic information such as the length-length relationship, the length-weight relationship and the relative condition factors is very important to provide complete basic information for the management of *Rasbora* sp. in Tamblingan Lake. The aims of this research was to reveal the accurate type of measure for estimating fish body weight, growth pattern and condition of *Rasbora* sp. in Tamblingan Lake, Bali.

2. Material and Methods

The fish sampling was conducted on January until December 2019 in Tamblingan Lake, Bali. The method of fish sampling was purposive sampling by determining fish sampling stations taking into the ecological conditions of Tamblingan Lake. There were five sampling stations that selected based on ecological characteristics (Table 1) which is considered to describe the condition of Tamblingan Lake, Bali (Figure 1).

The fish sample were captured by gillnet with a width of 300 m and a height of 2 m and a mesh size of 0.5; 1.0; 1.5; 2.0; 2.5; 3.0 cm. The gillnet settled in the afternoon (05.00 PM) and hauled in the morning (at 08.00 AM) in the next day. Fish sample separated based on sampling station and then preserved with formaldehyde 10%. Every fish sample was measured in length by ruler with an accuracy of 0.1 cm and weighed using a digital scale with 0.01 g accuracy.

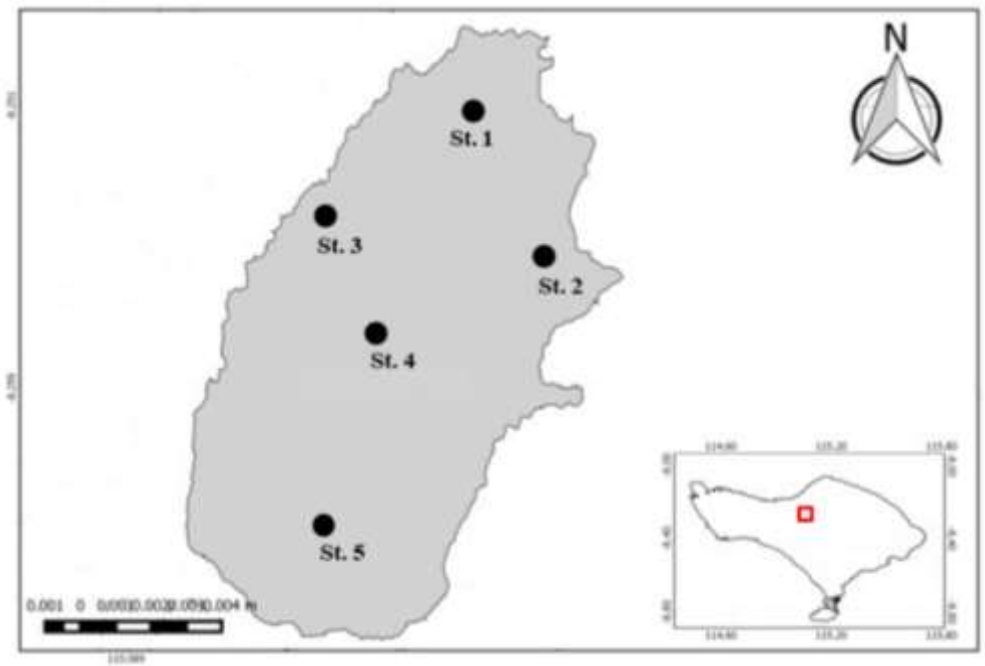

Figure 1. Maps location of the fish sampling in Tamblingan Lake during January until December 2019

Table 1. Name station and ecological characteristic of each bonylip barb sampling station in Tamblingan Lake during January until December 2019

No.	Name station	Ecological characteristic
1.	Lenggang	It was area that overgrown with aquatic plants (*Nymphoides* sp.) and the topography was rather steep and rocky.
2.	Pura Dalem	A rocky lake littoral zone, aquatic plants (*Cyperus* spp.), fishing area, and holy area for Hindu religion.
3.	Tirta Mengening	Cliff littoral zone, found dead tree trunks, and holy area.
4.	Tengah	Location for the fishers to spread their nets, the water current is quite strong, and the deepest zone of Tamblingan Lake.
5.	Pos Nelayan	It was overgrown with *Nymphoides* sp., a sloping littoral zone, and a location for the fishermen to catch fish by spearfishing.

Length-length relationships (SL-FL, SL-TL, FL-TL) were analyzed by linier regression. All types of length characters were analyzed with weight. The length-weight relationship was using the equation:

$$W = aL^b \quad (1)$$

Description:
W: weight (g); a and b: regression constant of length-weight; L: length of fish (mm)

Fish condition estimated by relative condition factors (Kn) using the equation (Le Cren, 1951):

$$Kn = \frac{W}{W^*} \quad (2)$$

Description:
Kn: relative condition factor; W: observed weight (g); W*: expected weight (g) form length-weight regression

3. Results and Discussion

3.1 The length-length relationship

Total sample of *Rasbora* sp. during January until December 2019 was 121 individuals. The range of total length (TL) and weight *Rasbora* sp. in Tamblingan Lake was 4.7 – 13.1 cm and 1.2 – 21.4 g. The length-length relationship of *Rasbora* sp. (TL-FL, TL-SL and FL-SL) has highly correlation R^2>0.97 (Figure 2).

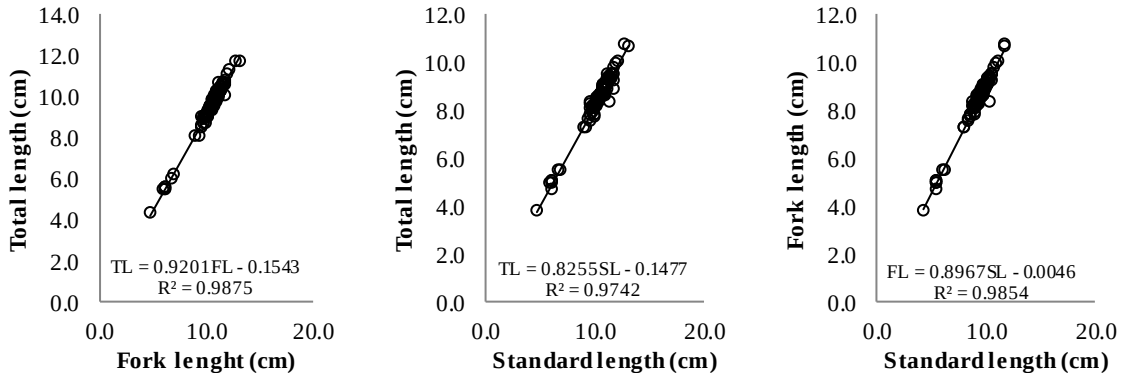

Figure 2. The length-length relationship of Rasbora sp. in Tamblingan Lake during January until December 2019

The length-length relationship is the morphometric parameter that important analysis to fisheries resources management [16, 17]. The length-length relationship of *Rasbora* sp. (TL-FL, TL-

SL and FL-SL) has highly correlation. Several fish species also had the highly correlation on the length-length relationship was *Pseudobrama simoni* [18], Glossogobius giuris [7] *Carassius auratus gibelio* [19], *Rasbora argyrotaenia* [4], *Sardinella gibbosa* [20]. The length-length relationship determine by sex [19], ecology factor and fish physiology [5, 21]. All length character of *Rasbora* sp. in Tamblingan was approached estimate on analyzed the length-weight relationship.

3.2 The length-weight relationship

The result of every type of length with *Rasbora* sp. body weight has strong correlation R^2>9.4. All type of length able to estimate the fish weight well, however the total length (TL) type was the most accurate type of length measurement in estimating the body weight of *Rasbora* sp. in Tamblingan Lake, Bali (Figure 3). Based on b value in the total length-weight relationship, the growth pattern of *Rasbora* sp. in Tamblingan Lake was isometric that describe the growth in length along with the incrase in body weight. The other research that discussed about the length-weight relationship of Genus *Rasbora* in other ecosystems shown in Table 2.

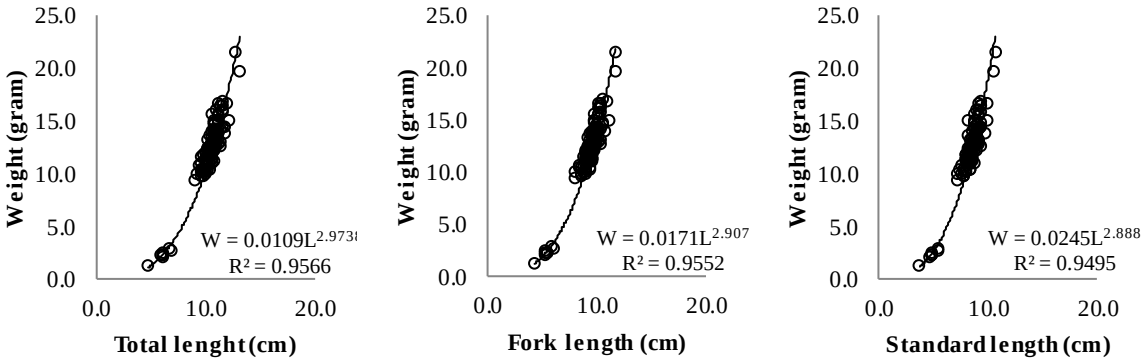

Figure 3. The length-weight relationship of Rasbora sp. in Tamblingan Lake during January until December 2019

The length-weight relationship is the basic information to take an approach the growth parameter of fish species in difference habitat. *Rasbora* sp. in Tamblingan Lake has isometric growth pattern. The growth pattern of fish determine by several factor such as, food availability [22], season [23, 24] condition and quality of aquatic ecology [25] and gonad maturation [26]. The other research result that discussed the length-weight relationship of *Rasbora* sp. in the other aquatic ecosystem displayed in Table 2.

Table 2. The length-weight relationship of *Rasbora* in other ecosystems

Location	Species	Sex	b	Growth Pattern	Reference
Tamblingan Lake (Bali)	*Rasbora* sp.	Pooled	2.97	Isometric	This research
Buyan Lake (Bali)	*Rasbora argyrotaenia*	Pooled	3.28	Allometric (+)	[4]
Beratan Lake (Bali)	*Rasbora argyrotaenia*	Pooled	3.26	Allometric (+)	[4]
Batur Lake (Bali)	*Rasbora argyrotaenia*	Pooled	3.26	Allometric (+)	[4]
Laut Tawar Lake (Aceh)	*Rasbora tawarensis*	Male Female	2.59 2.57	Allometric (–) Allometric (–)	[27]
Batang River (South Kalimatan)	*Rasbora argyrotaenia*	Male Female	2.71 3.02	Allometric (–) Isometric	[28]
Jatigede Reservoir (West Java)	*Raebora argyrotaenia*	Pooled	2.70	Allometric (–)	[10]
Kerian River (Malaysia)	*Rasbora sumatrana*	Pooled	3.61	Allometric (+)	[29]
Sokong River (Lombok)	*Rasbora lateristriata*	Pooled	2.51	Allometric (–)	[30]

Selaka Rivers (Lombok)	*Rasbora lateristriata*	Pooled	3.47	Allometric (+)	[31]
Babak Rivers (Lombok)	*Rasbora lateristriata*	Pooled	2.65	Allometric (–)	[31]

3.3 Relative condition factor (Kn)

The value of the relative condition factor (Kn) of *Rasbora* sp. in Tamblingan Lake quite fluctuating on every month of observation. The relative condition factor of this species ranged from 0.77-1.24 with average 1.01 (Table 3). The highest value of relative condition factor was found on August and December, while the lowest value found on March.

Table 3. Relative condition factor (Kn) of *Rasbora* sp. in Tamblingan Lake during January until December 2019

Month	n	Range	Average
January	7	0.93 – 1.17	1.00
February	5	0.87 – 1.07	0.99
March	12	0.77 – 1.10	0.95
April	7	0.82 – 1.21	0.96
May	13	0.80 – 1.02	0.94
June	2	0.92	0.92
July	8	0.90 – 1.10	1.02
August	17	0.85 – 1.24	1.02
September	18	0.95 – 1.20	1.07
October	23	0.85 – 1.22	1.01
November	3	1.03 – 1.13	1.09
December	6	0.98 – 1.24	1.08
Total	121	0.77 – 1.24	1.01

Condition factor is one of the indicators of aquatic ecological health [32] that indicate the nutritional adequacy and individual fitness [33]. The highest value of relative condition factor designate the fish in prosperous and the habitat condition supporting the fish life [33, 34] as well as the indicator of spawning period of fish [35]. The other fish species in genus Rasbora like *R. tawarensis* in Laut Tawar Lake [27, 36], *R. lateristriata* in Central Lombok waters [31], *R. argyrotaenia* in Flood Plain Rungan River, Central Kalimantan [37] and in Batang River, South Kalimantan [28] also in good condition factor. Fish species in genus Rasbora is very adaptive in some inland waters ecosystems. [38, 39] states that Family Cyprinidae is relatively large number of species in freshwater and has good adaptability, so the distribution of this species is wide in many freshwater ecosystems. The value of relative condition factor determine by gonad maturation [40], food availability and feeding intensity [41, 42], temperature [43] and the condition of aquatic ecosystem [44].

4. Conclusion

The total length, fork length and standard length has highly correlation on the length-length relationship. The total length was the accurate length character to estimate the body weight of *Rasbora* sp. in Tamblingan Lake. The growth pattern of *Rasbora* sp. in Tamblingan Lake was isometric and in good condition with the range of relative condition factor between 0.77 – 1.24.

Acknowledgements

The authors would thank you to Swarna Jawa Bali (SJB) Dwipa members, Putu Roni Graha Persada and Dewa Gde Tribodhi Saputra and also Mr. I Nengah Semen who helped to collect the fish sampling during the research period.

References

[1] Keivany, Y., Nezamoleslami, A., Dorafshan, S., Eagderi, S. (2015). Length-weight and length-length relationships in populations of *Garra rufa* from different rivers and basins of Iran. *International Journal of Aquatic Biology*, 3(6), 409–413.

[2] Kara, A., Acarli, D., İlkyaz, A.T., Babaoğlu, A.O. (2020). Length-weight and length-length relations for 21 fish species caught in Izmir Bay. *Acta Adriatica*, 61(2), 197–204. doi: 10.32582/aa.61.2.8.

[3] Phan, G. H., Linh, L.T.T., Dinh, Q.M., Truong, N.T., Nguyen, T.H.D. (2021). Length-weight relationship, growth pattern and condition factor of *Glossogobius giuris* caught from coastal areas in the Mekong Delta. *AACL Bioflux*, 14(3), 1478–1485.

[4] Parawangsa, I.N.Y., Tampubolon, P.A.R.P., Pertami, N.D. (2021). Karakter panjang, hubunganpanjang-bobot dan kondisi ikan nyalian buluh (*Rasbora argyrotaenia* Bleeker, 1849) di Catur Danu Bali. *Bawal*, 13(1), 45–55. doi: http://dx.doi.org/10.15578/bawal.13.1.2021.45-55.

[5] Hossain, M.Y. (2010). Length-weight, length-length relationships and condition factors of three schibid catfishes from the Padma River, Northwestern Bangladesh. *Asian Fisheries Science*, 23(3),329–339. doi: 10.33997/j.afs.2010.23.3.005.

[6] Dinh, Q.M., Qin, J.G., Dittmann, S., Tran, D.D. (2016). Morphometric variation of parapocryptes serperaster (Gobiidae) in dry and wet seasons in the Mekong Delta, Vietnam. *Ichthyological Research*, 63(2), 267–274. doi: 10.1007/s10228-015-0497-0.

[7] Alam, M. M., Jahan, S.N., Hussain, M.A., De, M., Goutham-Bharathi, M.P., Magalhães, A.L.B., Mazlan, A.G., Simon, K.D. (2013). Length-length relationship, length-weight relationship and condition factor of freshwater fish species of Bangladesh. *AACL Bioflux*, 6(5), 498–509.

[8] Haris, H., Mutiara, D., Arsyad, N. (2018). Kebiasaan makan ikan seluang (*Rasbora argyrotaenia*) di Perairan Sungai Musi. *Sainmatika: Jurnal Ilmiah Matematika Dan Ilmu Pengetahuan Alam*, 15(2), 123–128. doi: 10.31851/sainmatika.v15i2.2244.

[9] Suryani, F.Y., Setyawati, T.R., Yanti, A.H. (2019). Struktur populasi ikan seluang (*Rasbora argyrotaenia*) di Hilir Sungai Sekadau Kecamatan Sekadau Hilir Kabupaten Sekadau. *Jurnal Protobiont*, 8(2), 74–81. doi: 10.26418/protobiont.v8i2.34031.

[10] Herawati, T., Lili, W., Mustikawati, R., Adhardiansyah, Diliana, S.Y. (2017). Pertumbuhan ikan paray (*Rasbora argyrotaenia*, Blkr) di Waduk Jatigede Kabupaten Sumedang Provinsi Jawa Barat. *Akuatika Indonesia*, 2(1), 71–78. doi: 10.24198/jaki.v2i1.23428.

[11] Sentosa, A.S., Djumanto. (2010). Habitat pemijahan ikan wader pari (*Rasbora lateristriata*) di Sungai Ngrancah, Kabupaten Kulonprogo. *Jurnal Iktiologi Indonesia*, 10(1), 55–63.

[12] Zulfadhli, Fadhillah, R. (2019). Domestikasi ikan bileh (*Rasbora* sp) asal perairan Aceh Barat dalam wadah budidaya berbeda. *Jurnal Perikanan Tropis*, 6(2), 101–107.

[13] Syarif, A.F., Putri, D.F.A., Robin. (2021). Induksi maturasi ikan seluang (*Rasbora einthovenii*) betina menggunakan Hormon GNRH Analog + Anti Dopamin melalui pakan. *Jurnal Sains Akuakultur Tropis*, 5(1), 22–33.

[14] Ningrum, D.R.K., Budi, D.S., Sulmartiwi, L. (2019). Induksi pemijahan ikan wader pari (*Rasbora argyrotaenia*) menggunakan Ovaprim TM dengan dosis berbeda. *Depik*, 8(2), 117–224. doi: 10.13170/depik.8.2.14076.

[15] Pertami, N.D., Tampubolon, P.A.R.P., Parawangsa, I.N.Y., Persada, P.R.G., Manangkalangi, E., Syafei, L.S. (2020). The ratio of native and alien species fish in Buyan and Tamblingan Lake, Bali. *IOP Conference Series Earth and Environmental Science*, 404(1), 1–10. doi:10.1088/1755-1315/404/1/012058.

[16] Mahmoudi, R., Soltani, M., Matinfar, A., Gilkolai, S.R., Kamali, A. (2014). Morphometric relationship between length-weight, length-length and condition factor in farmed rainbow trout (*Oncorhynchus mykiss*). *Bulletin of Environment, Pharmacology and Life Sciences*, 3(4), 215–220.

[17] Omar, S.B.A., Kariyanti, Yanuarita, D., Umar, M.T., Lawi, Y.S.A. (2020). Length-weight relationship and condition factor of the celebes rainbowfish *Marosatherina ladigesi*, endemic to the Maros karst region, South Sulawesi, Indonesia. *AACL Bioflux*, 13(6), 3384–3396.

[18] Wang, T., Wang, H.S., Sun, G.W., Huang, D., Shen, J.H. (2012). Length-weight and length-length relationships for some Yangtze River fishes in Tian-e-Zhou Oxbow, China. *Journal of Applied Ichthyology*, 28(4), 660–662. doi: 10.1111/j.1439-0426.2012.01971.x.

[19] Radkhah, A., Eagderi, S. (2015). Length-weight and length-length relationships and condition factor of six cyprinid fish species from Zarrineh River (Urmia Lake Basin, Iran). Iranian Journal of Ichthyology, 2(1), 61–64.

[20] Tampubolon, P.A.R.P., Pertami, N.D., Wujdi, A. (2021). Morphoregression and first size at maturity of goldstripe sardinella (Sardinella gibbosa) from Bali Strait Waters. I*ndonesian Fisheries Research Journal*, 27(1), 17–26. doi: http://dx.doi.org/10.15578/ifrj.27.1.2021.17-26.

[21] Le Cren, E.D. (1951). The length-weight relationship and seasonal cycle in gonad weight and condition in the the lenght-weight relationship and seasonal cycle in gonad weight and condition in the perch. *British Ecological Society*, 20(2), 201–219.

[22] Ebrahimi, G., Ouraji, H. (2012). Growth performance and body composition of kutum fingerlings, *Rutilus frisii* Kutum (Kamenskii 1901), in response to dietary protein levels. *Turkish Journal of Zoology,* 36(4), 551–558. doi: 10.3906/zoo-1008-139.

[23] Jyrwa, L., Bhuyan, R.N., Nath, R. (2015). Length-weight relationship and condition factor of *Neolissochilus hexagonolepis* (McClelland) in Meghalaya , India : A Comparative Study. *International Journal of Fisheries and Aquatic Studies*, 3(1), 419–422.

[24] Djumanto, Setyobudi, E., Simanjuntak, C.P.H., Rahardjo, M.F. (2020). Estimating the spawning and growth of striped snakehead *Channa striata* Bloch, 1793 in Lake Rawa Pening Indonesia. *Scientific Reports*, 10(1), 1–11. doi: 10.1038/s41598-020-76825-5.

[25] Jusmaldi, Hariani, N. (2018). Hubungan panjang bobot dan faktor kondisi ikan wader bintik dua *Barbodes binotatus* (Valenciennes, 1842) di Sungai Barambai Samarinda Kalimantan. *Jurnal Iktiologi Indonesia,* 18(2), 87–101. doi: 10.32491/jii.v18i2.426.

[26] Hanif, M.A., Siddik, M.A.B., Ali, M.M. (2020). Length-weight relationships of seven cyprinid fish species from The Kaptai Lake, Bangladesh. *Journal of Applied Ichthyology,* 36(2), 261–264. doi: 10.1111/jai.14016.

[27] Muchlisin, Z.A., Musman, M., Azizah, M.N.S. (2010). Length-weight relationships and condition factors of two threatened fishes, *Rasbora Tawarensis* and *Poropuntius Tawarensis*, endemic to Lake Laut Tawar, Aceh Province, Indonesia. *Journal of Applied Ichthyology*, 26(6), 949–953. doi: 10.1111/j.1439-0426.2010.01524.x.

[28] Ahmadi. (2021). Length-weight relationship and condition factor of the silver rasbora (*Rasbora argyrotaenia*) from Sungai Batang River, South Kalimantan, Indonesia. *Philippine Journal of Science*, 150(6B), 1735–1749.

[29] Isa, M.M., Rawi, C.S.M., Rosla, R., Shah, S.A.M., Shah, A.S.R.M. (2010). Length-weight relationships of freshwater fish species in Kerian River Basin and Pedu Lake. *Research Journal of Fisheries and Hydrobiology*, 5(1), 1–8.

[30] Harris, A., Liliyanti, M.A., Sumahiradewi, L.D., Artiningrum, N.T. (2021). morphometric, meristic characters, and gonad maturity level of pepudah fish (*Rasbora lateristriata*) from Sokong Rivers, North Lombok District. *Jurnal Pendidikan Biologi dan Sains*, 6(1), 28–37.

[31] Asrial, E., Harris, A., Abdolah. (2017). Fisheries biology aspectsof yellow rasbora (*Rasbora lateristriata* Blkr 1854) from Central Lombok, Indonesia. International Journal of Recent Scientific Research, 8(11), 21547–21553.

[32] Mir, J.I., Shabir, R., Mir, F.A. (2012). Length-weight relationship and condition factor of *Schizopyge curvifrons* (Heckel, 1838) from River Jhelum, Kashmir, India. *World Journal of Fish and Marine Sciences*, 4(3), 325–329. doi: 10.5829/idosi.wjfms.2012.04.03.63155.

[33] Gubiani, É.A., Ruaro, R., Ribeiro, V.R., de Santa Fé, U.M.G. (2020). Relative condition factor: Le Cren's legacy for fisheries science. *Acta Limnologica Brasiliensia,* 32(e3), 1–9. doi: 10.1590/s2179-975x13017.

[34] Ujjania, N.C., Sharma, L.L., Balai, V.K. (2013). Length-weight relationship and condition factor of indian major carp (*Labeo rohita* Ham., 1822) from Southern Rajasthan, India. *Applied Biological Research*, 15(2), 104–108.

[35] Hossain, M.Y., Ahmed, Z.F., Leunda, P.M., Jasmine, S., Oscoz, J., Miranda, R., Ohtomi, J. (2006). Condition, length-weight and length-length relationships of the asian striped catfish *Mystus vittatus* (Bloch, 1794) (Siluriformes: Bagridae) in the Mathabhanga River, Southwestern Bangladesh. *Journal of Applied Ichthyology*, 22(4), 304–307. doi: 10.1111/j.1439-0426.2006.00803.x.

[36] Hasri, I., Kamal, M.M. (2011). Pertumbuhan dan laju eksploitasi ikan endemik *Rasbora tawarensis* (Weber & de Beaufort, 1916) di Danau Laut Tawar, Aceh Tengah. *Jurnal Iktiologi Indonesia,* 11(1), 21–28.

[37] Sulistiyarto, B. (2012). Hubungan panjang berat , faktor kondisi , dan komposisi makanan ikan saluang (*Rasbora argyrotaenia* Blkr) di Dataran Banjir Sungai Rungan, Kalimantan Tengah. *Jurnal Ilmu Hewani Tropika*, 1(2), 62–66.

[38] Beamish, F.W.H., Sa-Ardrit, P., Tongnunui, S. (2006). Habitat characteristics of the cyprinidae in small rivers in Central Thailand. *Environmental Biology of Fishes,* 76(2–4), 237–253. doi: 10.1007/s10641-006-9029-0.

[39] Rusmilyansari, Wahab, A.A., Wiryono, Cahyati, R. (2021). Fish species composition and diversity in a river, a swamp, and a reservoir in Banjar District, South Kalimantan Province. *AACL Bioflux*, 14(1), 412–23.

[40] Dan-Kishiya, A.S. (2013). Length-weight relationship and condition factor of five fish species from a tropical water supply reservoir in Abuja, Nigeria. *American Journal of Research Communication*, 1(19), 175–187.

[41] Soni, N., Ujjania, N.C. (2017). Length-weight relationship and condition factor of indian major carps of Vallabhsagar Reservoir, Gujarat, India. *Indian Journal of Fisheries*, 64, 186–189. doi: 10.21077/ijf.2017.64.special-issue.76263-27.

[42] Jisr, N., Younes, G., Sukhn, C., El-Dakdouki, M.H. (2018). Length-weight relationships and relative condition factor of fish inhabiting the marine area of the Eastern Mediterranean City, Tripoli-Lebanon. *Egyptian Journal of Aquatic Research*, 44(4), 299–305. doi: 10.1016/j.ejar.2018.11.004.

[43] De Giosa, M., Czerniejewski, P., Rybczyk, A. (2014). Seasonal changes in condition factor and weight-length relationship of invasive *Carassius gibelio* (Bloch, 1782) from Leszczynskie Lakeland, Poland. *Advances in Zoology* 2014, 1–7. doi: 10.1155/2014/678763.

[44] Asadi, H., Sattari, M., Motalebi, Y., Zamani-Faradonbeh, M., Gheytasi, A. (2017). Length-weight relationship and condition factor of seven fish species from Shahrbijar River, Southern Caspian Sea Basin, Iran. *Iranian Journal of Fisheries Sciences*, 16(2), 733–741.