Plant Archives Vol. 20, Supplement 2, 2020 pp. 3262-3265 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

FOOD HABITS OF MATANO MEDAKA, *ORYZIAS MATANENSIS* (AURICH, 1935) AT LAKE TOWUTI, SOUTH SULAWESI, INDONESIA

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Abstract

Matano medaka fish (*Oryzias matanensis*) is one of the endemic freshwater fish in Lake Towuti with a high economic value, which is used as ornamental fish. This study aims to determine the food habits of Matano medaka fish in Lake Towuti. The study was conducted from November 2017 to October 2018. Sample analysis was carried out at the Laboratory of Fisheries Biology, Department of Fisheries, Hasanuddin University, Makassar. The method used to determine Matano medaka food habits is Index of Preponderance (IP). The results showed that male and female Matano medaka fish in Lake Towuti were omnivorous (insectivorous) with the main food were insects, supplementary foods were litter, and complementary foods were phytoplankton (*Pinnularia*, *Closterium*, *Navicula*, *Synedra*, and *Nitzschia*).

Introduction

Matano medaka fish (*Oryzias matanensis*) is one of the species of the genus *Oryzias* which has an exciting coloring pattern, so it has been exploited for a long time by the local community as ornamental fish. In contrast to Japan, scientists use medaka fish (*Oryziaslatipes*) as a model animal, replacing zebrafish (*Danio rerio*), to study organogenesis, sex determination, genetics, evolution, and research related to human diseases (Kinoshita *et al*., 2009; Naruse *et al*., 2011; Murata *et al*., 2020).

At present, the presence of Matano medaka fish populations is increasingly rare in Lake Matano, its natural habitat, but populations of this species can be found in Lake Towuti. Matano Medaka fish allegedly migrated from their natural habitat to the rivers that connect the Malili Lake Complex so they can reach Lake Towuti. Also supported by the results of personal observations conducted by Lumbantobing in 2018 who found Matano medaka fish with a slightly large size found quite abundant in the Lake Matano Outlet area, the Petea River that flows its water to Mahalona Lake. Furthermore, the water from Mahalona Lake flows to Lake Towuti through the Tominanga River.

The alleged migration process carried out by Matano Medaka fish is also supported by preliminary research conducted in September 2016 at Lake Matano. The results obtained from four observation sites on Lake Matano, only one tail of Matano medaka fish was found around Lake Matano Inlet. Then in March 2017, a re-observation was made for two consecutive days, the results obtained were four Matano medaka fish which were also found around the Lake Matano Inlet, although three stations from before had added the observation site.

Based on this and several other considerations, in June 2017, the observation site was then moved to Lake Towuti, which is in the same complex as Lake Matano. These observations found ten tails ofMatano medaka fish around Lake Towuti Inlet and 14 tails around TanjungBakara, so it was decided that research activities would be carried out in Lake Towuti waters by making the two places as observation stations.

In addition to the various threats and pressures faced by Matano Medaka fish in their habitat, information related to ecological, biological, and reproductive aspects of these fishes is remaining low. Meanwhile, this information is needed to preserve this endemic fish so that it can be managed optimally. Research that has been done to date on Matano medaka fish is still limited to the systematic and general description conducted by Kottelat& Whitten (1996) and histology of the liver and intestines by Fahmi *et al*. (2019).

The status of this endemic fish population has been vulnerable since 1996 (Kottelat, 1996). However, Lumbantobing (2019) states that the current status of the fish is near threatened. Food habits are crucial information because food availability is a factor that determines population dynamics, growth, and condition of fish in the water (Sasongko *et al*., 2019). This study's results can be used as necessary information in efforts to protect and conserve the habitat of the Matano medaka fish species, especially in Lake Towuti.

Material and Methods

Time and Location

The study was conducted in Lake Towuti, South Sulawesi, Indonesia (Figure 1), for twelve months with a time interval of sampling once a month, which was carried out in November 2017 to October 2018.

Fig. 1 : Map of sampling locations for Matano medaka fish, *Oryzias matanensis* (Aurich, 1935) on Lake Towuti.

The observation station at Lake Towuti can be divided into two stations: TanjungBakara Station and Lake Towuti Inlet Station. Station selection is based on variations in habitat, the presence of aquatic plants, and fish samples.

Tanjung Bakara Station: Coordinates of 02º40'48 "LS and 121º25'55" BT, substrates in the form of sand, mud, and rocks, located in areas affected by sawmills (where the log splits into sheets) and high population activity in the field of fisheries and household, there are numerous aquatic plants, and the water depth is 1 - 10 m.

Lake Towuti Inlet Station: Originating from the Tominanga River, coordinates 02º39'55 "LS and 121º31'42" BT, the substrate in the form of sand, stone, and gravel, has no influence from population activities in both fisheries and households, there are no water plants with a water depth of 1 - 20 m.

Sample handling

Analysis of food habits was carried out on 80 matano medaka fish consisting of 20 male fish and 20 female fish at TanjungBakara Station, and 20 male fish and 20 female fish at Lake Towuti Inlet Station. Fish samples measured the length and weight, then performed surgery to remove the stomach and then preserved it using 10% formalin. The identification of gastric contents was carried out at the Fisheries Biology Laboratory, Hasanuddin University, Makassar. Observation of gastric contents was carried out using a microscope with a magnification of 10 / 0.25 with three times of repetition. The contents of the stomach are further identified using manuals of Edmondson's (1959), Barsanti & Gualtieri (2014), and Belinger & Sigee (2015).

Data analysis

The composition of determining the main food of fish Matanomedaka is known by analysis of the contents of the digestive tract. The contents calculation of the digestive tract is done by calculating the Index of Preponderance. The formula applied refers to Natarajan & Jhingran (1961):

$$IP = \frac{Vi \; x \; Oi}{\Sigma \; Vi \; x \; Oi} \; x \; 100\%$$

Note: IP = Index of Preponderance, Vi = percentage of the volume of one type of food, and Oi = percentage of frequency of occurrence of one kind.

Result

The results of the food habits analysis of male and female Matano medaka fish at TanjungBakara Station can be seen in Figure 2, while the food habits of male and female Matano medaka fish at Inlet Lake Towuti Station can be seen in Figure 3.

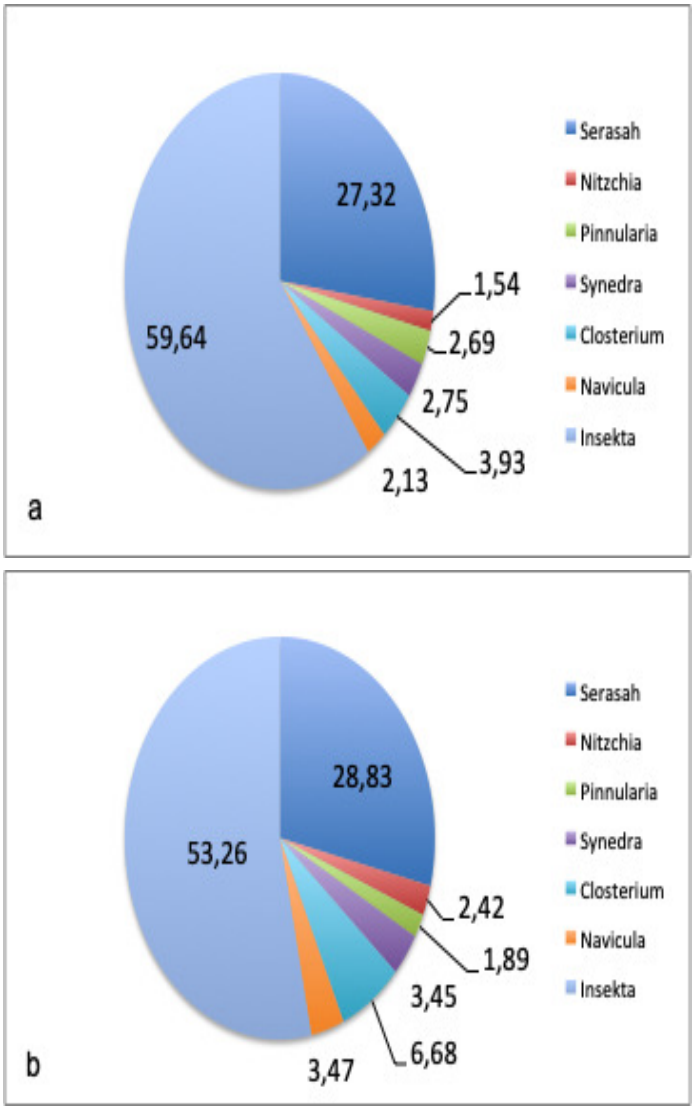

Fig. 2 : The spectrum of fish food composition of Matano medaka, *Oryzias matanensis* (Aurich, 1935) male (a) and female (b) at TanjungBakara Station.

The analysis results of the stomach contents of Matano medaka fish at Station TanjungBakara and Inlet Lake Towuti can be classified into three groups of food, such as insects, litter, and phytoplankton. Based on the index of preponderance (IP) or the most substantial part index, the leading food is determined if the IP > 40%, supplementary food if the IP is 4 - 40%, and supplementary food if the IP < 4%.

Based on Figure 2 it is known that the main food of male Matano medaka fish at TanjungBakara Station is insects (IP = 59.64%), supplementary food is litter (IP = 27.32%), and complementary foods are phytoplankton groups (*Closterium*, *Synedra*, *Pinnularia*, *Navicula*, and *Nitzschia* which have IP values respectively 3.93%, 2.75%, 2.69%, 2.13%, and 1.54%). Furthermore, in female Matano medaka fish the main food was insects (IP = 53.26%), supplementary food was litter (IP = 28.83%)and *Closterium* (IP = 6.68%), and supplementary food was phytoplankton (IP = *Navicula*, *Synedra*, *Nitzschia*, and *Pinnularia*, which have IP values respectively 3.47%, 3.45%, 2.42%, and 1.89%).

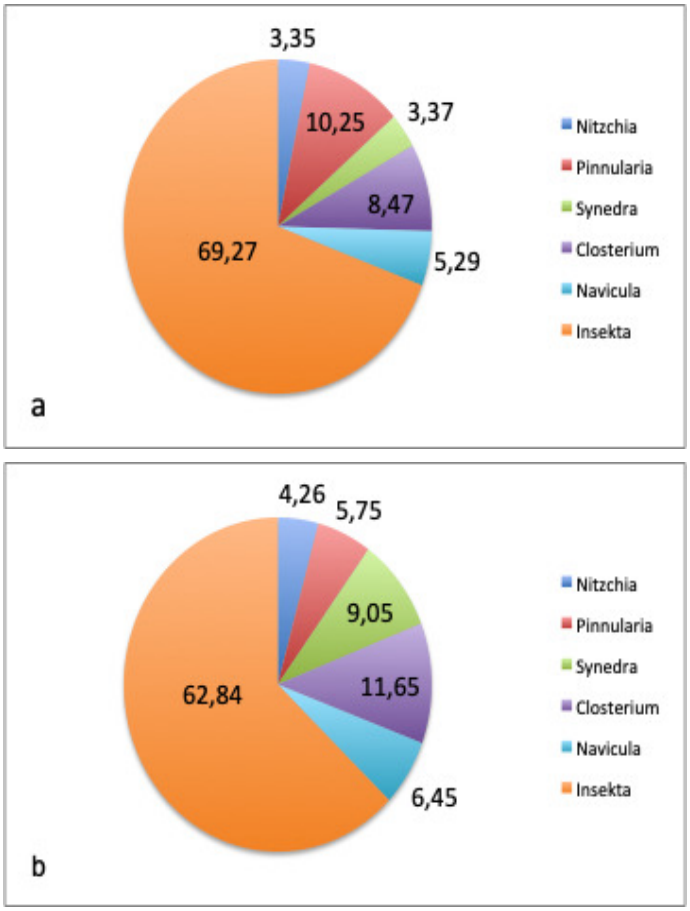

Fig. 3 : The spectrum of fish food composition of Matano medaka, *Oryzias matanensis* (Aurich, 1935) male (a) and female (b) at Towuti Lake Inlet Station.

Figure 3 illustrates that the main food of Matano medaka male fish at Lake Towuti Inlet Station is insects (IP = 69.27%), supplementary food is phytoplankton group consisting of *Pinnularia* (IP = 10.25%), *Closterium* (IP = 8.47%), and *Navicula* (IP = 5.29%), then complementary foods are *Synedra* (IP = 3.37%) and *Nitzschia* (IP = 3.35%). Matano medaka females have primary insect food (IP = 62.84%) and supplementary food is phytoplankton group consisting of *Closterium* (IP = 11.65%), *Synedra* (IP = 9.05%), *Navicula* (IP = 6.45%), *Pinnularia* (IP = 5.75%), and *Nitzschia* (IP = 4.26%).

Discussion

According to Effendie (2002), food habits are concerning the type, the quantity, and the quality of food eaten. While feeding habits are everything related to the time, place, and process of fish getting their food. Food is an essential part of controlling factors of reproduction, population dynamics, and fish conditions in waters (Paujiah *et al*., 2013).

Taofiqurohman *et al*. (2007 in Gani *et al*., 2015) explained that food customs and the way fish eat naturally depend on the environment where they live. Food habits for fish are influenced by the availability and abundance of food in waters, where the availability of food is influenced by the environment such as the temperature, light, space for fish, and surface area of water (Gani *et al*., 2015).

The results of food habits analysis generally found that the main food of male and female Matano medaka fish are insects (aquatic insects), while supplementary food is litter, and complementary foods are phytoplankton groups (*Pinnularia*, *Closterium*, *Navicula*, *Synedra*, and *Nitzschia*). So, it is recognized that Matano fish male and female medaka in Lake Towuti conclude as omnivorous fish that tend to be carnivorous (insectivorous).

The same thing was also found in opudi fish (*Telmatherina celebensis*) in Lake Towuti (Sulistiono *et al*., 2007), *Oryzias cf. Javanicus* in the Cisadea River, West Java (Paujiah *et al*., 2013), and Opudi fish (*Telmatherina prognatha*) in Lake Matano (Chadijah, 2020).

In contrast to found forronolindu fish (*Oryzias sarasinorum*) in Lake Lindu, Central Sulawesi, it classified to herbivorous fish (phytoplanktoneating) with its leading food is *Melosira* sp. (Gani *et al*., 2015), as well as *Oryzias nigrimas* in Lake Poso, Central Sulawesi, which is classified as omnivorous fish that tend to be herbivorous (Novalina *et al*., 2019).

Based on the observation station, the types of food used by male and female fish tend to be the same and are only distinguished by their percentage. The percentage of food types that are slightly different between male and female Matano medaka fish at each station depends on the taste of fish in utilizing food at each station. The number of organisms eaten by fish can be caused by uneven distribution factors, availability of food species, factors from the fish itself, and other factors that affect the waters (Effendie, 2002; Sukimin, 2004).

The distinct of Matano medaka fish food at TanjungBakara Station and Inlet of Lake Towuti Station depend on the presence of litter food, where this type is only found in gastric of Matano medaka fish at TanjungBakara Station. Due to the location of the TanjungBakara station has several aquatic plants and trees around the lake's edge, which are contributelitter to the waters. Therefore, Matano medaka fish caught in this area consume a type of litter food.

Conclusion

In conclusion, Matano medaka fish (*O. matanensis*) are omnivorous fish that tend to be carnivores (insectivores). Matano medaka natural foods in Lake Towuti consist of insects, litter, and phytoplankton (*Pinnularia*, *Closterium*, *Navicula*, *Synedra*, and *Nitzschia*).

Reference

Barsanti, L. and Gualtieri, P. (2014). Algae. Anatomy, Biochemistry, and Biotechnology. Second edition. Taylor & Francis, Boca Raton. 301 p.

Bellinger, E.G. and Sigee, D.C. (2015). Freshwater Algae. Identification, Enumeration, and Use as Bioindicators. Second edition. Wiley Blackwell, Chichester. 275 p.

Chadijah, A. (2020). Ekobiologisebagai Dasar Pengelolaan Ikan Endemik Opudi (*Telmatherina Prognatha* Kottelat, 1991) di Danau Matano, Sulawesi Selatan. Disertasi. Sekolah Pascasarjana. Institut Pertanian Bogor. Bogor.

Edmondson, W.T. (ed.) (1959). Fresh-Water Biology. John Wiley, New York. 1248 p.

Effendie, M.I. (2002). BiologiPerikanan. Yayasan Pustaka Nusantara. Yogyakarta.

Fahmi, M.R.; Prasetyo, A.B. and Vidiakusuma, R. (2019). PotensiIkan Medaka (*Oryzias woworae, Oryzias javanicus dan Oryzias profundicola*) sebagaiIkanHias dan Ikan Model. Prosiding Seminar Nasional Ikan ke 8. Masyarakat Iktiologi Indonesia.

Gani, A.; Nilawati, J. and dan A. Rizal (2015). Studi habitat dan kebiasaanmakan (*Food Habit*) ikanronolindu (*Oryzias sarasinorum* Popta, 1905) di DanauLindu, Sulawesi Tengah. Jurnal Sains dan Teknologi Tadulako 4(3): 9-18.

Kinoshita, M.; Murata, K.; Naruseand, K. and Tanaka, M. (2009). Medaka. Biology, Management, and Experimental Protocols. Wiley-Blackwell. John Wiley & Sons, Ltd., Publication, Ames, Iowa. 419 p.

Kottelat, M. (1996). *Oryzias matanensis. The IUCN Red List of Threatened Species 1996*: e.T15575A4837136.

Kottelat, M. and Whitten, A.J. (1996). Freshwater Fishes of Western Indonesia and Sulawesi: Additions and Corrections. Periplus Edition. Hongkong.

Lumbantobing, D. (2019). *Oryzias matanensis*. The IUCN Red List of Threatened Species 2019: e.T15575A90980691.

Murata, K.; Kinoshita, M.; Naruse, K.; Tanaka, M. and Kamei, Y. (eds.). (2020). Medaka. Biology, Management, and Experimental Protocols. Volume 2. Wiley-Blackwell. John Wiley & Sons, Ltd., Publication, Hoboken, New Jersey. 344 p.

Naruse, K.; Tanaka, M. and Takeda, H. (eds.). (2011). Medaka. A Model for Organogenesis, Human Disease, and Evolution. Springer, Tokyo. 387 p.

Natarajan, A.V. and Jhingran, A.G. (1961). Index of preponderance. A method of grading the food elements in the stomach of fishes. Indian J. Fish. 8(1): 54-59.

Novalina, S.; Diana, A.; Sri., M.; Djoko, L.T. and Jaya, G.B.A. (2019). Food habits of the endemic ficefish (*Oryzias nigrimas*, Kottelat 1990) in Poso Lake, Central Sulawesi of Indonesia. RJOAS 3 (87): 125 – 130.

Paujiah, E.; Solihin, D.D. and Affandi, dan R. (2013). Strukturtrofikkomunitasikan di SunagiCisadea, KabupatenCianjur, Jawa Barat. JurnalIkhtiologi Indonesia 13 (2): 133 – 143.

Sasongko, A.S.; Anggoro, S. dan Yusuf, M. (2019). Kajian bioekologiikankerapulumpur (*Ephinephelus coloides*) di area karang kretek Perairan Ujung Negoro, Kabupatenbatang. INA – Rxiv Papers hal 1-5.

Sukimin, S. (2004). Modul praktikumbiologiperikanan. Bogor. FakultasPerikanan dan Kelautan. Institute Pertanian Bogor, Bogor.

Sulistiono, A.F.; Sofiah, S.; Brojo, M.; Affandi, R. and Mamangkey, J. (2007). Aspekbiologiikanbutini (*Glossogobiusmatanensis*) di DanauTowuti, Sulawesi Selatan. JurnalIlmu-ilmuPerairan dan Perikanan Indonesia 14(1): 13-22.