GROWTH AND CONDITION FACTOR OF RAINBOW SELEBENSIS (*Telmatherina celebensis* Boulenger) IN LAKE TOWUTI, SOUTH CELEBES

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ABSTRACT

Rainbow selebensis (*Telmatherina celebensis*) is Telmatherinidae family and endemic species in Lake Towuti. This species has beautiful color, potential to be ornamental fishes. The aim of this research is to study growth and condition factor of the fish, as a basic information for fish conservation. Samples were collected from March 2002 to April 2003 using experimental gill net with mesh sized 3/4, 1, 1¼, and 1½ inches. Growth pattern of male and female were isometric characteristic. Maximum total length of male and female were 119.7 mm and growth pattern were described as Von Bertalanffy formula were $Lt=119.7\ [1-e^{-3,40\ (t+0.03)}]$ and $Lt=119.7\ [1-e^{-1.60\ (t+0.07)}]$, respectively. Monthly condition factor of the fish varied between male and female ranging from 0.93–1.21 and 1.09–1.26, respectively. The highest peaks of 1.21 and 1.26, for male and female respectively occurred in November.

KEYWORDS: **growth, condition factor, *Telmatherina celebensis* and Lake Towuti**

INTRODUCTION

Rainbow selebensis (*Telmatherina celebensis* Boulenger) is one of the endemics fish type found in Lake Towuti. This lake, Lake Matano, and Lake Mahalona provide the three stream connected lake consecutively located in the downstream, upstream and midlle stream of the Holahola river of the Malili-Soroako region. The three lakes have been specified as recreational parks due to their panoramic beauty and virgin forest around them (pursuant to the Minister of Agriculture Decree No.274/Kpts/Um/1979).

Sixteen fish species of *Telmatherina* have been recorded and all are including endemic fish (Kottelat *et al.*, 1993). *T. celebensis* has beautiful body color, especially male. Its body is rust colored chocolate on the top and there are three or more vertical ribbon which appear more contrast compared to the female. Therefore the fish has potentially economic value as ornamental freshwater fish.

T. celebensis is also taken for consumption purposes by people around the lake (Nasution, 2006). This fish has been included in a vulnerable species group or potentially endangered species (IUCN, 2003). Therefore, protection against the destruction and threat to the fish population decreases due to the effect of environmental changes will be needed. Degradation of environmental quality is indirectly related to the deforestation and anthropogenic activities.

To prevent population decrease better informations is needed to support sustainability of fish resources management. Two aspects of the biological informations needed are growth and condition factor. Condition factor is one of the important growth element to show fish physical capacities and the relationship with survival and reproduction. The aim of this research is to study growth and condition factor of the fish, that can be used as a basic information for fish conservation and fishery resources management of *T. celebensis* in Lake Towuti, South Celebes.

MATERIALS AND METHODS

Study Site

The study was carried out in Lake Towuti, South Celebes (Figure 1) from March 2002 to April 2003. Sampling of fish was carried out every two months. Research stations are grouped into four sites as follow:

1. Station I: located in the area where there are aquatic plant with depth of water of 1 to 3 m (Cape of Bakara nearby sawmill).
2. Station II: located in the area where there are no aquatic plant within the depth of 1 to 5 m (inlet of Lake Towuti that come from Tominanga River).
3. Station III: located in the area where there are no aquatic plant within the depth of more than 10 m (close to Loeha Island).
4. Station IV: located in the aquatic plant area within the depth of 1 to 3 m (close to the outlet of Lake Towuti into the Hola-Hola River).

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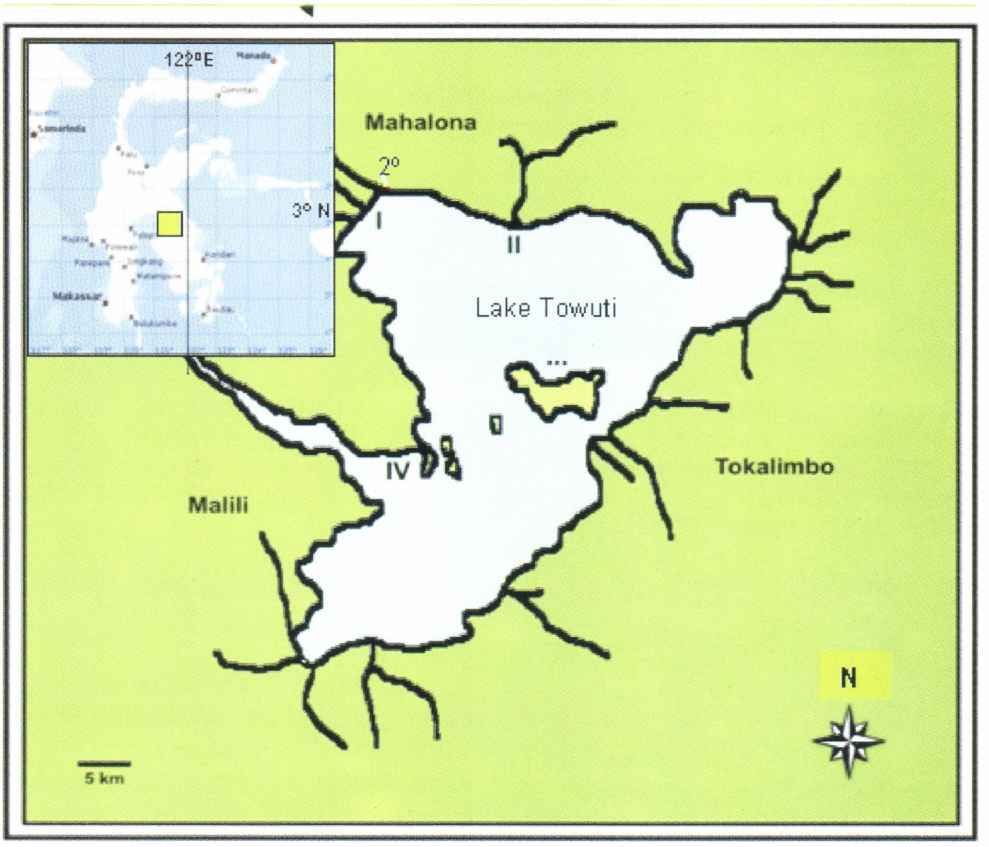

Figure 1. Research station in Lake Towuti.

Fish Sampling

Sample of fishes (Figure 2) was obtained using experimental gill net with four mesh size: ¾ inch (19 mm), 1 inch (25 mm), 1¼ inch (32 mm), and 1½ inch (38 mm). The total length of the net was 200 m (each of 4x50 mesh size). Net equipped with the float at the top and sinker at the bottom. Net was positioned perpendicular to the coastline in each station and start operated in the late afternoon at 16.00 until 07.00 in the next morning. Operation time of net was more or less 15 hours.

Figure 2. Rainbow selebensis (*Telmatherina celebensis*).

The catches obtained from each station were sorted and separated sexually. Length of fish sampled were measured by using calliper with the accuracy of 1 mm and were weighted by digital balance with accuracy of 0.01 g. All the fish were grouped into some length class to obtain normal population size structure.

Data Analysis

Length Weight Relationship

The length weight relationship of fish is calculated following the Ricker (1975) formula, that is:

$$W=a\,L^{b} \quad \ldots\ldots (1$$

where:
W = weight of fish (g)
L = total length of fish (mm)
a and b = constants of the regression equation

This formula can be linearized by converting both sides into logarithmic form:

$$\text{Log } W=\text{Log } a+b \text{ Log } L \quad \ldots\ldots (2$$

According to Carlander (1969) *in* Effendie (1979), most of b value laid between 2.4 to 3.5. When b value is equal to three (b=3), fish growth in length is equal to the growth in weight and is referred as isometric growth. If b is bigger or smaller than three then the growth is allometric. If b value less than three (b<3), indicating a thin or slender fish, where length growth is faster than weight growth. If b value is bigger than three (b>3) indicating that the fish is fat or plump, where weight growth is faster then length growth.

Growth

Growth pattern of *T.celebensis* can be predicted by Von Bertalanffy equation as follows:

$$L_t=L_\infty\,[1-e^{-K(t-to)}] \quad \ldots\ldots (3$$

where:
L_t = length of fish in t year (mm)
L_∞ = average maximum length
t_o = theoretical fish age at length=0 mm
K = Von Bertalanffy growth coefficient

Parameter of K and L_∞ were estimated with ELEFAN I from software FiSAT II (Sparre & Venema, 1998) and t_o was estimated from Paully emphirical formula, as follows:

$$\text{Log } (-t_o)=-0.3922-0.2752 \text{ log } L_\infty-1.038 \text{ log } K \quad \ldots\ldots (4$$

Condition Factor

Condition factor that reflecting the plumpness of fish were calculated following Effendie (1979):

$$K_t=10^5\,W/L^3 \quad \ldots\ldots (5$$

where:
K_t = condition factor
W = the average weight of fish (g)
L = the average length of fish (mm)
10^5 = the specified value as K_t approaching one

RESULTS AND DISCUSSION

Length frequency distribution

The size of *T. celebensis* caught using experimental gill net with four mesh size (¾, 1, 1¼, and 1½ inch), ranging from 55.9 to 103.2 mm for male and 51.1 to 98.4 mm for female (Figure 3). The highest frequency occurred within the length class of 74.8 to 79.5 mm in male and female, respectively.

All fish samples were caught by the net with the mesh size of ¾ and 1 inch. Whereas at mesh size of 1¼ and 1½ inch net no fish were caught. This data indicate that the fish caught by the net provide the biggest fish size group within the fish population and has reached the matured gonad.

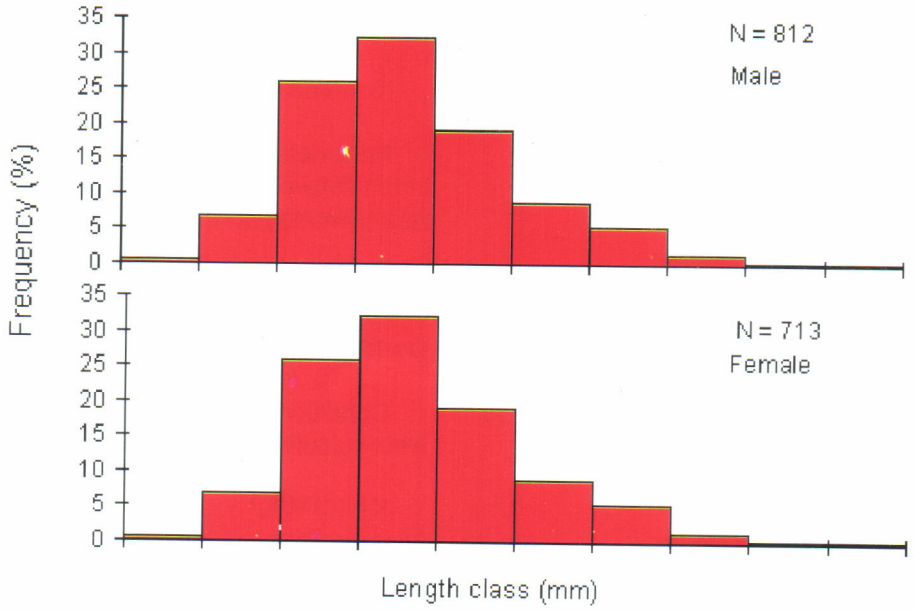

Figure 3. Length frequency of male and female *T. celebensis* in Lake Towuti.

Length Weight Relationship

Analysis of length weight relationship will lead to the identification of the growth pattern of the fish. From growth pattern, it is possible to determine the fish body form wether the fish is fat or thin. According to Brown (1957), the factors influencing growth pattern consisted of internal and external factors. Example of internal factors are diameter of egg size and genetic factor whereas external factors include temperature, light, chemical factors, water current, and niche.

Length weight relationship of male and female *T. celebensis* follow the equations $W=0.00078\ L^{3.0729}$; $r^2=0.81$, and $W=0.00005\ L^{3.04756}$; $r^2=0,90$ (Figure 4). According to Carlander (1969) *in* Effendie (1979), most of b values ranging from 2.4 to 3.5. Base on t test indicate that the male with b=3.1 and female b=3.1 or approximately equal to 3.0. For b value equal to 3.0 indicates that the growth follow isometric pattern, while for b¹3 follow allometric pattern.

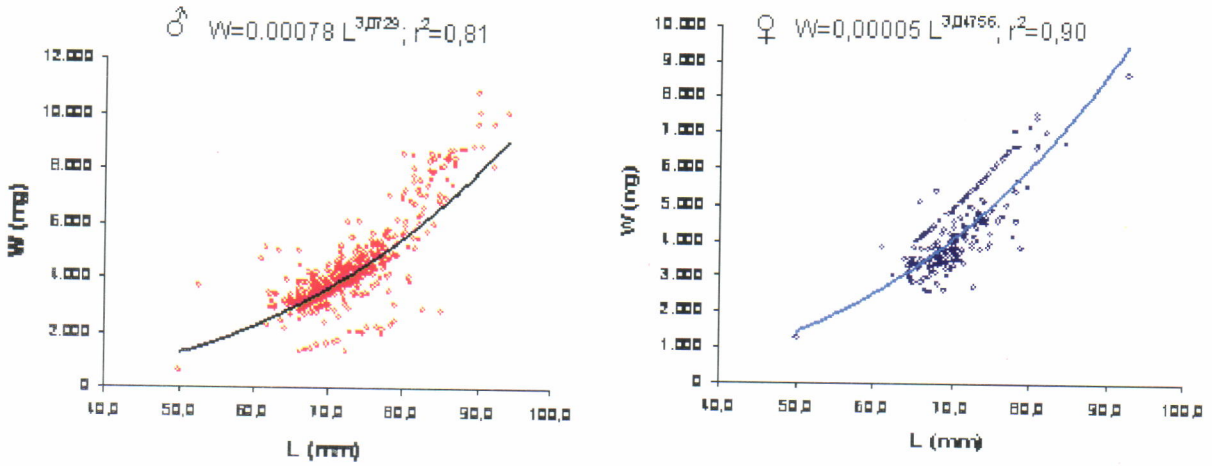

Figure 4. Length weight relationship of male (♂) and female (♀) *T. celebensis*.

From the isometric growth pattern of both male and female it can be concluded that growth in length is equal to growth in weight. Morphologically the fish body is fusiform and slender. Due to its physical it is anticipated that this fish provide a fast swimmer and migratory type. The body form influence movement of fish in water. *T. celebensis* body form is also like tuna (thunniform) according to Jobling (1995) that provide a fast swimmer type. *T. celebensis* fish found spread over the lake of Towuti ranging from littoral zone to the middle of lake close to the island of Loeha (Wirjoatmodjo *et al.*, 2003; Nasution *et al.*, 2004).

Growth

Growth is one of the important biological parameters to understand the population dynamics of *T. celebensis* more thoroughly. Based on length data measurements, the average maximum length of fish (L_∞) and the growth coefficient (K), the Von Bertalanffy growth equation of male and female of *T. celebensis* are $L_t=119.7\ [1-e^{-3.40\ (t+0.03)}]$; $L_\infty=119.7$ mm and K=3.40 and $L_t=119.7\ [1-e^{-1.60\ (t+0.07)}]$; $L_\infty=119.7$ mm and K=1.60, respectively (Figure 5).

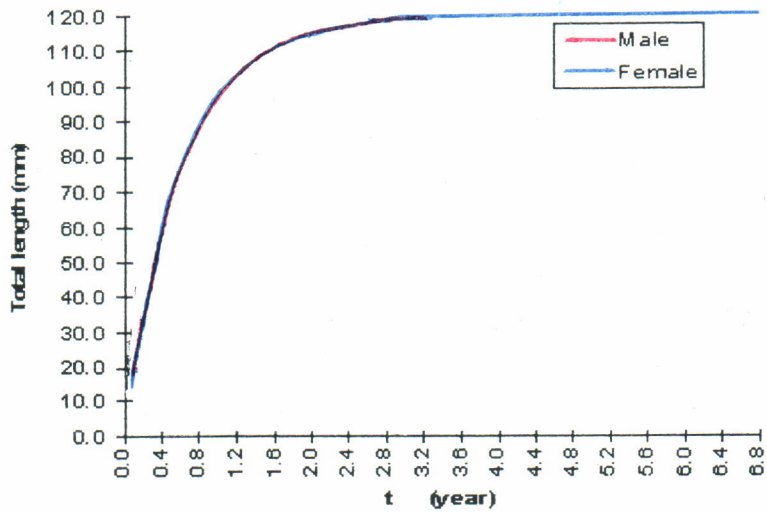

Figure 5. The Von Bertalanffy growth curves of male and female *T. celebensis.*

From growth coefficient of male of 3.40 year^{-1} and female 1.60 year^{-1}, it is likely that growth rate of male is higher than female or the male growth is faster than female. Base on the growth curves, the male *T. celebensis* reach maximum total length at 0.8 years and the female at 1.6 years old. So far, no data that have been published to comparing growth coefficient of the same species or family in Lake Towuti.

Condition Factor

Condition factor provide an indirect indicator of the environmental influence to the fish physical condition, formulated in body weight function that compare to fish body length. Condition factor of *T. celebensis* show in Figure 6.

Monthly condition factors of *T. celebensis* varied between male and female. Male between 0.93 to 1.21 and female between 1.09 to 1.26. There are some fluctuation in the curve of condition factor, but the highest value occured in November which were equal to 1.21 for male and 1.26 for female. Peak curve is interpreted as the accuracy of environmental conditional change toward better condition in November. The changing of environmental condition was mainly due to the frequent rainfall occurring after September. Some allochtonous materials from land enter the lake and enrich food-stuff in the lake. Fish abundance was also increased in November in line with the increasing height of water level (Nasution *et al.*, 2004).

Figure 6 also shows the change of environmental quality that happened in November, where condition factor of male and female reach its highest. Beside as environmental quality indicator, increasing condition factor reflecting an increasing activity of *T. celebensis* reproduction resulted from the improvement of gonad development. In November improvement of gonad maturity of *T. celebensis* were occurred as reflected by the large number of matured fish composition found both male and female (Nasution, 2005).

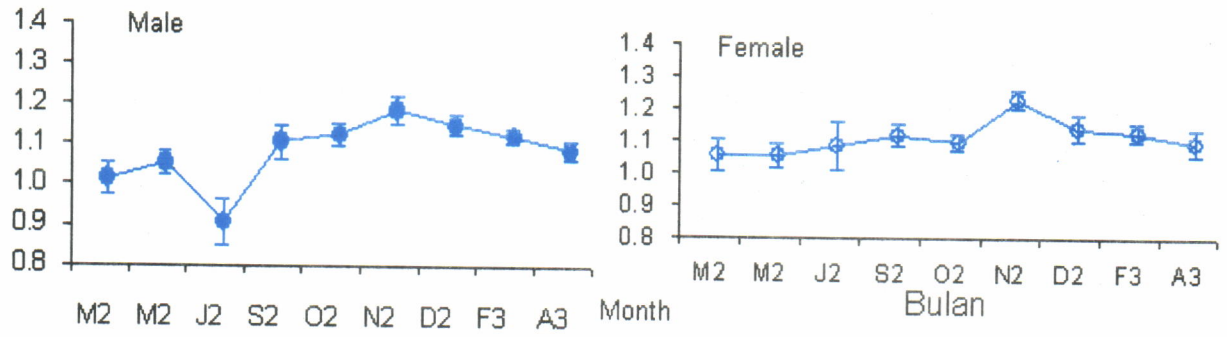

Figure 6. Condition factors of male and female *T. celebensis* in Lake Towuti (M2: March, M2: May, J2: July, S2: September, O2: October, N2: November, D2: December 2002, F3: February, and A3: April 2003.)

CONCLUSION

The result of K value for male *T.celebensis* is higher than the female, and since K value represent how fast the fish grow to its the maximum length, than the time of male to reach its the maximum length at the same condition is faster than female.

The b value for male and female is equal to three, (isometric growth), or the growth in length is equal to the growth in weight. Maximum length of male and female of *T.celebensis* of 119.7 mm, so that the Von Bertalanffy growth formula for the fish were $L_t=119.7[1-e^{-3.40(t+0.03)}]$ and $L_t=119.7[1-e^{-1.60(t+0.07)}]$, respectively.

The highest peaks of condition factors of 1.21 and 1.26, for the respective male and female occurred in November.

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