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SHORT COMMUNICATION

LENGTH TO WEIGHT RELATIONSHIP OF SEA BASS *LATES CALCARIFER* (BLOCH) REARED IN A CLOSED RECIRCULATING SYSTEM

L. Volvich* and S. Appelbaum

The Bengis Centre for Desert Aquaculture, The Jacob Blaustein Institute for Desert Research, Ben Gurion University, Sede Boker Campus, 84990, Israel

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The length to weight relationship of sea bass, *Lates calcarifer,* reared for two years in our laboratory in an indoor recirculating system, was determined as follows: W (g) = 0.0107 TL (cm)$^{3.0347}$, R^2 = 0.9974. The values found in this study correspond to length/weight relationships found for a natural population by other researchers, indicating that sea bass cultivated in captivity under intensive conditions and at high stocking densities do not seem to differ in body appearance from those in nature.

Introduction

One of the most widely used mathematical models in science is the power function $y = ax^b$ with variables x and y and constants a and b (Peters, 1983; Calder, 1984; Schmidt-Nielsen, 1984; Bookstein et al., 1985; Reiss, 1989). Such a model characterizes, for example, the relationship between fish length and weight. Length/weight relationships are important in fisheries science, notably to raise length-frequency samples to total catch, to estimate biomass from underwater length observations, to evaluate fish growth and body condition, etc.

* Corresponding author. Telefax: 972-8-6596810, email: fish@bgumail.bgu.ac.il

The sea bass *(Lates calcarifer)*, also known as barramundi, has recently been introduced to Israel from Australia and Thailand as a promising candidate for cultivation in the underground, brackish, geothermal water of the Negev desert in the southern part of Israel. Knowledge of the length/weight relationship of sea bass cultured under controlled conditions is valuable for further biological and nutritional studies of this species.

Patnaik and Jena (1976) calculated the length/weight relationship of sea bass in a natural population. In the present study, the length/weight relationship of sea bass reared intensively indoors was determined.

Materials and Methods

Sea bass obtained by induced spawning and reared indoors were periodically measured for two years to determine their total length (cm) and weight (g). Total length was measured from the lower jaw to the tip of the tail, spread normally. The smallest sea bass measured were those that had just arrived as fry from the Bluewater Hatchery, Cairns, Australia, in 1998 and from the Ardag Hatchery in Eilat, Israel, in 1999.

The barramundi were reared at densities ranging 0.5-70 kg/m^3 (depending on their size) in freshwater recirculating systems consisting of sedimentation tanks and biological filters. Dechlorinated fresh water entered the system at a rate of 5-10% of the total system volume daily. Aeration was provided to ensure >5 ppm O_2. The water quality parameters in the growing systems were within the optimal range for barramundi growth: temperature 26-29°C, dissolved oxygen 5-7 mg/l, ammonia <0.5 mg/l, nitrite <0.025 mg/l.

Fish were fed dry feed (Marine Grower Extruded, protein 48-50%, fat 20%, Shivuk Raanan, Israel) with a pellet size of 1-4.5 mm at a daily rate of 10% (at the beginning of the experiment) to 2% (at the end) of the fish body weight, adjusted as the fish grew. The smallest fish was 2.8 cm and 0.3 g and the largest 61 cm and 3300 g. Measurements were made on 154 fish. Data were entered into the Microsoft Excel program to calculate the length/weight relationship according to the formula $W = aTL^b$.

Results and Discussion

During rearing, fish were eager to be fed. They developed and grew well with no signs of diseases or abnormalities. Occasional mortalities throughout the rearing period were caused by technical problems and ranged between 10-20%. The function W (g) = 0.0107 TL (cm)$^{3.0347}$, R^2 = 0.9974 for a length of 2.8-61 cm and a weight of 0.3-3300 g is shown in Fig. 1.

Ganguly et al. (1959) studied the length/weight relationship of *Lates calcarifer* in a natural population in relation to other morphometric characteristics. They found the length/weight relationship to be Log W = -5.01888+3.0342 Log L, R^2 = 0.9988.

De (1971) investigated the length/weight relationship of postlarvae, fry and juveniles of *L. calcalifer,* revealing a strong positive correlation for postlarvae (10-15 mm) as Log W = 6.41506 + 3.62342 Log L; fry (16-45 mm) as Log W = 6.83589 + 3.188958 Log L; and juveniles (50-200 mm) as Log W = 6.70072 + 3.22692 Log L.

Patnaik and Jena (1976) studied the length/weight relationship of this species based on 563 specimens from Lake Chilka in India. Regardless of period of collection, sex and size, the calculated relationship was W (g) = 0.0196 TL (cm)$^{2.917}$, within the size range of 24-1010 mm and 0.2-12,707 g. Fig. 2 shows that our data was approximately the same when plotted using the formula of Patnaik and Jena (1976).

Rodgers (1996) provided observations of length/weight relationships of reared barramundi fry (2-10 cm and 0.13-12.67 g). The calculation was: Total weight (g) = 2.654158 E$^{-0.5}$ x Total length (mm)$^{2.839441}$. A correlation of our results with those of Rodgers (1996) is shown in Fig. 3. Comparisons of length/weight relationship for sea bass and other fish species is given in Table 1.

This study shows that the length/weight relationship of sea bass reared intensively indoors is comparable to the length/weight relationship of a natural population (Patnaik and Jena, 1976), indicating that sea bass cultivated in captivity under intensive conditions at high stocking densities do not differ in body appearance from their counterparts in nature.

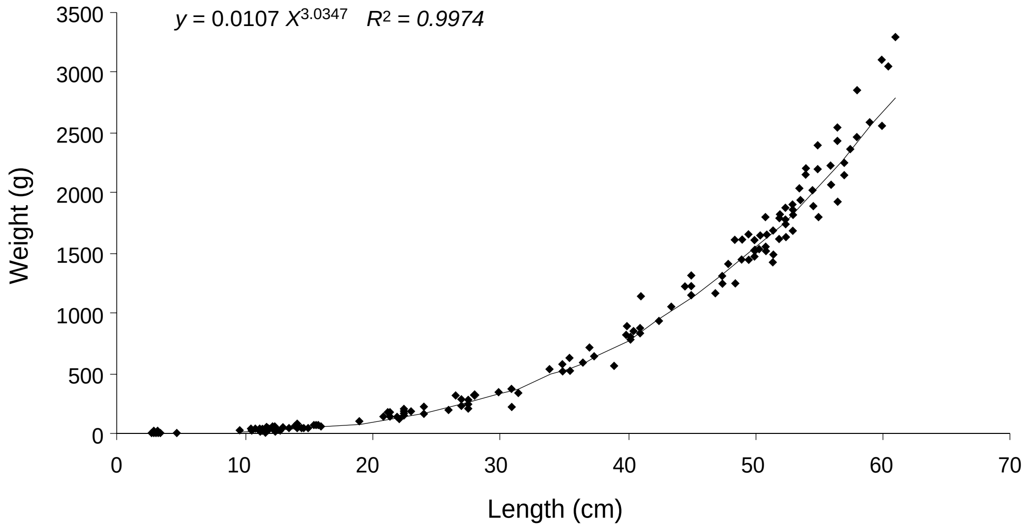

Fig. 1. Length/weight relationship of indoor reared sea bass *(Lates calcarifer).*

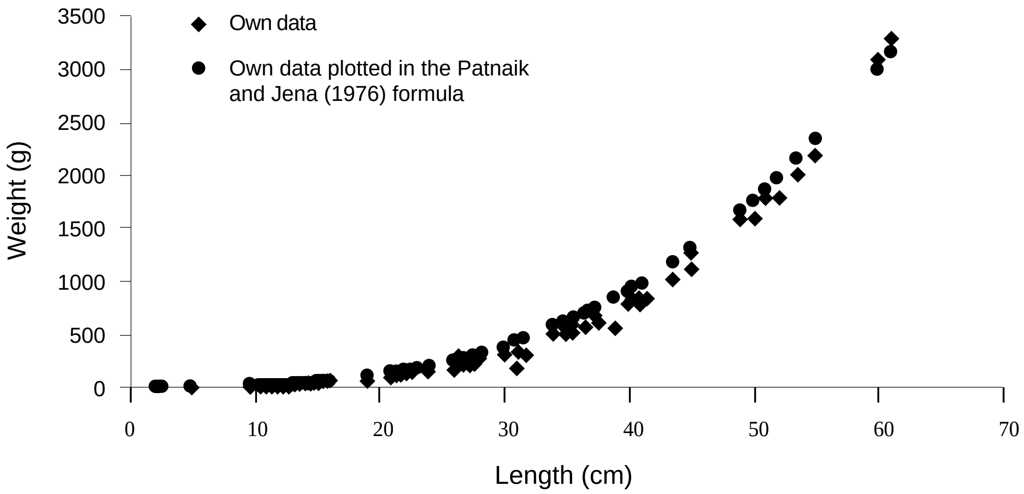

Fig. 2. Length/weight relationship (comparative data) of indoor reared sea bass *(Lates calcarifer).*

Table 1. Length/weight relationship of fish species (comparison of various authors' data).

Fish species	*Length/weight relationship*	*Total length (cm)*	*Number of fish*	*Author*
Lates calcarifer	$W = 0.0107\ TL^{3.0347}$	2.8 - 61	154	Present study
Lates calcarifer	$W = 0.0196\ TL^{2.917}$	2.4 - 101.0	563	Patnaik and Jena, 1976
Dicentrarchus labrax	$W = 0.0067\ TL^{3.146}$	24.4 - 88.0	417	Dulcic and Kraljevic, 1996
Dicentrarchus labrax	$W = 0.0060\ TL^{3.039}$	33.5 - 80.5	799	Gonçalves et al., 1997
Cyprinus carpio carpio	$W = 0.0167\ TL^{3.015}$	16.5 - 36.5	67	Shimadate et al., 1957
Cyprinus carpio carpio	$W = 0.0158\ TL^{2.624}$	29.3 - 76.5	171	Gerking, 1950
Oreochromis niloticus niloticus	$W = 0.0106\ TL^{3.258}$	4.3 - 22.0	612	Prein, 1990
Oreochromis niloticus niloticus	$W = 0.0369\ T^{L\ 2.899}$	13.5 - 44.0	63	Hardjamulia et al., 1988
Sparus auratus	$W = 0.0088\ TL^{2.96}$	18.5 - 68.0	231	Gonçalves et al., 1997

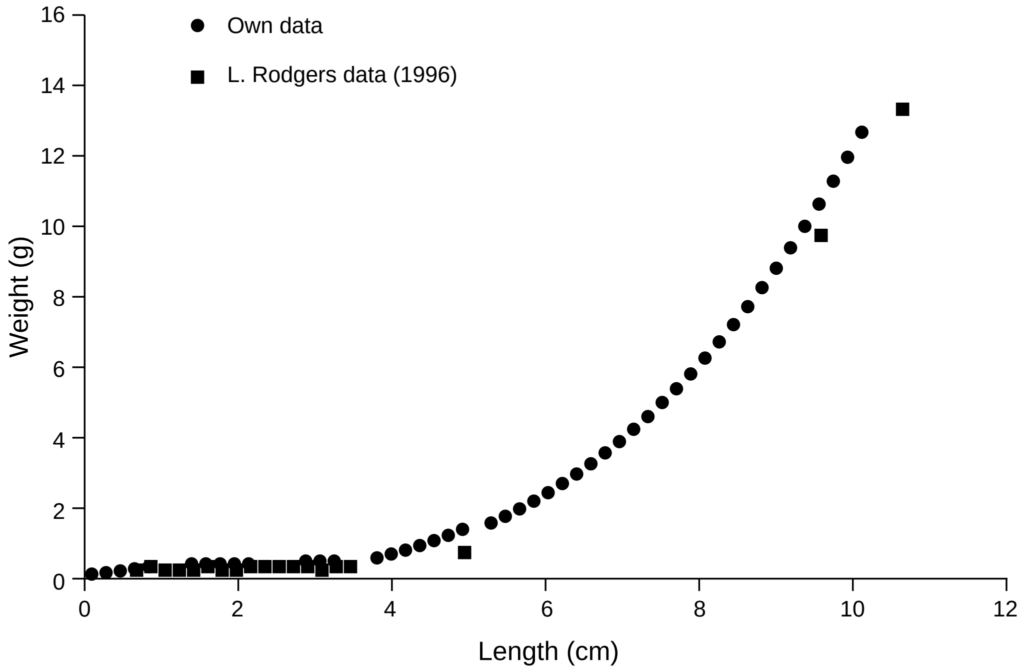

Fig. 3. Length/weight relationship of indoor reared sea bass *(Lates calcarifer)* fry.

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References

Bookstein F.L., Chernoff B., Elder R.L., Humphries J.M. Jr., Smith G.R. and R.E. Strauss, 1985. *Morphometrics in Evolutionary Biology. The Geometry of Size and Shape Change, with Examples from Fishes.* Spec. Publ. 15, Acad. Nat. Sci., Philadelphia, PA. 277 pp.

Calder W.A., 1984. *Size, Function, and Life History.* Harvard Univ. Press, Cambridge, MA. 431 pp.

De G.K., 1971. On the biology of postlarvae juveniles stages of *Lates calcarifer* (Bloch). *J. Indian Fish. Assoc.* 1(2):51-64.

Dulcic, J. and M. Kraljevic, 1996. Weight-length relationship for 40 fish species in the eastern Adriatic (Croatian waters). *Fish. Res.,* 28(3):243-251.

Ganguly D.N., Mitra B. and N. Bhattacharya, 1959. On the interrelationship between total length, standard length, depth and weight of *Lates calcarifer*. *Proc. Natl. Inst. Sci. India,* 25(B):175-187.

Gerking, S.D., 1950. A carp removal experiment at Oliver lake, Indiana. *Invest. Ind. Lakes Streams,* 3(10):373-388.

Gonçalves J.M.S., Bentes L., Lino P.G., Ribeiro J., Canário A.V.M. and K. Erzini, 1997. Weight-length relationships for selected fish species of the small-scale demersal fisheries of the south and south-west coast of Portugal. *Fish. Res.,* 30:253-256.

Hardjamulia A., Setiadi K.E. and N.S. Rabegnatar, 1988. Some biological aspects of the predominant fish species in the Jatiluhur Reservoir, West Java, Indonesia. In: S. De Silva (ed.). *Reservoir Fishery Management* *and Development in Asia.* Int. Dev. Res. Centre, Ottawa, Canada.

Patnaik S. and S. Jena, 1976. Some aspects of biology of *Lates calcarifer* (Bloch) from Chilka lake. *Indian J. Fish.,* 23(1&2):65-71.

Peter, R.E., 1983. *The Ecological Implications of Body Size.* Cambridge Univ. Press, Cambridge. 329 pp.

Prein, M., 1990. *Multivariate Analysis of Tilapia Growth Experiments in Ponds: Case Studies from the Philippines, Israel, Zambia and Peru.* Dissertation, Kiel Univ., Germany. 125 pp.

Reiss M.J., 1989. *The Allometry of Growth and Reproduction.* Cambridge Univ. Press, Cambridge. 182 pp.

Rodgers L., 1996. Feeds, feeders and feeding practices for the nursing of barramundi fry. pp. 65-71. In: *Barramundi Farming Information Package. Introductory Information for Prospective Barramundi Farmers.* Freshwater Fish. and Aquacult. Centre, Walkamin, Australia.

Shimadata M., Nakamura K., Koyama H., Ito T. and J. Toi, 1957. Effect of fertilization and significance of artifical feeding to fish production in farm pond, Shioda Plain, Nagano Prefecture. *Bull. Freshwat. Fish. Res., Lab.* Tokyo, 7(1):1-32.

Schmidt-Nielsen K., 1984. *Scaling: Why is Animal Size So Important?* Cambridge Univ. Press, Cambridge. 241 pp.

Erratum

In the article "Rapid wound healing in African carfish, *Clarias gariepinus*, fed diets supplemented with ascorbic acid", published in *The Israeli Journal of Aquaculture - Bamidgeh* 53(2):69-79, the authors were erroneously listed as "Erazo-Pagador and Din" instead of "Erazo-Pagador and Shariff".