IJBPAS, August, 2012, 1(7): 904-912

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

BIOLOGY OF GROWTH AND REPRODUCTION OF BROWN TROUT (*Salmo trutta macrostigma*, Dumeril, 1858) OF THE AQUATIC ECOSYSTEM: SIDI RACHID RIVER IN CENTRAL MIDDLE ATLAS (MOROCCO)

ABBA ELHASSAN[1], BELGHYTI D[1], ELIBAOUI H[2], BENABID M[3],CHILLASSE L[4]

1: Laboratory of Environment and Renewable Energies, Department of Biology, Ibn Tofail University, Faculty of Science, Kenitra, 14000, Morocco.

2: Laboratory of Biodiversity and Natural Resources, Department of Biology, Faculty of Science, University Ibn Tofail, BP 133, Kenitra 14000, Morocco

3: National Center of Hydrobiology and Pisciculture (CNHP) BP11 - 53100-Azrou Morocco

4: Laboratory of Ecology and biodiversity of wetlands, Moulay Ismail University, Faculty of Science, Meknes, Morocco

***Corresponding Author: Email: abbaelhassan@hotmail.com**

ABSTRACT

This study has been realized through a partnership between the National Center of Hydrobiology and Fish Culture (Azrou /Morocco) and the Ibn Tofail Faculty (Kenitra, Morocco) in the context of a doctoral thesis.The brown trout (Salmo trutta macrostigma.), a Moroccan fresh water fish endemic, has not been studies seriously concerned biological and ecological. This study presents biology of growth and reproduction on the period between may, 2007 and April, 2008 of one small river of brown trout in the Central Middle Atlas of Morocco the length-weight relationship and the coefficient of condition of brown trout,. The results of the parameters of length-weight relationship are: **$Pt = 11.55081 \cdot 10\text{-}3 \cdot Lt^{3.021}$**, the values of the coefficient **b** is superior to **3**. For reproduction, 335 specimens (122mm <Lt <375mm), including 120 males and 215 females were used. Monthly monitoring of the gonadosomatic index (GSI) and hepatosomatic index (HIS) and maturity of gonads showed

that the breeding season of this salmonid is between November and January. The relative fecundity of brown trout varies with the size and body weight.

Keywords: Morocco, Sidi Rachid River, Biological Traits, Growth, Reproduction, Brown Trout

INTRODUCTION

The rational exploitation of fish species can not be conceived without knowledge of its key biological parameters and in particular those relating to reproduction and growth. Reproduction of a fish is one of the biological parameters needed in any study of fish. Indeed, in practice it is a prime consideration for any improvement in stocking and management of aquatic environments and therefore the management of fish **[1, 2]**. The study of reproduction requires the determination of the size at first maturity, the sexual cycle and fertility. All these parameters are related to environmental factors **[3, 4, 5]**, and food-web environment. Brown trout (Salmo trutta macrostigma) endemic of Morocco colonize waters of high mountains especially the waters of the Middle Atlas as Wadi Sid Rashid which is part of 150 km of salmonid waters of Morocco **[6]**.

The objective of this study is to determine some biological parameters of brown trout at Sidi Rachid River in Morocco during a period between May 2007 and April 2008.

MATERIALS AND METHODS

Presentation Study Site

The Sidi Rashid River geographical coordinates 5 ° and 33 ° 28'W 9'N is located at an altitude of 1620m. It is situated in the depression of Ras El Ma **(Figure 1)** corresponding to a synclinal fold, which is part of the plateau Tazioualt Tamrabta which is one of the four structural elements of the Causse of Ifrane characterized by carbonate rocks **[7]**. The study area is part of the watershed under way Sebou downstream part of the large pool of hydraulic Sebu is one of the most important basins in Morocco because it contains near-third (1/3) surface water and groundwater 20% of the country **[8]**. Standing water regime of the river is provided by the sources, the mean annual flow of the main source of the river is about 172 L / S **[8]**. The Sidi Rashid River has a wooded riparian vegetation, this latter can indirectly affect fish habitat by creation **[9, 10, 11]**.

Sampling- Fish

The data used in this study came from samples taken from May 2007 to April 2008 electro fishing conducted by a team of technicians from the National Center of

Hydrobiology and Pisciculture (NCHP / Azrou) at Sidi Rashid River. Electric fishing allows the capture of many species especially small fish usually little or no catchable by other methods. In addition, the harvested material is in excellent condition since it is still living in most cases. The number of fish harvested by sampling generally varies between 30 and 50.

Weight and Total Length

Once caught and anesthetized, the trout were weighed by a balance-type Precisa (XB2200C) with an accuracy of 0.01 g to determine the total weight (Pt), with a ichtyomètre, it was determined the total length (Lt). The total number of fish used for the study of 438 specimens. Measurement of Pt and Lt allowed us to determine the relationship between these two parameters Pt= aLtb (a: constant and b: allometric coefficient) and the condition factor K = Pt/Lt3.

Weigh-in and Liver Gonads

Of the 97 trout authorized by the High Commission for Water, Forests and Desertification Control (HCEFLCD / Morocco), measures of liver and gonads of females were made near to the hundredth of a gram (0.01 g) by a Precisa balance type (XB2200C) after dissection of the fish in the laboratory of the National Center of Ichthyology and Hydrobiology under the Fish Azrou HCEFLCD. These different measures are used to determine the sexual cycle of brown trout and fertility by calculating two indices: GSI (gonadosomatic index is the ratio of gonad weight P (g) on the total weight of fish (g)) (GSI = gonad P / P fish) and HSI (hepatosomatic index, which is the ratio of liver weight (g)) on the total weight (g) of fish) (P = HSI liver / P fish). In addition to the previous weightings', sex and sexual maturity of different trout have been noted to determine the sex ratio and size at first maturity.

RESULTS AND DISCUSSION

Total Weight-Total Length

The relationship between total weight (Pt) and total length (Lt) of the 438 specimens sins, the total length of brown trout from the Sidi Rachid River varies between 6.3 cm (Pt = 3g) and 37, 5 cm (Pt = 514g). The overall average of the total length is 18, 65cm (Pt = 110.38 g). The relationship between these two morphometric parameters is of type:

Pt = 11.55081 • 10-3 • Lt 3.021 for a correlation coefficient of 0.9515. This value translates as a regression highly significant (p = 0.01) and condition factor K = 1.7. The allometric coefficient b (b = 3.021) and the condition K> 1 shows that growth in weight is significant compared to that of length **[12, 13, 14, 15]**, and that this value of K greater

than 1 shows that the brown trout studied adapts well to its habitat.

Sex - Ratio and Size at First Maturity

The numerical distribution of the sexes is expressed in our case by the total number of females from the different sexes of the sampled population. For brown trout, the proportion of each sex is the order of 58.90% for females against 41.10% for males. These percentages clearly show a predominance of females compared to males. Size at first maturity determined by the biological method shows that the smaller mature encountered during the reproductive period of brown trout measuring 130 mm total length for females and 113 mm total length for males. The age corresponding to the sizes mentioned above is 1 +, that is to say that trout can mature from 1 + for males and females.

Indices of Sexual Maturity

The hepatosomatic index (HSI) varies in function of time. It peaked in males (1, 9%) in September **(Figure 2)** and 1.6% in females during November **(Figure 3)**, a period called the period of reserve accumulation in the liver. The HSI then decreases and reaches its minimum in December and January, this decrease results in the transfer of reserves from the liver to gonads which explains the significant increase in GSI in both sexes **(Figure 4, 5).** Comparing the values of GSI gender shows that they are greater in females than in males, this difference is related to the heavy weight of the ovaries compared to testes. The HSI and GSI medium in both sexes are respectively 1.27 ± 0.32% and 2.71 ± 3.8% for females, against 1.32 ± 0.2% and 0.81 ± 1.08% in males. The significant decline in the gonadosomatic index after December is due to the period of spawning in brown trout. The study of GSI in both sexes shows that the brown trout has a sexual cycle with a single peak. This shows that this fish belongs to the group in a single spawning fish per year and is part of iteroparous fish **[16, 17]**. The relationship between the evolution of GSI and the HIS **(Figure 6, 7)** of brown trout from the river Sidi Rashid. The analysis of the monthly evolution of the two reports shows that in males as in females, the increase in GSI is preceded by changes in the HSI of the one part, on the other, when the GSI reached its peak, RHS reaches the maximum are low. This is explained by accumulation of reserves in the liver during the sexual rest period, to be used for the development of the gonads.

The evolution of the diameter of oocytes **(Figure 8)** corroborates with the GSI, the maximum size is reached during the month of December (4mm), for against the protoplasmic stage is characterized by sizes of 2.10-3 mm in diameters.

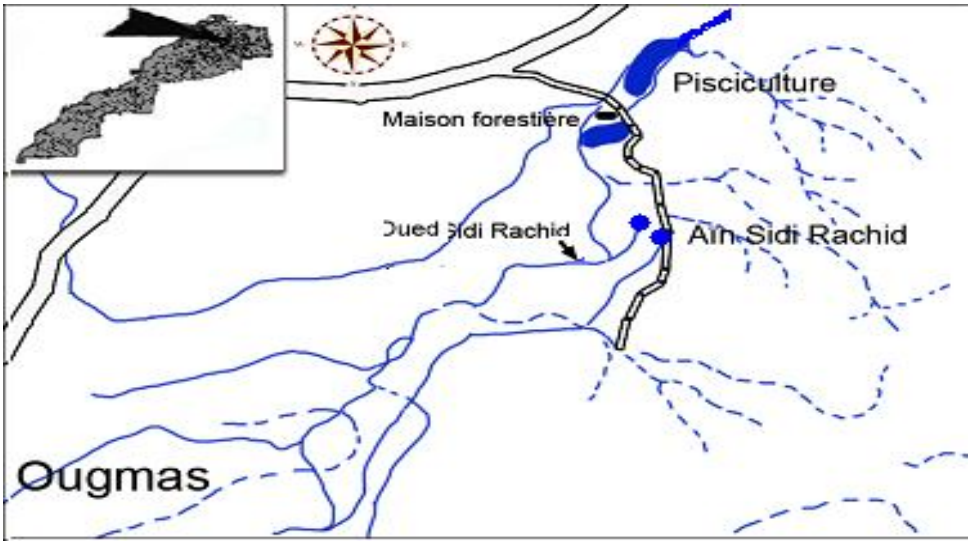

Figure 1: Drainage of the Ras El Ma with Oued Sidi Rashid (Sidi Rachid River) (Excerpt from the 1976 topographic map of Azrou. Scale 1:50,000.)

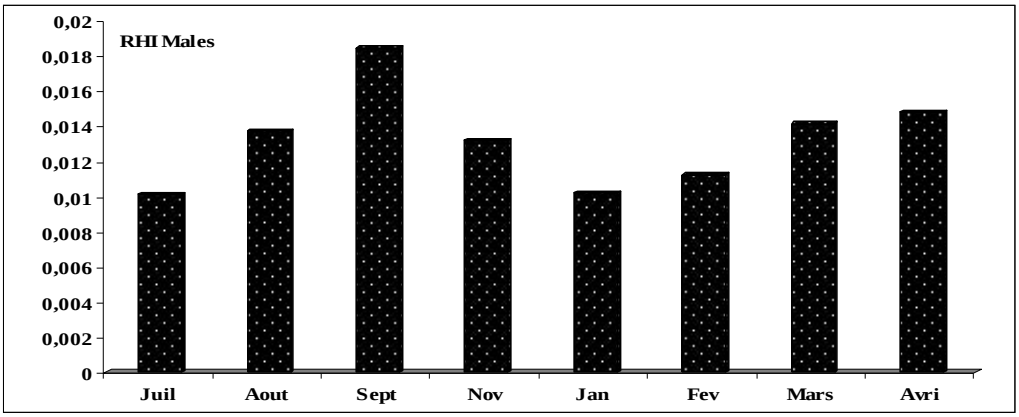

Figure 2: Evolution of Hepatosomatic Index in Males

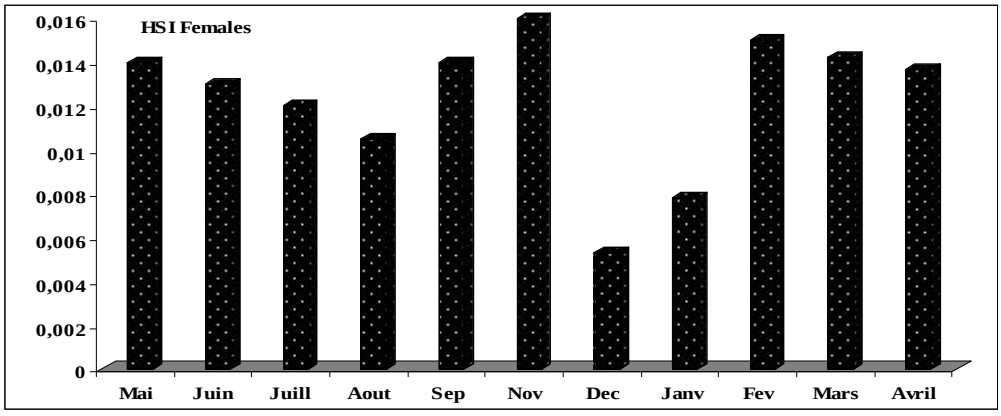

Figure 3: Evolution of Hepatosomatic Index in Females

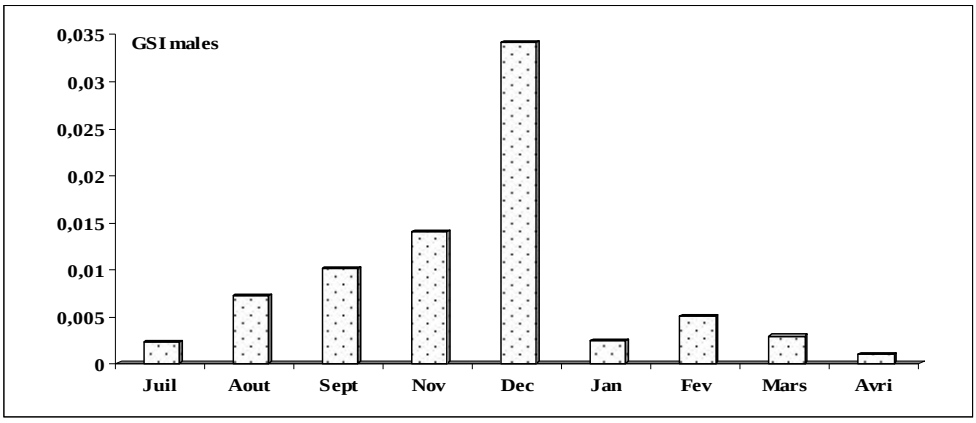

Figure 4: Evolution of Gonadosomatic Index In Males

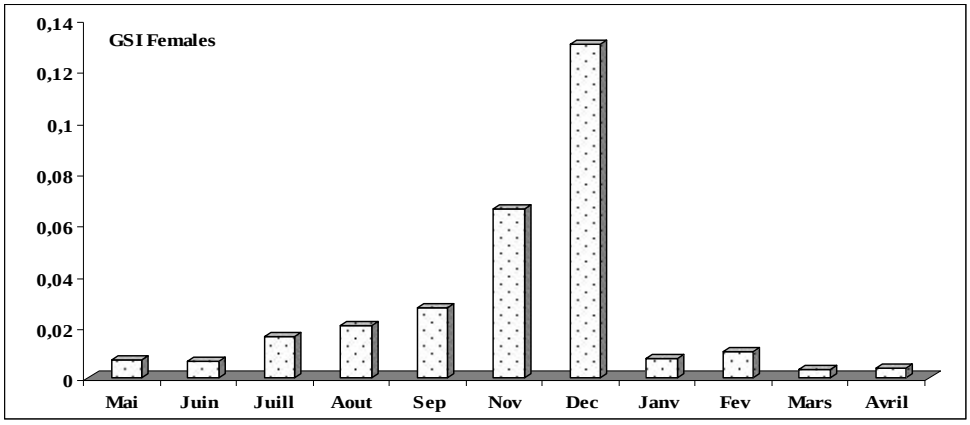

Figure 5: Evolution of Gonadosomatic Index In Females

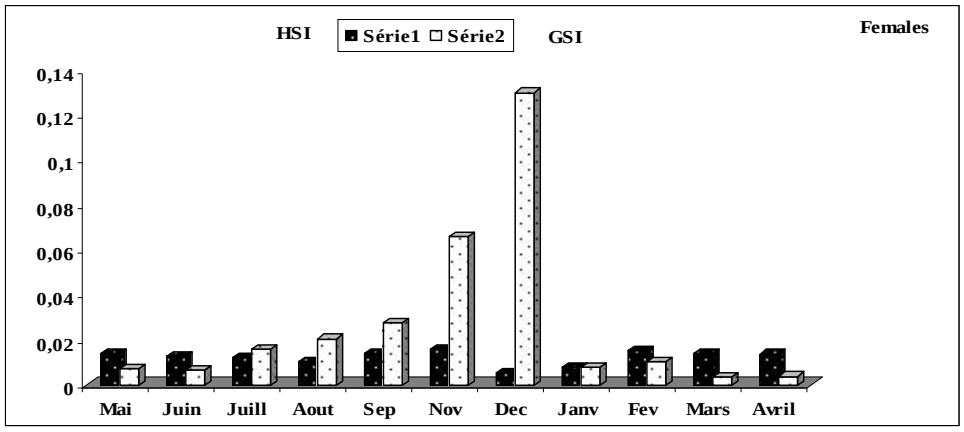

Figure 6: Relationship Between the Evolution of GSI and The HIS In Females

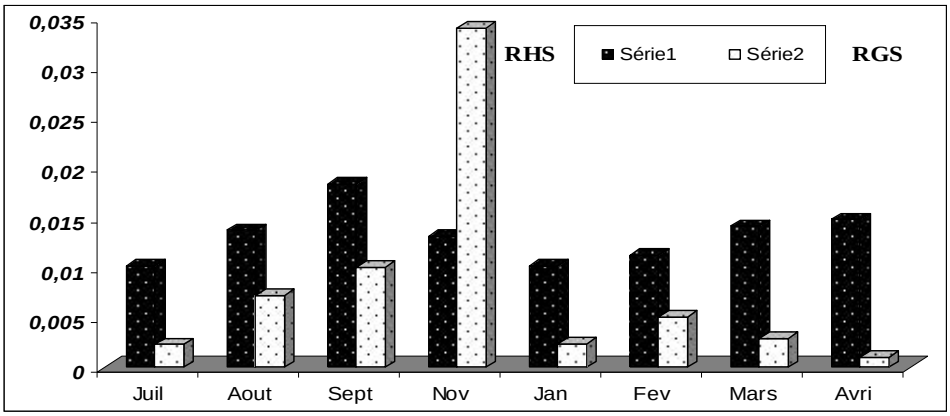

Figure 7: Relationship Between the Evolution of GSI and the HIS In Males

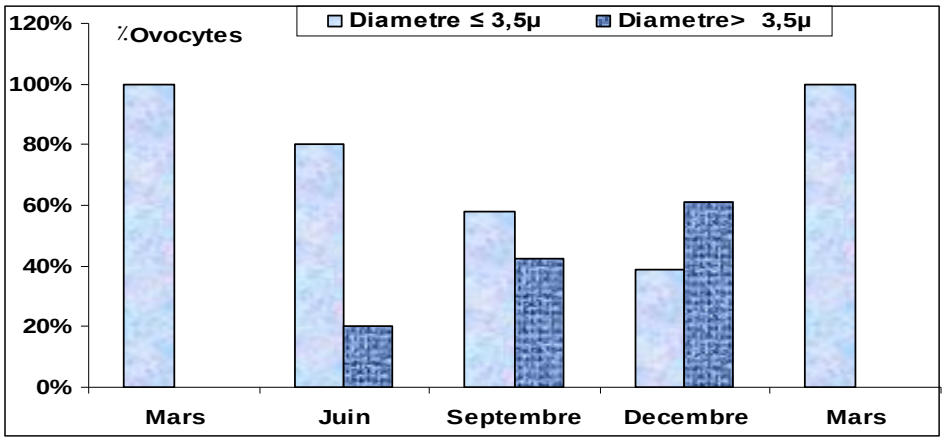

Figure 8: Evolution of the Diameters of Oocytes of Brown Trout

CONCLUSION

The fish management requires studying a large number of parameters whose bioogie. The fish fauna of Morocco, is threatened due to several factors such as natural drought occurring in Morocco lately, especially overfishing and poaching. . Measures must be taken for better conservation of this rich ichthyological and especially trout river in species endemic to Morocco.

REFERENCES

[1] Pronier O, Analyse des peuplements ichtyologiques des plans d'eau français et perspectives de gestion piscicole.Thèse, Sc. Agronomique, ENSAT, France, 2000.

[2] Essamlali I, Mesfioui A and Bazairi H, Etude du régime alimentaire du Merlu (MERLUCCIUS

MERLUCCIUS,LINNAEUS 1758) et du Pageot (PAGELLUS ACARNE, RISSO 1826) de la cote Nord Atlantique Marocaine. 3ème Journées Internationale des Géosciences de l'Environnement.Maroc, El Jadida les, 8 (9), 2005.

[3] Prolonge-Chevalier C, 2007, Etude histologique du développement sexuel de l'apron du Rhône Zingel asper L., Percidé endémique menacé d'extinction, Thèse de doctorat, École doctorale de l'Ecole Pratique des Hautes Etudes, Lyon, 2007, 66.

[4] Mooij WM, and Vannes HM, Statistical-analysis of the Somatic growth-Rate of 0+fish in relation to temperature under natural conditions, Canadian Journal of fisheries and aquatic Sciences,55 (2), 1998, 451-45.

[5] McCormick JH and Leino RL, Factors contributing to first year recruitment failure of fishes in acidified waters with some implications for environmental research, T. Am. Fish. Soc., 128, 1999, 265–277.

[6] Amhaouch A, Mémoire de 3ème Cycle: Etude physico-Chimique et Ichtyologique des Lacs du Moyens Atlas : Cas d'Ifrah et Sidi Ali. ENFI. Salé. Maroc., 1995.

[7] Martin J, Le Moyen Atlas Central, Editions du Service Géologique du Maroc, Rabat, Maroc., 1981.

[8] Rapport: Débat National sur l'eau, Bassin du Sebou, Maroc., 2006.

[9] Brusven M, Meehan WR and Ward JF, Summer use of simulated undercut banks by juvenile chinook salmon in an artificial Idaho channel. North Amer. J. Fish. Manage., 6, 1986, 32-37.

[10] Meehan WR, Brusven MA, Ward J, Effects of ardflcial shading on distribution and abondance of juvenile chinook saimon, Great Bassin Naturalist, 47 (l), 1987, 22-31.

[11] Maridet L and Souchon Y, 1995, Habitat Potentiel de la truite fario (SALMO TRUTTA FARIO,L. 1758) dans trois cours d'eau du Massif Central,Bull.Fr. Peche Piscic., 336, 1995, 1-18.

[12] Micha JC, 1973, Etude des populations piscicoles de Oubangui et tentatives de sélection et d'adaptation de quelques espèces à l'étang de pisciculture, Ed CTFT, Paris, 1973, 110.

[13] Ricker WE, 1980, Calcul et interprétation des statistiques

biologiques des populations de poisons, Bulletins de l'office des recherches sur les pêcheries du Canada, 191F, 1980, Ottawa.

[14] Coulibaly ND, Length-weight relationships of 11 fish species of Burkina Faso., 2003, 20-22. *In*: Fish biodiversity: local studies as basis for global inferences, Palomares MLD, Samb B, Diouf T, Vakily JM & Pauly D (eds), ACP-EU Fish. Res. Rep., 2003, 14, 281.

[15] Williams JE, Coefficient of condition of fish. Chapter 13 In: Schneider, J. C. (Ed) Manual of fishery survey methods II with periodic updates, Michigan Department of Natural Resources, Fisheries Special Report No. 25, Ann Arbor, 2000.

[16] Weedle GK. and Burr BM, Fecundity and dynamics of multiple spawning in darters : an in-stream study of *Etheostoma rafinesquei,* Copeia, 1991, 419-433.

[17] McEvoy LA and McEvoy J, Multiple spawning in several commercial fish species and its consequences for fisheries management, cultivation and experimentation, J. Fish Biol., 41, 1992, 125- 136.