

**UNIVERSITY GRANTS COMMISSION
BAHADUR SHAH ZAFAR MARG
NEW DELHI – 110 002**

**PROFORMA FOR SUBMISSION OF INFORMATION AT THE TIME OF SENDING THE
FINAL REPORT OF THE WORK DONE ON THE PROJECT**

1. Title of the Project : 'Estimation of Age and Longevity of Representative Vertebrate Species by Skeletochronology'
2. Name and address of the Principal Investigator : **Dr. Suresh M. Kumbar,**
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3. Name and Address of the Institution : Department of Zoology,
Arts, Commerce and Science College Palus, Dist. Sangli,
Maharashtra, 416 310
4. UGC Approval letter No. & Date : F. No. 42-619/2013 (SR); dated: 25/03/2013
5. Date of Implementation : 01/04/2013
6. Tenure of the project : Four Years (01/04/2013 to 31/03/2017)
7. Total Grant Allocated : Rs. 12,30,800.00
8. Total Grant Received : **Rs. 8,26,800.00**
9. Final Expenditure : **Rs. 8,26,800.00**
10. Title of the Project : 'Estimation of Age and Longevity of Representative Vertebrate Species by Skeletochronology'
11. Objectives of the project : Following are the objectives,
 - a) pattern of growth marks formation in the scales, otoliths and vertebrae in fishes and in phalangeal bones in amphibians, reptiles, birds and mammalian representative species.
 - b) applicability and reliability of skeletochronological technique for determination of age in representative vertebrate species.
 - c) age compositions of a population and similarities or variability's if any between populations of the same species inhabiting different locations.
 - d) confirmation of formation of growth marks whether they are annual or not by conducting long term experiments.
12. Whether objectives were achieved: **Yes**, Detailed report enclosed as **Annexure-I**
(give details)

13. **Achievements from the Project:** Skeletochronology is one of the best techniques for assessment of age and longevity in amphibians and reptiles due to its accuracy, reliability and applicability to the live samples. Most of the skeletochronological studies on vertebrate species emerge from temperate area; corresponding studies on tropical vertebrate species are very little. In vertebrates, annual growth layers in bones serves as indices for determining the age and longevity of individual animal (s). Therefore, the present work was initiated to study the age and longevity of representative vertebrate species inhabiting the tropical climate of Southern India by using skeletochronological method. From this project work four research papers have been published in UGC Approved peer reviewed National and International journals and also research findings have been presented in four National and International conferences. Project fellow has awarded M. Phil. degree from the Shivaji University, Kolhapur.

Sr. No.	Title of the presented Paper	Name of Conference	Organized Department	Date	Level
1.	Determination of age structure of freshwater fish <i>O. vighorsii</i> by comparison of scales, otoliths and vertebrate ring counts	ICCMBSD-2015	Department of Zoology, S. G. M. College, Karad.	22-23/04/2015	International
2.	Age and longevity study of road mortally Indian common toad <i>Duttaphrynus melanostictus</i> (Schneider, 1799) by skeletochronology”	NCBBM-2016	Department of Zoology, Shivaji University, Kolhapur	15 -16/01/2016	National
3.	Comparison of otolith, scale & vertebra for the age determination in freshwater fish <i>S. balookee</i> from the Krishna River	XXVI National Symposium on Chronobiology	Department of Zoology, Mysore University, Mysore	02-03/06/2016	National
4.	Occurrence of growth marks in the phalanges of Indian black rat <i>Rattus rattus</i>	South Asian Small Mammal conservation Conference	SMCRF, Kathmandu, Nepal	27-29 / 08/2017	International

14. SUMMARY OF THE FINDINGS: (IN 500 WORDS)

The results of the present investigation contribute in following scientific findings in the field of vertebrate gerontology,

1. Long term experimental study conducted in the agricultural pond at Gavan village, Sangli District, Maharashtra has confirmed that the formation of growth marks are annual in the freshwater fish *Labeo rohita* inhabiting southern India therefore, they can be regarded as 'year rings' for assessing the age of individual animal.

2. Comparison of otoliths, scales and vertebrae ring counts for assessment of age and longevity of freshwater fish *Salmophasia balookee*. One to five growth rings consisting of growth zones and lines of arrested growths (LAGs) were noticed in different body sized fishes. The percent agreement between otolith and scale ages were 88.81% and otolith and vertebrae ages was 99.25%. Results indicate that otoliths and vertebrae are most suitable aging materials compared to those of scales in *S. balookee*.

3. Ninety three road mortal Indian common toad, *Duttaphrynus melanostictus* were used for assessment of age and longevity by skeletochronology. This is the first time road mortal toads were used for age structure study. Among the toads studied, 25.86% showed no LAGs, 30.10% one LAG each, 23.65% two LAGs, 13.98% three LAGs, 5.38% four LAGs and 1.07% of toads exhibited nine LAGs in their phalangeal histology. This toad may live for 10 years in nature.

4. Age structure of 40 individuals (22 males and 18 females) of Indian garden lizard *Calotes versicolor* inhabiting southern India was determined by skeletochronology. Average snout vent length (SVL) was 9.49 ± 1.74 cm and 8.35 ± 1.07 cm, whereas the median age was 2.77 ± 1.31 (range = 2 - 5) for males and females respectively. No statistically significant differences were noticed in body mass and SVL between the sexes. However, there was a positive correlation between body mass and SVL ($r = 0.86$). The maximum longevity of this lizard is 5 - 6 years in natural population.

5. Bone growth marks consisting of growth zones and lines of arrested growth (LAGs) are detected in the cross sections of phalanges of Red vented Bulbul (*Pycnonotus cafer*) studied from the first time. One to five growth marks are noticed in the cross section of red vented bulbul.

6. Skeletochronological technique was applied first time for determination of age in tropical rodent species. Bone growth marks consisting of growth zones and lines of arrested growth (LAGs) are detected in the cross sections of phalanges in Indian rodent species *Rattus rattus*. One to five growth marks are noticed in the cross section of phalanges indicating this species live for a maximum of five years.

15. Contribution to the Society (Give details) : The project funding has been extremely useful for capacity building of students and research scholars in the area of vertebrate ecology, demography and life history.

16. Whether any Ph.D. enrolled / produced out of the project : Yes, Project Fellow Awarded M. Phil. degree from the Shivaji University, Kolhapur and now Registered for Ph. D. Degree

17. No. of publications out of the Project (please attach) : Four papers have been published

1. Swapnali B. Lad **Suresh M. Kumbhar** and Abhjit B. Ghadage (2014). Comparison of otolith, scale and vertebrae for age estimation of freshwater exotic fish *Oreochromis mossambicus*. *Indian Journal of Applied Research*, 4(6): 537-541.
2. Kumbhar S. M. and S. B. Lad (2016). Estimation of age and longevity of freshwater fish *Salmophasia balookee* from otoliths, scales and vertebrae. *Journal of Environmental Biology*. 37: 943-947.
3. Suresh M. Kumbhar and Swapnali B. Lad. (2017). Determination of age and longevity of road mortal Indian common toad *Duttaphrynus melanostictus* by skeletochronology. *Russian Journal of Herpetology*. 24(3): 217-222.
4. Suresh M. Kumbhar (2017). Age and longevity of Indian garden lizard *Calotes versicolor* (Daudin 1802) by skeletochronology. *Russian Journal of Herpetology*. (in Press)


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