



**Marathwada Shikshan Prasarak Mandal's**

## **Sunderrao Solanke Mahavidyalaya, Majalgaon**



### **INTERNAL QUALITY ASSURANCE CELL**

#### **CRITERION-6: GOVERNANCE, LEADERSHIP AND MANAGEMENT**

##### **6.3 Faculty Empowerment Strategies**

**6.3.1 The institution has effective welfare measures and Performance Appraisal System for teaching and non-teaching staff**

**Sample PBAS 2018-2019**

**DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD**  
**Revised API - PBAS Pro forma for Recruitments and Promotion under CAS**  
**As per UGC's 4<sup>th</sup> Amendment dated 11<sup>th</sup> July, 2016**

**ANNUAL SELF- ASSESSMENT FOR THE PERFORMANCE BASED APPRAISAL  
SYSTEM**

**(ACADEMIC YEAR 2018-2019)**

**PART A: GENERAL INFORMATION AND ACADEMIC BACKGROUND**

1. **Name (In Block Letters)** :- PAWAR RAJKUMAR TUKARAM
2. **Department** :- ZOOLOGY
3. **Current Designation & Grade Pay** :- Assistant Professor, AGP Rs 8000/-
4. **Date of Last Promotion** :- 13/07/2016
5. **Which position and grade pay are you an applicant under CAS?** :- Associate Professor  
Stage 4 (AGP Rs. 9000/-)
6. **Date of Eligibility for promotion** :- 13/07/2019
7. **Address (With Pin Code)** :- Dept. of Zoology, Sunderrao Solanke  
Mahavidyalaya, Majalgaon Dist.  
Beed 431131 (Maharashtra)
8. **Telephone No.** :- 09028700713  
**Email** :- [drrajpawar@rediffmail.com](mailto:drrajpawar@rediffmail.com)  
[drrajpawar@gmail.com](mailto:drrajpawar@gmail.com)
9. **Academic Qualifications (from S.S.C. till post graduation) :-**

Examinations	Name of Board/University	Year of Passing	% of Marks obtained	Division/Class /Grade	Special/Optional Subjects
S. S.C.	Div. Board Aurangabad	1995	60.28	First Division	Maths, Science & Social Sci.
H.S.C.	Div. Board Aurangabad	1998	57.31	Second Division	Chem, Phy, Bio, Geography
B.Sc.	Dr. B.A. M. University, Aurangabad	2001	71.32	First Class	Zoology, Chemistry Industrial Chem.
M.Sc.	Dr. B.A. M. University, Aurangabad	2003	70.2	First Class	Zoology

**10. Research Degree (s)**

Degree	Title	Date of award	University
Ph.D.	Studies on the Cestode Parasites of Fishes from Siluridae Family	28/05/2007	Dr. B.A.M. University, Aurangabad

**11. Appointments held prior to joining this institution**

Designation	Name of the Employer	Date of		Salary with Grade	Reason of leaving
		Joining	Leaving		
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**12. Positions held after appointment at this institution:-**

Designation	Department	Date of actual holding		Grade
		From	To	
Professor Assistant	M.S.P. Mandal's Arts, Comm. & Science College, Kille-Dharur	13.07.2007	11.12.2009	---
Assistant Professor & Research Guide	M.S.P. Mandal's Sunderrao Solanke Mahavidyalaya, Majalgaon, Dist. Beed	12.09.2009	Till date	---

**13. Period of teaching experience:-**

P.G. Classes (in Years) : ---

U.G. Classes (in Years) : 12 Years

**14. Research Experience excluding years spent for M. Phil / Ph.D. (in years):** 12 years

**15. Fields of Specializations under the Subject / Discipline:** Fishery Science, Parasitology

- a. Parasitology
- b. Endocrinology, Fishery Science

**16. Academic Staff College Orientation / Refresher Course/ ISTE – AICTE Sponsored STTP/SBP attended so far.:-**

<b>Name of the Course / Summer School</b>	<b>Place</b>	<b>Duration</b>	<b>Sponsoring Agency</b>
83 <sup>rd</sup> Orientation Course	Rani Durgawati Vishwavidyalaya, Jabalpur (M.P.)	07.05.2012 to 02.06.2012	UGC –ASC
Refresher Course in Life Sciences	Gujrat University, Ahemdabad, Gujrat	04.03.2013 to 24.03.2013	UGC –ASC
Refresher Course in life sciences on Emerging Trends in Life Sciences	Rani Durgawati Vishwavidyalaya, Jabalpur (M.P.)	02.06.2014 to 21.06.2014	UGC –ASC
Short Term Course	Dept. of Zoology, Degori College, Aurangabad	15.06.2013 to 20.06.2013	M.S.P. Mandal's Degori College, Aurangabad
Short Term Course	Rani Durgawati Vishwavidyalaya, Jabalpur (M.P.)	09.01.2017 to 14.01.2017	UGC – HRDC
Short Term Course	Dr. B.A.M. University, Aurangabad	21.01.2019 to 27.01.2019	UGC- HRDC

**PART B: ACADEMIC PERFORMANCE INDICATORS**

**CATEGORY I: TEACHING, LEARNING AND EVALUATION RELATED ACTIVITIES**

**a. Direct teaching** Maximum Score 70, for Assistant Professor, Maximum Score 60 for Associate Professor & Professor.

**a. i. Classroom teaching** lectures, seminar (As per allocation)

Sr. No.	Course/ Paper	Level	Mode of Teaching *	No. of Periods/hours allotted		No. of Periods/hours engaged per annum	Actual score (Actual hours spent per academic year ÷ 7.5/7.75/7.75)
				Per week	Per annum		
<b>Semester- I, III &amp; V</b>							
1.	B.Sc. F.Y. I (Th.)	U.G.	L/S	03	45	45	6.00
2.	B.Sc. S.Y. VII (Th.)	U.G.	L/S	03	45	45	6.00
3.	B.Sc. T.Y. XVI (Th.)	U.G.	L/S	03	45	45	6.00
<b>Semester- II, IV &amp; VI</b>							
4.	B.Sc. F.Y. IV (Th.)	U.G.	L/S	03	45	45	6.00
5.	B.Sc. S.Y. XI (Th.)	U.G.	L/S	03	45	45	6.00
6.	B.Sc. T.Y. XX (Th.)	U.G.	L/S	03	45	45	6.00

\* Lecture (L), Seminar (S), Tutorial (T), Practical (P), Contact Hours(C)

**a. ii. Classroom teaching**(including lectures, seminar) in excess of UGC norms (As per allocation)

Sr. No.	Course/ Paper	Level	Mode of Teaching*	Hours/Periods per academic year engaged	Actual score (Actual hours spent per academic year ÷ 7.5/7.75/7.75)
1	B.Sc. F.Y. I & IV (Th.)	U.G.	L/S	08	1.06
2	B.Sc. S.Y. VII & XI (Th.)	U.G.	L/S	07	0.93
3	B.Sc. T.Y. XVI & XX (Th.)	U.G.	L/S	08	1.06

\*Lecture (L), Seminar (S)

a. **iii. Tutorials and Practical's, Field work, Project Supervision** (Actual as per student attendance register)

Sr. No.	Course/ Paper	Tutorials/Practical/Field work/ Project supervision	Hours/Periods per academic year engaged	Actual score (Actual hours spent per academic year ÷ 7.5/7.75/7.75)
1.	I & II Semester	Practical's- Paper No. III & VI	15x3x4 = 45x4= 180	24
2.	III & IV Semester	Practical's -Paper No. IX & XIII	15x3x2 = 45x2x2 =180	24
3.	V & VI Semester	Practical's -Paper No. XVIII & XXII	15x3x2 = 45x2x2 =180	24
4.	V Semester	Field Work At Maharashtra Fish Seed Production Centre (MFSPC)	10	1.33
5.	III & IV Semester	Project Supervision- Survey on Vertebrates animal fauna of Majalgaon City	20	2.66
6.	V & VI Semester	Project Supervision- Indian Major Carps & Exotic Carps Breeding Practices at MFSPC	20	2.66

**Sub Total a. Direct Teaching Max. Score 70/60 Actual score a i+ii+iii**  
 = 36+3.05+78.65 = 117.7

b. **Examination duties** - Maximum Score 20, for Assistant Professor & Associate Professor, Maximum Score 10 for Professor.

Sr. No.	Types of Duties	Dates from- to	Actual Hours Spent	Actual Score(Actual hours spent per academic year ÷ 10 )
1.	Invigilation / Supervision	15/11/2019 to 20/11/2019 24,26/11/19	8x4=32	3.2
2.	Vigilance Squad M/A 2019	27/03/2019 to 10/04/2019	12x8=96	9.6
3.	Internal Assessment (Internal Examiner B.Sc. F.Y., S. Y. & T.Y. Pr.)	07.03.2019 to 09.03.2019	8 x 3 = 24	2.4
		13/03/2019 to 15/03/2019	8x3= 24	2.4
4.	External Assessment	02.03.2019 & 05.03.2019 to 06.03.2019	8 x 3 = 24	2.4
		11.03.2019 to 12.03.2019	8x2 =16	1.6
		24.04.2019	8	0.8
<b>Total actual score b</b>			<b>224</b>	<b>22.4</b>

c. **Innovative Teaching** - Maximum Score 10 for Assistant Professor, Maximum Score 15 for Associate Professor, Maximum Score 20 for Professor.

Sr. No.	Nature of Activity	Max Score	Actual hours spent per academic year	Actual score (Actual hours spent per academic year ÷ 10)
1.	Use of innovative methodologies for teaching		40	4.0
2.	Use of ICT		70	7.0
3.	Preparation of study material		20	2.0
4.	Mentoring		40	4.0
	<b>Sub total (max score 10)</b>	10/15/20	<b>170</b>	<b>17.0</b>
	<b>Total of Category 1 Max score</b>	100/95/90		<b>70+20+10=100</b>
	<b>Minimum API score required for Category I</b>	80/75/70		<b>100</b>

### CATEGORY II - CO- CURRICULAR, EXTENSION, PROFESSIONAL

#### DEVELOPMENT RELATED ACTIVITIES

Category II	Nature of activity	Maximum API score	Actual hours spent per academic year	Actual score	Verified API score	Page No.
a	<b>i. Student related co-curricular, extension and field based activities</b> i. Discipline related co-curricular activities organized <ul style="list-style-type: none"> <li>▪ Field work, field studies study tour</li> <li>▪ Student seminar</li> <li>▪ Quiz, debate, elocution, (on subject )</li> <li>▪ Essay competition on Subject</li> <li>▪ Survey conduction</li> <li>▪ Subject association activity</li> </ul>		10 Hours 30 Hours 05 Hours	1.0 3.0 0.5		
	<b>ii. Other co-curricular activities</b> <ul style="list-style-type: none"> <li>• Tree plantation</li> <li>• AIDS/Awareness</li> </ul>		10 Hours 10 Hours	01 01		
	<b>iii. Extension and dissemination activities</b> Organizing subject related event like lecture on special topics		10 Hours	01		
<b>Total Category II a</b>		<b>15</b>	<b>138 Hours</b>	<b>13.8</b>		

b	<p><b>Contribution to corporate life and management of the department and institution through participation in academic and administrative committees and responsibilities.</b></p> <ul style="list-style-type: none"> <li>• IQAC coordinator</li> <li>• Head Departments</li> <li>• Chairperson/ Convener</li> </ul>		<p>75 Hours      7.5  100 Hours      10.0  16 Hours      1.6</p>		
	<p><b>ii. Participation in</b></p> <ul style="list-style-type: none"> <li>• Editorial Board</li> <li>• Admission committee</li> <li>• Membership / participation in state/ Central bodies/committees on education research</li> </ul>		<p>10 Hours      01  60 Hours      6.0  20 Hours      2.0</p>		
<b>Total Category II b</b>		<b>15</b>	<b>281 Hours</b>	<b>28.1</b>	
c	<p><b>Professional Development activities</b></p> <ul style="list-style-type: none"> <li>• Participation in One Day human resource enrichment Programme.</li> <li>• Participation in human resource enrichment workshop on MOOCs, E-modules, IPR</li> <li>• Participation in one day National seminar on quest for quality in Higher Education</li> <li>• Short term training course UGC HRDC, Dr. BAMU, Aurangabad</li> </ul>		<p>08 Hours      0.8  08 Hours      0.8  08 Hours      0.8  56 Hours      5.6</p>		
<b>Total Category II c</b>		<b>15</b>	<b>80 Hours</b>	<b>8.0</b>	
<b>Total of Category II Max score</b>		<b>45</b>	<b>499 Hours</b>	<b>49.9</b>	
<b>Minimum API score required for Category II (for Assessment )</b>			<b>*50/50/50/50 /100</b>	<b>50</b>	



**CATEGORY: III**  
**RESEARCH AND ACADEMIC CONTRIBUTIONS**

**III A) (i) Published Papers in Refereed Journals as notified by the UGC\* (25 points per publication)**

Sr. No.	Title with page nos.	Journal	ISSN / ISBN No.	Impact factor, if any	No. of co-authors	Whether principal author/corresponding author/Guide	Self appraisal score	API score verified	Page nos. of relevant documents
1	Ichthyofaunal biodiversity and conservation status of Majalgaon reservoir, Marathwada, (M.S.), India. Pp. 159-163	International Journal of Research and Analytical Reviews	E-ISSN - 2348 - 1269	5.75	---	Principal author	20		
2.	Nervous system and Neurosecretory cells in Cestoda Lytocestus vyasaiei Pawar, 2011 (Caryophyllaidea) Vol.6, Issue I, pp. 213-2015	International Journal of Scientific research in Biological Sciences	E-ISSN - 2347 - 7520	1.013	---	Principal author	10		
3.	Histopathological studies of Wallago attu (Bleeker) Infected with Gangesia (Gangesia) ramkai Pawar, 2008	Research Journey International Multidisciplinary E- Research Journal	ISSN 2348 - 7143	6.261	---	Principal author	20		
Sub total A (i)							<b>50</b>		

**(ii) Published Papers in Other Reputed Journals as notified by the UGC\* (10 points per publication)**

Sr. No.	Title with page nos.	Journal	ISSN/ISBN No.	Impact factor, if any	No. of co-authors	Whether principal author/corresponding author/Guide	Self appraisal score	API score verified	Page nos. of relevant documents
Sub total A (ii)									

<b>Total A ( i+ii)</b>	<b>50</b>
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**III B) Publications other than journal articles (books, chapters in books)**

**(1) Text/Reference, Books published by International Publishers, with ISBN/ISSN number as approved by the University and posted on its website. The List will be intimated to UGC. (30 Points per Book for Single Author)**

Sr. No.	Title with page nos.	Type of Book & Authorship	Publisher & ISSN/ ISBN No.	Whether peer reviewed	No. of co-authors	Whether principal author /corresponding author /Guide	Self Appraisal score	API score Verified	Page No. of relevant documents
<b>Sub Total B i)</b>							<b>NIL</b>		

**(ii) Subject Books, published by National level publishers, with ISBN/ISSN number or State / Central Govt. Publications as approved by the University and posted on its website. The List will be intimated to UGC. (20 Points per Book for Single Author)**

Sr. No.	Title with page nos.	Type of Book & Authorship	Publisher & ISSN/ ISBN No.	Whether peer reviewed	No. of co-authors	Whether principal author /corresponding author /Guide	Self Appraisal score	API score Verified	Page No. of relevant documents
<b>Sub Total B ii)</b>							<b>NIL</b>		

**(iii) Subject Books, published by other local publishers, with ISBN/ISSN number as approved by the University and posted on its website. The List will be intimated to UGC. (15 Points per Book for Single Author)**

Sr. No.	Title with page nos.	Type of Book & Authorship	Publisher & ISSN/ ISBN No.	Whether peer reviewed	No. of co-authors	Whether principal author /corresponding author /Guide	Self Appraisal score	API score Verified	Page No. of relevant documents
<b>Sub Total B iii)</b>							<b>NIL</b>		

**(iii) Chapters in Books published by National and International level publishers, with ISBN/ISSN number as approved by the University and posted on its website. The List will be intimated to UGC. (International -10 points per Chapter National – 5 Points per Chapter)**

Sr. No.	Title with page nos.	Type of Book & Authorship	Publisher & ISSN/ ISBN No.	Whether peer reviewed	No. of co-authors	Whether principal author /corresponding author /Guide	Self Appraisal score	API score Verified	Page No. of relevant documents
<b>Sub Total B iv)</b>							<b>NIL</b>		

<b>Total B( i+ii+iii+iv)</b>	<b>NIL</b>
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**III C) Research Projects:  
III C) Sponsored Projects**

- A) Major projects: grants above Rs.30 lakhs for Engineering/ sciences & above Rs.5 lakhs for others, 20 points per project,  
 B) Major project: grants above Rs. 5 lakhs up to Rs. 30 lakhs for Engineering/ science and Rs.3 lakhs minimum to Rs. 5 lakhs for others, 15 points per project,  
 C) Minor project: grants above Rs.1 lakhs up to Rs. 5 lakhs for Engineering/ sciences & above Rs.1 lakhs up to Rs. 3 lakhs for others, 10 points per project,

Type of project	Title	Agency	Year of completion	Whether Co-PI	Grant (Rs. Lakh)	Self appraisal Score	API score Verified	Page No. of relevant documents
<b>Sub Total C (i)</b>						<b>NIL</b>		

**III C (ii) Consultancy Projects** (Amount mobilized with minimum Rs.10 lakhs for Engineering/sciences & minimum of Rs.2 lakhs for others, 10 points for every Rs 10 lakhs & Rs. 2 lakhs. Respectively)

Sr. No.	Title	Agency	Year of completion	Whether Co-PI	Amount Mobilized (Rs. Lakh)	Self appraisal Score	API score Verified	Page No. of relevant documents
<b>Sub Total C (ii)</b>						<b>NIL</b>		

**III C (iii) Projects Outcome/Output:**

**Patent / Technology transfer / Product process**

Major Policy document prepared for international bodies like WHO/UNO/UNESCO/UNICEF etc. Central / State Govt./Local Bodies(30 for each International / 20 for each national level output or patent. Major policy document of International bodies – 30 Central Government – 20, State Govt.-10 Local bodies – 5)

Sr. No.	Name of the Project	Funding Agency	Whether Co-PI	Amount Mobilized (Rs.)	Self appraisal score	API score Verified	Page No. of relevant documents
<b>Sub Total C (iii)</b>						<b>NIL</b>	

<b>Total C (i+ii+iii)</b>	<b>NIL</b>
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**III D Research Guidance** (In the case of joint supervision points are to be equally shared)

(For M. Phil. degree awarded 5 points per candidate, Ph.D. degree awarded 15 points per candidate. Ph.D. thesis submitted 10 points per candidate)

Sr. No.	Number Enrolled	Thesis Submitted	Degree awarded	API Score Claimed by the candidate	API Score Verified	Page No. of relevant documents
<b>Sub Total D</b>				<b>NIL</b>		

### III E Fellowships, Awards and Invited lectures delivered in conferences / seminars

#### III E (i) Fellowships/ Awards

A. International Award /Fellowship from academic bodies/associations -15 per Award / 15 per Fellowship.

B. National Award/Fellowship from academic bodies/associations -10 per Award / 10 per Fellowship. C. State/University level Award from academic bodies/associations -5 per Award

Sr. No.	Fellowship /Award	Year	Level International/ National/ State/ University	Awardee Academic body / Association	API Score claimed by the candidate	API Score verified	Page no. Of relevant documents
1.	Fellowship of Association Zoologists, India (F.A.Z.I.)	2019	National	Association of Zoologists, India	10		
<b>Sub Total E (i)</b>					10		

#### III E (ii) Invited lectures / papers International level 7 per lecture, National level 5 per lecture, State / University level 3 per lecture

##### a. Invited lectures

Sr. No.	Title of Lecture /Academic Session	Title of Conference /Seminar etc	Organized by	Whether international /National	API score claimed	API Score Verified	Page No. of relevant documents
<b>Sub Total E (ii)</b>					<b>NIL</b>		

#### (ii) Invited lectures / papers International level 5 per paper, National level 3 per paper, State / University level 2 per paper

##### b. Papers presented

Sr. No.	Title of Lecture /Academic Session	Title of Conference / seminar etc	Organized by	Whether international/ National / State or University level	API score claimed	API Score verified	Page No. of relevant documents
1.	Biodiversity and Conservation of Ichthyofauna from Majalgaon	<b>National seminar on Biodiversity and it's conservation</b>	Dept. of Zoology, D S Garad College	National	03	03	

	Reservoir, Marathwada region of Maharashtra, India.		Mohol, Dist. Solapur			
2.	Histopathological Studies of Wallago attu (B) infected with Gangesia (Gangesia) ramkai, Pawar, 2008	<b>National Conference on Contribution of Biological research for sustainable development</b>	Arts, Commerce and Science College, Kille-Dharur, Dist. Beed	National		
3.	Study of nervous system and neurosecretory cells in cestode Gangesia (Gangesia) ramkai, Pawar, 2008, from freshwater fish Wallago attu	<b>National Conference on Innovative Research in Science and Technology</b>	R.B. Attal Arts, Science and Commerce College, Georai, Dist. Beed	National		
4.	Ichthyofaunal biodiversity and conservation of Majalgaon reservoir, Marathwada, (M.S.), India.	<b>State level seminar on Emerging trends in biodiversity conservation</b>	K. J. Somaiya College of A.C. & S. Kopergaon	State		
<b>Sub Total E (ii)</b>					<b>03</b>	

<b>Total E (i+ii)</b>	<b>03</b>
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*The score under this sub-category shall be restricted to 20% of the minimum fixed for Category III for any assessment period*

**III (F) Development of e-learning delivery process/material 10 per module**

1. E- Content Development -Module I- Course Code-Zool-602- Fishery Science II
2. E- Content Development -Module II- Course Code-Zool-602- Fishery Science II

**SUMMARY OF CATEGORY III**

Details	By Candidate	By Committee	Remark
<b>Total A)</b>	50		
<b>Total B)</b>	---		
<b>Total C)</b>	---		
<b>Total D)</b>	---		
<b>Total E)</b>	13		
<b>Total F)</b>	20		
<b>Grand Total</b>	<b>83.00</b>		

**List of Enclosures:**

(Please attach, copies of certificates, and / or letters sanction orders, papers etc. wherever. Necessary)

1. Letter of Time Table and extra work load	2. Invigilation & D-CAS centre letter of Paper assessment
3. Letter of Appointment on various committees	4. External and Internal examiner letters for B.Sc. practical Examination
5. Certificate of IQAC Coordinator Honor	6. Certificate of one day National seminar on RAF
7. One day Faculty orientation programme on IPR	8. Certificate of one day State level seminar on RAF
9. Certificate of Editorial board member	10. Certificate of Membership
11. Certificate of National seminar	12. Research papers

### UNDERTAKING

I **Dr. Pawar Rajkumar Tukaram** undertake that the information provided is correct as per records submitted by me to College / Institute / university and / or documents enclosed along with the duly filled PBAS Performa.

Particulars	Maximum API Score	API score claimed	API score verified
Category I	100	100	
Category II	45	50	
Category III	--	83	
<b>Total</b>		<b>233.00</b>	

My PBAS based APIs score carries

233.00

Place: Majalgaon  
Date: 27/04/2019

Signature of the faculty with designation  
Dr. Pawar Rajkumar Tukaram  
(Assistant Professor)

Place: Majalgaon  
Date: 27/04/2019

Signature  
Head of the Department  
Sunderao Solanke Mahavidyalaya  
Majalgaon Dist - Beed.

Place: Majalgaon  
Date: 27/04/2019

Principal / Director/ Vice- Chancellor

PRINCIPAL

Sunderao Solanke Mahavidyalaya  
Majalgaon Dist - Beed (M.S.)

**N. B.:** The individual PBAS Performa duly filled along with supporting documents, submitted for CAS promotions will be duly verified by the college/Institute/university as necessary and placed before the Screening cum Evaluation Committee or Selection Committee for assessment / verification.



Marathwada Shikshan Prasarak Mandal's

R. B. Attal Arts, Science and Commerce College, Georai, Dist. Beed.

NAAC Reaccredited 'B' Grade

ISO : 9001 : 2015 Certified



One Day Human Resource Enrichment Programme: 2018-2019

on

'Dimensions of Curriculum, Teaching- Learning and Evaluation'

2<sup>nd</sup> September 2018

Organized

By

Department of Botany & Zoology

## Certificate

This is to certify that Mr./Mrs./Dr. R. T. Pawar of  
Sundarrao Solunke Maharidyalaya, Majalgaon College has Participated in One Day Human Resource  
Enrichment programme on "Dimensions of Curriculum Teaching- Learning and Evaluation" for senior college  
teachers in Bio-sciences organized by Department of Botany & Zoology, R. B. Attal Arts, Science and Commerce College,  
Georai, Dist. Beed at Balbhim College, Beed.

  
Dr. S. N. Solanke

Co-ordinator

  
Dr. R. K. Nimbalkar

Principal



Marathwada Shikshan Prasarak Mandal's



# DEOGIRI COLLEGE, AURANGABAD

( NAAC 'A' Grade with CGPA 3.75 and UGC's CPE Status )

## HUMAN RESOURCE ENRICHMENT WORKSHOP

9<sup>th</sup> December, 2018

# CERTIFICATE

*This is to certify that Mr. Pawar Rajkumar Tukaram of Sunderrao Solanke Mahavidyalaya, Majalgaon attended "Human Resource Enrichment Workshop" organized by Internal Quality Assurance Cell of Deogiri College, Aurangabad on 9<sup>th</sup> December, 2018.*

*This workshop covered active sessions on MOOC, E-Modules, Intellectual Property Rights of Establishment of Incubation Centre and its Management.*

Dr. Shivajirao Thore  
Principal





Marathwada Shikshan Prasarak Mandal's

# R. B. Attal Arts, Science & Commerce College



Georai Tq. Georai Dist. Beed

## National Conference

on

## Innovative Research in Science & Technology

16<sup>th</sup> February, 2019

### CERTIFICATE

This is to certify that Dr./Mr./Mrs. R. T. Pawar (Sundarasa Solankhe College, Majalgaon) has Chaired the session / participated / invited lecture / presented / entitled Study of Nervous System ..... Fish Walkways in One Day National Conference on "Innovative Research in Science & Technology" organized by R. B. Attal Arts, Science and Commerce College, Georai, Dist. Beed on 16<sup>th</sup> February, 2019.

Dr. Bhagat S. S.

Convener

Mr. Sangale V. P.

Vice Principal

Dr. Shikhare R. V.

Vice Principal

Dr. Nimbalkar R. K.

Principal & Organizer

**UNIVERSITY GRANTS COMMISSION**  
**HUMAN RESOURCE DEVELOPMENT CENTER**

**Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY**  
**AURANGABAD - 431 004 MAHARASHTRA (INDIA)**



NAAC Reaccredited "A"



**UGC SPONSORED SHORT TERM COURSE**

This is to certify that

Dr. Mr. / Mrs. / Miss. : Pawan R. J.  
Assistant Professor in Zoology, Punderrao Solanke  
Mahavidyalaya, Majalgaon, Dist- Beed  
affiliated to Dr. Babasaheb Ambedkar Marathwada Univ. A'bad  
participated in the Short Term Course on Workshop on MOOCs,  
e-content Development and open Educational Resources  
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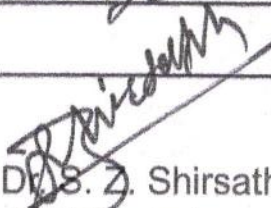
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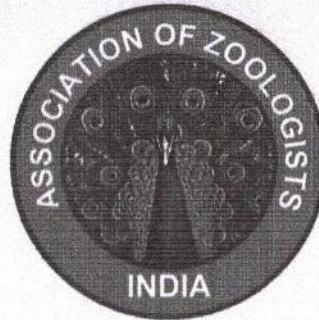
  
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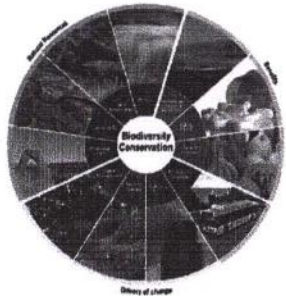
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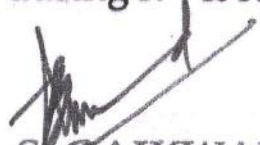
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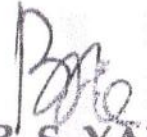
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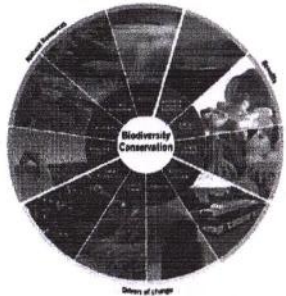
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## Histopathological Studies Of *Wallago Attu* (Bleeker) Infected With *Gangesia* (*Gangesia*) *Ramkai* Pawar, 2008.

**Rajkumar T. Pawar**

Department of Zoology, Sunderrao Solanke Mahavidyalaya, Majalgaon, Dist. Beed

### Abstract:

The present investigation deals with the study of histopathology of *Wallago attu* (Bleeker) infected with cestode *Gangesia* (*Gangesia*) *ramkai*. In the present results are showing pathogenic effect on host because they cause heavy mechanical damage creating ill health of host. The parasites causes mechanical damage to hosts intestinal layers suggesting that the worm (*Gangesia* (*Gangesia*) *ramkai*) under consideration has penetrative type of scolex. Not much effort is put by the parasite to survive in the intestine and the scolex is not so much helpful. It seems that the environment of the intestine is quite favourable for the worm *Gangesia* (*Gangesia*) *ramkai* which is rich in protein, glucose and fat content. So the worm finds it easy to absorb the same through tegument for growth and nourishment.

**Key words:** Cestoda, *Gangesia* (*Gangesia*) *ramkai*, *Wallago attu* (B.), Microtomy, Histopathology.

### Introduction:

The degree of response varies from host to host and also varies in different tissue sides, within the host. It varies markedly in some species with the stream of a particular species of host and parasite. Sometimes necrotic nodules or abscesses also develop and sometimes no marked cellular secretions are seen, even though the scolex enters and dilates the crypts of Liberkuhan and invades the lamina propria to cause bleeding. Thus the host parasite relationship results in the gain of one organism and the loss of another and leads to various diseases and disorders. Naturally it is important to study this relationship, not because of their parasitological value but for the relative existence of mankind. These studies may have considerable intrinsic interest and raise fundamental questions, common to other areas of biology, at a molecular, cellular, tissue and whole organism level.

Review on the pathogenesis of adult cestodes has been made by Rees, G. (1967). There is also extensive literature on the pathogenesis of larval cestodes in fish, but little is known of the reactions in the invertebrate's hosts, and many adult parasite tapeworms have been studied, for their histopathology. In fishes Mcvicar (1972) described host parasite relationship of *Echeneibothrium*, *Phyllobothrium* and *Acanthobothrium*. Sircar and Sinha (1980) have also studied the histopathology of *Lytocestus indicus*.

The cestode parasites the most favourable and selected site is the alimentary canal, and the reason is to meet their primary need of food from the host. Cestodes have also been found to infect many fish and cause pathological effects on the host. In some cases the parasites have caused severe changes in the host. Others who have reported on the cestode infection in fishes on histopathological changes caused by cestode parasites by Mackiewicz *et al.* (1972), Molnar *et al.* (2003), Ruhela *et al.* (2006), Williams (2007), C.J. Hiware *et al.* (2008), Nanaware *et.al.*, (2011), Jadhav *et al.* (2012), Laxma Reddy and Benarjee (2014) and Jyoti Shirsat *et.al.* (2018).

The present communication deals with the study of histopathology of cestode *Gangesia* (*Gangesia*) *ramkai* intestinal tapeworm of host *Wallago attu* (Bleeker).

### Material and Methods:

For the histopathological study, the freshwater fish, *Wallago attu* were brought to the laboratory and dissected out the intestine. Some of the intestines were infected and some were not. The worms were collected washed in saline solution, flattened, preserved in 4% formalin and later processed for taxonomical studies. The infected intestine with cestode parasites on closer observation identified as *Gangesia* (*Gangesia*) *ramkai*. Few worms were flattened, processed and stained for taxonomical studies. The worms, which were attached to intestine, were kept intact and small pieces of such intestines and other healthy intestine were fixed in Bouin's fluid fixative. Fixed tissues were washed, dehydrated through alcoholic grades, cleared in xylene and embedded in paraffin wax with melting point (58-60°C).

Blocks were cut at 8µ and slides were stained with standard haematoxylin and eosin stain, staining was carried out using haematoxylin and eosin staining technique (Bullock, 1963). Best slides were selected and observed under the microscope for histopathological study.



### Result and Discussion:

Parasitism of cestodes with their respective hosts is shown in the histopathological studies. This study is carried out with micro technique, where the section were cut  $8\mu$  on a rotary microtome and stained with Haematoxylin and Eosin stain. The selections of best slide of uninfected (healthy) and infected intestine was carried out and taken the photography after observing under microscope structure.

The normal histological structure (Healthy intestine) of the host *Wallago attu* (Bleeker), showed that the healthy villi and all layers are clearly observed (Figure 1) whereas the histopathology of infected intestine with the cestode *Gangesia (Gangesia) ramkaei* n.sp. is showing penetrative type of scolex, invades through the tissues and cause damage to villi, epithelium of host tissue (Figure 2).

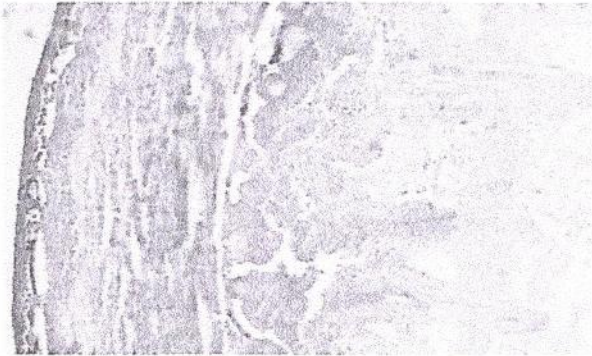


Figure 1. The normal (healthy intestine) histological structure of the host *Wallago attu* (B.)



Figure 2. T. S. of intestine showing the approaching parasites, *Gangesia (Gangesia) ramkaei* and attached parasites to intestinal tissue.



Figure 3. T. S. of intestine showing highly infected and damaged intestinal tissue.

In the transverse section seen that the worm are approaching to the intestinal villi. The mucosal layer of intestine and invades the host tissue, the worm is not only successful to enter into the intestine forming the ulceration in the intestinal wall; causing damage to the host tissue (Figure 3). The parasites were either free in the intestinal lumen of mixed with necrotic debris consisting of mucosal epithelium and monocular cells or embedded in the infesting of fibrocytes, lymphocytes, plasma cells and macrophages.

The present findings are more or less similar to the observations made by Nanware and Bhure (2011) studied histopathological observation of *Capra hircus* L. infected with *Stilesia jadahave*. Their result shows the worm is not having very close contact but it has developed very weak contact and attached loosely to

crypts of Liberkuhn. Pathan *et al.* (2011) from intestine of *Aetomylaeus nichoffii* parasitized by *Uncibilocularis* sp. His observation shows infected intestinal tissue gets broken due to penetration of hooks and formed ulcer. Recently Kaldate *et al.*, (2012) observed the intestine where in extensive damage caused to the villi. Laxma Reddy and Benarjee (2014) observed that the stomach is highly affected due to helminth infestation which was evidenced by total eruption of villi from the mucous membrane which resulted to a major disruption of the structural organization of the organ which might have profound influence on the nutrition and digestion process of the fish. Jadhav *et al.* (2012) studied the damage caused by *Circumoncobothrium* sp. in epithelial layer. Jyoti Shirsat *et al.*, (2018) also observed that intestinal tissue of the fish which includes shortening and damaging villi, thickening of the muscle layer, destruction of the villi, hold fast penetration of the mucosa and the damage of both the mucous and submucous membranes as compared with the normal intestinal tissue.

Thus it can be concluded that the parasite finds the food material and other favorable necessary requirement for its nourishment and growth from the host tissue by causing damage to the intestinal tissue of host. Furthermore it is essential to study in detail the hosts nutrition other aspects in relation to parasitic interaction but from above it can be concluded that the worm, *Gangesia (Gangesia) ramkaei* are of pathogenic nature and are harmful to fishes and has got importance in aquaculture point of view i.e. the fish disease management side.

#### Acknowledgement:

The authors are thankful to professor and head department of Zoology, Dr. Babasaheb Ambedkar Marathwada University Aurangabad for providing laboratory facilities.

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## Nervous system and neurosecretory cells in cestoda *Lytocestus vyasaei* Pawar, 2011 (Caryophyllidea)

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**Abstract-** The nervous system and neurosecretory cells of cestode *Lytocestus vyasaei* (Caryophyllidae) was investigated using histochemistry on the basis cytological structure. Morphologically the central nervous system consists of cephalic ganglionic mass and the lateral longitudinal nerve cords. The cephalic ganglionic mass consists of moderate number of apolar cells, unipolar cells, bipolar cells, and few multipolar cells, which are darkly stained. The bipolar cells are spindle shaped with two axons, unipolar cells are rounded with single axon and multipolar cells are with many axons with full neurosecretory material. The present findings suggest that and neurosecretory cells in nervous system may play an important integrative role of both neuronal and endocrine in the flatworm.

**Keywords:** *Lytocestus vyasaei* (Cestoda), Nervous system, neurosecretory cells, *Clarias batrachus* etc.

### I. INTRODUCTION

The nervous system of platyhelminthes is significant, because it represents an intermediate stage in the evolution of the nervous system. It has been assumed that, the adoption of a parasitic mode of life by groups, such as cestodes, must necessarily have led to a reduction or secondary simplification of their nervous system, or that the sedentary life style of the adult does not require a very elaborate or well-organized nervous system. It is assumptions that have been responsible in part, for the lack of interest shown in the nervous system of the cestodes.

Many scientists have worked out the nervous system of cestode parasites, [1] illustrated that there are 10 longitudinal nerve cords, interconnected by 20 transverse strands. The ten nerve cords anteriorly branched from a nerve ring in the neck and join in the centre of the scolex at a second ring. This was described in *C. mutabilis* and was considered to be most like that of trematodes. Later this theory was criticized by Luhe [2] that it did not differ from other cestodes in having 10 longitudinal cords. Another theory was proposed by Mrazk [3] that a single large scolex bears a nerve ring, a dorsal and a ventral nerve cord and two lateral cords with 16 nodes. Johnstone [4] described the nervous system of trypanorhynch tapeworm *Grillotia orientalis*. Shield [5] described the nervous system of *Dipylidium ganinum*, *E. granulosus* and *Hydatigera taeniaeformis* and confirmed to the typical cyclophyllidean pattern.

Present knowledge of the nervous system of cestodes shows that there are at least two longitudinal nerve cords this theory is well established. Regarding the neurosecretory system it is indicating that there are two classes of neurosecretory cell bodies, one type being neurosecretory, the other non-neurosecretory. The cytology of the nervous system consists various ganglionic cells and was identified at cerebral ganglia. But Rees [6] observed in *Acanthobothrium coronatum* that, the commissures constitute the nervous system. There is an opinion that the nervous system arises from the neurosecretory cells, this was observed by Andrew et al. [7]. Pintner [8] described giant fibers, originating from large multipolar cells, in the posterior commissure and running along with the nerve fibers, of the lateral cords and the tentacular nerves.

The purpose of the present study is a re-examination of the earlier studies and re-description of functional ultrastructure of the caryophyllaidea cestode *Lytocestus vyasaei* nervous system and neurosecretory cells. In the present investigation an attempt has been made to study the nervous system and neurosecretory cells of the cestode worms *Lytocestus vyasaei* [9] collected from the freshwater fish, *Clarias batrachus* (L) Marathwada region of Maharashtra state, India.

### II. MATERIAL AND METHODS

Eleven freshwater air breathing fish *Clarias batrachus* (Linnaeus) were brought to the laboratory from

the Kham River at Aurangabad district and dissected out and the intestine were examined for cestode infection. Out of eleven intestines, four intestines were heavily infected. The identified worms were separated and few of them were fixed in 4% formalin for taxonomical studies and rest was fixed in Bouin's fluid at 24-48 hours.

The material was washed in distilled water and Lithium carbonate solution, then dehydrated in alcohol grades and embedded in paraffin wax. (58-60°C). Blocks were cut at 7µ and slides were stained with Mallory's triple stain [10]. The best slides were selected after observation and the visual criteria of specific histochemical staining were adopted for determining the nervous system and neurosecretory cells.

### III. RESULT AND DISCUSSION

The nervous system of the cestode *Lytocestus vyasaevi* has the central nervous system which is clearly visible. The central nervous system consists of cephalic ganglionic mass and the lateral longitudinal nerve cords. From the cephalic ganglionic mass, two longitudinal nerve cords are running anterior head region to posterior region; these cords are thick and contain bundles of nerve fibers and neurosecretory cells. The neurosecretory cells are found in cortical parenchymatous tissue in head and neck region (Fig. A & B).

The cephalic ganglionic mass consists of moderate number of apolar cells, unipolar cells bipolar cells, and few multipolar cells, which are darkly stained. The bipolar cells are spindle shaped with two axons, unipolar cells are rounded with single axon and multipolar cells are with many axons with full neurosecretory material. The Longitudinal section of middle and posterior region of the worm, four types of neurosecretory cells are located in the longitudinal nerve cord and peripheral region also more number of cells occurs in longitudinal muscle and reproductive components (Fig. C & D).

Morphologically, apolar cells are round or oblong in shape, with or without axons and nucleus is round, red in color, the cytoplasm shows affinity with Mallory's triple stain that is pinkish violet in color. The unipolar cells are medium in size and spherical in shape, with single axon and nucleus is round or dark stained and the cytoplasm stained pinkish violet in color. The bipolar cells are larger than unipolar cells and spindle in shape, with two axons and cytoplasm gave weak staining with Mallory's triple stain. The multipolar cells are many in number it is found in cephalic ganglionic mass of the middle region of worm and the cytoplasm gave weak staining with Mallory's triple stain (Fig. E & F).

In *Lytocestus indicus*, Putative neurosecretory cells (pNSC) are recognized on the basis of phloxinophilic and Fuchsinophilic nature of their cytoplasm, pNSC in *L. indicus* are dimensionally small. Morphologically, there are four types of pNSC i.e. apolar, unipolar, bipolar and multipolar

cells are found both in the cortical and medullary parenchyma of the neck and strobilar regions also he observed in longitudinal muscles and components of the reproductive system. In the present study four types of neurosecretory cells are found in cephalic ganglionic mass of middle region of worm, these are apolar, unipolar, bipolar and multipolar cells and results are in accordance with Lyngodh et.al. [11]. Similar observation was done by Shinde, G.B. et.al. [12] in the nervous system of *Raillitina (Raillitina) tetragona* consist of an anterior nerve ring in rostellum with a number of nerve cells in a ring formed by a number of bipolar cells, with few unipolar and multipolar cells, which are larger, their nuclear membrane thin and smooth, nucleolus large and darkly stained.

### IV. CONCLUSION

The nervous system in cestode parasites has proved exceedingly difficult to study, due to the lack of a delimiting sheath on the nerve trunks, and to the subsequent problems of demonstrating the nerves by routine staining methods. In this study caryophyllidea cestodes observed that cephalic ganglionic mass with neurosecretory cells and lateral longitudinal nerve cords which are darkly stained.

#### Acknowledgement:

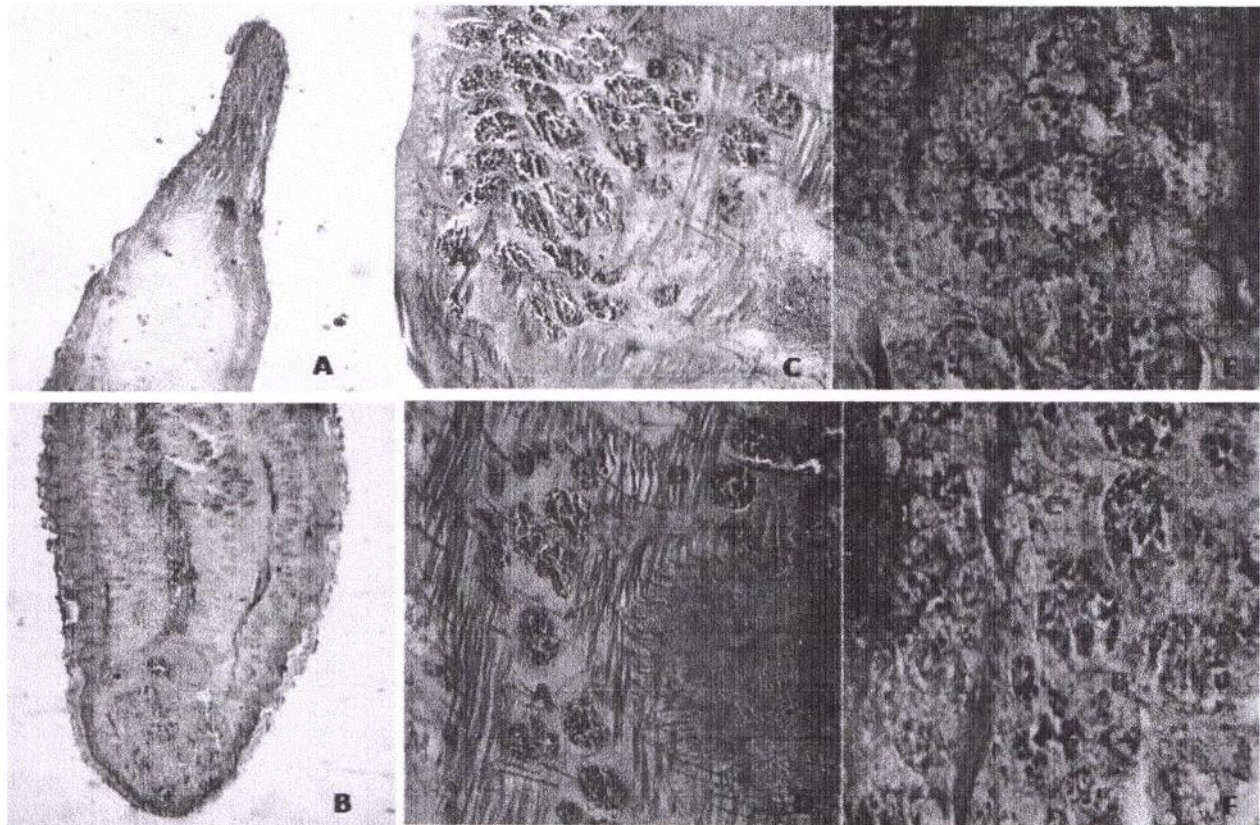
The authors are thankful to Prof. and Head Department of Zoology, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad for providing the research laboratory facility.

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### Nervous system and neurosecretory cells in *Lytocestus vyasaei*

Fig.A. L.S. of head region showing central nervous system and neurosecretory cells in corticular paranchymatous tissue.

Fig.B. L.S. of middle and posterior region showing longitudinal nerve cord and neurosecretory cell.

Fig.C. L.S. of middle region of worm showing - A and D types of neurosecretory cells. A- Apolar D- Multipolar

Fig.D. L.S. of middle region of worm showing A and D types of neurosecretory cells- A- Apolar D- Multipolar

Fig.E. L.S. of middle region of worm showing - B and C types of neurosecretory cells-B- Unipolar, C- Bipolar, N- Nucleus, NU- Nucleolus, NSM- Neurosecretory material

Fig.F. L.S. of middle region of worm showing - B and C types of neurosecretory cells- B- Unipolar, C- Bipolar



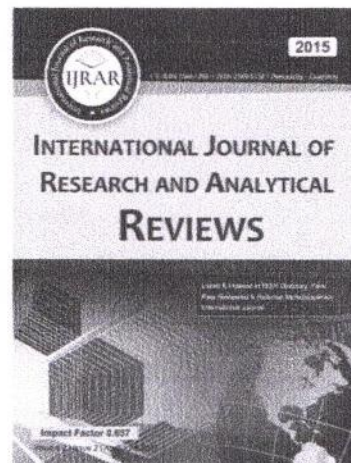
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## Ichthyofaunal Biodiversity and Conservation Status of Majalgaon Reservoir, Marathwada, (M.S.), India

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**ABSTRACT:** This contribution focuses on the biodiversity and conservation aspects of fishes in one of the large freshwater body of Marathwada region, Maharashtra, 'Majalgaon reservoir'. The extensive survey was conducted from April, 2017 to March, 2018. A total of 42 species were recorded belonging to 29 genera, 15 families and 9 orders. As far as the fishes under different orders are concerned, order Cypriniformes consists of 20 species, Siluriformes of 8 species, Channiformes of 4 species, Perciformes of 3 species, Osteoglossiformes and Mastacembaliformes of 2 species each and Anguiliformes, Cyprinodontiformes and Mugiliformes of 1 species each. The analysis showed that as per IUCN red list category 52.38% are least concern, 19.04% are not evaluated, 9.52% species are near threatened, 7.14% are data deficient, 4.76% are lower risk near threatened and vulnerable respectively as well as 2.38% are lower risk least concern. The study confirms that this freshwater body may prove congenial for conservation of regional fish diversity, especially for local and endangered fish species.

**Keywords:** Conservation Status, Ichthyofauna, IUCN categorization, Threats to fish diversity.

### Introduction

India has rich biological resources that qualify it as one of the mega diversity countries of the world. Fishes exhibit enormous diversity in their morphology, habitat they live in and biology. In India there are 2500 species of fishes out of which 930 are freshwater and 1,570 are marine (Kar, D. 2003). Freshwater biodiversity has declined faster than either terrestrial or marine biodiversity over the past 30 years (Jenkins, M. 2003). Stabilization of ecosystems such as wetlands is very essential for the sustainable utilization of resources. Freshwater fish are one of the most threatened taxonomic groups because of their high sensitivity to the alterations of aquatic habitats (Darwall, W.R.T. and Vie, J.C. 2005).

Ichthyofaunal diversity of an ecosystem represents the diversity and abundance of fish fauna. Many fish species have become highly endangered in freshwater ecosystems where heavy demand is placed on freshwater (Sebastian Raju *et al.*, 2014). Reservoir is not only an important source of water for drinking, agricultural operations, recreation, and sewage disposal but also considerably supports a substantial fishery. It not only supplements to nutritious diet but also is a source of livelihood for local fishing community. Hence, information about fish fauna inhabiting wetlands and other aquatic ecosystems is prerequisite for the development of culture as well as capture fishery.

The freshwater fish diversity is changing and getting depleted alarmingly fast as a result of the combined and interacting influences of over exploitation, water pollution, flow modification, destruction or degradation of habitat and invasion by exotic species (Revenga *et al.*, 2005). Present survey was conducted in Majalgaon reservoir, of Marathwada region, Maharashtra, India to explore the invaluable fishery resources of the reservoir.

### Materials and Methods

The periodical survey of the Ichthyofaunal biodiversity of Majalgaon reservoir was conducted for a period of one year (from April 2017 to March 2018). Fishes were collected at different sites of the reservoir with the help of local fisherman using gill net, cast net, drag net, hooks and lin. Fishes were also collected from local fish markets located on the banks of reservoir. The collected fishes were preserved in 10% formalin according to their size and labeled them. Fishes were identified up to the species level using keys developed by Jayaram (1981), Talwar and Jhingran (1991), Jayaram (1999) & Jayaram (2010). Identified fishes were confirmed by the experts in the field of fish taxonomy. Classification was carried out on lines of Day (1989), Jayaram (1961) and Nelson (1976).

Data on current conservation status of fish was obtained from the report of the Conservation, Assessment and Management Plan (CAMP) workshop (Molur *et al.* 1998) on freshwater fishes of India and IUCN Red List Category of Threatened Species (IUCN, 2017).

Data regarding abundance of different fish species, threats faced by the fish fauna and economic importance was obtained from direct observation and interaction with the local stakeholders and internet search tools.

**Result and Discussion**

The results of present study confirm the occurrence of 42 fish species belonging to 29 genera, 15 family to 9 orders (Table 1). List of fish including their conservational status was given in Table 1. Out of 42 fish species order Cypriniformes was dominant with 20 (47.61%) species to be followed by order Siluriformes with 8 (19.04%) species, Channiformes with 4 (9.52%) species, Preciformes with 3 (7.14%) species while the orders of Osteoglossiformes & Mastcembeliformes each with 2 (4.76%) species, and rest of the orders, Angulliformes, Cyprnidontiformes and Mugiliformes each with 1 (2.38%) species (Table 2).

Out of 42 species, major percent (45.23%) of fish were lower risk near threatened according to CAMP, 1998 but from the remaining 21.42% are vulnerable, 19.04% are not evaluated and 7.14% are endangered and lower risk least concern respectively. As per IUCN red list category 52.38% are least concern, 19.04% are not evaluated, 9.52% species are near threatened, 7.14% are data deficient, 4.76% are lower risk near threatened and vulnerable respectively as well as 2.38% are lower risk least concern (Table 3).

**Table 1.** Ichthyofaunal biodiversity and Conservation status of Majalgaon reservoir.

Order/Family/Species	CAMP Status	IUCN Status	Frequency	Commercial Importance	Threats
Order Osteoglossiformes					
Family Notopteridae					
1. <i>Notopterus notopterus</i>	LRnt	LC	C	C,F,O	HL,OE,T
2. <i>Notopterus chitala</i>	EN	NT	R	F,O	AL, OE
Order Angulliformes					
Family Angullidae					
3. <i>Anguilla bengalensis</i>	EN	LC	R	F,O	HL,OE, P
Order Cypriniformes					
Family Cyprinidae					
4. <i>Chela phulo</i>	NE	NE	R	F	SP
5. <i>Chela sladoni</i>	LRlc	LC	R	F,O	P,T
6. <i>Cyprinus corpio</i>	NE	NE	A	C,F,O,S	SP
7. <i>Catla catla</i>	VU	NE	A	C,F,S	HL,P
8. <i>Cirrhinus mrigala</i>	LRnt	LC	C	C,F	HL,OE,SL
9. <i>Amblypharyngodon microlepis</i>	LRlc	LC	M	O	O,F
10. <i>Discognathus lamta</i>	LRlc	LC	M	F,O	HL,OF
11. <i>Labeo rohita</i>	LRnt	LC	C	C,F,S	HL,OE,S,T
12. <i>Labeo calbasu</i>	LRnt	LRnt	R	C,F	OE,P
13. <i>Osteobrama cotio</i>	LRnt	NE	C	O	HL,P
14. <i>Puntius amphibias</i>	VU	DD	R	O	HL,P
15. <i>Puntius sarana sarana</i>	VU	LC	C	F,O,S	HL,T
16. <i>Puntius ticto ticto</i>	LRnt	LC	M	O,F	OF,HL
17. <i>Puntius sophera</i>	LRnt	LC	C	O	OF,P
18. <i>Hypothalamichthys molitrex</i>	NE	NT	C	F,O,S	OF,HL,P
19. <i>Thynnichthys sandkhol</i>	NE	DD	R	F,S	HL,P
20. <i>Ctenopharyngodon idella</i>	NE	NE	C	C,F	SP
21. <i>Rasbora daniconius</i>	LRnt	LC	M	F,O	OF,P
Family Cobitidae					
22. <i>Lepidocephalichthys guntea</i>	LRnt	LC	C	F,O	HL,P
23. <i>Nemacheilus botia</i>	LRnt	LC	C	F,O	HL,T
Order Siluriformes					
Family Bagridae					
24. <i>Mystus aor</i>	NE	LC	C	F,O	HL,P

**EMERGING TRENDS IN BIODIVERSITY CONSERVATION (ETBC-2019)**

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	25. <i>Mystus bleekeri</i>	VU	LC	M	F,O	OF,P,T
	26. <i>Mystus cavasius</i>	LRnt	LC	C	F,O	OF,HL,T
	27. <i>Mystus seenghala</i>	LRnt	LC	C	F,O	OF,P,T
Family	Clariidae					
	28. <i>Clarias batrachus</i>	VU	VU	C	C,F,O	T
Family	Heteropneustidae					
	29. <i>Heteropneustes fossils</i>	VU	VU	M	C,F,O	OF,HL,T
Family	Siluridae					
	30. <i>Wallago attu</i>	LRnt	NT	R	F,S	P,T
	31. <i>Ompak bimaculatus</i>	EN	NT	R	C,F,O	OF,HL,P,T,SL
Order	Cyprinodontiformes					
Family	Belontiidae					
	32. <i>Xenentodon cancila</i>	LRnt	LC	M	O	OF
Order	Mugiliformes					
Family	Mugilidae					
	33. <i>Mugil cephalus</i>	NE	LC	M	F,O	SP
Order	Channiformes					
Family	Channidae					
	34. <i>Channa gaucha</i>	VU	LC	M	F,O	HL,OE
	35. <i>Channa marulius</i>	LRnt	LC	M	F,O	HL,OF
	36. <i>Channa striatus</i>	LRnt	LRlc	C	C,F,O	OF,T
	37. <i>Channa punctatus</i>	LRnt	LRnt	C	F,O	HL,OF,T
Order	Mastacembaliformes					
Family	Mastacembelidae					
	38. <i>Mastacembelus armatus</i>	VU	NE	C	F,O	P
	39. <i>Mastacembelus pancalus</i>	LRnt	NE	M	F,O	OF,HL,P,T
Order	Preciformes					
Family	Anabantidae					
	40. <i>Anabas testudineus</i>	VU	DD	R	F,O	OF,OE
Family	Gibiidae					
	41. <i>Glassogobius giuris</i>	LRnt	LC	C	F,O	SP
Family	Cichlidae					
	42. <i>Oreochromis mossambica</i>	NE	NE	A	F,O	SP

Threat Status :- LC- Least Concern, VU- Vulnerable, DD-Data deficient, NE- Not Evaluated, LRnt- Lower Risk near threatened, NT- Near threatened, LRlc- Lower Risk least concern, EN- Endangered.  
 Abundance:- C- Common, R- Rare, M- Moderate, A- Abundant.  
 Commercial value:- C- Cultivable, F- Food Fish, O- orentamental, S- Sport fish  
 Threats:- HL- Habitat Loss, OE- Over Exploitation, P- Pollution, T- Trade, SP- Stable Poptation, SL- Siltation, OF- Over Fishing.

**Table 2.** Number and percent composition of families, genera and species under various orders

Sr. No.	Order	Families	Genus	Species	% of families in an order	% of Genera in an order	% of Species in an order
1	Osteogossiformes	1	1	2	6.66	3.44	4.76
2	Angulliformes	1	1	1	6.66	3.44	2.38
3	Cypriniformes	2	15	20	13.33	51.72	47.61
4	Siluriformes	4	5	8	26.66	17.24	19.04
5	Cyprinodontiformes	1	1	1	6.66	3.44	2.38
6	Mugiliformes	1	1	1	6.66	3.44	2.38
7	Channiformes	1	1	4	6.66	3.44	9.52

8	Mastacembaliformes	1	1	2	6.66	3.44	4.76
9	Preciformes	3	3	3	20.00	10.34	7.14
Total		15	29	42			

**Table 3.** Number and percentage occurrence of fish fauna of Majalgaon reservoir under the conservation status CAMP, 1998 and IUCN 2013

Sr. No.	Threat Category	CAMP		IUCN	
		Number	Percentage	Number	Percentage
1	Lower risk Near Threatened	19	45.23	2	4.76
2	Not Evaluated	8	19.04	8	19.04
3	Endangered	3	7.14	--	--
4	Vulnerable	9	21.42	2	4.76
5	Lower Risk least Concern	3	7.14	1	2.38
6	Data Deficient	--	--	3	7.14
7	Critically endangered	--	--	--	--
8	Least Concern	--	--	22	52.38
9	Near Threatened	--	--	4	9.52

Further result revealed that 3 species are found abundant, 11 species are moderately found, 18 species are common and 10 species are rarely found in the reservoir. Among the fish recorded 35 species are food fish, 34 species are with ornamental value, 11 are cultivable and 6 fish species are sport fish. Exotic species recorded in the reservoir are *Cyprinus carpio*, *Hypothalamichthyes molitrix*, *Ctenopharyngodon idella* and *Oreochromis mossambica*.

Different types of fish fauna under threats of the Majalgaon reservoir concern, habitat loss is the major threats causing severe damage to 54.76% of total species followed by pollution (38.09%), over fishing and trade (35.71%), over exploitation (19.04%), stable population (14.28%) and siltation (7.14%).

A growing population and increasingly intense land use in the reservoir led to the rise in polluting inputs, including industrial effluents, pesticides and fertilizers from aquaculture, agriculture and domestic sewage (Venot, J. et al., 2008). The large scale industrialization and the consequent effluent discharge are the important threat to the fish fauna. Introduced species for various purposes have been suggested as possible threats to the native fish fauna. These practices seem to have caused severe habitat degradation and decline of many important native food fishes. The fish fauna of this reservoir is also subjected to over exploitation for consumption, since the fish fauna of this lake supports the livelihood of several economic classes, there is an urgent need to design and implement conservation action plans.

Fish conservation measures on wide variety of factors must be taken into consideration to develop a comprehensive action plan. A holistic approach, integrating the concept of sustainable development and conservation measures could improve the situation. Considerable efforts should be made to conserve the biodiversity of fish. In order to conserve the valuable biodiversity of fish fauna of Majalgaon reservoir, the strategies should be adopted are: Restocking of economically important fish species, Proper introduction and control of exotic species, implementing closed seasons, regular supervision and monitoring of the reservoir, enforcement of strict rules and regulations on overfishing, Alternative livelihood to the local people, Sustainable fish harvest, captive breeding, Mass awareness, Educating and activating the fishermen cooperative societies and research and development.

### Conclusions

The result of the present study revealed that, Majalgaon reservoir contains rich ichthyofaunal biodiversity. However the ichthyofaunal biodiversity of this reservoir is in declining mode due to several anthropogenic threats. In order to conserve this resource a holistic approach, integrating the concept of sustainable development and conservation measures should be adopted. Present study provides a comprehensive data on biodiversity, conservation status and the gene pool of unique ichthyofauna of Majalgaon reservoir.

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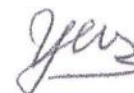
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<p><b><u>1<sup>st</sup> Quadrate e- Content</u></b></p> <p>1. e-Text for Module II- Course Fishery Science –II</p> <p>Introduction</p> <p>Fish diseases</p> <p>Breeding of fishes</p>	<p><b><u>2<sup>nd</sup> Quadrate e-Tutorial</u></b></p> <p>Video and Audio content in an Organized form, Animation, Simulation, Virtual Lab</p>
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