Department of Fisheries Biology is the *Mother department* of Fisheries since it touches almost all the aspects of fisheries science more or less. In keeping with the time, however, the department has updated itself with new subjects and streams to cater for the demands in the fishery sector. The change of emphasis is in the direction of starting Post graduate courses in *Fisheries Biotechnology* and *Fisheries Resources Management*. **Education:** The department is conducting all the UG courses assigned to it as per the new syllabus laid down by ICAR. Students are taken for field collections, visits and tours etc. as per the demand of the courses.

The department has already started PG courses, initially in Fisheries Biology stream and then in *Fisheries Biotechnology* and *Fisheries Resources Management*. Since 2012-13, the department has started Ph.D. (Fisheries Resources Management).

**Research:** The departmental research work addresses some major areas of importance or concern such as biodiversity assessment, clam resources, biological works on commercial species, collection and validation of indigenous knowledge, mud crabs, specimen identification preservation and detection of White Spot Disease (WSD) in shrimps.

**Extension:** So far the department has conducted various extension programs for the fishermen, fish farmers and also for school students. Awareness programs pertaining to endangered aquatic species, monsoon ban on fishing, freshwater prawn farming etc. were conducted by the department.
1. **Academic Programmes**: Provide the details of each doctoral programme as

   a. **Doctoral Programmes**

   **Name of the programme: Fisheries Resource Management**

<table>
<thead>
<tr>
<th>Semester No.</th>
<th>Term No.</th>
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<th>Credits</th>
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<tr>
<td>I I</td>
<td>I FRM 602</td>
<td>2+1=3</td>
<td>APPLICATIONS OF FISHERIES MODELS IN STOCK ASSESSMENT.</td>
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<tr>
<td></td>
<td></td>
<td>FRM 601</td>
<td>2+1=3</td>
<td>ASSESSMENT OF AQUATIC BIODIVERSITY</td>
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<td></td>
<td></td>
<td>FRM 603</td>
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<td>CONSERVATION AND MANAGEMENT OF EXPLOITED FISHERIES RESOURCES</td>
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<tr>
<td>II II</td>
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<td>FRM 605 0+2=2</td>
<td>DATA COLLECTION AND ESTIMATION OF EXPLOITED FISHERY RESOURCES</td>
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<td>FRM 604</td>
<td>2+1=3</td>
<td>CORAL REEF MANAGEMENT</td>
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<td></td>
<td>FRM 607 1+1=3</td>
<td>ISSUES IN CAPTURE FISHERIES</td>
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<td></td>
<td></td>
<td>ST 602 0+2=2</td>
<td>SOFTWARE IN FISHERIES DATA ANALYSIS &amp; MANAGEMENT</td>
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   **Course Curricula and syllabi:**

   b. **Masters programmes**

   **Name of the programme:**

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<td></td>
<td>FRM 501 2+1=3</td>
<td>INLAND FISHERIES RESOURCES</td>
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<td></td>
<td>FRM 503 2+1=3</td>
<td>MARINE ECOSYSTEMS, BIODIVERSITY AND CONSERVATION</td>
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<td>FRM 510 2+1=3</td>
<td>DEVELOPMENTAL BIOLOGY OF FINFISH AND SHELLFISH</td>
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<td>FRM 504 2+1=3</td>
<td>TROPICAL FISH STOCK ASSESSMENT</td>
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<td>I I</td>
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<td>FUNDAMENTALS OF MOLECULAR BIOLOGY</td>
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<td>FBT 502 2+1=3</td>
<td>BASIC CONCEPTS OF FISH BIOLOGY</td>
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<td>FBT507 2+1=3</td>
<td>CELL AND TISSUE CULTURE</td>
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<tr>
<td>II II</td>
<td>FBT 509 1+1=2</td>
<td>AQUACULTURE BIOTECHNOLOGY</td>
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FBT 508 1+1=3 MARINE BIOTECHNOLOGY
FBT 506 1+1 = 2 BIOINFORMATICS
FBT 503 2+1=3 GENE STRUCTURE & REGULATION OF EXPRESSION
FBT 504 2+1=3 GENETIC ENGINEERING & ITS APPLICATIONS IN FISHERIES
STM 502 1+1=2 RESEARCH METHODOLOGY

Course Curricula and syllabi:

c. Bachelor programmes

<table>
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<tr>
<th>Semester No.</th>
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<th>Course No.</th>
<th>Credits</th>
<th>Title of the course offered by the department</th>
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<td>FBIOL 123</td>
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<td>Taxonomy of Shellfishes</td>
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<tr>
<td>II II</td>
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<td>FBIOL 124</td>
<td>2+1=3</td>
<td>Anatomy &amp; Biology of Shellfishes</td>
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<td>FBIOL 215</td>
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<td>Inland Fisheries</td>
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<td>IV II</td>
<td>II II</td>
<td>FBIOL 226</td>
<td>2+1=3</td>
<td>Physiology of finfishes &amp; shellfishes</td>
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<td>V I</td>
<td>I</td>
<td>FBIOL 317</td>
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<td>VI II</td>
<td>II II</td>
<td>FBIOL 328</td>
<td>2+1=3</td>
<td>Fish Stock Assessment &amp; Management</td>
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Course Curricula and syllabi of each subject:

2. Infrastructure
a. Laboratories: TWO
b. Name of the important instruments/facilities:
   1. PCR Testing facility
   2. Museum displaying important preserved specimens
c. Activities: Provide the details such as the different educational and research activities that can be performed in the laboratory
   - PCR testing for viral disease diagnostics.
   - RAPD studies for genetic differentiation of fish stocks as part of post graduate research activities.
   - Identification and preservation of commercially important aquatic specimens
   - Reproductive and feeding biology of commercially important fish stocks
d. Photographs: Photographs of the important instruments preferably with students using these instruments/equipments or being demonstrated.

3. Faculty
a. Academic staff: Assistant Professor and above with the details of the staff as given below

<table>
<thead>
<tr>
<th>Recent Photograph</th>
<th>Name of the Faculty</th>
<th>Dr. V.R. Joshi</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Post Held</td>
<td>Professor and Head of Department</td>
</tr>
<tr>
<td></td>
<td>Date of Birth</td>
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<tr>
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<td>Qualification</td>
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<tr>
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<td></td>
<td>M.Sc./M.Tech</td>
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<td>Present area of research</td>
<td>Development of value added</td>
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</table>
products from fresh *Acetes*, Biological studies of commercially important species

**Contact details**
- Land line No.: 02352 234694
- Mobile: 9422441167
- Fax/Email: 02352 – 232987, vithalrjoshi@gmail.com

**Name of the Faculty**: Dr. S.D. Naik  
**Post Held**: Associate Professor  
**Date of Birth**: 18-02-1963  
**Qualification**: B.F.Sc, M.Sc (Fish.), PhD (Fisheries)  
**Area of Specialization**: Marine Biology, Marine Fisheries, Fish resource management  
**Experience (Years)**: 28  
**Research Projects guided**
- PhD: 3 (Advisory member)  
- M.Sc./M.Tech: 5 (Five), 17 (Advisory member)  
**Present area of research**: Marine Biology, Marine Fisheries, Fish resource management

**Contact details**
- Land line No.: 02352-232241  
- Mobile: 8275454821  
- Fax/Email: 02352-232987, naiksdn2003@yahoo.co.in

**Name of the Faculty**: Dr. M.S. Sawant  
**Post Held**: Assistant Professor  
**Date of Birth**: 27.4.1965  
**Qualification**: M.Sc. (Fish), Ph.D. (Marine Biology)  
**Area of Specialization**: Marine Biology, Marine Fisheries, Fish resource management  
**Experience (Years)**: 19 years  
**Research Projects guided**
- PhD: -  
- M.Sc./M.Tech: 3  
**Present area of research**

**Contact details**
- Land line No.: 02352 – 232241 (Ext. 212)  
- Mobile: 9422965829  
- Fax/Email: 02352 – 232987

**Name of the Faculty**: Dr. Ravindra Pawar  
**Post Held**: Assistant Professor  
**Date of Birth**: 19.03.1970  
**Qualification**: M.Sc. (Fisheries Management), Ph.D. (Marine Biology)  
**Area of Specialization**: Fisheries resources management; Fisheries biotechnology
<table>
<thead>
<tr>
<th>Name of the Faculty</th>
<th>Dr. V.H. Nirmale</th>
</tr>
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<tbody>
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<td>Date of Birth</td>
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</tr>
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<td>Contact details</td>
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</tr>
<tr>
<td></td>
<td>Mobile 827563 5577</td>
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<tr>
<td></td>
<td>Fax 02352 – 232987</td>
</tr>
<tr>
<td></td>
<td>Email <a href="mailto:ravindra.fisheries@gmail.com">ravindra.fisheries@gmail.com</a></td>
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<table>
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<tr>
<th>Name of the Faculty</th>
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</tr>
<tr>
<td></td>
<td>Mobile 9422965859</td>
</tr>
<tr>
<td></td>
<td>Fax 02352 – 232987</td>
</tr>
<tr>
<td></td>
<td>Email <a href="mailto:bhaskarbhosale@yahoo.co.in">bhaskarbhosale@yahoo.co.in</a></td>
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</table>
4. Instructional Farm

b. Location:

c. Infrastructure: such as irrigation facilities (source: well, farm pond, canal, irrigation system: drip, sprinkler etc), water measurement, polyhouse, shednet house, farm equipments, fertigation unit, rain out shelters etc.

d. Activities: Provide the details such as the different educational, research and demonstration activities that can be performed on the farm

e. Photographs: Photographs of the important facilities preferably with students using those or being demonstrated.

5. Research Activities and Achievements (including projects)
a. Variety/Implements released: Nil

b. Research Recommendations: Provide the details of the research recommendations approved in Joint Agresco along with relevant photographs

   a) Storage studies on frozen green mussel in curry.
   b) Extraction of gelatin from Pink perch skin
   c) Development of fish kurkure and prawn kurkure.
   d) Development of prawn noodles and fish noodles.
   e) Developed technique of mass breeding of goldfish throughout the year (1998)
   f) To preserve the colour of fish in the fisheries museum, 20 ppm BHA mixed in the 5% formaldehyde solution gives the retention of colour more than one year. (2004)
   g) Developed “Somachrom” be used for retention of natural colour of marine Fishes and Freshwater fishes. (2004)
   h) Developed Mudcrab (Scylla spp.) farming and fattening technique (2002).
   i) Remedial measures were recommended to avoid the destruction of fishing gear by pufferfishes along the Ratnagiri and Sindudurg district
   j) Developed feed formulation technique and marked aquarium fish feed “FIFOO” (2001)
   k) During September to January period, less than 20 mm sized clam, Paphia malbarica (Tisarya) not to be harvested from natural resources (2011).

c. Research Outcome/Findings: Provide the details of the important research findings/outcome of the research experiments conducted along with relevant photographs

   1. Seasonal variations in plankton composition and nutrient content from mangrove waters of Ratnagiri. Seasonal variations in plankton composition, environmental parameters and nutrients from mangrove waters of Ratnagiri were studied.
   2. Potential of laterite stone quarries to enhance production of freshwater fish - Pilot scale trials. Resource utilization of rainfed laterite stone quarries to establish freshwater fish (IMC) culture is being undertaken. Studies on growth and production of IMC yearlings in these resources are being carried out.

   d. Completed Research Projects/Programmes/Schemes

   Title : Pilot scale demonstration of Fish Ball in Curry
   UR Nos. :
   Objectives : Transfer of technology and acceptability and marketability trials
   Name of PI/ Co-PI : Dr. V.R. Joshi, Dr. A.U. Pagarkar, Dr. A.K. Balange
   Sponsoring Agency : Rajiv Gandhi Science and Technology Commission, Mumbai
   Duration : Three years
   Total Outlay : 24.57 lakhs
Summary of achievements: Demonstration of product preparation was carried out in different districts of Konkan. Acceptability trials were carried out in different cities and metros in the state. Improvement in the technology of value addition was made as per the suggestions.

Relevant Photographs:

Title : Studies on seed production of Mudcrab, Scylla spp.

Objectives : To develop the technique of seed production of Mudcrab.

Name of PI : Dr. S.D. Naik

Co-PI : Shri. H.B. Dhamagaye

Sponsoring Agency : Rajiv Gandhi Science and Technology Commission (RGSTC), Mumbai.

Duration : 4 yrs.

Total outlay : 22.17 lakh

Summary of achievement:

Developed the technique of broodstock management of Scylla tranquibarica. Developed the technique of continuous moniculture of live food Brachionus plicatilis and Nanochloropsis in the laboratory and on farm. Standardized the larval rearing technique up to Megalopa stage - last larval stage - seed. Transferred the developed technology to the farmers, fishermen and entrepreneurs by conducting training programmes on “seed production of crab” which was conducted by Dept. of Fisheries Biology, College of Fisheries & Rajiv Gandhi Science and Technology, Mumbai.

e. Ongoing Research Projects/Programmes/Schemes:

Only provide the name of the ongoing Research Projects/Programmes/Schemes. The details of the ongoing Research Projects/Programmes/Schemes will have to be provided by the concerned in charge in the separate format provided for this purpose. The link will be provided here with those details.

1. Induced maturation and breeding of Mudcrab (Scylla tranquibarica) under captive condition.

2. GIS Coordinated Inventory of Exploited Endemic Freshwater Ichthyofauna of the Konkan Region of the Northern Western Ghats

6. Repository of abstracts of the theses:

Provide here the years wise details of the abstract of the theses/projects approved by the Department/Section for Bachelor, Masters and Doctoral theses in following format

Biology of Sardinella longiceps along Ratnagiri coast off, Maharashtra.

Student Name - Abhay Vilas Deshmukh

Degree for which the thesis submitted : MSc

Name of guide - Dr. S.R. Kovale

Year - 2008

ABSTRACT

The Indian oil sardine Sardinella longiceps plays an important role in the commercial fisheries of west coast of India. LT when compared against other morphometric characters indicated that the values of their constants a and b, and coefficient of correlation (r) showed highest rate of growth in LF' (b=0.8822) followed by other characters LS (b=0.4544), g (b=0.2162), Ch" (b=0.1896), Ch' (b=0.1725), Ph (b=0.1677), D1D1' (b=0.1062), AA' (b=0.0806), Ig (b=0.0661), UO (b=0.0505), Vh (b=0.0332), Ah (b=0.0247), Eg (b=-0.0212), and 00' (b=0.0189).

Coefficient of correlation (r) values indicated that amongst the characters compared against LT, highest correlation (r=0.9045) existed between the compared characters LT' and LF' followed by Ch" (r=0.8805), Ch' (r=0.8241), DI DI' (r =0.7561) Eg (r=-0.7552), UO
The length frequency distributions showed higher occurrence of fish in length intervals between 17 to 18 cm contributing 28.7%.

The length weight relationship equations analysed for males were $W = 0.0350 L^{2.4918}$ and for females were $W = 0.0536 L^{2.3410}$ indicating no significant difference between the sexes. The average GSI values of females were 1.4998 with maximum GSI values 5.4962% in the month of September and minimum (0.4299) GSI values from the months of October. In males the maximum GSI value 4.4962% were observed in the month September and minimum 0.2992 GSI value were observed from month of October. Observations reveal that spawning in *S. longiceps* generally takes place only once in a year. In the Ratnagiri catches it was observed that the females were always more in number with an average ratio of 1 male: 1.1549 females with highest ratio in the month of January. The size at maturity varied from 16 to 20 cm, with occurrence of well developed mature gonads in the months of August-September and spent ones in the months of November to February. Based on the gonadal studies, it can be concluded that the spawning season is of short duration and commences from July and ends in September.

Histological observations were made on the ovaries of *S. longiceps*. The maturity stages I, II and III occurred during the months from November to February. The stages IV and V occurred during the months from March to May. The stages VI and VII occurred during the months from August to September. The approximate number of mature eggs in the ovaries of the gravid females with the total weight of fish ranging from 0.050-0.060 kg varied from 45,000-75,000.

Systematics and biology of estuarine crab *Scylla* spp. of Ratnagiri coast, Maharashtra.

Student Name - Anil Bhaskar Funde
Degree for which the thesis submitted : MFSc
Guide Name - Dr. S.D. Naik
Year - 2008

ABSTRACT

Estuarine mud crab (family: Portunidae) are considered as one of the important seafood items for aquaculture in Southeast Asian countries due to their esteemed delicacy, medical value and demand for local and export market. Since estuarine crabs are caught from the coastal and adjacent estuarine areas and are utilized for both local consumption and seafood exports present work was initiated to acquire the basic knowledge regarding systematics and biology of estuarine crabs along coast of Ratnagiri. As the present work was initiated to study their systematics, detailed taxonomic analysis has been carried out based on morphological studies, covering 13 morphological characters with 23 ratios obtained from 32 parameters and 20 meristic counts. The anatomical studies, including information on mandible structure and myotaxonomy, behavioural studies including, breeding behaviour and feeding behavior. Based on the analysis of above aspects observations are recorded for two commonly available mud crab species in the Ratnagiri coastal water viz. *S. serrata* and *S. tranquebarica*. Among these two, *S. serrata* mud crab species is available throughout the year along the Ratnagiri coast. There fore biological studies of *S. serrata* were conducted during April-2007 to March-2008. The highlights of the results are as follows.

The overall sex ratio of male to female was found 1: 0.96. Female of *S. serrata* attain sexual maturity after reaching 9.0 cm carapace width and above. The relationship between the carapace width and body weight of *S. serrata* and *S. tranquebarica* were estimated as $W = (0.3254) L^{2.0502}$ and $W = (0.4804) L^{1.2212}$ respectively. The estimate equation of *S. serrata* is $W = 0.4974 + L^{2.6951}$ or Log $W = -0.3033 + 2.6951 \log L$ for male and $W = 10.0809 + L^{1.2212}$ or Log $W = 1.0036 + 1.2212 \log L$ for female. *S. tranquebarica* was $W = 0.1001 + L^{3.2932}$ or Log $W = -0.9993 + 3.2932 \log L$ for male $W = 1.6765 + L^{2.1432}$ or Log $W = 0.2244 + 2.1432 \log L$ for female. GSI showed a single peak breeding season during February to April for male and female of *S. serrata*. Spawning of *S. serrata* was found to occur only in coastal water during the month of December to April. *S. serrata* and *S. tranquebarica* predominantly feed on detritus and fish matter respectively.
Fecundity of *S. serrata* ranges from 12,632 to 13,695, the size was 16.3 cm (ICW) in the month of April.

**BIOLOGY OF *NEMIPTERUS JAPONICUS* ALONG THE RATNAGIRI COAST OFF MAHARASHTRA**

Name of the student : Shri. Sureshkumar P.S.
Degree for which the thesis submitted : MFSc
Name of the Guide : Dr. Swapnaja A. Mohite
Year : 2010 – 11

**ABSTRACT**

The fishes of the family Nemipteridae (order: Perciformes) popularly known as threadfin breams, are distributed in the tropical and subtropical seas. *Nemipterus japonicus*, the Japanese threadfin bream, has wide spread distribution throughout the Indian Ocean and plays an important role in the commercial fisheries of west coast of India. Present study analyses the various aspects of Biology of *N. japonicus* along the coast of Ratnagiri, Maharashtra, such as length frequency, length-weight relationship, food and feeding habits as well as reproductive development.

The total length of *N. japonicus* have been compared against morphometric characters, LF, LS, UO, OO’, EG, IG, D1D1’, Vh, AA’, g, Ah, Ph, Ch’ and Ch”. The equations for the samples collected along the Ratnagiri coast were LF’ = -0.925 + 0.7317 LT, LS = 5.677 + 0.918 LT, UO = 1.7460 + 0.038 LT, OO’ = 1.7244 + 0.0903 LT, Eg = 0.8385 + 0.0261 LT, Ig = -1.4988 + 0.0438 LT, D1D1’ = -0.5988 + 0.2978 LT, Vh = 0.8925 + 0.2042 LT, AA’ = 0.498 + 0.14 LT, g = 0.9621 + 0.1838 LT, Ah = 0.3583 + 0.102 LT, Ph = -0.996 + 0.225 LT, Ch’ = 0.1226 + 0.3881 LT, Ch” = 0.6625 + 0.1838 LT.

The length-weight relationship equations analysed for Males were W = 4.1904 L^2.7671, females were W = 4.3385 L^2.6168, for indeterminate were W = 4.9880 L^2.9812 and for total were W = 4.4780 L^2.6285 indicating no significant difference between the sexes. The food and feeding habits revealed that *N. japonicus* is a voracious bottom feeding carnivore, feeding mainly on crustaceans. Studies on reproductive biology showed that *N. japonicus* is a fractional spawner and spawning season appears to be December to March. The average GSI values of females were 0.33416 with maximum GSI values 0.3939% in the month December and minimum 0.2105% GSI value from the months of November respectively and for males were 0.21774 with maximum GSI value 0.3005% in the month of November and minimum 0.1679% GSI value from the month of December. The length at maturity was estimated at 120 mm in females. It attained 190 mm, 260 mm and 290 mm at the completion of 1st, 2nd and 3rd years, respectively. In the Ratnagiri catches there was an overall predominance of females in the population of all months except in the month of November and male female ratio is $1:1.5136$. Fecundity of the fish was found to range from 26,930 to 74,182, the average being 46,822 eggs. It was seen that maturity stages I, II and III occurred in September to November. IV and V occurred in December and January and fully matured VI and VII stages were observed in February to March.

**MORPHOMETRICS, GONAD DEVELOPMENT AND FOOD FEEDING OF THE WHITE FISH *Lactarius lactarius* (Bloch & Schneider, 1801)**

Name of student – AKHADE ROSHAN RAMAKANT
Degree for which the thesis submitted : MFSc
Name of guide - Dr. M.S. Sawant
Year - 2011

Abstract- The present study on morphometrics, food and feeding, reproductive biology, length-weight relationship, age and growth, mortality of *Lactarius lactarius* (Bloch and Schneider, 1801) is based on weekly collection of catch efforts, length frequency data from Ratnagiri,
Mirkarwada during the period May 2010 to April 2011. The total length of *L. lactarius* has been compared against various morphometric characters, LF, LS, UO, UG, OO, Eg, D1D1, D2D2, Ph, Vh, AA, UD1, UD2, UPh, UVh, UA, D1h, h, q, UJ. The equations for the various morphometric characters obtained were LF = \(-1.5992 + 1.0015\) LT, LS = \(-3.6217 + 1.0002\) LT, UO = \(0.3957 + 0.0504\) LT, UG = \(0.1777 + 0.2573\) LT, OO = \(0.4059 + 0.0446\) LT, Eg = \(0.1556 + 0.0208\) LT, D1D1 = \(-0.3590 + 0.1340\) LT, D2D2 = \(0.0327 + 0.2316\) LT, Ph = \(-0.2941 + 0.2463\) LT, Vh = \(-0.0170 + 0.1054\) LT, AA = \(0.0675 + 0.2786\) LT, UD1 = \(-0.2569 + 0.3334\) LT, UD2 = \(-0.2137 + 0.4717\) LT, UPh = \(0.4550 + 0.2240\) LT, UVh = \(0.2338 + 0.2655\) LT, UA = \(0.0969 + 0.4093\) LT, D1h = \(-0.0323 + 0.1238\) LT, h = \(0.0443 + 0.2920\) LT, q = \(0.0381 + 0.0822\) LT, UJ = \(0.0002 + 0.1310\) LT. Studies revealed that *L. lactarius* is found to be carnivorous in feeding habit, feeding mainly on fish followed by crustaceans and molluscs. The studies on reproductive biology indicated that *L. lactarius* spawns throughout the year. The average GSI value in females was 2.3719, while maximum value recorded was in the month of February (3.8039) and minimum in the month of June (1.0382). The average GSI value of males was 1.5555 and maximum GSI value (2.4620) was recorded in the month of February, while and minimum (1.0033) value was recorded in the month of August. The males were always more in number with an average ratio of 1:0.8842 females. Females outnumbered males only in the month of September with the ratio of 1: 2.20 and in the months of August and March. The fecundity ranged from 20,341 to 4,49,540 eggs with an average of 120,340 eggs. Histological observations of ovaries inferred that the maturity stages I and II occurred throughout the year except in the month of April. Stages III, IV, V, VI and VII also occurred throughout the year. The length-weight relationship analysed was found to be isometric, with the equation for males as W = 0.0140 L^{2.9398} and for females as W = 0.0099 L^{3.0544}, (P > 0.05) allometric for indeterminant (W = 0.0272 L^{2.6613}) and allometric for total (W = 0.0133 L^{2.9539}) (P < 0.05). The analysis of covariance indicated no significant difference between the sexes. The length frequency distribution showed higher occurrence of fish in length interval between 130 to 139 mm LT. The growth parameters \(L_{\infty}\) and K were estimated by ELEFAN-I, taking length frequency of *L. lactarius* and employing FiSAT programme. The \(L_{\infty}\) and K estimated were 315 mm and 0.90 year\(^{-1}\) respectively. The total instantaneous mortality coefficient (Z), natural mortality coefficient (M) and fishing mortality coefficient (F) were estimated to be 4.67, 1.64 and 3.03 respectively. Exploitation ratio (E) and exploitation rate (U) estimated were 0.68 and 0.67 respectively indicating overexploitation of resources.

**MORPHOLOGY AND BIOLOGY OF *Meretrix meretrix* (Linnaeus, 1758) ALONG RATNAGIRI COAST, MAHARASHTRA**

Name of the student : Miss Prajwala Pandurang Sawant
Degree for which the thesis submitted : MFSc
Name of the Guide : Dr. Swapnaja A. Mohite
Year : 2011 - 12

**ABSTRACT**

Several venerid clams species occur along the west coast of Maharashtra. *Meretrix meretrix* is one of these important clams, which have formed vast beds on the estuarine area of Ratnagiri. They are exploited on commercial basis throughout the year for local as well as for external markets due to the heavy demand. Present study analyses the biological aspects and environmental parameters of this clam found along the Ratnagiri coast.

Logarithmic relationships between length and weight were calculated as for males, Log \(W = \log (-3.3292) + 2.93 \log L\) and for females as Log \(W = \log (-3.3272) + 2.93 \log L\), respectively. The combined equation for both the sexes was, Log \(W = \log (-3.2844) + 2.90 \log L\). This clam attains the length of 30 mm at the end of the first year, 42 mm at second year and 45 mm at the end of third year. \(L_{\infty}\) value calculated was 58.80 mm. First recruitment appearance in October indicated that the breeding must have been taken place in September, which was confirmed from the annual gonadal development cycle studied. During the present study, initiation of gametogenesis in *M. meretrix* could be attributed to the changes in the environmental parameters, especially temperature and salinity. The lowering of temperature and
salinity during the monsoon period coincided with the gonad developments. The sudden increase in the salinity and temperature might have acted as stimuli for the initiation of spawning, also resulting in the decrease in the protein and lipid values. During this period the carbohydrate and moisture values showed increasing trend, also indicating the lower values of edibility.

**BIOLOGY OF Megalaspis cordyla (Linnaeus, 1758) OFF RATNAGIRI COAST, MAHARASHTRA**

Name of the student : Miss. Trupti Dharmaji Jadhav  
Degree for which the thesis submitted : MFSc  
Name of the Guide : Dr. Swapnaja A. Mohite  
Year : 2011 - 12

**ABSTRACT**

*Megalaspis cordyla*, the horse mackerel belonging to the family Carangidae (order: Perciformes) are the main contributors of the carangid catch along the Ratnagiri coast. Present study analyses the various aspects of biology of *M. cordyla* along the coast of Ratnagiri, Maharashtra, such as length frequency, length-weight relationship, food and feeding habits as well as reproductive development.

The morphometric characteristics of *M. cordyla* were compared and were given by the equations as: 

- FL = 0.2207 + 0.8928 TL; SL = - 0.20 + 0.814 TL; UO = 0.2044 + 0.0485 TL; UG = 0.042 + 0.168 TL; D1D1 = 0.3397 + 0.0883 TL; D2D2 = 1.1898 + 0.1043 TL; Ph = -1.17740 + 0.3405 TL; Vh = 0.2451 + 0.0921 TL; AA = 0.4358 + 0.0839 TL; LD = 0.4080 + 0.2060 TL; Cd = 0.073 + 0.023 TL; Lj = -0.1791 + 0.1096 TL; Lj = -0.0948 + 0.5301 TL. The meristic characters include number of scutes may vary from 42-60 and the pyloric caecae were found in between 215 to 382 numbers.

The length-weight relationship equations for males were *W* = -3.8345 *L*^{2.4873}; females, *W* = -3.7219 *L*^{2.4363}; for indeterminate, *W* = -4.4411 *L*^{2.7428} and for total were *W* = -4.2569 *L*^{2.6682} indicating no significant difference between the sexes. The food and feeding habits revealed that *M. cordyla* is a pelagic carnivore fish, feeding mainly on fish, crustaceans and cephalopods etc. with fish as a main item preferred. Studies on reproductive biology showed that *M. cordyla* is a total spawner and spawning season appears to be August to May. Fecundity of the fish was found to range from 92,268 to 5,49,900, the average being 2,47,671.4 eggs. Ova diameter was in the range of 0.15 to 0.82 mm.

**Biological studies of Indian Mackerel.Rastrelliger kanagurta ( cuvier,1817) off Ratnagiri coast, Maharashtra.**

Student Name – Mukeshkumar Parasram Bhendarkar  
Degree for which the thesis submitted : MFSc  
Guide Name - Dr. S.D Naik  
Year -2012

**ABSTRACT**

The Indian mackerel forms a major fishery resource by itself in the Indian marine fisheries sector. The present study is based on morphometrics, length frequency, length-weight relationship, food and feeding, reproductive biology of *Rastrelliger kanagurta* (Cuvier, 1817) from Ratnagiri waters, during the period March 2011 to February 2012. The total length of *R. kanagurta* have been compared against morphometric characters LF, LS, UO, UG, 00, Eg, D1D1, D2D2, Ph, Vh, AA, UD1, UD2, UpH, UVh, UA, h, q, UJ. The equations for the samples collected along the Ratnagiri coast were LF = 1.1955 + 0.8198 LT; LS = 1.3579 + 0.7241 LT; UO = 0.0199 + 0.0301 LT; UG = 0.78 + 0.1828 LT; 00 = 0.0775 + 0.0457 LT; Eg = 0.1137 + 0.0197 LT; D1D1 = -0.4026 + 0.1522 LT; D2D2 = 0.0529 + 0.1034 LT; Ph = -0.0748 + 0.1165 LT; Vh = 0.2552 + 0.0876 LT; AA = -0.1282 + 0.1022 LT; UD1 = -0.2893 + 0.2793 LT; UD2 = 0.3826 + 0.4689 LT; UpH = 0.5442 + 0.1971 LT; UVh = 0.6264 + 0.2314 LT; UA = 0.6021 + 0.4825 LT; h = -0.3815 + 0.213 LT; q = -0.0445 + 0.0284 LT; UJ = -0.4237 + 0.1754 LT. The length frequency distribution showed higher occurrence of fish in length interval between 22-24 cm TL. The length-weight relationship analysed was found to be positive allometric and the
pooled equation for male and female obtained was at Log W = -2.3268 + 3.2787 Log L

Studies revealed that R. kanagurta is found to be planktivorous in feeding habit, feeding mainly on zooplankton followed by phytoplankton. The studies on reproductive biology indicated that R. kanagurta spawns in month of April. The average GSI value in females was 3.5373 while maximum value recorded was in the month of April (6.0607) and minimum in the month of January (1.1473). The average GSI value of males was 2.7549 and maximum GSI value (4.0717) was recorded in the month of April, while and minimum (0.9220) value was recorded in the month of January. The size at first maturity was estimated to be 19.8 cm for male while the female, at 20.6 cm LT. Sex ratio showed deviation from 1:1 in certain months. The fecundity of fish ranged from 55,264 to 3,14,568 eggs with an average of 1,08,266 eggs.

**Reproductive Biology of Estuarine Crab, Scylla tranquebarica (Fabricius 1798) along Ratnagiri coast, Maharashtra.**

Name of student : Shivam Shantaram Sonavane.
Degree for which the thesis submitted : MFSc
Name of guide - Dr. S.D. Naik.
Year -2012

Abstract

*Scylla tranquebarica* (Fabricius 1798) commonly called as green crab forms the mainstay of crab fishery in India and is economically most important portunid crab. Estuarine crabs are the common edible crab of India which are fished along both the coast of India and have great demand in local and in foreign market such as USA, China, Japan and Singapore for frozen soft shell mud crab and value added products which expanding internationally. Present work was initiated to acquire the basic knowledge regarding systematic and biology of estuarine crabs off Ratnagiri coast of Maharashtra, India. Therefore work was initiated primarily to study their reproductive biology studies which has been carried out based on different aspects such as sex ratio, gonado somatic index, maturation and spawning, ova diameter, fecundity and the embryological studies including different embryonic stages and their morphological characters, incubation periods, time of hatching. Based on the analysis of above aspects observations were done on this mud crab species which are found in the estuarine waters of Ratnagiri coast, and are available throughout the year. Therefore, detailed reproductive biological studies of *S*.tranquebarica were carried out during the month of March-2011 to February-2012. The highlights of the results as follows.

The overall sex ratio of male to female was found to be 1:1.30. Male and Females of *S*.tranquebarica attain sexual maturity after reaching 10.0 cm and 11.0 cm. CW (carapace width) respectively. In *S*. tranquebarica, GSI showed a single oscillation having peak during August-2011 to November-2012 in female whereas, September-2011 to November 2012 in males respectively. Different maturity stages were found during the study periods with stage I (immature), stage II (maturing) throughout the year the highest percentage of III (mature) being in the month of October. Spawning Of *S*.tranquebarica was found during the months of August-2011 to November 2011. Ova diameter of *S*.tranquebarica ranges from 0.04-0.38mm. with maximum size ranges from 0.24-0.38mm during the month of September -2011 to December-2011. The fecundity of *S*.tranquebarica ranges from 16,15,000 to 54,48,000 eggs with an average of 37,34,516 eggs, in the size ranges of 19.8-21.1 cm CW and 1100-1490 gm weight. The incubation period required for embryonic development of *S*.tranquebarica was in between 9-13 days. The embryonic developmental stages of *S*.tranquebarica were identified based on the morphological characters and that divided into five stages, viz. Blastula Gastrula, Eye placode, Pigmentation and Heartbeat.

**MOLECULAR IDENTIFICATION OF OYSTER SPECIES USING RANDOM AMPLIFIED POLYMORPHIC DNA [RAPD] ANALYSIS**

Name of the candidate : Miss.Pooja Vinayak Salvi
Degree for which the thesis submitted : MFSc
Year of submission : 2012
Taxonomic species identification of oysters by external morphological characters is a difficult task. RAPD-PCR analysis is a relatively simple method for identification of genetic markers at different taxonomic levels without knowledge of the genome being investigated. Molecular identification and species-diagnostic markers for four oyster species *Crassostrea gryphoides*, *C. madrasensis*, *C. rivularis* and *Saccostrea cucullata* from Ratnagiri were investigated by randomly amplified polymorphic DNA analysis. In total, forty seven RAPD bands ranging from 500 to 900 bp in size were consistently generated from primer OPA09 (5'GGGTAACGCC3') and primer OPB01 (5'GTTTCGCTCC3') with eight polymorphic bands (percentage polymorphism 17.02) and thirty nine monomorphic bands. The maximum genetic distance was observed between *C. madrasensis* and *C. rivularis* species (0.4274). The lowest genetic distance was observed between *C. madrasensis* and *C. gryphoides* species (0.0561). The estimates of effective number of alleles (ne), Nei's (1973) gene diversity (h) and Shannon's index (I) for four oysters species were 1.6676, 0.3871 and 0.5674 respectively. The phylogenetic relationships between four oyster species revealed that *C. rivularis* and *S. cucullata* are genetically closer to each other and these two species are relatively closer to *C. madrasensis*. It has been observed that *C. gryphoides* is at a comparatively larger genetic distance from other three species.

MOLECULAR DISCRIMINATION OF SIX MULLET SPECIES FROM RATNAGIRI COAST USING RANDOM AMPLIFIED POLYMORPHIC DNA [RAPD] ANALYSIS

Name of the candidate : Miss. Pranita Govind Nadkar
Degree for which the thesis submitted : MFSc
Year of submission : 2012
Name of the Guide : Dr. M.S. Sawant

**Abstract:**

Mullets belonging to family Mugilidae constitute to be a very important group of fishes having immense commercial significance. They are popular in many countries as food fish due to its delicacy. Its fishery is distributed along coastal and estuarine waters of tropical and subtropical regions. In view of increasing interest by researchers and aquaculturist to culture mullets as candidate species, all information on taxonomic identification of these species on genetic levels will be a valuable information. There is no information available on the molecular discrimination of mullet species from India and Ratnagiri. This study thus, generated species specific RAPD profile of six species of mullets (i.e. *Mugil cephalus*, *Liza parsia*, *Liza tade*, *Valamugil seheli*, *Osteomugil speigleri*, and *Ellochelon vaigiensis*) and investigated the phylogenetic relationship.

In the present work, genetic analysis using RAPD markers was done in taxonomically identified samples of six species of mullets. RAPD-PCR was carried out by using three selected primers from a total of 40 primers. The three primers amplified bands in all six species of mullets and were therefore used for final analysis. A total of 36 RAPD bands in the size range of 100 to 900bp were generated by three primers, with five polymorphic bands (13.88%) and 31 monomorphic bands. Within all the six species, *V. seheli* and *M. cephalus* were found to have least genetic distance, whereas maximum genetic distance was found in *L. tade* and *M. cephalus*.

The results of the present study revealed high genetic variability among six species of mullets. The obtained RAPD data thus represents the first information about species identification in mullets from Ratnagiri, which can serve as a baseline data for further molecular studies of mullets.

**BIOLOGY OF Lepturacanthus savala (Cuvier, 1829) OFF RATNAGIRI COAST, MAHARASHTRA**

Name of the student : Miss. Pallavi Keshav Pakhmode
Degree for which the thesis submitted : MFSc
Name of the Guide : Dr. Swapnaja A. Mohite
Year : 2012 – 13
ABSTRACT

*Lepturacanthus savala*, the ribbonfish belonging to the family *Trichiuridae* (Order: Perciformes) are the main contributors of the trichurid catch along the Ratnagiri coast. Present study analyses the various aspects of biology of *L. savala* along the coast of Ratnagiri, Maharashtra, such as length frequency, length-weight relationship, food and feeding habits as well as reproductive development.

The morphological characteristics of *L. savala* were compared and given by the equations as: TL = 14.081 + 0.984 SL, UO = 0.60 + 0.057 SL, YJ = 2.176 + 0.124 SL, OO = 0.528 + 0.01 SL, Eg = 0.283 + 0.005 SL, PDL = 1.175 + 0.905 SL, DD = -0.529 + 0.892 SL, SVL = 4.535 + 0.335 SL, Ph = 1.093 + 0.092 SL, h = 0.533 + 0.074 SL.

The meristic characters included dorsal fin spine which may vary from 3-4 and the pyloric caecae were found in between 15-16 numbers. Teeth in the main series in upper and lower jaw were 7-15 numbers. Teeth on the mandible were much smaller than those on premaxilla.

The length-weight relationship equation analysed for males was Log W = -3.2801 + 3.0311 Log L, females was Log W = -3.8222 + 3.3608 Log L, for indeterminate was Log W = -3.4377 + 3.1173 Log L and for total population, Log W = -3.6049 + 3.2285 Log L indicating no significant difference between the sexes. The fish matured at 38 cm and attained 43, 58 and 65 cm in 1st, 2nd and 3rd years, respectively. The food and feeding studies revealed that *L. savala* is a carnivore fish, feeding mainly on fish, crustaceans and cephalopods etc. in which fish is preferred as a main food item. Studies on reproductive biology showed two spawning peaks annually viz. March to May and October to December. The fecundity of *L. savala* in size range of 36 to 65 cm, ranged from 1,421 to 25,535 eggs with an average of 12757.68 eggs per female. Ova diameter was in the range of 0.11 to 1.61 mm.

Studies on biology of Indian Squid, *Loligo duvauceli* (d’Orbigny) from Ratnagiri coast of Maharashtra

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<th>Nitin Pawar</th>
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<tr>
<td>Name of the Guide</td>
<td>Shri. Bhaskar Bhosale</td>
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Abstract:

*Loligo duvauceli* is emerging as one of the important components of by-catch of trawl landings at Ratnagiri. The length – weight relationship indicated the allometric growth in squid *L. duvauceli*. The morphometric characters indicated high degree of correlation among the compared characters with dorsal mantle length. The qualitative and quantitative analysis of food revealed that *Loligo duvauceli* is a carnivore, feeding mainly on fishes followed by crustaceans and cephalopods. Highest GSI value was observed in April for males & November and January for females. Sex ratio indicated that males are dominant than females throughout the year except January and March. This species spawns throughout the year with peak spawning from November to January. Mature specimens of this species were observed throughout the year. Ova diameter for this species was in the range of 0.12 to 2.10 mm. On an average *L. duvauceli* produces about 5,442 eggs. Length at first maturity (L₅₀) has been estimated to be 86 mm. The largest recorded male of *L. duvauceli* was 332 mm and female was 202 mm. The asymptotic length (L∞), growth coefficient (K) & t₀ were estimated as 376 mm, 0.95 year⁻¹ & -0.0567 respectively by modal progression method. This species attain size of 233, 324 and 355 mm dorsal mantle length at the end of I, II and III year respectively. The mortality parameters Z, M & F estimated were 4.50, 1.82 & 2.7 respectively by employing FiSAT programme. Probability of L₅₀ for *L. duvauceli* calculated was 107 mm. The present exploitation ratio is 0.6 & exploitation rate is 0.59. Relative yield per recruit analysis shows that the Eₘₐₓ is at 0.519. Reduction in the present level of effort has been suggested to sustain the fishery of *L. duvauceli* along the Ratnagiri coast.

4. Extension Activities
   a. The training programmes organized
1. Title: Mud crab farming (*Scylla serrata*)
Sponsor: NFDB
Date and duration:  1) 20.1.2011 to 24.1.2011
               2) 01.2.2011 to 05.2.2011
Participants: 60 nos. (Farmers, fishermen, entrepreneurs)

2. Title: Seed production of Mudcrab spp. (*Scylla tranquibarica*)
Sponsor: RGSTC
Date and duration:  1) 28-3-2012 to 30-3-2012
               2) 01-3-2013 to 05-3-2013
Participants: 27 nos. (Farmers, fishermen, entrepreneurs)

b. Seminar/Symposia/Conference/Workshop Organized
   Nil

c. Farmer melawa organized
   1. Title: Awareness programme on endangered species
      Sponsor: 
      Date and duration : 20.7.10, Mirkarwada, Ratnagiri
      Participants : 62
      Name of the speakers along with their topics
      Dr.S.D.Naik - Need for conservation of endangered species
      Dr. S.A.Mohite - Wildlife Protection Act 1972
      Dr. V.H. Nirmale - Introduction to endangered species
      One photograph

   2. Title: Sustainable Fisheries
      Sponsor: 
      Date and duration : 24.12.10, Anusare, Ratnagiri
      Participants : 53
      Name of the speakers along with their topics
      Dr.P.D.Redekar - Objectives of Sustainable Fisheries
      Dr.S.D.Naik - Need for Monsoon Ban Fishing
      Dr. S.A.Mohite - Wildlife Protection Act 1972
      One photograph
3. Title: **Sustainable Fisheries**
Sponsor: 
Date and duration : 30.9.11, Sakhartar, Ratnagiri
Participants : 30
Name of the speakers along with their topics
Dr. R.A. Pawar - Need for Sustainable Fisheries
Dr. S.A. Mohite - Need for Monsoon Ban Fishing
Dr. V.H. Nirmale - Management measures for marine Fisheries
Dr. M.S. Sawant - Educational courses in Fisheries
One photograph

4. Title: **Monsoon Fishing Ban**
Sponsor: 
Date and duration : 29.7.12, Purnagad, Ratnagiri
Participants : 50
Name of the speakers along with their topics
Dr. S.A. Mohite - Need for Monsoon Ban Fishing
Dr. S.D. Naik - Crab culture
Dr. S.T. Sharangdhara - Preparation of Byproducts
Dr. B.P. Bhosale - Educational courses in Fisheries
One photograph

5. Title: **Sustainable Fisheries**
Sponsor: 
Date and duration : 20.10.12, Guhagar, Ratnagiri
Participants : 350
Name of the speakers along with their topics
Dr. R.A. Pawar - Need for Sustainable Fisheries
Dr. S.A. Mohite - Need for Monsoon Ban Fishing
Dr. S.D. Naik - Crab culture and crab fattening
Dr. V.H. Nirmale - Educational courses in Fisheries
One photograph
d. **Radio/TV Talks delivered by the staff members of the Department/Section:**
Provide the relevant details such as name of the person, topic, where and when delivered etc.

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e. **Farmer-Scientist Forum:** The name of the form along with the in charge of the forum, members of the forum (name, address and phone number) and activities of the forum be provided here.

f. **Other Extension Activities:** Provide the details of any other notable extension activities performed by the Department/Section

g. **Publications:** Provide the details of the following publications published by the Department/Section in bibliographical form

**Books**

- *Shobhivant Mashyanche Palan aani vyastapan*
- *Jitada aani chekada sheti*
- *Nimkharya paanyatil Khekadyache bijotpadan*
- Booklet/bulletin: Sea Bass and Crab Farming
- Folders
- Souvenir/Proceedings of Seminar/Symposia/Conference/Workshop Organized
- Training manuals of the training programme organized

Training book (Marathi)” *Shobhivant Mashache Utpadan ani Mtsyalayache Vyavsthapan*”

Khekadyache Jivashastra(Marathi)
Published NFDB book by COF, Ratnagiri & Kharland Research Station, Panvel.

List of published Journal Research papers


12 Balange A.K. Joshi, V. R., Pagarkar, A.U. and Dagare, R.A. Standardization of fish ball in curry at pasteurization temperature2002, 11 (1) 25-28*Applied Fisheries and Aquaculture*


Full length research papers published in Proceedings of Seminar/Symposia/Conference/Workshop

5. Details of other activities (for e.g. seed production, production of other commodities etc)

6. Contact Information
   Name of the Head
   Name of the Department
   Postal Address
   Landline Number
   Mobile Number
   Fax
   Email

7. News and Events