

# Department of Fisheries Resources Economics, Statistics and Extension Education (FRESE)

## A) EDUCATION:

**1. Name of the Department/Section:** Department of Fisheries Resources Economics, Statistics and Extension Education, College of Fisheries, Ratnagiri

**2. About Department:** Department of FRESE is in function since the inception of College of Fisheries, Ratnagiri. Under this Department, Post-graduate degree courses (M.F.Sc) in the discipline of Fisheries Economics (2 seats) and Fisheries Extension (4 seats) are offered every year. Ph.D. Degree course in Fisheries Extension (2 seats) is also conducted.

**3. Academic Programs:**

### a. Ph.D. (Fisheries Extension)

#### Course Structure

#### LIST OF COURSES

#### Major Courses (12 Credits):

No.	Course Code	Semester	Course Title	Credit Hrs.
1	FEX 601*	I	Methodologies in Extension Research	2+1
2	FEX 602	II	Educational Technology and Instructional Design	2+1
3	FEX 603*	I	Gender Mainstreaming and Livelihood Development	2+1
4	FEX 604*	II	Extension Service System Management	2+1
5	FEX 605	I	Technology Commercialisation and Intellectual Property Management	2+1
6	FEX 606	II	Policy Engagement and Extension	2+1
7	FEX 607*	I	Participatory Approaches in Fisheries Extension	1+1
<b>Total</b>				<b>13+7=21</b>

#### \*Compulsory Courses

**Minor Courses (6 credits):** Courses relevant for student's research work or necessary for building his/her overall competence from following disciplines can also be taken as minor courses.

No.	Minor Courses will be offered from following disciplines:
1	Fisheries Economics
2	Aquaculture
3	Fisheries Resource Management
4	Fish Processing Technology
5	Aquatic Environment Management
6	Fisheries Engineering and Technology

**Supporting Courses (5 credits):** The subject not related to the major subject. It could be any subject considered relevant for student’s research work (such as Statistical Methods, Design of Experiments etc.) or necessary for building his/her overall competence can be taken.

**Doctoral Seminar (2 credits):**

Course Code	Semester	Course Title	Credits
FEX 691	III	Doctoral Seminar	0+1
FEX 691	IV	Doctoral Seminar	0+1

**Doctoral Research (75 credits):**

Course Code	Semester	Course Title	Credits
FEX 699	II to VI	Doctoral Research	0+75

**Course Contents**

FEX 601	METHODOLOGIES IN EXTENSION RESEARCH	2+1
<b>Objective</b>	To cater the need of equipping the scholars with essential skills in conducting high quality research which helps them to design working strategies, processes and models for professional development.	
<b>Theory</b>		
<b>UNIT I</b>	<b>Measurement properties of research instruments:</b> Measurement properties: Dimensionality, reliability and validity; Dimensionality – Unidimensionality and multidimensionality, Methods of assessing dimensionality, Formative and reflective constructs; Validity - Importance, Internal validity - face validity; content validity, Substantive Validity, Structural Validity; External validity - Convergent and Discriminant Validity, known-group validity, Criterion- Related Validity, Consequential Validity, nomological validity; Methods of assessing various forms of validities – Judges rating, Lawshe’s Content Validity Ratio, Item-objective congruence index; latent variable method; Reliability - Internal consistency reliability – Split- Half, Cronbach alpha; Temporal Stability reliability - test-retest method; Interrater Consistency and Consensus - interrater reliability and interrater agreement; Alternative Forms or parallel forms reliability – Reliability of difference - Factors Affecting the Validity and Reliability of Test Scores; Generalizability Theory;	
<b>UNIT II</b>	<b>Errors in management:</b> Errors – Meaning and sources; Types - Sampling error , Non-sampling or measurement error and Processing error – Meaning, causes; Effects of errors and biases on data quality; Bias in behavioural research – Meaning, causes, Types – Respondent and researcher biases; Methods of reducing errors and biases in surveys, questionnaires, personal interviews, focus groups and online methods.	
<b>UNIT III</b>	<b>Scales, indices and tests:</b> Approaches to measurement and scale development - Classical test theory. Formative or index models, The C–OAR–SE approach and Item Response Theory; Item analysis in Classical test theory – item difficulty and item discrimination; Scoring performance in scales and tests – meaning, types and methods; Scale development strategies – deductive and empirical; Stimulus-centred scales – method of equally appearing intervals, paired comparison, Person scaling – Q methodology; Subject-centre scales – The Likert scale and Semantic Differential; Steps in constructing a multi-dimensional scale using confirmatory factor analysis,; Response scales - Guttman’s	

	scalogram analysis and The Rasch method;	
<b>UNIT IV</b>	<b>Indices and tests:</b> Indexes –Meaning, types, importance; Similarities and differences with scales, Methods of constructing indexes; Common indexes used in extension. Measurement invariance –Meaning, types, methods of assessing measurement invariance. Tests – meaning, types, importance; steps in conducting various tests – knowledge test.	
<b>UNIT V</b>	<b>Qualitative research methods and emerging approaches:</b> Qualitative methods – Meaning; Types – Ethnography, Grounded theory, Phenomenology, Ecological psychology, Discourse Analysis; Observational research; Case study research – Sampling and sample size; Data collection methods - In-depth interviews, Focus groups, Direct observation, Record review; Content analysis; Unobtrusive Measures; Projective and semi-projective techniques; Selecting right qualitative method – Strengths and limitations of qualitative research; Analysis and interpretation of qualitative research data; Research synthesis – meaning, importance, methods ; Systematic reviews and meta-analysis – meaning, steps, and applications; Policy research. Mixed methods research – meaning, purpose, types and applications; Participatory research – Meaning, importance, types, methods and tools and applications; Action research – Meaning, importance, Principles, Types, Steps in conducting action research, application in behavioural sciences. Social Network Analysis – Meaning, importance, types, steps in social network analysis, applications; Advanced methods of measuring perception and beliefs. Multi criteria decision making, analytical hierarchy approach.	
<b>UNIT VI</b>	<b>Ethics in extension research:</b> Research reports – Meaning, types, contents; Presentations – Meaning, types, principles of good presentation - Tell 'Em” and KISS 'Em” principles; Research publications – meaning, importance, types; Guidelines for preparing research papers - Peer review process, citation styles; Open access publishing; Publishing in social media. Software’s in academic writing. Ethics in conducting behavioural research; Human subject research – Meaning, history, and ethical guidelines; Ethical aspects of collecting and using Indigenous knowledge and farmers technologies; Ethical practices in publishing; Plagiarism – meaning, sources, Identifying and correcting plagiarism in a research paper using anti-plagiarism software.	
<b>Practical</b>	Practice in developing research instruments; Methods of assessing measurement properties of research instruments - dimensionality, reliability and validity; Hands-on experience in constructing tests, scale and indexes; Practice in summated scale development using confirmatory factor analysis; Hands on experience in assessing measurement invariance; Practicing and collecting data using participatory tools and techniques, analysing and interpreting qualitative data; Hands-on experience in writing systematic review using meta-analysis; Field practice in conducting action research; Practical experience in writing research paper; Hands on exercises using software for qualitative data analysis; Practice in detecting and correcting plagiarism using software	
<b>FEX 602</b>	<b>EDUCATIONAL TECHNOLOGY AND INSTRUCTIONAL DESIGN</b>	<b>2+1</b>
<b>Objective</b>	To develop knowledgeable, responsive and effective teachers committed to educating diverse group of learners in a dynamic extension landscape.	
<b>Theory</b>		

<b>UNIT I</b>	<b>The landscape of educational technology and instructional design:</b> Understanding various terms - educational technology, instructional design, instructional systems design, curriculum design, pedagogy, andragogy; Brief overview of the origin and evolution of ET and ID as theory and practice; what is the relevance of ET and ID relevant in extension and rural advisory services? Extensional professionals as instructional designers and architects of the learning experience; Types of learning or learning domains- Bloom's taxonomy of the cognitive domain, Krathwohl and Bloom's affective domain and Simpson's psychomotor domain.
<b>UNIT II</b>	<b>Technology enabled learning:</b> What is the role of technology in education? Digital media, new tools and technology; Open and distance Learning (ODL); Online Education - Synchronous and Asynchronous learning models; eLearning, Massive Open Online Courses - SWAYAM, Open Education Resources (OERs), Course CERA, EduEx, CoL, RLOs; digital education and its applications in higher agricultural education; Smart classrooms and Campuses, Web-based remote laboratory (WBRL); Integrating media and digital tools into ID; types and implications of disruptive technologies for higher education and extension; Augmented learning; Adaptive learning; meaning, features and good practices in using open source Learning Management Systems (Moodle); Quality assurance and certification in e-learning.
<b>UNIT III</b>	<b>Theories and models of instruction:</b> Howard Gardner's Theory of Multiple Intelligences, David Kolb's Experiential Learning Cycle, Albert Bandura's Social Learning Theory, Rand Spiro's Cognitive Flexibility Theory and Its Application In eLearning, Wlodkowski's Motivational Framework for Culturally Responsive Adult Learning; ADDIE Model, Dick and Carey Model, SAM Model, Bloom's Taxonomy; integrating the theories of instruction into the practice of ID in extension and RAS ecosystem.
<b>UNIT IV</b>	<b>Creating instruction and instructional strategies:</b> Overview of planning, designing and implementing the curricula and learning experiences; Needs Analysis - meaning, approaches and steps; Task and content analysis - meaning, approaches, steps and techniques (topic analysis, procedural analysis, and the critical incident method); Learner analysis – meaning, importance and approaches, relevance of Maslow's Hierarchy of Needs and learning styles, Captive Audience vs. Willing Volunteers, Universal vs. user-centered design, Learner Analysis Procedures; Writing learning objectives: Meaning of Learning Goal and Learning Objectives; ABCDs of well-stated objectives; Setting goals, translating goals into objectives; Contextualizing ADDIE process within the Extension learning environment: Organizing content and learning activities - scope and sequence of instruction; Posner's levels of organizing (Macro, Micro, Vertical, and Horizontal) and structures of organizing (content vs. media) instruction, Gagne's events of instruction, Edgar Dale's Cone of Experience; Methods of Delivery- classroom teaching, programmed instruction, synchronous and asynchronous modes of distance education; Changing role of a teacher in classroom and teaching competencies.
<b>UNIT V</b>	<b>Organizing content and learning activities:</b> Scope and sequence of instruction; Posner's levels of organizing (Macro, Micro, Vertical, and Horizontal) and structures of organizing (content vs. media) instruction, Gagne's events of instruction, Edgar Dale's Cone of Experience; Methods of Delivery- classroom teaching, programmed instruction, synchronous and asynchronous modes of distance education; Changing role of a teacher in classroom and teaching competencies.

<b>UNIT VI</b>	<b>Trends in instructional design and evaluating instruction:</b> Alternatives to ADDIE (Analysis, Design, Development, Implementation and Evaluation) model - Rapid prototyping and constructivist ID, reflections on instructional design as science and as an art; Relating ID models and process in extension learning environment; research in education and instructional design. Meaning of Assessment, Measurement and Evaluation; Developing learner evaluations and their reliability & validity; assessment techniques for measuring change in knowledge, skill and attitude of learners - Objective Test Items, Constructed-Response Tests, Direct Testing, Performance Ratings, Observations and Anecdotal Records, Rubrics, Portfolios, Surveys and Questionnaires, Self-Reporting Inventories, Interviews; Conducting learner evaluation pre-, during and post- instruction; Formative and Summative Evaluation- meaning, approaches and steps; Evaluating Learner Achievement and the Instructional Design Process; Evaluating the success of instruction; Performance appraisal of teachers.	
<b>Practical</b>	Preparation of the analysis Report that includes the task/content analysis and learner analysis and the Design Plan includes learning objectives and corresponding instructional strategies and assessment items; Prepare course outline and lesson plan with an appreciation for diverse learning styles based on temperament, gender, and cultural/ethnic differences and deliver a lecture for UG/PG students; Assessing learning styles through Barsch and Kolb inventories; Development and testing of survey instruments for evaluating learning outcomes/ competencies of students; Development and testing of survey instruments for performance appraisal / competency assessment of teachers; Design an online e-learning module on a topic of interest as a capstone project - integrate and apply the knowledge and skills gained from the course for creating an effective learning experience for a target audience; Designing and developing a theme based knowledge portals; Exercises on designing an online course using open source LMS like Moodle or EdX; Select and evaluate or design for social media; Prepare a short research paper on recent theories and models of instructional design; Interview an instructional designer of your choice and prepare a synthesis report about what job roles he/she perform, What ID processes does he or she use, challenges faced; Develop a prototype for one of the lessons in your design plan using PowerPoint or a website builder such as Weebly to create the screens integrating multimedia content and various functionalities; Field visit to a virtual learning/augmented learning lab, e-learning labs, distance learning centres, etc; Hands-on practice with video-editing software, web conferencing and video conferencing solutions.	
<b>FEX 603</b>	<b>GENDER MAINSTREAMING AND LIVELIHOOD DEVELOPMENT</b>	<b>2+1</b>
<b>Objectives</b>	To orient students on the importance of “Gender mainstreaming” as well as the other concepts related to gender. The students will be able to understand the gender roles and responsibilities and how in the present times, the roles may be shifting	
<b>Theory</b>		

<b>UNIT I</b>	<b>Gender related concepts and divides:</b> Historical perspective of gender: Feminism and emergence of gender as a concept, Scope of gender studies in agriculture and rural development; Agrarian Importance of Gender: Understanding the importance of gender in national and global agriculture-Key gender issues and challenges in agriculture/fisheries - Gender and value chain- Global actions to address gender-needs and strategies to address gender and women empowerment. Gender related concepts and divides: Understanding of the concepts of gender, gender equality and equity, gender balance, gender blind, gender relations, gender neutrality, gender bias and discrimination, gender rights, gender roles and responsibilities. Gender budgeting, Gender divides and their implications such as gender digital divide, gender access to resources and inputs divide, gender mobility divide, gender wage divide, Gender needs: practical and strategic.
<b>UNIT II</b>	<b>Gender analysis:</b> Gender analysis: Importance, usage, prerequisites, Tools for gender analysis, gender sensitive indicators: HDI, GDI, GEM; Gender and technology: How gender and technology impact each other, Gender neutral technology, Gender sensitive technology, Gender supportive assistance in technology adoption- Gender in fisheries research and extension.
<b>UNIT III</b>	<b>Gender mainstreaming, women empowerment and policies for women:</b> Gender mainstreaming: Importance of gender mainstreaming in agriculture, Extension strategies to address gender issues such as gender and health, nutrition, gender in agricultural / fisheries value chains, gender and climate change adaptation, gender and globalization& liberalization for mainstreaming gender concerns into the national programmes and policies. Women Empowerment: Importance of women empowerment, Current national women empowerment and gender indices. Women empowerment approaches (technological, organizational, political, financial, social, legal and psychological).Global Best Practices, Policies and Frameworks: Global best practices, women empowerment and gender mainstreaming models and frameworks for addressing gender concerns in agriculture/fisheries, approaches of various organizations: gender mainstreaming and special women focused programmes in agriculture and rural development.
<b>UNIT IV</b>	<b>Livelihoods and its challenges:</b> Basic concepts of livelihood and development, Types of development-Immanent/inherent and interventionist/ intentional; Why promote livelihood; Livelihood intervention: definition, types-Spatial, segmental, sector-sub-sector; Systemic view of Livelihoods, Understanding Rural Livelihoods-Farm, Non-Farm, and off farm; Linkages with Farm and Off-farm Livelihoods; Economic Models; Livelihood Challenge- Political economy of Livelihoods, Issues of access to farm and non-farm livelihoods; Livelihoods from a Gender Perspective-Feminization of agriculture/ poverty, women in the unorganized sector, the issue of unpaid and informal work; Livelihood Coping Mechanism-Climate Change and Livelihoods; Livelihoods and Disasters.
<b>UNIT V</b>	<b>Livelihood frameworks, intervention and promotion approaches:</b> Sustainable Livelihoods Approaches (SLAs)-Definitionand origins of SLA; Assets or capitals and capabilities in SLA and its linkage to the other capitals; Vulnerability Assessment-Shocks, trends, seasonality; Policies, institutional context and processes; Conceptual Frameworks-DFID, CARE, UNDP, OXFAM, BASIX livelihood triad, Nine square Mandala or Rural Livelihood System's Framework, etc; Past, Present and possibilities for the future of the SLA, critiques of the approach.

<b>UNIT VI</b>	<b>Livelihood promotion approaches:</b> Approaches and programs in India; Livelihood and a Rights Based Approach-MGNREGA and its critique; Livelihood and a Social Capital based approach: NRLM; Livelihood Augmentation (LA)- Basic concepts; Pathways: a) Entrepreneurial strategies for LA; b) NRM based intervention; c) Market based interventions including Value-chain analysis; d) ICT based interventions; e) Livelihood and allied agriculture based livelihood; f) Forest based Livelihoods vis a vis Livelihood Protection and Promotion: Contribution of NTFP in supporting rural livelihoods.	
<b>Practical</b>	enterprise/ entrepreneur/ members and other related stakeholders; Visit to agencies supporting women empowerment followed by report presentation. Each student to visit a different organization such as State Rural Livelihood Mission, Women Development Corporation, Department of Agriculture, Important NGOs working for women empowerment; Interaction with a successful women entrepreneur/ SHG; Case studies based on livelihood promotion and rural development. Case studies on Livelihood augmentation and gender related issues in fisheries sector.	
<b>EX 604</b>	<b>EXTENSION SERVICE SYSTEM MANAGEMENT</b>	<b>2+1</b>
<b>Objectives</b>	To make students' understand extension administration and management, and the functions associated with management.	
<b>Theory</b>		
<b>UNIT I</b>	<b>Extension service system:</b> Meaning and scope of extension service system and its management; Public administration and bureaucracy - concepts, origin and development; Marxian, Weberian and Gandhian thoughts on bureaucracy; bureaucratic vs. developmental organization.	
<b>UNIT II</b>	<b>Processes of management:</b> POSDCORB; Structure, organisation, function, working and management of public extension service agencies like DoFs, FFDA, BFDA, MPEDA, NFDB, NABARD, Fisheries Development Corporations, State Fish Seed Development Corporations, KVKs, SAUs, Fisheries Co-operatives, international agencies, corporate sector, private organizations and MNCs.	
<b>UNIT III</b>	<b>Organisational conflicts:</b> Delegation of power, autonomy and organisational communication and conflicts in governmental, UN agencies, non-governmental and private extension service organisations; Conflicting roles and responsibilities of extension agents.	
<b>UNIT IV</b>	<b>Organisational communication:</b> Meaning, methods, types and techniques; functions and importance in motivation and control; formal and informal communication networks in GOs, NGOs and POs; behaviour of individuals in organisations; Organisational change and communication; patterns of communication of organisational communication; managing organizational communication in fisheries sector.	
<b>UNIT V</b>	<b>Research, extension and client systems linkages:</b> Linkages and coordination between Dept. of Fisheries and other line Depts. like Irrigation / Water Resources, Environment, Forestry, Agriculture at grassroots, District, State and Central levels; HRD policy in governmental, non-governmental and private extension service organizations. Strengthening governance - transparency, accountability and people's participation.	

<b>UNIT VI</b>	<b>Strengthening extension service system:</b> Strengthening the Human Resources of Extension System - Strengthening the Information and Communications Technology (ICT) Capacity. Decentralize the existing extension system. Developing Participatory Public Extension System: PRA, RRA, etc. Investments needed to strengthen extension systems: Civil Works, Equipment, Vehicles, Technical Assistance and Operational Expenses. Supervising, monitoring, and evaluating extension projects.	
<b>Practical</b>	Case study and analysis of State Departments of Fisheries in selected States; Case studies in structure organization, staffing, career advancement, quality of service delivery at grassroots level in governmental, nongovernmental and private extension service organisations like DoFs, FFDA, NABARD, State Fish Seed Development Corporations, KVKs, Fisheries Co-operatives, NGOs, and private sector organisations; Study of patterns of communication and effectiveness of Fisheries Development Organisation; Study visit to DoF, NGOs, NABARD, private sector agencies involved in fisheries extension.	
<b>FEX 605</b>	<b>TECHNOLOGY COMMERCIALISATION AND INTELLECTUAL PROPERTY MANAGEMENT</b>	<b>2+1</b>
<b>Objectives</b>	To develop a critical understanding among extension students about how the technology commercialization process is linked to IPR management and entrepreneurship development	
<b>Theory</b>		
<b>UNIT I</b>	<b>Overview of intellectual property rights:</b> Introduction to IPR; Overview & Importance; Genesis; IPR in India and IPR abroad; Patents, copyrights, trademarks & trade secrets, geographical indication, industrial design; Emergence of IPR Regimes and Governance Frameworks - Trade-Related Aspects of Intellectual Property Rights (TRIPS), Convention on Biological Diversity (CBD), Cartagena Protocol, International Union for Protection of New Plant Varieties (UPOV), and BIMSTEC.	
<b>UNIT II</b>	<b>IPR protection laws and systems:</b> National IPR Policy; and IPR laws; procedures for filing IP protection; Systems of IP protection and management in agricultural universities and research institutions and also by stakeholders; Mechanisms of IPR Management – Institutional arrangement, IP Management processes – invention disclosure; IP portfolio management; Infringement management; National Biodiversity Act (2002); Protection of Plant Varieties and Farmers Rights Act (2001); Guidelines for registration and transfer of biological resources; Farmers rights; Mechanisms of documenting/ collecting, protecting and commercialising farmers varieties and other biological resources; National Biodiversity Authority, PPVFRA and other agencies involved in management of biological resources in India. Access to Genetic Resources and Sharing of Benefits.	
<b>UNIT III</b>	<b>Traditional and indigenous knowledge:</b> Grassroots and Farmers Innovations – Meaning, forms and importance; Systems of documentation, registration, protection and commercialisation. Documentation of traditional indigenous knowledge – Traditional Knowledge Digital Library (TKDL), Community Biodiversity Registers (CBRs), People’s Biodiversity Registers (PBRs), Plant Biodiversity Register, and Honeybee Network.; The Global Concerns on Use of Genetically Modified Organisms in Food and Agriculture; The Cartagena Protocol on Biosafety; Regulation of GMO in India.	



<b>UNIT IV</b>	<b>Technology commercialisation and IP valuation:</b> Technology - Definition, functions, process of technological advancement – invention, discovery, innovation and technology; Types of innovation - Basic research, Breakthrough innovation, Disruptive Innovation and Sustaining Innovation; Technology transfer and commercialisation, Technology transfer Vs Commercialisation; Technology commercialisation process – elements, models, systems and processes; Technology commercialisation strategies – Meaning, approaches for technology commercialisation – technology scaling up, technology licensing, handholding, agripreneur development;	
<b>UNIT V</b>	<b>Technology assessment and refinement:</b> Meaning; Importance; Approaches and methods of assessment and refinement of various technologies – stakeholder oriented approaches including participatory technology assessment and refinement; Returns to investment; IP Valuation-Oxford context, IP Valuation methods - Cost approach; Income approach - Discounted Cash Flow, Risk-Adjusted Net Present Value, Net Present Value with Monte Carlo Simulation and Real Options Theory; Market approach - Industry Standards Method, Rating/Ranking Method, Rules of Thumb Approach and Auction Method; Hybrid approaches; Royalty rate method.	
<b>UNIT VI</b>	<b>Technology incubation and promotion:</b> Technology business incubation - Meaning, functions and types; stakeholder-oriented incubation process – Livelihood incubation, village incubators. System of technology incubation- incubation process; its effectiveness; Managing profit oriented and non-profit incubators; Schemes for promoting incubators in India; Technology Scouting and Innovations in technology incubation. Technology promotion: meaning, types, business meetings, scientist-industry/ entrepreneur meets, technology conclave, business plan competition, farmers fairs, technology shows; Business Etiquette; business networking	
<b>Practical</b>	Understanding the technology commercialisation process – Visit to Technology Commercialisation Unit of ICAR Institute/ Agricultural University ; Understanding the IPR protection practices – Visit to Patent Attorney office; Hands-on experience in drafting IPR application – Patent/Copyright/ Trademark; Documenting Traditional and indigenous knowledge – Field experience in using various protocols of using traditional and indigenous knowledge; Hands on experience in technology licensing process including drafting agreements; Understanding the Technology Business Incubation – Visit to Agri Business Incubator or Technology Business incubator; Hands on experience in planning and organising technology promotion events; Hands on experience in various techniques in business communication and Business etiquette; Protecting unique local goods through Geographical Indications – Hands on experiences in documenting and registering Geographical indications; Technology assessment/ validation of traditional and indigenous knowledge – QuIK and other methods; Hands on experience in technology valuation.	
<b>FEX 606</b>	<b>POLICY ENGAGEMENT AND EXTENSION</b>	<b>2+1</b>
<b>Objective</b>	To develop the capacities of students to successfully engage with policyactors and bringing about desirable policy changes to strengthen extension.	
<b>Theory</b>		

<b>UNIT I</b>	<b>Understanding policy, policy advocacy and tools:</b> Why policies are important for extension? Role in providing structure, ensure funding and framework for providing functions-examples; Policy: definitions and types: Is policy a product or a process or both? Policies and institutions-How these influences defining organizational roles and performance in extension organizations- Role of policies in upscaling knowledge-
<b>Unit II</b>	Role of extension in influencing policies to enable innovation; Definition of advocacy, Approaches to policy advocacy-Advising, Media campaigning, Lobbying, Activism, Information education communication (IEC) and Behaviour change communication (BCC); Advocacy for RAS; Policy advocacy strategy.
<b>UNIT III</b>	<b>Policy analysis and development process:</b> Explain the meaning and use of policy analysis in decision- making; Describe different types of policy analysis- empirical, evaluative or normative policy analysis, retrospective / prospective policy analysis, predictive / prescriptive / descriptive policy analysis; How to do policy analysis? - understand the process of policy analysis, highlight the different methods and techniques used in policy analysis, doing ethical policy analysis; Tools for policy impact- research tools, context assessment tools, communication tools, policy influence tools. Whodrives policy change? National Governments, Donors, Civil Society- varied experiences:
<b>Unit IV</b>	<b>Understanding the environment and key actors in policy space-</b> problem identification-policy adoption, implementation and evaluation; stakeholder mapping, identifying opportunities and barriers, mobilising financial resources; Dealing with policy incoherence: identifying contradictions and challenges in policy implementation. Generating evidence:
<b>Unit V</b>	<b>Role of policy research;</b> analysing the usefulness and appropriateness of the evidence; Using evidence in policy advocacy; Good practices in influencing policies Organising policy dialogues: Policy engagement strategy-Engaging with policy makers: GO and NGO experiences; Policy working groups; advisory panels; use of committees:
<b>UNIT VI</b>	<b>Policies in fisheries sector:</b> Policy and regulatory environment in Marine Fisheries Sector, Inland Fisheries Sector, Brackish water Aquaculture Sector, Freshwater Aquaculture Sector, International policy and regulatory scenario in fisheries sector; FAO's CCCRF; UN's Law of the Sea and other conventions; EU's Common Fisheries Policy; Fisheries policy and regulation of select countries in Asian and American region; WTO and Fisheries; Subsidies and taxation in fisheries sector, NIFAP, Marine Policy.
<b>Practical</b>	Analysis of country/state level fisheries/ extension policy to understand the policy intentions from strengthening EAS; Analysis of fisheries policies of other countries: policy intentions, processes adopted in development of the policy and mechanisms of policy implementation Interaction with key policy actors in EAS arena at the state/national level (e.g.: Secretary of fisheries, Director of fisheries, etc) to explore policy level challenges in EAS; Identifying what evidence policy makers look for from extension research (Is the evidence available? If so what form? (Reports, Briefs etc), If not, develop a plan; Explore how different stakeholders influence policies (e.g.: policy advocacy of prominent NGOs, private sector and public sector) -What mechanisms and tools they use; Identifying policy level bottlenecks that constrain effective EAS delivery at the district level- E.g.: Issues around linkages between KVK and ATMA; inter-departmental collaboration; public private partnerships; joint action etc.; Case studies on

	sub-sectoral review of fisheries policy and legislative framework in select Indian States; Case studies on shrimp culture policy and development in Thailand & East Coast of India; Case studies on leasing policy in Bihar, Rajasthan, Tamil Nadu, Orissa, Karnataka, Maharashtra and Himachal Pradesh; Case studies on implications of WTO agreements for Indian and world fisheries.	
<b>FEX 607</b>	<b>PARTICIPATORY APPROACHES IN FISHERIES EXTENSION</b>	<b>1+1</b>
<b>Objectives</b>	To make students' gain knowledge on participatory approaches in fisheries extension programmes.	
<b>Theory</b>		
<b>UNIT I</b>	<b>Participatory approaches for aquatic resources management and development:</b> need, importance and guiding principles; Community mobilization methods - Farmer-First Approach; Trickle Down System –concept, method and processes; Knowledge Driven Extension System –concept and method.	
<b>UNIT II</b>	<b>Community based fisheries management and Fisheries co- management:</b> Concept, origin, importance, types, method, processes, stakeholder rights, responsibilities and participation, institutional mechanisms, implementation constraints, experiences from other countries; conflict resolution and management; Public- Private-Community Partnership.	
<b>UNIT III</b>	<b>Participatory Learning Approach (PLA):</b> Role-plays, case studies, brainstorming, and ranking of priority issues, discovery-based experiential learning, participatory education methods like FGD;	
<b>Unit IV</b>	Participatory appraisal techniques - census mapping, resource mapping, social mapping; selection of participatory methods and their uses; Farmer Field Schools for Aquaculture. Strength and weakness, Constraints in PRA methods	
<b>Practical</b>	Conducting Participatory Rural Appraisal in select villages and developing action plans; Conducting focused group discussion and developing action plan; Facilitating group formation based on the felt needs and to implement the action plans / plan of work; Reviewing national and international case studies on participatory approach to aquaculture research and development; case studies and simulation exercises on fisheries co-management /community based fisheries management.	

### Supporting Courses (6 credits)

<b>FST 501</b>	<b>Research Methodology</b>	<b>1+2</b>
<b>Objectives</b>	•To learn basic concepts and terms in research, and understand the research processes • To develop skills in planning, designing, conducting and writing research projects	
<b>Theory</b>		
<b>UNIT I</b>	Definition and characteristics of science and research; types of research; research paradigms; research ethics; Research process: steps in planning and conducting a research study; Myths and reality in science/research and research practice.	
<b>UNIT II</b>	Formulating a research problem: reviewing the literature, identifying researchable problem, defining research objectives, identifying variables, constructing hypotheses; Conceptualizing a research design: research design, selecting an appropriate research design in fisheries science research, experimental and non-experimental research designs; Data sources: primary and secondary data, method of data collection; Validity and reliability in research studies; Types of surveys and	

	sampling frameworks.	
<b>UNIT III</b>	Writing a research proposal; Collecting data: ethical issues concerning different stakeholders; Data analysis: editing and coding of data & developing a frame of analysis, analysis and inference; Writing a research report: types and formats of reports, writing Masters' thesis, writing a research article; Communicating science to different stakeholders, science-public-policy interface.	
<b>Practical</b>	Exercises on literature review –searching offline and online catalogues and journals (OPAC, ASFA, CeRA, etc); Exercises / case studies on formulation of researchable problem, research questions, research objectives; Exercises / case studies on defining variables construction of hypotheses; Exercises / case studies on selection of appropriate research designs; Constructing an instrument for data collection; Exercises on testing reliability and validity Exercises on preparing a research proposal / outline of research work; Exercises on critical review of research articles, theses and their presentation; Exercises / case studies on data analysis and drawing inferences; Exercises / case studies on writing a research article. Exercises / case studies on writing a popular article for farmers / public Exercises on communicating science to policy makers	
<b>FST 502</b>	<b>Statistical Methods</b>	<b>1+2</b>
<b>Objectives</b>	To acquaint students with various statistical methods and techniques. To provide hands-on-training in data analysis both using step-by-step approach and also through statistical software	
<b>Theory</b>		
<b>UNIT I</b>	Levels of measurement, Descriptive statistics; Theory of probability, Random variable; Probability distributions, mathematical expectation; Binomial, Poisson and Normal distributions and their applications in fisheries	
<b>UNIT II</b>	Concept of sampling distribution, standard error, confidence interval, test of hypotheses, type I and type II errors, level of significance; $\chi^2$ , t and F distributions; Tests of significance based on Z, $\chi^2$ , t and F distributions.	
<b>UNIT III</b>	Simple correlation, rank correlation; Simple and multiple regression models; Length-weight relationship in fisheries; Index numbers	
<b>UNIT IV</b>	Planning of an experiment and basic principles of design of experiments (Randomization, Replication and Local control); Analysis of Variance (ANOVA), Completely Randomized Design (CRD), Randomized Complete Block Design (RCBD), Latin Square Design (LSD); Introduction to factorial experiments	
<b>UNIT V</b>	Planning of sample surveys; Sampling versus complete enumeration; Sampling designs: Simple random sampling, Stratified sampling, Systematic sampling, Cluster sampling, Multistage sampling and their applications in fisheries; sample size determination, Estimation of marine and inland fish landings in India and problems encountered	
<b>UNIT VI</b>	Non-parametric tests, advantages and limitations over parametric tests; Run test, Sign test, Wilcoxon-Mann-Whitney U test, Kruskal-Wallis test and Friedman's test	

<b>Practical</b>	Descriptive statistics; Exercises on Probability distributions; Testing of hypothesis based on normal, $\chi^2$ , t and F distributions; Correlation and regression analyses; Analysis of data obtained from CRD, RBD, LSD; Exercises on selection of samples and estimation of population means using sampling designs; Exercises on non-parametric tests
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## b. Ph.D. (Fisheries Economics)

### Course Structure

#### LIST OF COURSES

#### Major Courses (12 Credits):

No.	Course Code	Semester	Course Title	Credit Hrs.
1	FEC 601*	I	Fisheries Production and Sustainability	1+1
2	FEC 602	II	Applied Econometrics	2+1
3	FEC 604*	I	Fishery Resource Evaluation and Governance	1+1
4	FEC 605*	II	Institutional and Legal Environment for Fish Business	2+0
5	FST 601	I	Advanced Statistical Methods	2+1
6	FEC 603*	II	Economics of Development and Planning	2+0
7	FEC 606	I	Indian Fisheries Trade and International Scenario	1+1
8	FST 602	II	Software for Fisheries Data Analysis and Management	0+2
<b>Total</b>				<b>11+7=18</b>

#### \*Compulsory Courses

**Minor Courses (6 credits):** Courses relevant for student's research work or necessary for building his/her overall competence from following disciplines can also be taken as minor courses.

No.	Minor Courses will be offered from following disciplines:
1	Fisheries Extension
2	Aquaculture
3	Fisheries Resource Management
4	Fish Processing Technology
5	Aquatic Environment Management
6	Fisheries Engineering and Technology

**Supporting Courses (5 credits):** The subject not related to the major subject. It could be any subject considered relevant for student's research work (such as Statistical Methods, Design of Experiments etc.) or necessary for building his/her overall competence can be taken.

#### Doctoral Seminar (2 credits):

Course Code	Semester	Course Title	Credits
FEC 691	III	Doctoral Seminar	0+1
FEC 691	IV	Doctoral Seminar	0+1

#### Doctoral Research (75 credits):

Course Code	Semester	Course Title	Credits
FEX 699	II to VI	Doctoral Research	0+75

**Ph.D. (Fisheries Economics)**  
**Course Contents**

<b>FEC 601</b>	<b>FISHERIES PRODUCTION AND SUSTAINABILITY</b>	<b>1+1</b>
<b>Objective</b>	To impart skill of fish production and sustainability in the different culture systems	
<b>Theory</b>		
<b>UNIT I</b>	<b>Introduction:</b> Fishery resources of India- Capture and culture fisheries- Status and prospects - Production function in culture and capture fisheries of India- Inland fisheries in India- Marine fisheries in India- Mariculture – Present status and future potential.	
<b>UNIT II</b>	<b>Production economics:</b> Fish catch and fishing effort- Catch per unit effort- Fishing costs and returns- Estimation of economics of fisheries- Dynamic economic models of fishing- Sustainable yield- sustainable yield curves- Open access equilibrium- Maximum economic yield- Maximum sustainable yield- Change in open access equilibrium yield- Free and open access equilibrium- Total revenue, costs and sustainable yield with respect to effort.	
<b>UNIT III</b>	<b>Fisheries management:</b> Fisheries Management Theories- Objectives and techniques of fisheries management -Criteria for fisheries management- Need for management- Implementation of management Measures-	
<b>UNIT IV</b>	<b>Fisheries regulations:</b> Objectives of fisheries regulation- Need and types of regulation in Indian Fisheries- Overfishing- Problems of overfishing- Reasons for overfishing- Measures adopted to minimize overfishing.	
<b>Practical</b>	Production status of fishery resources in India; Analysis in the production of marine fisheries in India; Analysis in the production of maritime states in east coast of India; Analysis in the production of maritime states in west coast of India; Analysis in the production of inland fisheries in India; Analysis in the production of inland states in India; Catch and effort surveys; Estimation of cost and returns of different capture fisheries methods; Estimation of cost and returns of different culture fisheries methods; Case studies on various sectors of fisheries.	
<b>FEC 602</b>	<b>APPLIED ECONOMETRICS</b>	<b>2+1</b>
<b>Objective</b>	To provide comprehensive knowledge of advanced econometric tools for better understanding of economic problems.	
<b>Theory</b>		
<b>UNIT I</b>	<b>Model specifications:</b> Econometric model specification criteria, specification errors, measurement errors of dependent and explanatory variables, Different model specification criteria	
<b>UNIT II</b>	<b>Instrumental variables:</b> Review of classical regression model, hypothesis testing, estimation subject to linear restriction, Mixed estimation - use of instrumental variables in regression analysis,	
<b>UNIT III</b>	<b>Qualitative regression tools:</b> Use of Dummy variables, Models for qualitative dependent variable-LPM, multinomial logit models.	
<b>UNIT IV</b>	<b>Simultaneous equations:</b> Simultaneous equation systems: Basic rationale, identification problems, Single equation methods of estimation-indirect least squares, two stage least squares and K-class estimators, limited information maximum likelihood, three-stage least squares, and full information maximum likelihood; Relative merits of these methods and their small and large sample properties. SURE	

	estimates.	
<b>UNIT V</b>	<b>Time series analysis:</b> Introduction to time series analysis – trend, cycle and seasonality, time series models, Basic ideas in fitting non-linear regression models	
<b>UNIT VI</b>	<b>Time series modelling:</b> Distributed lag models, Analysis of economic time series – Stationarity and unit root test, ARIMA, ARCH group of models and co-integration. Neural Network Models, Pooling of cross- section and time series data.	
<b>Practical</b>	Estimation of multiple regression model; Estimation of LPM; Logit and Probit models – comparing two regressions; Chow test - Indirect least squares 2SLS, SURE, 3SLS; Estimation of simultaneous equation models; unit root tests for stationarity, fitting of ARIMA and ARCH group of models; Co integration. Model selection; Hands on using econometric packages like SPSS and SAS	
<b>EC 604</b>	<b>FISHERY RESOURCE EVALUATION AND GOVERNANCE</b>	<b>1+1</b>
<b>Objective</b>	The students will be exposed to economic evaluation techniques in the realm of resource governance in fisheries.	
<b>Theory</b>		
<b>UNIT I</b>	<b>Ecosystem valuation:</b> Present status of Natural environmental ecosystems in India - Economic Tools – Markets for the Environment, Valuing the natural ecosystems in fisheries - Cost-Benefit analysis and Environmental risk. Problems in natural Fishery Resources management- misuse of natural resources, Accountability and transparency.	
<b>UNIT II</b>	<b>Environmental policies and tools:</b> A History of Environmental ‘Regulation, Environment, Security, Violence: The Malthusian Legacy, Problems of “Regulating” Nature, Introduction to Policy Analysis: A policy tool approach. Property Rights and Common Property Management, Payments for environmental services.	
<b>UNIT III</b>	<b>International Environmental Agreements:</b> Evolution in Environmental Governance, Governance Strategies, Governance Tools, Analytical issues in assessing participation and devolution, Participatory approaches in natural resource management and policy.	
<b>UNIT IV</b>	<b>Environmental Impact assessment:</b> Concept and principles of EIA; methodologies for EIA in fisheries and aquaculture sector; Institutional (International/National/State/Local) arrangements and strategies for estimation, amelioration and compensation for impacts; Aquaculture Authority Bill and AAI. Environment related conflicts and dispute resolution; Coasian theorem and stakeholder decision making process.	

<b>Practical</b>	Environmental Policy Analysis; Developing Criteria for Evaluating Environmental Policies; Frameworks for environmental governance analysis; Common Property and Community-Based Resource Management; Case studies on environmental economics of shrimp farming (intensive/semi-intensive/extensive) and poly culture farms; Application of Extended Domestic Resource; Cost Ratio and Policy Analysis Matrix for aquaculture; Case studies on the sustainability of various capture fishery systems; Exercise on global warming and fisheries development concepts in valuing environment; Productivity change method, substitute cost method, Hedonic price method, Travel cost method, Contingent valuation methods.	
<b>EC 605</b>	<b>INSTITUTIONAL AND LEGAL ENVIRONMENT FOR FISH BUSINESS</b>	<b>2+0</b>
<b>Objective</b>	To provide an insight into the legal and institutional aspects that impact the efficiency and performance of fish business organizations.	
<b>Theory</b>		
<b>UNIT I</b>	<b>Legal system and business:</b> The Indian legal system an overview. The Indian Contract Act (1872): Meaning, nature, and scope; types of contracts; essentials of a valid contract, offer and acceptance, capacity to contract, free consent, performance of contract. Issues in international business transactions: International Sale of Goods, The Sales Contract, Letters of Credit, Foreign Direct Investment, Protection of intellectual property, Dispute Resolution.	
<b>UNIT II</b>	<b>Acts and laws:</b> Companies Act (1956): Incorporation, commencement of business, types of companies, management, winding up of companies; Negotiable Instruments Act. Factory Act, Labour laws, Industrial dispute Act.	
<b>UNIT III</b>	<b>Management systems for food quality and safety:</b> Management systems for food quality and safety: Regulatory provisions and acts: Essential Commodities Act, APMC Act, Consumer Protection Act, RTI Act, MRTP Act. Regulations related to food safety, hygiene and quality: national FPO (1955)	
<b>UNIT IV</b>	<b>Acts and laws for food quality and safety:</b> Food Safety and Standards Act (2006), and other Acts related to fish, fruits, meat, milk, grading and standardization (AGMARK) and international (sanitary and phyto-sanitary requirements, Codex, ISO, HACCP, Good Manufacturing Practices (GMP) and Good Agricultural Practices (GAP)) (BMPs in Aquaculture and Fisheries)	
<b>UNIT V</b>	<b>Institutional environment:</b> Role of institutions in fish business: Ministry of Food Processing Industries, Ministry of Food and Consumer Affairs, Product Boards, Export Promotion Council, Food Safety and Standards Authority, India, etc. International institutions facilitating fish business. Provisions related to FDI in agriculture and food production and distribution.	
<b>UNIT VI</b>	<b>Corporate social responsibility:</b> Nature and importance of ethics and moral standards; corporations and social responsibilities, scope and purpose of business ethics; Ethics in business functional areas; industrial espionage; solving ethical problems; governance mechanism.	
<b>Practical</b>	NIL	



<b>FST 601</b>	<b>ADVANCED STATISTICAL METHODS</b>	<b>2+1=3</b>
<b>Objective</b>	To provide exposure on advanced statistical methods to students. Hands-on-training for analysis of data using statistical software.	
<b>Theory</b>		
<b>UNIT I</b>	<b>Probability distributions:</b> Negative Binomial, Hyper-geometric, Exponential and their applications in fisheries; Multiple and partial correlation and regression; Path coefficient method; Transformation of data.	
<b>UNIT II</b>	<b>Matrix algebra:</b> Multivariate normal distribution; MANOVA; Principal component analysis; Canonical correlation; Discriminant analysis; Factor analysis, Cluster analysis; Multi-Dimensional Scaling.	
<b>UNIT III</b>	<b>Linear programming:</b> Objective function, graphical solution of linear programming problem, Simplex method.	
<b>UNIT IV</b>	<b>Analysis of Categorical Data:</b> Logistic regression, Log-linear models; Tau, Kappa and Deviance measures.	
<b>UNIT V</b>	One sample tests: Binomial, Fisher's exact probability; Two related samples tests: McNemar, Wilcoxon signed rank tests; Two independent samples tests: Median and Wald-Wolfowitz run tests; Kruskal Wallis One-way ANOVA and Friedman Two-way ANOVA for rank data. Measures of association in nominal data: Spearman and Kendall rank correlation coefficients, Kendall partial rank correlation coefficient of concordance.	
<b>Practical</b>	Exercises on Negative Binomial, Hyper-geometric and Exponential distributions; Multiple and partial correlations; Multiple and partial regression analysis; Path coefficient method; MANOVA; Principal component analysis; Canonical correlation; Discriminant analysis; Factor analysis, Cluster analysis; Multi-Dimensional Scaling; linear programming; Logistic regression and log-linear models; Non-parametric tests; Familiarization of statistical software viz., SAS, SPSS and R	

<b>FEC 603</b>	<b>ECONOMICS OF DEVELOPMENT AND PLANNING</b>	<b>2+0</b>
<b>Objective</b>	To provide orientation to the concepts and measures of economic development and planning.	
<b>Theory</b>		
<b>UNIT I</b>	<b>Economic development and growth:</b> Development Economics – Scope and Importance - Economic development and economic growth, divergence in concept and approach - theories of development; Indicators and Measurement of Economic Development – GNP as a measure of economic growth – Green GNP - Criteria for under development – Obstacles to economic development, Economic and Non-Economic factors of economic growth.	
<b>UNIT II</b>	<b>Theories of development:</b> Role of fisheries in economic development, characteristics of developing and developed economies; theories of development; role of economic, technological, social, cultural, political and environmental factors; interdependence between fisheries and industrial development.	
<b>UNIT III</b>	<b>Growth models:</b> Growth models – Harrod - Domar, neo-classical, Von Neumann; development strategies in India; five-year plans and fisheries. Growth analysis, determinants of growth and their measurements.	

<b>UNIT IV</b>	<b>Planning:</b> Planning models, features of planning in capitalist, socialist, neosocialist and mixed economies; types of planning - micro level, regional, sectoral, agro eco regional development.	
<b>UNIT V</b>	<b>Institutions and policies:</b> Role of non-government organizations (NGOs) and self-help groups (SHGs) in agriculture and fisheries development; characterizing fisheries growth, changes in fishing and farming pattern, decomposition analysis and sources of output growth; transfer of technology - constraints to technology adoption, yield gap analysis and research planning; fisheries information system. Fisheries policy analysis and reforms.	
<b>UNIT VI</b>	<b>Food and nutritional security:</b> Concepts of food and nutritional security, production oriented policies, food price policies, food subsidies, food safety and food quality. Measurement of poverty, poverty alleviation programmes.	
<b>Practical</b>	-	
<b>FEC 606</b>	<b>INDIAN FISHERIES TRADE AND INTERNATIONAL SCENARIO</b>	<b>1+1</b>
<b>Objective</b>	To familiarize the student with the evolution, growth and performance of Indian fisheries trade in international context.	
<b>Theory</b>		
<b>UNIT I</b>	<b>Evolution of Indian fisheries industry:</b> Growth and evolution of Indian fisheries industry; size, organisation, structure. Export promotion measures in India-Duty draw back-Deemed exports – ASIDE-MDA-MAI-EPGC- innovations and productivity in Indian fisheries industry.	
<b>UNIT II</b>	<b>Trade theories and policies:</b> International trade; Nature of international trade - Theories of international trade - Modern theories of international trade.	
<b>UNIT III</b>	<b>Concepts of terms of trade:</b> Free trade, protection, tariffs, quantitative restrictions and other non-tariff measures- Globalisation and changing facets of global and Indian fisheries industry.	
<b>UNIT IV</b>	<b>Institutional frame work:</b> Growth of global fisheries industry- Fresh, frozen, cured, canned and other types- Fisheries industry in US, Japan, European Union, Australia, Asian and African countries - Institutional frame work in India for foreign trade- Internalization of Indian fisheries trade.	
<b>Practical</b>	Pattern and Performance of India's Seafood Exports; Export Composition and destination of Indian seafood products; Product and market diversification; Competitiveness of Indian fish and fish products; Exports of value added seafood products; Case studies on non-tariff barriers in fisheries trade; Case studies on dumping and anti-dumping measures in seafood trade; Studies on world shrimp, tuna and cephalopod industries; Analysis of International price trends and volatility; WTO and trade dispute settlement	

### Supporting Courses (6 credits)

<b>FST 501</b>	<b>Research Methodology</b>	<b>1+2</b>
<b>Objectives</b>	<ul style="list-style-type: none"> <li>• To learn basic concepts and terms in research, and understand the research processes</li> <li>• To develop skills in planning, designing, conducting and writing research projects</li> </ul>	
<b>Theory</b>		
<b>UNIT I</b>	Definition and characteristics of science and research; types of research; research paradigms; research ethics; Research process: steps in planning and conducting a research study; Myths and reality in science/research and research practice.	

<b>UNIT II</b>	Formulating a research problem: reviewing the literature, identifying researchable problem, defining research objectives, identifying variables, constructing hypotheses; Conceptualizing a research design: research design, selecting an appropriate research design in fisheries science research, experimental and non-experimental research designs; Data sources: primary and secondary data, method of data collection; Validity and reliability in research studies; Types of surveys and sampling frameworks.	
<b>UNIT III</b>	Writing a research proposal; Collecting data: ethical issues concerning different stakeholders; Data analysis: editing and coding of data & developing a frame of analysis, analysis and inference; Writing a research report: types and formats of reports, writing Masters' thesis, writing a research article; Communicating science to different stakeholders, science-public-policy interface.	
<b>Practical</b>	Exercises on literature review –searching offline and online catalogues and journals (OPAC, ASFA, CeRA, etc); Exercises / case studies on formulation of researchable problem, research questions, research objectives; Exercises / case studies on defining variables construction of hypotheses; Exercises / case studies on selection of appropriate research designs; Constructing an instrument for data collection; Exercises on testing reliability and validity Exercises on preparing a research proposal / outline of research work; Exercises on critical review of research articles, theses and their presentation; Exercises / case studies on data analysis and drawing inferences; Exercises / case studies on writing a research article. Exercises / case studies on writing a popular article for farmers / public Exercises on communicating science to policy makers	
<b>FST 502</b>	<b>Statistical Methods</b>	<b>1+2</b>
<b>Objectives</b>	To acquaint students with various statistical methods and techniques. To provide hands-on-training in data analysis both using step-by-step approach and also through statistical software	
<b>Theory</b>		
<b>UNIT I</b>	Levels of measurement, Descriptive statistics; Theory of probability, Random variable; Probability distributions, mathematical expectation; Binomial, Poisson and Normal distributions and their applications in fisheries	
<b>UNIT II</b>	Concept of sampling distribution, standard error, confidence interval, test of hypotheses, type I and type II errors, level of significance; $\chi^2$ , t and F distributions; Tests of significance based on Z, $\chi^2$ , t and F distributions.	
<b>UNIT III</b>	Simple correlation, rank correlation; Simple and multiple regression models; Length-weight relationship in fisheries; Index numbers	
<b>UNIT IV</b>	Planning of an experiment and basic principles of design of experiments (Randomization, Replication and Local control); Analysis of Variance (ANOVA), Completely Randomized Design (CRD), Randomized Complete Block Design (RCBD), Latin Square Design (LSD); Introduction to factorial experiments	
<b>UNIT V</b>	Planning of sample surveys; Sampling versus complete enumeration; Sampling designs: Simple random sampling, Stratified sampling, Systematic sampling, Cluster sampling, Multistage sampling and their applications in fisheries; sample size determination, Estimation of marine and inland fish landings in India and problems encountered	
<b>UNIT VI</b>	Non-parametric tests, advantages and limitations over parametric tests; Run test, Sign test, Wilcoxon-Mann-Whitney U test, Kruskal-Wallis test and Friedman's test	

<b>Practical</b>	Descriptive statistics; Exercises on Probability distributions; Testing of hypothesis based on normal, $\chi^2$ , t and F distributions; Correlation and regression analyses; Analysis of data obtained from CRD, RBD, LSD; Exercises on selection of samples and estimation of population means using sampling designs; Exercises on non-parametric tests	
<b>FST 602</b>	<b>SOFTWARE FOR FISHERIES DATA ANALYSIS AND MANAGEMENT</b>	<b>0+2</b>
<b>Objectives</b>	To provide hands on training on the use of various statistical packages in data analysis.	
<b>Practical</b>	Introduction to computer software: SPSS, SAS, SYSTAT and STATISTICA for analysis and presentation of fisheries data; Basic concepts of database management systems; Introduction to MS-ACCESS, ORACLE (RDBMS); Exercises on analysis of data using MS-EXCEL, SPSS, SAS, FISAT, SYSTAT and STATISTICA; Creation of Database using MS-ACCESS, ORACLE.	
<b>Suggested Reading</b>	Kettell 2003. <i>MS Office: The Complete Reference</i> . Khattree R & Naik D. 2000. <i>Multivariate Data Reduction and Discrimination with SAS Software</i> . SAS Institute North Carolina. <i>SPSS Base 11.0: User's Guide</i> . SPSS Inc., Bangalore. <i>STATISTICA : The Small Book User Guide</i> . StatSoft, USA. Steven F. 2001. <i>Oracle PL / SQL Best Practices: Optimising Oracle Code</i> . SPD/O'Reilly Reprints. <i>Systat 8.0: Getting Started Manual</i> .	

### **c. M. F. Sc. (Fisheries Extension)**

#### **Course Structure**

#### **LIST OF COURSES**

#### **Major courses (20 credits):**

<b>No.</b>	<b>Course Code</b>	<b>Semester</b>	<b>Course Title</b>	<b>Credit Hrs.</b>
1	FEX 501*	I	Global Extension Landscape	2+1
2	FEX 502	II	Communication and Journalism	2+1
3	FEX 503*	I	Knowledge and Innovation Systems	2+1
4	FEX 504	II	Organizational Behaviour and Development	2+1
5	FEX 505	I	ICT for Development	2+1
6	FEX 506*	II	Monitoring, Evaluation and Impact Assessment	2+1
7	FEX 507	I	Aquapreneurship Promotion and Value Chain Development	1+1
8	FEX 508	I	Sociology, Psychology and Community Organisation	2+1
9	FEX 509	II	Risk Management and Climate Change Adaptation	2+1
10	FEX 510*	I	Capacity Development	1+1
				<b>18+10=28</b>

**\*Compulsory Courses**

**Minor Courses (8 Credits):** Courses relevant for student's research work or necessary for building his/her overall competence from following disciplines can be also taken as minor courses.

No.	Minor Courses will be offered from following disciplines:
1	Fisheries Economics
2	Aquaculture
3	Fisheries Resource Management
4	Fish Processing Technology
5	Aquatic Environment Management
6	Fisheries Engineering and Technology
7	Fish Nutrition and Feed Technology

**Supporting Courses (6 credits):** The subject not related to the major subject. It could be any subject considered relevant for student's research work (such as Statistical Methods, Design of Experiments etc.) or necessary for building his/her overall competence can be taken. A few courses are suggested as under:

Course Code	Semester	Course Title	Credits
FST 501	I	Research Methodology	1+2
FST 502	II	Statistical Methods	1+2
STAT 501	I	Mathematics for Applied Sciences	2+0
STAT 502	I	Statistical Methods for Applied Sciences	3+1
STAT 511	II	Experimental Designs	2+1
STAT 512	II	Basic Sampling Techniques	2+1
STAT 521	I	Applied Regression Analysis	2+1
STAT 522	II	Data Analysis Using Statistical Packages	2+1
MCA 501	I	Computers Fundamentals and Programming	2+1
MCA 502	II	Computer Organization and Architecture	2+0
MCA 511	I	Introduction to Communication Technologies, Computer Networking and Internet	1+1
MCA 512	II	Information Technology in Agriculture	1+1
BIOCHEM 501	I	Basic Biochemistry	3+1
BIOCHEM 505	II	Techniques in Biochemistry	2+2

**Common Courses (Non-Credit) (5 credits):**

No.	Course Code	Semester	Course Title	Credit Hrs.
1	PGS 501	I	Library and information services	1+0=1
2	PGS 502	I	Technical Writing and Communication Skills	1+0=1
3	PGS 503	II	Intellectual Property and its Management in Agriculture	1+0=1
4	PGS 504	II	Basic Concepts in Laboratory Techniques	1+0=1
5	PGS 505	III	Agricultural Research, Research Ethics and Rural Development Programmes	1+0=1

**Master's Seminar (1 credit):**

Course Code	Semester	Course Title	Credits
FEX 591	IV	Master's Seminar	0+1

**Master's Thesis Research (30 credits):**

Course Code	Semester	Course Title	Credits
FEX 599	III	Master's Research	0+15
FEX 599	IV	Master's Research	0+15
		<b>Masters' Research</b>	<b>0+ 30</b>

**M. F. Sc. (Fisheries Extension)  
Course Content**

FEX 501	GLOBAL EXTENSION LANDSCAPE	2+1
<b>Objectives</b>	To help the students to appreciate the process and the impact of extension reforms implemented in many countries, the new approaches that are evolving globally in different regions and the policy challenges in managing a pluralistic extension system	
<b>Theory</b>		
<b>Unit I</b>	<b>Basics of extension &amp; advisory services:</b> Genesis and Evolution of Extension; Understanding education, extension education, extension research, and extension service; Formal, Informal and Non-formal education; Principles and Philosophy of Extension Education; Meaning and Importance of Extension and Advisory services (EAS); Core competencies of an extension professional beyond ToT- performing new functions to deal with new challenges.	
<b>Unit II</b>	<b>Extension systems and approaches:</b> Public Extension Systems in India: Historical as well as current systems at state (DoF), national (NAREES) and international levels (WF, NACA, FAO, ICSF, WAS, AFS); Extension systems in different regions: South Asia (Bangladesh and Sri Lanka), South East Asia (Japan, China, Thailand, Indonesia and Vietnam), USA, and Europe. Extension approaches (General extension approach, commodity specialized approach, T&V approach, Participatory approach, Project approach, Farming systems approach Cost-sharing Approach, Educational institution approach); Paradigms of agricultural extension (Technology transfer, advisory work, Human resource development, Facilitation for empowerment); RRA and PRA, Participatory Learning and Action (PLA), Participatory technology development (PTD); Fisheries Co-management; ATMA; Marianad model, BENFISH, Matsyafed model	

<b>Unit III</b>	<b>Extension delivery:</b> Pluralism in Extension Delivery, private sector (input firms, aqua-business companies, consultants); Non- Governmental Organisations (National/international)/Civil Society Organisations (CSOs)/SHGs in providing extension; Farmer Producer Organisations - scope, strength and weaknesses-experiences; Media and ICT based extension services; Managing pluralism in EAS -challenges and experiences.	
<b>Unit IV</b>	<b>Extension programs and institutions development:</b> Meaning, concept and major paradigms / models; Agriculture and rural Development programs; Important pre-independent extension programs; Extension/ToT programs: NES, ND, ORP, KVK, LLP, FSR&E, TAR-IVLP, NATP, NAIP, NMAET; Fisheries policies and programs: FFDA, BFDA, Blue revolution schemes; Institutions: NFDB, MPEDA-NETFISH, NaCSA, CAA, ICAR-FIs, NITIAayog, MANAGE, EEI.	
<b>Unit V</b>	<b>Challenges before extension and advisory services (EAS):</b> New Challenges before farmers/fishers and extension professionals: Supporting fishers/farmers to manage the declining aquatic resources/CPRs; Gender Mainstreaming- How extension can enhance access to knowledge/resources among women & men fishers/farmers; Nutrition- Role of extension in promoting fish as healthy food; Linking fishers/farmers to markets; Adaptation to climate changes-How extension can contribute to up-scaling climate smart fisheries/aquaculture	
<b>Unit VI</b>	<b>Supporting family farms:</b> Doubling fishers/farmers income; In and out Migration in inland and marine fisheries; Attracting and Retaining Youth in Fisheries/Aquaculture; Fisher/Farmer distress; Facilitating access to credit, inputs and services; Networking and partnership development including GFRAS (Global Forum for Rural Advisory Services) and its regional networks; Extension and Sustainable Development Goals (SDGs); Financing Extension: Mobilizing resources for extension; Strengthening extension policy interface- generating evidence on impact of extension and policy relevant communication.	
<b>Practical</b>	Visits to formal, informal and non-formal educational organization and familiarizes their functional activities. Technology of transfer, advisory work, and Human resource development in fisheries programmes. ToT models of ATMA, Marianad, BENFISH, Matsyafed, etc. Public and private extension services of aqua-business companies, consultants, SHGs, KVK, NATP, NAIP, FFDA, BFDA, MPEDA-NETFISH, NaCSA, CAA, etc.. Global and national ICT based fisheries extension services Gender Mainstreaming in fisheries for poverty reduction Climate resilient fisheries/aquaculture Review of national, state and regional extension networks and policies	
<b>FEX 502</b>	<b>COMMUNICATION AND JOURNALISM</b>	<b>2+1</b>
<b>Objectives</b>	To orient the students towards the basics, approaches and applications of communication for facilitation and development.	
<b>Theory</b>		

<b>Unit I</b>	<b>Communication:</b> Meaning and importance, perspectives, characteristics, elements, process, Types (Individual, group and mass communication), Directions(Upward, downward and horizontal) and levels of communication; Verbal and non-verbal communication; Message - meaning and dimensions; Message distortion types; Barriers to Communication; Noise; Key Communicator, homophily and heterophily, credibility, fidelity, empathy and feedback in communication; Communication skills & competence, Communication effectiveness; Theories and Models of communication.
<b>Unit II</b>	<b>Media and development communication:</b> Audio Visual aids: classification and selection; Traditional Media and Methods for communication and development programmes; Extension teaching methods; Extension & Development Communication- concept, importance and approaches; Organizational communication; Modularized communication, Business communication-concept, methods and processes; Use of social media in communication; Media mix.
<b>Unit III</b>	<b>Understanding the structure and construction of news:</b> Language and principles of writing: Basic differences between the print, electronic and online news. Organising a news story, 5W's and 1H, Inverted pyramid Criteria for news worthiness, principles of news selection, use of archives, sources of news, use of internet
<b>Unit IV</b>	<b>Journalism:</b> Journalism – Meaning, scope and importance, principles, theories; Development journalism – meaning, scope and importance, principles, theories; Growth of and challenges for development/ farm journalism in India.
<b>Unit V</b>	<b>Facets of journalism:</b> Basics of Writing – News stories, feature articles, magazine articles, farm bulletins and folders; Art of clear writing: Readability and comprehension testing procedures; Script development and Story board preparation; Magazine journalism - profile and feature writing; Radio and television journalism - principles and practices of gathering, writing and producing news for radio and television; Photo journalism - visual language, skills and techniques; Photography: principles and use in extension; New media journalism – websites , blogs, social media; Responsible journalism - fairness and balance, libel, and the commercial nature of the media, constructive criticism; Advertisements – principles and practice.
<b>Unit VI</b>	<b>Media role:</b> Role in democracy. Responsibility to society. Press and democracy. Contemporary debates and various issues relating to media. Ethics in journalism.



<b>Practicals</b>	Communication skill development and public speaking; Developing extension materials: folders, leaflets, booklets, newsletters, popular and scientific articles, blogging, etc.; News writing and success stories writing; Digital photography and image editing; video production; Visit to news channels/ printing press/fishing villages; Organization of content - choice of media, categorization of photographs, queuing of audio and video clips, logical sequencing, text entry; Identification, articulation and analysis of major issues related to fisheries; Critical analysis of fisheries related news stories and feature articles from development magazines / newspapers; Designing, editing and publishing campus newsletters; Interface with editors of journals and magazines; Critical analysis of fisheries related radio news stories; Producing radio news items for broadcast; Digital photography and image editing; Study and practice of various kinds of video editing systems; Practice and use of digital photography.	
<b>FEX 503</b>	<b>KNOWLEDGE AND INNOVATION SYSTEMS</b>	<b>2+1</b>
<b>Objectives</b>	To orient the students about the various knowledge and innovation systems in fisheries	
<b>Theory</b>		
<b>Unit I</b>	<b>Knowledge systems:</b> Knowledge- meaning, epistemology, sources and types; Origins of the innovation systems concept-Innovation vs Invention; Agricultural/Fisheries Innovation System (AIS) and AKIS; Role of different actors in AIS; Importance of interaction and knowledge flows among different farming sectors	
<b>Unit II</b>	<b>Innovation systems:</b> Innovation – definition – innovation decision process - Role of Extension in AIS, Different views to analyse AIS: structural view, functional view, process view and capacity view.	
<b>Unit III</b>	<b>Diffusion and adoption process:</b> Diffusion – meaning and elements; Diffusion research and its criticism; Generation of innovations in fisheries – Innovation development process; Concept and stages of Innovation-decision process; Diffusion process, Adoption process, Models of diffusion and adoption, Adopter categories and their characteristics; Factors influencing adoption and attributes of innovations.	
<b>Unit IV</b>	<b>Change agents in the adoption process:</b> Change agent – meaning, roles, factors of success; Centralized and decentralized diffusion systems; Innovation in organizations; Consequences of innovations - model and classification; Opinion leader – meaning, characteristics, types, their measurement and role Critical mass.	
<b>Unit V</b>	<b>Indigenous knowledge systems:</b> Indigenous knowledge - meaning , scope and importance, types and systems; Indigenous vis-a-vis Scientific knowledge; Indigenous-Information, Practices and technologies; Documentation, validation, Conservation, and dissemination of ITK and Grassroots level innovations in fisheries; Access and use of indigenous knowledge; Peoples' Biodiversity Register; Issues in protection of traditional knowledge / ITK - understanding Indian Biological Diversity Act and National Biodiversity Authority, limits to benefit sharing – IPR, Prior Informed Consent, TRIPS vs. CBD; Integration of Indigenous knowledge and modern technologies.	

<b>Unit VI</b>	<b>Enabling and scaling up innovations:</b> Role of enabling environment: Policies and institutions in enabling innovation; Methodologies for AIS Diagnosis: Typologies of existing methodologies-strengths and limitations; Scaling Up: Definitions, Changing views on scaling up, Approaches to Scaling Up: Push, pull, plant, probe: Scaling up pathways: Drivers and spaces for scaling up; Framework and Tools for Scaling up: Planning and implementing a scaling up pathways; Scalability assessment tools; Role of policies in scaling up: Influencing policies for scaling up; Innovation Management for scaling up knowledge and implications for Extension and Advisory Services	
<b>Practicals</b>	Documentation of ITK in fisheries; Development of Case studies of ITK in fisheries; Institutions and NGOs involved in ITK collection and validation, testing appropriateness of ITKs; Concept mapping; describing fisheries technologies; explaining case study of the diffusion process of select fisheries innovations; Identify one fisheries activity and use AIS framework to diagnose actors and their roles, patterns of interaction, institutions determining interaction and the enabling policy environment and develop an AIS Diagnosis Report (Review and Key informant interviews); Undertake a case study on a successful case of scaling up knowledge and identify factors that contributed to its success; Identify one specific knowledge (a technology, an approach) that has been recently introduced and develop an Upscaling Strategy.	
<b>FEX 504</b>	<b>ORGANISATIONAL BEHAVIOUR AND DEVELOPMENT</b>	<b>2+1</b>
<b>Objectives</b>	To orient students on the importance of knowledge and skills on various management functions, as applicable to extension organizations	
<b>Theory</b>		
<b>Unit I</b>	<b>Basics of organizational behaviour:</b> Introduction to organizations-concept and characteristics of organizations; Typology of organizations; Theories of organizations: Nature of organizational theory, Classical theories, Modern management theories, System Theory - Criticisms and lessons learnt/analysis; Organization Behaviour- Concepts, Scope, Importance, Models of OB.	
<b>Unit II</b>	<b>Group behaviour in organization (organizational system):</b> Foundations of group, Group behaviour and Group dynamics, Group Development and Cohesiveness, Group Performance and Decision Making, Intergroup Relations; Teams in Organisations-Team building experiential exercises, Interpersonal Communication and Group; Leadership: Meaning, types, Theories and Perspectives on Effective Leadership, Power and Influence, leadership styles; Motivation-Concept & Theories, Managing motivation in organizations	
<b>Unit III</b>	<b>Organizational conflict management:</b> Conflict Management and Negotiation skills, Problem-solving techniques; Job analysis, Job performance and Job-stress management; Occupational stress – meaning, sources, effects, coping mechanism, effects and management; Occupational stress in farming, farmer groups/ organizations, research and extension organizations. Organizations Structure- Need and Types, Line & staff, functional, committee, project structure organizations, centralization & decentralization; Organizational Culture vs Climate; Organizational Change; Organizational Learning and Transformation.	

<b>Unit IV</b>	<b>Organizational development and interventions:</b> Organizational development- Concept and process; Meaning, Importance, Characteristics and types of Organization development Interventions; OD consultant Types of OD consultants and their advantages, qualifications, Comparison of traditional consultants Vs. OD consultants.	
<b>Unit V</b>	<b>Management in organizations:</b> Concept and principles of administration and management, Classical and modern theories, Schools of management thoughts. Functions of management – planning, organizing, staffing, directing and leading, controlling, coordinating, reporting and budgeting; Managerial skills. Concept of HRM and methods, Job satisfaction and morale; Performance appraisal – Meaning, Concept and Methods. Authority and responsibility, Delegation and decentralization, line and staff relations; Supervision – Meaning, Responsibilities, Qualities and functions of supervision, Essentials of effective supervision; Coordination at different levels of extension management, Methods of coordination	
<b>Unit VI</b>	<b>Management techniques:</b> Management by Objectives (MBO) and Total Quality Management (TQM); Time management; Critical analysis of organizational set up of extension administration at various levels; Management Information Systems (MIS): Concept, tools and techniques, MIS in extension organizations.	
<b>Practicals</b>	authority, decision-making patterns; Exercise on OD interventions (Interpersonal, Team, Structural, Comprehensive) with its procedure to conduct in an organization Case studies/ success stories on performance of SHGs in fisheries Case Analysis of organization in terms of process – attitudes and values, motivation, leadership Study of individual and group behaviour at work in an organization; Conflicts and their management in an organization; Documenting occupational stress in farming, farmer groups/organizations Exercises on stress management and time management; Exercises on team building and negotiation skill development Understanding organizational change process tools and techniques Case analysis on organizational change process; Stakeholder analysis mapping.	
<b>FEX 505</b>	<b>ICT FOR DEVELOPMENT</b>	<b>2+1</b>
<b>Objectives</b>	To orient students on advances in ICT initiatives, knowledge management process smart/ disruptive technologies and data analytics	
<b>Theory</b>		
<b>Unit I</b>	<b>ICTs - concepts, roles and initiatives:</b> ICTs- meaning, concepts, basics of ICTs, global and national status, types and functions of ICTs, meaning of e-Governance, e-learning, m-Learning, advantages and limitations of ICTs.	
<b>Unit II</b>	<b>Knowledge management:</b> meaning, approaches and tools. Role of ICTs in Agricultural Knowledge Management. e-Extension, overview on Global and national e-extension initiatives, Inventory of e-Extension initiatives in Agriculture and allied sectors from Central and State governments, ICAR, SAUs, private sector and NGOs in India.	

<b>Unit III</b>	<b>ICT applications:</b> Knowledge centres (tele centres), CSC, digital kiosks, web portals, community radio, internet radio, Kisan call centres, mobile based applications, INCOIS-PFZ advisories; Self-learning CDs on Package of practices, Augmented Learning, Virtual Learning, social media, Market Intelligence and Information Systems-e-NAM, Agmarknet, etc. Expert System/ Decision Support System/ Management Information Systems, Farm Health Management & Intelligence System for Plant /Animal/ Soil Health, Fishery, Water, Weather, etc. National e-Governance Plan in Agriculture (NeGP-A)	
<b>Unit IV</b>	<b>Networks and policies:</b> Global and regional knowledge networks, international information management systems, e-Learning platforms (MOOCS, Coursera, EduEx, etc.); Digital networks among extension personnel, Farmer Producers Organisations (FPOs) / SHGs/ Farmers Groups. Video conference, live streaming and webinars, types and functions of social media applications, guidelines for preparing social media content, engaging audience, data-analytics and info graphics.	
<b>Unit V</b>	<b>Smart technologies for extension:</b> Open technology computing facilities, System for data analytics/ mining/ modelling/ Development of Agricultural simulations; Remote Sensing, GIS, GPS, Information Utility (AIU);	
<b>Unit VI</b>	<b>Disruptive technologies for extension:</b> Disruptive technologies Analysis; Internet of Things (IoTs), Drones, Artificial intelligence (AI), block chain technology, social media and Big Data analytics for extension.	
<b>Practical</b>	Content and client engagement analysis Case studies and exercises on ICT based interventions in fisheries and agriculture Designing extension content for ICTs; Creating and designing webportals, blogs, social media pages Development and use of online and offline e-learning modules in fisheries Live streaming extension programmes and organizing webinars Visit to KCC; Exercises on developing mobile based applications; Developing social media pages for disseminating fisheries related information; Writing for digital media Developing video content related to fisheries Conducting exercise on remote sensing and GIS.	
<b>FEX 506</b>	<b>MONITORING, EVALUATION AND IMPACT ASSESSMENT</b>	<b>2+1</b>
<b>Objectives</b>	To make students' understand the concepts of participatory development planning, monitoring, evaluation and impact assessment.	
<b>Theory</b>		
<b>Unit I</b>	<b>Introduction to monitoring:</b> Monitoring- Definition, Objectives, tools, methods and approaches; Major Components of project Monitoring: Special Diagnostic studies, Project Completion report, project sustainability. Monitoring Standards: Past quality or performance, the quality of other systems, desired quality, Professional standards, the quality required, Planning targets and Optimal quality.	

<p><b>Unit II</b></p>	<p><b>Concept of evaluation:</b> Meaning and concept in different contexts; Why Evaluation is Done and When?, Purpose of Evaluation; Principles of Evaluation; Types of Evaluation: Objective Oriented, Management Oriented; Context Evaluation, Input evaluation, Process Evaluation, Product Evaluation, Consumer oriented evaluation, Expertise Oriented Evaluation, Adversary Oriented Evaluation, Naturalistic and Principal oriented evaluation, goal free evaluation and meta evaluation; Process of Evaluation- Evaluation at the beginning, Evaluation during the programme, Evaluation at the end; Use of evaluation findings; Statistical Tools for evaluation; Evaluation theories - Three broad categories of theories that evaluators use in their works - programme theory, social science theory, and evaluation theory (other theories / approaches - Utilization-Focused Evaluation &amp; Utilization-Focused Evaluation (U-FE) Checklist, Values Engaged Evaluation, Empowerment Evaluation, Theory-Driven Evaluation).</p>
<p><b>Unit III</b></p>	<p><b>Programme planning:</b> Steps, analyse programme effectiveness, accountability; Objectives, types, criteria and approaches of programme evaluation; The context of program evaluation in agricultural extension; Competency and credibility of evaluator; Integration between theory and practice of evaluation: –evaluation forums, workshops, conferences and apprenticeship / internship. Ten Steps in programme evaluation; SWOT Analysis; Bar Charts (Gantt Charts and Milestone Charts); Networks - Programme Evaluation and Review Technique (PERT) and Critical Path Method (CPM); Bennett’s Hierarchy of Evaluation; LFA.</p>
<p><b>Unit IV</b></p>	<p><b>Impact assessment indicators and approaches:</b> Meaning, Need, Features, Benefits, Concepts; Indicators for Impact Assessment - Direct indicators, Indirect or proxy indicators, Quantitative indicators, Qualitative indicators, Result chain / hierarchy of indicators; Methods of Impact Evaluation- Learning retention of participants (KOSA), Impact on the job performance, Impact on organizational effectiveness, Impact on stakeholder’s competency</p>
<p><b>Unit V</b></p>	<p><b>Impact assessment framework:</b> Meaning of inputs, outputs, outcomes, impacts and their relation with monitoring, evaluation and impact assessment; Indicators for impact assessment – meaning and concept; Selecting impact indicators; Types of impact indicators for technology and extension advisory services - social and behavioural indicators, socio-cultural indicators, technology level indicators, environmental impact assessment indicators and institutional impact assessment indicators; SDGs, Yield-related Public participation models: crisis management, conventional participation, participation in project- cycle, concurrent participation, dedicated participation framework; Social auditing: concept, elements, steps, potential problems, benefits.</p>
<p><b>Unit VI</b></p>	<p><b>Impact assessment approaches</b> – Quantitative, qualitative, participatory and mixed methods with their advantages and disadvantages; Quantitative Impact Assessment Types – Based on Time of Assessment (Ex-ante and ex-post), Based on Research Design (Experimental, quasi experimental, Non-experimental). Econometric Impact Assessment: - (Partial Budgeting Technique, Net Present Value, Benefit Cost Ratio, Internal Rate of Return, Adoption Quotient etc.). Qualitative and Participatory Impact Assessment Methods. Quantitative and qualitative techniques for impact assessment, Social impact analysis;</p>

	Economic impact analysis cost- benefit analysis, social- cost benefit analysis, partial budget analysis; Environmental impact analysis; Institutional impact analysis; Sustainability analysis, human impact assessment methods.	
<b>Practical</b>	<p>Search the literature using web / printed resources and identify evaluation indicators for the following: Utilization-Focused Evaluation, Values Engaged Evaluation, Empowerment Evaluation, Theory-Driven Evaluation; Visit to Directorate of Extension in an university and enquire about extension programmes being implemented / coordinated by Directorate. Developing an evaluation proposal of any one programme using ‘Ten Steps in Programme Evaluation’ Field studies for identification and ranking of criteria/indicators for impact assessment,</p> <p>Identifying a fisheries development programmes and their objectives being implemented in your state. Strengths, Weaknesses, Opportunities and Threats related to the identified programme objectives in the SWOT grid. Visit a nearby KVKs / ATIC. Select any agriculture technology with package of practices and extension advisory services promoted by KVK / ATIC. Identifying impact assessment indicators for social and behavioural indicators, socio-cultural indicators, technology level indicators, environmental impact assessment indicators and institutional impact assessment indicators; Exercises on evaluation of fisheries development programmes using the techniques of evaluation; Exercises on CPM and PERT.</p>	
<b>FEX 507</b>	<b>AQUAPRENEURSHIP PROMOTION AND VALUE CHAIN DEVELOPMENT</b>	<b>1+1</b>
<b>Objectives</b>	To orient students on the importance of aquapreneurship, fish Markets, supply chains and value chain analysis	
<b>Theory</b>		
<b>Unit I</b>	<p><b>Basics of aquapreneurship and Facilitation for entrepreneurship development:</b> Entrepreneurship - concept, significance and scope, theories and models; Entrepreneurship Development Cycle and process; Aquapreneurship – meaning, drivers, characteristics, importance, types of entrepreneurs; Startups, small businesses, startups, group/ community-based entrepreneurship; Entrepreneur and Manager; Approaches for assessing characteristics of entrepreneurs– enterprising tendency, entrepreneurship intention, entrepreneurship orientation; Critical competencies required for entrepreneur in managing the businesses – technical, communication, financial, human; entrepreneurial university approach. Approaches for developing agricultural enterprises through extension and advisory services – individual, group and community based approaches; Specific roles of extension agents in creating agricultural entrepreneurs; Pluralistic extension and extension agents working with other agents; Free and fee for extension services for business upgrading for farmers/farmer groups; Competencies of extension professionals for creating entrepreneurs.</p>	

<b>Unit II</b>	<b>Basics of business planning, entrepreneurial ecosystem and Infrastructure requirement:</b> Feasibility report, business plan, bankable project and detailed project report – similarities and differences; elements of business plan – the team and its competencies, business idea, gaps, opportunities and risks, key products and services, target market and consumer segments, marketing plan, financial plan, intellectual property and others. Meaning, elements ; Government policy support and schemes for development of agricultural and allied enterprises (Start-up India, Make in India, Digital India, Atal Innovation Mission and others; Entrepreneurship policy and schemes at different states of India); Sources of funding for agripreneurship/ aquapreneurship – Debt and equity capital, grants and subsidies, angel investor, venture capitalist, bank lending, NABARD, and others; entrepreneurial culture, Mentoring and handholding – incubators.
<b>Unit III</b>	<b>Infrastructure for supporting agricultural entrepreneurship</b> – warehouse, cold storage and transportation and other support systems, technology development system, education and training, human capital and workforce, systems for assessing capacity requirement and capacity building, local and global markets and regulatory framework ;Policy approaches for women entrepreneurship development , Organisations promoting entrepreneurship in India; Emerging perspectives – focus on startups and support mechanisms, climate- smart technology businesses; block chains for value chain management
<b>Unit IV</b>	<b>Extension and value chain:</b> Supply chains – meaning, structure, Value chains – meaning, importance, types; supply chains Vs value chains; Value chain development and value chain extension; Steps in a value chain analysis; Three dimensions of the value chain process; Participatory tools used in a value chain analysis- Focus groups, Ranking and weighting, Historical calendars, Market mapping, Evaluation of Business development services, Market visits, Learning journeys, Semi- structured interview, Structured interviews, Direct observation; Extension toolkits and approaches for value chain development; Value chain upgrading strategies on farmer and extension agent level.
<b>Practical</b>	Field visit to any entrepreneurship promotion agency of Govt. of India (e.g. Small farmer agribusiness consortium, EDI etc.); Business plan preparation and presentation – covers all aspects of choosing the business idea, financial estimates, market planning and others and presentation; Assessing the entrepreneurship potential of a prospective entrepreneur – enterprising tendency, entrepreneurship intention and entrepreneurship orientation scales administration and explain the processes Field visit to market support system – warehouse, cold storage unit, regulatory market etc. Field visit to Banks and Venture capitalist/ angel investors or other private investing agencies; Value chain mapping using participatory approaches. Field visit to successful aquapreneurs –startup, Farmer Producer Organization, SHG business, large business to orient themselves with different types of aquapreneurship; Field visit to technology business incubator.
<b>FEX 508</b>	<b>SOCIOLOGY, PSYCHOLOGY AND COMMUNITY ORGANISATION</b>
<b>Objectives</b>	To orient the students towards basics in sociology, psychology and cognitive processes.

<b>Theory</b>	
<b>Unit I</b>	<b>Overview of sociology:</b> Basic Concepts in Sociology – Society, Understanding of basic rural institutions, Social structure, Community, Social institution, Culture, Social change, Cultural change, Social system, Social process, Social conflict, Social values, Norms, Folkways, mores, customs; cultural relativism, cultural integration, cultural lag, acculturation; Family, Kin and Clan – its relationship with group behaviour and rural development; Social Stratification : class and caste system, their impact on rural development; Social Process and Social Interaction – Concepts, types; Competition, Conflict, Cooperation Accommodation and Assimilation, and change in social process due to developmental programmes.; Community Organization (CO): Meaning and Models.
<b>Unit II</b>	<b>Dynamics of change:</b> concept, types and importance in rural community; Typology of change- planned, indoctrinational, technocratic, coercive, emulative, etc; Theories of social change – Immanency, Functionalism, Economic, Technological, Historical, Ideological, Evolutionary and Field Theory; Factors affecting change under rural settings; Stimulants and Barriers to change. Social Capital, Collectivism-Interdependence in larger groups, conformity and functional analysis of roles.
<b>Unit III</b>	<b>Preamble to Psychology:</b> Psychology as a science and its importance in extension education, Perception- nature, selectivity & laws, Importance of perception in extension work, Sensation vs Perception; Attitudes - meaning, characteristics, assumptions, types, theories and models of attitude formation; Methods of changing attitudes, Stereotypes and Prejudices, factors in attitude change. Liking / affect – meaning, types and theories; Attraction – meaning, types and theories; Persuasion – meaning, theories and techniques; Social influence and groups – conformity, compliance and obedience
<b>Unit IV</b>	<b>Information processing:</b> Meaning, principles; Basic assumption. Models of information processing - Waugh and Norman model of primary and secondary memory; Atkinson and Shiffrin’s stage model of memory; Sensory memory- working, short and long term memory. Other models including blooms taxonomy and Sternberg’s Information Processing Approach. Computer- mind analogy. Teaching-learning process.
<b>Unit V</b>	<b>Attention and perception:</b> Meaning, types, theories and models; Consciousness; Motivation- nature, characteristics and types of motives, techniques of motivating farm people, Measuring motivation- TAT, sentence completion, etc., Emotion- its nature, types of emotional response, theories of emotion, self-motivation; harnessing emotions productively, Empathy and its theories, reading emotions, role of emotion in regulating human behaviour, Psychosocial distress and coping mechanisms in farming situations. Personality – individual differences and theories of personality, Multiple Intelligences- IQ, emotional intelligence, social intelligence, managing emotions; relationship between IQ and EQ, handling relationships; social skills. Defence mechanisms- types and importance
<b>Unit VI</b>	<b>Cognitive processes and learning:</b> Cognitive processes –Attention, perception, remembering and forgetting, knowledge and expertise – foundations and theories; Principles and processes of perception; Consciousness – meaning, types, sleep and dreams; Learning and Memory - meaning, Learning – foundations, approaches, styles and theories; Cognitive approaches of learning – meaning, principles theories and models; Memory – foundations, types ; Behavioural approaches of learning –



	foundations and theories - classical conditioning, operant conditioning, applied behaviour analysis; Social cognitive and constructivist approaches to learning – foundations and theories – social cognitive theory, Self-regulated learning; learning styles – meaning, types and applications in learning	
<b>Practical</b>	Learning - Classical conditioning and operant conditioning; Assessment of emotional intelligence; Exercises in problem solving; Exercises in visual perception; Measuring self-concept using psychometric tools; Experiment on factors influencing information processing; Assessment of attitudes; Visit to a village to study rural institutions; Focus group discussions to identify stimulants and barriers to changes existing in rural community; Understanding perception - Attentional Blink and Repetition Blindness exercise; Understanding attention -Testing selective attention capacity and skills and processing speed ability through Stroop test; Hands-on experience in the techniques for assessing creative thinking – divergent and convergent thinking; Assessing learning styles through Barsch and Kolb inventories; Practical experience in building self-esteem; Hands on experience in methods of persuasion; Field experience in assessing social judgement; Simulation exercise to understand decision-making under different situations; Exercise in rational decision-making.	
<b>FEX 509</b>	<b>RISK MANAGEMENT AND CLIMATE CHANGE ADAPTATION</b>	<b>2+1</b>
<b>Objectives</b>	To equip students to identify, evaluate and evolve ways to address (mitigate and manage) risks and climate change.	
<b>Theory</b>		
<b>Unit I</b>	<b>Understanding risk and distress:</b> Introduction to risk, risk management, uncertainty, sensitivity and distress, General risk theory, Risk analysis methods, Risk perception and decision making, Indicators of risk and distress in agriculture – identification, selection and assessment, Understanding the agrarian distress in Indian agriculture, Sources of distress in Indian farming -changing farm size, land use, cropping patterns, pricing policy, markets and terms of trade, Typology of crisis in agriculture; Droughts, floods and Indian agriculture, Distress and farmer suicides - causes and socio-economic consequences	
<b>Unit II</b>	<b>Managing risk and distress:</b> Ways to reducing/managing risk and distress in Indian agriculture/fisheries; crop and life insurance; Developing support systems; Planning, implementation and evaluation of risk/distress management programs; Institutional frameworks for risk and disaster management – NDMA&SDMAs; Developing District Agriculture Contingency Plans; Risk management by diversification; Good practices and lessons from other countries; Responses of government, non-government and extension system to agrarian crisis; National Farmers Policy.	
<b>Unit III</b>	<b>Extension professionals and risk management:</b> Understanding social-psychological and behavioural dimensions of farmers under risk/distress; Risk perception and communication; Helping farmers manage farm level risks - mobilising resources, linking with markets, strengthening capacities; Working with village level risk management committees; Operational skills for preparing contingency and disaster management plans; Institutional and extension innovations in managing risk and distress; Policy and technological preferences for dealing with drought and flood.	

<b>Unit IV</b>	<b>Introduction to climate change science:</b> Basic concepts of and terms in climate change science; impacts of climate change; anthropogenic drivers of climate change, Climate change and Indian agriculture; climate adaptation vs. disaster risk reduction; anticipated costs of adaptation; climate change and poor; Overview of UNFCCC framework and institutions, Kyoto Protocol and beyond; India's National Action Plan on Climate Change and National Mission on Strategic Knowledge on Climate Change; National Coastal Mission, Institutional arrangements for managing climate change agenda.	
<b>Unit V</b>	<b>Introduction to climate change adaptation and mitigation:</b> Introduction to Climate Change Adaptation, Conducting a vulnerability assessment (CVI and SEVI frameworks), Identifying and selecting adaptation options; Global, national and state level initiatives and plans to support climate change adaptation, private sector and civil society initiatives and activities; Mainstreaming climate change adaptation into development planning, Financing climate adaptation and budgetary allocations for programmes, Gender and climate change adaptation, Agricultural development programmes and strategies towards climate change adaptation and mitigation, Community based and Ecosystem based adaptation strategies, preparing evidence based intervention plans for vulnerability reduction at micro and macro-levels.	
<b>Unit VI</b>	<b>Climate Smart Agriculture (CSA) and extension &amp; advisory services:</b> Climate smart agriculture; Developing climate smart and climate resilient villages; Stakeholders and determinants involved in climate smart agriculture; Climate smart agriculture and EAS; Innovative extension approaches used in CSA; Climate information services, Farmers perceptions about climate change; Farm and household level manifestations and adaptation strategies; Barriers and limits to adaptation; Farmers feedback on performance of extension methods; Skills, competencies and tools required for extension professionals at different levels and development departments in up scaling CSA.	
<b>Practical</b>	Hands-on practice in using risk assessment/analysis tools; Case studies on risk / distress assessment in agriculture -Indian and global lessons / Experiences from NICRA Project in agriculture and allied sectors; Developing criteria, indicators and indices for assessment of risk, vulnerability and resilience; Hands on practice on use of vulnerability and risk assessment tools and techniques; Case studies on success stories of climate change adaptation and community based initiatives; Developing district and village level intervention plans for climate change adaptation; Field Visits to State Disaster Management Authority; Case studies on climate smart agriculture / villages from India and world; Case studies on impact assessment of crop insurance programs, disaster management programs; Capstone project on documenting ITKs and local practices related to reducing risk / climate resilience agriculture	
<b>FEX 510</b>	<b>CAPACITY DEVELOPMENT</b>	<b>1+1</b>
<b>Objectives</b>	To make students' understand the concepts of training, capacity building, capacity development and human resource development in the context of roles and responsibilities of extension professionals	
<b>Theory</b>		

<b>Unit I</b>	<b>Capacity development- an overview:</b> Training, Capacity building, Capacity development and HRD-Meaning and differences; Training principles and Phases of training; Need and principles of Capacity development; Types and levels of capacities - Institutional capacities (include the rules, regulations and practices that set the overarching contextual environment), Organizational capacities (how various actors come together to perform given tasks), Individual capacities (technical, functional and leadership skills)
<b>Unit II</b>	<b>Capacity building:</b> Types of capacity building - Based on structure (structured, semi-structured & unstructured), Based on context (orientation, induction and refresher), and other categories (online, Webinar, distance etc.); Components of capacity development; Capacity development cycle; Approaches in Capacity Development - Informative approach, Participatory approach, Experimental approach/ Experiential, Performance based approach Steps in Designing and Planning of Capacity Development- Step 1. Select the participants, Step 2. Determine the participants' needs, Step 3. Formulate goal and objectives, Step 4. Outline the content, Step 5. Develop instructional activities, Step 6. Prepare the design, Step 7. Prepare evaluation form, Step 8. Determine follow-up activities; Evaluation of training: types and techniques of training evaluation
<b>Unit III</b>	<b>Capacity assessment and development methods:</b> Concept of Need Assessment; Approaches in Need Analysis- Performance Analysis, Task Analysis, Competency Study; Needs Survey ; Data Collection Methods in Identifying Needs - Rational Methods (Observation, Informal talks, Complaints, Comparison, Analysis of report, Opinion poll, Buzz session, Analysis of the new programme), Empirical Methods ( Job analysis, Performance evaluation, Checklist or Questionnaire Method, Tests, Critical Incident Technique, Card Sort Method, Focus Group Discussion, Interview, SWOT Analysis); Information and Skills required in Need Analysis; Identification of Needs through Task Analysis - Task identification, Task Analysis, Gap Analysis.
<b>Unit IV</b>	<b>Capacity development methods:</b> Lecture, Discussion, Syndicate, Seminars, Conference, Symposium, Role Play, Case study, Programmed Instruction, T - group / Laboratory methods, Brain storming; Delphi technique, Johari window; Factors Determining Selection of Methods - Capacity development objectives, subject matter, categories of participants, and the available resources like time, location, budget; Capacity Development Aids; Capacity Developer (Trainer): Meaning and concept; Types of Capacity Developers (regular, <i>ad-hoc</i> , part time, guest and consultants); Roles of Capacity Developer (explainer, clarifier, supporter, confronter, role model, linker, motivator, translator/interpreter, change agent); Good Capacity Developer – Qualities, skills and roles. Human resource development: Meaning, Importance and Benefits; Types of HRD Systems & Sub-systems Career system; Components of HRD System - Performance Appraisal, Potential Appraisal, Task System, Development System, Socialisation System, Governance; Functions of HRD- Organisational Development, Career Development, Capacity Development.
<b>Practical</b>	Capacity development needs assessment exercise; Planning organizing and conducting an extension capacity development programme; Designing a programme; Writing learning objectives; Developing objectives into curriculum; Training plan; Organizing capacity development workshop; Evaluation with pre & post training tests; Exercise on business games, simulation exercises, in-basket

	exercise; Activities on programmed instruction, experiential learning techniques; Exercises on Transactional analysis and Fish bowl Technique; Preparing questionnaires using Delphi technique; Conducting brain storming and buzz sessions on topics related to fisheries; Organizing FGDs in fishing villages/institutions; Conducting SWOT analysis of any institutions or any fisheries technologies; Preparation of checklist/ questionnaires on capacity development related to fisheries department officers /fish farmers; Role plays on fisheries related problems; Conducting exercises on need assessment; Practicing facilitation techniques; Self-discovery exercises
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### d. M. F. Sc. (Fisheries Economics)

#### Course Structure

#### LIST OF COURSES

#### Major courses (20 credits):

No.	Course Code	Semester	Course Title	Credit Hrs.
1	FEC 501*	I	Microeconomics	2+0
2	FEC 502*	II	Macroeconomics	2+0
3	FEC 503	I	Socioeconomics, Vulnerability and Fisherfolk welfare	2+1
4	FEC 504	II	Fishery Regulations and Ecosystem Valuation	2+1
5	FEC 505	I	Marketing Intelligence and Business Analysis	2+1
6	FEC 506	II	International Fisheries Trade	1+1
7	FEC 507	I	Fisheries Finance, Accounting and Control	2+1
8	FEC 508	II	Introduction to Econometric Tools	1+1
9	FEC 510	I	Management of R & D Innovations and Policy	1+1
10	FEC 511*	II	Economics of Fisheries Enterprises	1+1
11	FEC 512	I	Fisheries Development Planning and Policy	2+0
12	FEC 513*	II	Fisheries Project Management	1+1
				<b>19+9=28</b>

#### \*Compulsory Courses

**Minor Courses (8 Credits):** Courses relevant for student's research work or necessary for building his/her overall competence from following disciplines can be also taken as minor courses

No.	Minor Courses will be offered from following disciplines:
1	Fisheries Extension
2	Aquaculture
3	Fisheries Resource Management
4	Fish Processing Technology
5	Aquatic Environment Management
6	Fisheries Engineering and Technology
7	Fish Nutrition and Feed Technology

**Supporting Courses (6 credits):** The subject not related to the major subject. It could be any subject considered relevant for student's research work (such as Statistical Methods, Design of Experiments

etc.) or necessary for building his/her overall competence can be taken. A few courses are suggested as under:

Course Code	Semester	Course Title	Credits
FST 501	I	Research Methodology	1+2
FST 502	II	Statistical Methods	1+2
STAT 501	I	Mathematics for Applied Sciences	2+0
STAT 502	I	Statistical Methods for Applied Sciences	3+1
STAT 511	II	Experimental Designs	2+1
STAT 512	II	Basic Sampling Techniques	2+1
STAT 521	I	Applied Regression Analysis	2+1
STAT 522	II	Data Analysis Using Statistical Packages	2+1
MCA 501	I	Computers Fundamentals and Programming	2+1
MCA 502	II	Computer Organization and Architecture	2+0
MCA 511	I	Introduction to Communication Technologies, Computer Networking and Internet	1+1
MCA 512	II	Information Technology in Agriculture	1+1
BIOCHEM 501	I	Basic Biochemistry	3+1
BIOCHEM 505	II	Techniques in Biochemistry	2+2

**Common Courses (Non-Credit) (5 credits):**

No.	Course Code	Semester	Course Title	Credit Hrs.
1	PGS 501	I	Library and information services	1+0=1
2	PGS 502	I	Technical Writing and Communication Skills	1+0=1
3	PGS 503	II	Intellectual Property and its Management in Agriculture	1+0=1
4	PGS 504	II	Basic Concepts in Laboratory Techniques	1+0=1
5	PGS 505	III	Agricultural Research, Research Ethics and Rural Development Programmes	1+0=1

**Master's Seminar (1 credit):**

Course Code	Semester	Course Title	Credits
FEC 591	IV	Master's Seminar	0+1

**Master's Thesis Research (30 credits):**

Course Code	Semester	Course Title	Credits
FEC 599	III	Master's Research	0+15
FEC 599	IV	Master's Research	0+15
		<b>Masters' Research</b>	<b>0+ 30</b>

## Course Contents

<b>FEC 501</b>	<b>MICROECONOMICS</b>	<b>2+0</b>
<b>Objective</b>	To teach economics theories that apply to the decisions of individual consumers and producers and also firms.	
<b>Theory</b>		
<b>UNIT I</b>	<b>Consumer theory:</b> Theory of Demand- Consumer Behaviour- Cardinal Utility theory – Indifference Curves theory- Income and Substitution effect- Derivation of demand curve- Consumer surplus- Equilibrium of the consumer- Elasticity of demand - Market demand - Constant elasticity demand function	
<b>UNIT II</b>	<b>Production economics:</b> Basic theory of the firm: concepts, production functions, isoquants derivations and applications, optimization behaviour – alternative models, short run and long run cost functions; total price effect-substitution effect, output effect and profit maximization effect decomposition analysis-analytical approaches, joint products-concepts and constrained optimization.	
<b>UNIT III</b>	<b>Production theory:</b> Theory of production and costs- Production functions- Returns to scale – long run analysis of production – Law of variable proportions- Technological progress- Equilibrium of the firm- Choice of optimal combination of factors of production- Derivation of cost function from production function- Production function of a multiproduct firm- Iso-revenue curve of the multiproduct firm- Linear production functions- Linear programming	
<b>UNIT IV</b>	<b>Theory of costs:</b> Theory of costs- Cost curves- Traditional theory of costs- modern theory of costs- Short and Long run costs- Marginal cost, Minimum Average Total Costs- Analysis of Economies of Scale- Social and Private costs.	
<b>UNIT V</b>	<b>Factor pricing:</b> Theory of Price in Perfectly Competitive markets- The supply curve of the firm and industry- Short run equilibrium of the firm and industry- Equilibrium of firm and industry in long run- Optimal Resource Allocation- The stability of equilibrium - Dynamic equilibrium with lagged adjustment - Futures market- Hedging/ risk assumption.	
<b>UNIT VI</b>	<b>Welfare economics:</b> General Equilibrium theory- Two commodity exchange- Production and exchange- Multimarket equilibrium- General equilibrium and allocation of resources- Factor ownership and income distribution- Welfare economics- Pareto optimality- Maximization of social welfare- Welfare maximizing state.	
<b>Practical</b>	Nil	
<b>FEC 502</b>	<b>MACROECONOMICS</b>	<b>2+0</b>
<b>Objective</b>	To understand the basic concepts and principles of macroeconomics including the analytical tools used for them.	
<b>Theory</b>		
<b>UNIT I</b>	<b>Basic concepts:</b> Nature and Scope of Macroeconomics-Methodology and Keynesian Concepts National income-Concepts and measurement (GNP, NNP, PI &DI), methods for measuring national income, importance of NI analysis, Nominal and Real GDP .Balance of Payments (BoP)- meaning, structure, deficit and surplus , Disequilibrium , control measures	

<b>UNIT II</b>	<b>Theory of income and employment:</b> Classical theory of Employment and Say's Law-Modern theory of Employment and Effective Demand, Consumption function-Investment and savings: Consumption function –Average propensity to consume and marginal propensity to consume, measure of propensity to consumption, Keynes's theory of consumption and the determinants of consumption, Importance of consumption function.	
<b>UNIT III</b>	<b>Investment and Saving:</b> Saving function- average propensity to save and marginal propensity to save; Investment function – Meaning, types of investment, determinants of the levels of investment, Marginal efficiency of investment, Induced investment.	
<b>UNIT IV</b>	<b>Multiplier and accelerator:</b> Concept of Multiplier and Accelerator- Output and Employment-Rate of interest-Classical, Neo classical and Keynesian version-Theory of Multiplier- concepts of investment multiplier, derivation of investment Multiplier, Importance of multiplier; Aggregate demand and supply; unemployment – meaning, types; full employment	
<b>UNIT V</b>	<b>Monetary and fiscal policy:</b> Inflation-meaning, types, inflationary gap, cause and effect of inflation, Control measures for inflation; Monetary policy – Meaning, objective, instruments, Fiscal policy – Meaning, objective, Fiscal policy for economic growth, merits and demerits of the fiscal policy.	
<b>UNIT VI</b>	<b>Public finance and expenditure:</b> Public finance and Public expenditure – concepts, types of public expenditure, growth of public expenditure, effects of public expenditure on production and distribution; Government expenditure (Taxation) – Government budget constraints; Tax- meaning, classification, characteristics of good tax system, problems of equity in taxation.	
<b>Practical</b>	Nil	
<b>FEC 503</b>	<b>SOCIOECONOMICS, VULNERABILITY AND FISHERFOLK WELFARE</b>	<b>2+1</b>
<b>Objective</b>	To make the students understand about the socioeconomic conditions of the fisherfolk and the impact of climate change over it to assess their standard of living to draft various means of welfare schemes to them.	
<b>Theory</b>		
<b>UNIT I</b>	<b>Factors affecting socioeconomic status:</b> An over view of socioeconomic status of fisherfolk in India, Livelihood and Income- indebtedness- poverty, inequality and unemployment in fisheries- regional disparities in wage, work and livelihood security. Equity theory; Risk and uncertainty in fisheries -Standard of living of fisherfolk - Saving, Income, Consumption, poverty, Health status.	
<b>UNIT II</b>	<b>Socioeconomic analysis:</b> Concepts in socioeconomics - Gender discrimination, Income inequality, Gini coefficient and Lorenz curve, Theil index, Livelihood Index, Engel's curve, Duncan Socioeconomic Index (SEI), Occupational Status Score (OSS), household prestige (HHP) score - Recent measurement of economic development NEW (New Economic Welfare)- MRW (Measurement of Economic Welfare)- PQLI (Physical Quality Living Index)- HDI (Human Development Index)- Green GNP Index.	

<b>UNIT III</b>	<b>Fisheries and climate change:</b> Fisheries and climate change – Fisheries policy- Issues for future impact and adaptation- Socio economic condition and Fisheries policy- Fisheries and sustainability - Biodiversity of climate change- Indian fisheries current scenario in climate change - climate change threat- Impact of climate change in fisheries- Dynamics of climate change- Futuristic endeavor	
<b>UNIT IV</b>	<b>Climate change impact analysis:</b> Economic impact on climate changes –Climate change mitigation and adaptation- ongoing initiatives and future strategies for fisheries sector- Methods and tools for climate change adaptation- Impacts of climate driven extreme events and disasters in fishermen communities. Social impact on climate change -Vulnerability assessment – Top down and Bottom up approaches - Socio-economic vulnerability - Criteria and indicators – Vulnerability assessment framework and methods – Exposure, Sensitivity and Adaptive Capacity – Vulnerability Index – SeVI	
<b>UNIT V</b>	<b>Legal instruments to mitigate climate change:</b> An overview of international legal and policy framework to address climate change developed over time and points out some of the key issues under negotiation - history of international climate change negotiations and Nations Framework Convention on Climate Change (UNFCCC). - key provisions of the UNFCCC, its organisational structure, and different Party groups under the Convention - Kyoto Protocol and its associated bodies, as well as key commitments by Parties - an overview of main negotiation issues - highlights some of the key issues relevant for a future climate change regime.	
<b>UNIT VI</b>	<b>Welfare economics:</b> Fundamental theorems of welfare economics- Promising features of welfare economics, Welfare Schemes for fisherfolk in India- Women empowerment in Fisheries-Overview of fisherfolk welfare schemes-Fisheries Cooperatives, Corporations and NGOs in fisherfolk welfare development.	
<b>Practical</b>	Assessment of socioeconomic parameters of fisherfolk in marine fisheries sector; Assessment of socioeconomic parameters of fisherfolk in inland fisheries sector; Consumption and savings behaviour of fisherfolk; Nutrition and Health analysis of fisherfolk; Case studies on effects on climate change in world fisheries with special emphasis to Indian fisheries; Climate change impact on coastal fisheries and aquaculture in India; Case studies on sustainability of fisheries sector in India; Case studies on climate change driven disasters affecting the fishermen communities in India; Effectiveness of fisherfolk welfare schemes; Impact of welfare schemes on fisherfolk	
<b>FEC 504</b>	<b>FISHERY REGULATIONS AND ECOSYSTEM VALUATION</b>	<b>2+1</b>
<b>Objective</b>	To provide an overview of the concept and methods for payment for ecosystem services and their policy implications. This course is aimed at providing a rigorous and application-oriented treatment of different valuation techniques for measuring the value of aquatic environmental goods and services.	
<b>Theory</b>		
<b>UNIT I</b>	<b>Fisheries regulations:</b> Fisheries Regulations – Imperative needs for the regulation of marine fisheries in India, types of fishery regulations – possible objectives of fisheries regulations; Fisheries regulations followed in the maritime states of India	



<b>UNIT II</b>	<b>Aquaculture guidelines:</b> Aquaculture: Guidelines under CRZ notification of 1991 and its Amendments, land leasing policies, regulations on use of chemicals and antibiotics - features of Aquaculture Seed (Quality Control) Relevant Central/state legislative provisions of Environment, Wildlife, Water, Biodiversity: (riverine, reservoir and aquaculture), processing in different States
<b>UNIT III</b>	<b>Ecosystem valuation:</b> Environmental and ecosystem valuation – the concept of value and valuation –Theoretical basis of valuation – consumer surplus, compensating variation and equivalent variation. Cost-benefit analysis of a conservation project. Ecosystem valuation – Payment for ecosystem services. Ethical issues in valuation – choice of discount rate.
<b>UNIT IV</b>	<b>Methods of valuation - Revealed preference methods:</b> Taxonomy of ecosystem values – use value, non-use value, direct and indirect use value, existence value, bequest value and option value. Revealed preference methods – Change in productivity method – Averting behavior and substitutable private and environmental goods. Models for bundled attribute goods - Hedonic of differentiated commodities. Discrete choice model of differentiated commodities – Hedonic property value model. Replacement cost approach. Substitute goods approach. Travel cost methods.
<b>UNIT V</b>	<b>Methods of valuation –Stated preference methods:</b> Stated preference methods – Contingent behavior - contingent valuation techniques – Willingness to accept and willingness to pay – Bidding games. Choice experiment approach. Combining revealed preference and stated preference methods. Discrete choice models for stated preference data. Validity of stated preference data. Other methods - Benefit transfer.
<b>UNIT VI</b>	<b>Risk valuation and assessment:</b> Morbidity and Mortality Risk Valuation - Risk assessment and the environment - Conceptual models – Health production model - Endogenous mortality risk - Measuring the value of a statistical life - Wage hedonics - Valuing health changes. Defensive expenditures and cost of illness. Economic valuation of biodiversity. Measurement of carbon sequestration benefits. Measurement of climate change impact – agronomic vs. economic methods – Ricardian model, Just-Pope model.
<b>Practical</b>	Contemporary global environmental issues, movement, policies, programmes, laws and other regulatory mechanisms; Fishery regulation in India; Criteria for evaluating the environment related projects and review of Environmental Impact Assessment (EIA) techniques; Recreation demand models of environmental valuation – Contingent valuation techniques – Environmental Resource Accounting Techniques; Practical considerations and comparison of instruments of environmental policy; Non-Point source pollution control methodologies - economic valuation and environmental economics; Exercises on change in productivity method; Replacement cost method with examples and insights from literature; Exercises on hedonic pricing. Travel cost method – design and application with example, Stated preference approaches – Contingent valuation methods; Measuring WTP and WTA – Empirical exercises

<b>FEC 505</b>	<b>MARKETING INTELLIGENCE AND BUSINESS ANALYSIS</b>	
<b>Objective</b>	To give an idea about the marketing intelligence and business analysis applied in the fisheries sector.	
<b>Theory</b>		
<b>UNIT I</b>	<b>Research methodology:</b> The role of marketing intelligence in the firm -The process of marketing research -The difference between exploratory and confirmatory research -Secondary and primary data - Qualitative and quantitative research methodologies -Sampling theory.	
<b>UNIT II</b>	<b>Requirements in business analysis:</b> Requirements in Business Analysis - Management - communication - tracing - configuration and change management -quality assurance - Development - elicitation including stakeholders and/or product requirements development – specification	
<b>UNIT III</b>	<b>Business analytics:</b> Business Analysis -Internal analysis - External analysis - Business need definition - Gap analysis - Solution proposal (including feasibility analysis) - Solution delivery or maintenance program/project initiation- Business process definition - Business goals- Business needs- Business requirements- - Limitations and assumptions	
<b>UNIT IV</b>	<b>Modelling and forecasting:</b> Solution modelling - validation and verification - Solution evaluation and optimization - Assessing the solution options (proposals) -Evaluating performance of the solution - Solution/business process optimization. Model Volatility with ARCH and GARCH for Time Series Forecasting	
<b>UNIT V</b>	<b>Marketing research:</b> Definitions of the various methodological concepts -Various steps involved in designing a research plan -Data collection methods; Characteristics, structure, sources, value, and use of Big Data - The relationship between digital analytics and inbound marketing strategies-consumer information and measurement services- -Rules for designing a questionnaire.	
<b>UNIT VI</b>	<b>Data analysis in marketing research:</b> Data sources for assessing consumer preferences, firm performance, and market condition and competition- analyze enterprise data, especially for purposes of segmentation, targeting, positioning, and evaluating consumer value- process of organizing, writing, framing, and refining analytics reports- delivering effective presentations, and aligning analytic results with stakeholder needs and preferences	
<b>Practical</b>	Marketing Research – ethics, standards and issues; Utilisation of Secondary Data Resources for Customer Segmentation Pricing and Elasticity; Linear Regression Basics; Using Linear Regression to Forecast; Conjoint Analysis; Digital Marketing Metrics Customer Lifetime Value; Cluster Analysis; Finding and interpreting secondary data; Suggesting a methodology for fisheries marketing research; Tools and concepts of data visualization.	
<b>FEC 506</b>	<b>INTERNATIONAL FISHERIES TRADE</b>	<b>1+1</b>
<b>Objective</b>	To familiarize students with basic concepts and principles of economics applied to international trade with reference to fisheries.	
<b>Theory</b>		
<b>UNIT I</b>	<b>Introduction to international economics:</b> International Economics - concepts and scope, Nature of international trade, difference between domestic and foreign trade; Theories of international trade- absolute and comparative advantage, modern theories of international trade – Hecksher Ohlin theorem.	

<b>UNIT II</b>	<b>Concepts in trade:</b> Concepts of terms of trade, free trade, protection, tariffs, quantitative restrictions and other non-tariff measures; exchange rate; devaluation and depreciation; Balance of payments. EXIM policy of India in relation to fish and fishery products.
<b>UNIT III</b>	<b>Export- Import procedures:</b> Export- Import procedures, and certification. Growth of marine product exports – MPEDA and its development programmes
<b>UNIT IV</b>	<b>Institutions and trade policies:</b> GATT and WTO, transition from GATT to WTO, WTO provision and its agreements: Agreement on Agriculture (AoA), Agreement on SPS measures and its salient features, Role of Codex Alimentarius Commission (CAC) and Agreement in Trade Related Intellectual Property rights (TRIPs) WTO in dispute settlement.
<b>Practical</b>	Pattern and performance of India's seafood exports; Product and market diversification; Competitiveness of Indian fish and fish products; Exports of value added seafood products; Case study of a seafood export firm; Use of SPS / TBT measure; Non-tariff barriers in fisheries trade; Dumping and anti-dumping measures in seafood trade.
<b>FEC 507</b>	<b>FISHERIES FINANCE, ACCOUNTING AND CONTROL</b>
	<b>2+1</b>
<b>Objective</b>	To make aware about the innovations in the fisheries finance and accounting.
<b>Theory</b>	
<b>UNIT I</b>	<b>Principles of finance:</b> Importance of fisheries finance; principles of fisheries financial management, rural credit structure-demand and supply, sources and forms; estimation of credit requirement; cost of credit/capital; credit appraisal- –The concept of 3C's, 7P's and 3R's of credit. District Credit Plan and lending to agriculture/priority sector Micro-Financing
<b>UNIT II</b>	<b>Reforms in policies and institutions:</b> Reforms in fisheries credit policy; innovations in fisheries financing – micro Finance, role of institutions in fisheries, finance, public and private sector banks; cooperatives, micro-finance institutions (MFIs), SHGs; Financing through Co-operatives, NABARD and Commercial Banks and RRBs International Financial Institutions; successes and failures of co-operative sector in India; Role of co-operatives under emerging economic scenario.
<b>UNIT III</b>	<b>Capital and cost concepts:</b> Sources of long-term finance and cost of capital; concepts of components of working capital, managing working capital - cash management, dividend decision; capital budgeting, appraisal criteria; fish business financing system in India- money and capital markets, national, regional and global financial institutions; insurance; risk management; micro-credit.
<b>UNIT IV</b>	<b>Project formulation and appraisal:</b> Elements of project cycle: Identification, preparation, appraisal, financing and implementation of projects. Project Appraisal techniques: Undiscounted measures, ranking by inspection, pay-back period, average annual proceeds per unit of outlay, Time value of money. Use of discounted measures, derivation of incremental net benefit; B-C ratio, NPV and IRR. Project management Net-work Techniques – PERT and CPM
<b>UNIT V</b>	<b>Accounting types:</b> Branches of Accounting, Internal and External Users of Accounting. Financial Accounting- Meaning, Need, Concepts and Conventions; Advantages and Limitations, Accounting Standards. The Double Entry System- Its Meaning and Scope, The Journal, Cash Book, Ledger, Trial Balance, Trading Account, Profit and Loss Account, Balance Sheet, Entries and Adjustments of different heads in different Books and Accounts. Introduction of Company Accounts.

<b>UNIT VI</b>	<b>Accounting management:</b> Management Accounting-Meaning, Functions, Scope, Utility Limitations and Tools of Management Accounting. Cost Accounting – basics – significance – objectives, Classification of Costs, Marginal Costing. Responsibility Accounting— meaning and significance. Budgets and Budgetary Control-Types of Budgets.	
<b>Practical</b>	Rural Lending Programmes of Commercial Banks; Lead Bank Scheme- Preparation of District Credit Plan; Preparation of financial statements using farm/firm level data; Farm credit appraisal techniques and farm financial analysis through financial statements; Different case studies on fisheries cooperative societies and their performance (marine and inland sector); Practical exercise on PERT and CPM; Ratio analysis; Valuation of project inventories; Project appraisal techniques– undiscounted and discounted measures; Company accounts format and formatting	
<b>FEC 508</b>	<b>INTRODUCTION TO ECONOMETRIC TOOLS</b>	<b>1+1</b>
<b>Objective</b>	To make students acquainted with econometric tools applied to social sciences. This course on quantitative and econometric analysis focuses on practical applications that are relevant in fields such as economics, finance, public policy, business and marketing.	
<b>Theory</b>		
<b>UNIT I</b>	<b>Nature and scope of econometrics:</b> Definition and Scope of Econometrics; Methodology of econometrics - The nature of the econometrics Approaches – Simple regression estimation and testing procedures – Stochastic and Non-Stochastic relations – Statistical properties of least squares estimators –Confidence interval and Hypothesis testing – Goodness of fit – Reporting the results of regression Analysis; Matrix Algebra.	
<b>UNIT II</b>	<b>Introduction to classic linear regression analysis:</b> Two variable regression model – The basic assumptions; Application of regression model The covariance and covariance estimator – Functional forms of regression models and methods of estimation; Cobb-Douglas Production Model - Multiple regression model, Relationship between simple and multiple regression coefficients; Auto correlation-Heteroscedasticity; Multicollinearity; Meaning and problem. Autoregressive models for univariate time series stationary data (AR), trend (ARIMA), and seasonal component (SARIMA).	
<b>UNIT III</b>	<b>Regression models and forecasting techniques:</b> Simultaneous – Equation Models; Problems of Simultaneous equation model; Multinomial regression models Ordinal – Regression models.	
<b>UNIT IV</b>	<b>Forecasting with regression model:</b> Panel data regression models-Survival analysis – Parametric and non-parametric tests in Social Sciences; Adhoc procedures in Regression analysis – Estimation of Probit, Logit and Tobit Probability Models	
<b>Practical</b>	Analysis on fitting classical linear regression models; Detection of multicollinearity; Forecasting models; Heteroscedasticity and autocorrelation for the given data sets in fisheries; Parametric and non- parametric tests; Data analysis in MS excel, SPSS and STATA; Forecasting models that can be developed for univariate time series data.	
<b>FEC 510</b>	<b>MANAGEMENT OF R&amp;D INNOVATIONS AND POLICY</b>	<b>1+1</b>
<b>Objective</b>	To give an idea about the R&D Management and fisheries policy analysis.	
<b>Theory</b>		
<b>UNIT I</b>	<b>Innovation and technology:</b> Innovation, productivity and economic growth; Nature, process and importance of technological innovation. Role of fisheries in economic and rural development.	

<b>UNIT II</b>	<b>Fisheries in economic development theories:</b> Growth stage theories, structural transportation leading sectors and dual economy models. Technology adoption, diffusion and transfer- theoretical models and case studies, technology, resources and environment	
<b>UNIT III</b>	<b>Fisheries research systems:</b> Fisheries research systems -evolution and growth, selected case studies of major countries, investment trends, international comparisons, institutional details; Changing public-private roles in technology development. Institutions and fisheries development; collective actions, property rights, transaction cost economics.	
<b>UNIT IV</b>	<b>Theories and policies:</b> Need for separate/sound fisheries policy – resource polices, credit policies, input and product marketing policies – price policies. Theories of fisheries development – conservation, urban industrial impact, and diffusion, high-pay-off input. Science and technology policy – regulation, incentives; Technology and intellectual property rights- selected case studies.	
<b>Practical</b>	Measurement of productivity growth; Exercise on total factor productivity; Using frontier production function; Institutional structures and national and international fisheries research systems; Ex-ante and ex-post methods of estimation of R&D impacts in fisheries	
<b>FEC 511</b>	<b>ECONOMICS OF FISHERIES ENTERPRISES</b>	<b>1+1</b>
<b>Objective</b>	To make the students aware about the economics of the various culturefisheries and the post – harvest operations.	
<b>Theory</b>		
<b>UNIT I</b>	<b>Production economics:</b> Aquaculture in economic development- Production concepts in aquaculture Production function- Cost and return concepts in aquaculture- Optimization of use of single resource- Cost of production- Short run production cost- Long run cost- Production function analysis in various aquaculture system. Preparation of financial statements-Balance Sheet, Cash Flow Statement and Profit and Loss Account. Ratio Analysis and Assessing the performance of farm/firm.	
<b>UNIT II</b>	<b>Planning and budgeting:</b> Farm income and budget analysis- Planning and budgeting- Aquaculture management decisions- Resource, labour and financial management. Managing risks and uncertainties - Economics of different aquaculture systems- Socio economic issues. Causes for aquaculture problems- Government support policies for inland, coastal and marine aquaculture systems.	
<b>UNIT III</b>	<b>Value Chain Management concept:</b> Value Chain Management concepts, value addition in fish marketing. Constraints and approaches to VCM in fisheries sector. Domestic and external markets for fisheries products. Export – Infrastructure development from landing to marketing.	
<b>UNIT IV</b>	<b>Value chain analysis:</b> Post-harvest operations in inland and marine fisheries including deep sea fishing - methodological issues in marine capture fisheries- needed measures for the constraints in post-harvest operations -	
<b>Practical</b>	Estimation of cost and returns of different aquaculture systems in India; Production trends of aquaculture in India for the past 10 years and the projected production estimates; Production function analysis; Planning and budgeting; Financial analysis in aquaculture production systems; Case studies of various aquaculture systems in India; Visit to various shrimp hatcheries or farms; Visit to various finfish farms and ornamental units; Visit to various craft and gear manufacturing units; Cost and returns of marketing establishments including exportprocessing firms	
<b>FEC 512</b>	<b>FISHERIES DEVELOPMENT PLANNING AND POLICY</b>	<b>2+0</b>
<b>Objective</b>	To understand fisheries policy of different states and plans fordevelopment	

<b>Theory</b>	
<b>UNIT I</b>	<b>Planning:</b> Planning Commission era - Organisation, role and functions -Planning in India-Objectives, Strategy, allocation, achievements and bottlenecks, Types of planning, stages in planning process, planning models. Impact of development plans, international co-operation programmes. NITIAYOG; Planning under NITIAYOG; Planning and development in China and Russia; Planning and Free Market economies
<b>UNIT II</b>	<b>Fisheries development schemes and policies:</b> Fisheries Development and policy under the plans, Fisheries schemes; NFDB; NABARD schemes, State and center sector schemes and centrally sponsored schemes, Central Department of Fisheries; Agriculture policies, Need for a separate fishery policy. National Marine Fisheries Policy; Leasing policies for inland and brackish water bodies in different states, National Mariculture Policy; National Inland Fisheries and Aquaculture policy, Inputs Policy, Financing and Credit Policy, marketing and pricing policy, Export -Import Policy.
<b>UNIT III</b>	<b>Importance of fisheries in rural and economic development:</b> Importance of Fisheries in rural and economic development- centre and state level policies for fisheries- Fisheries policy issues- Fisheries sector strategy- Various resource policies- Fisheries policy and Legislation- Development of Fisheries during the Five-Year Plans- Fisheries credit and marketing policies
<b>UNIT IV</b>	<b>Planning and cooperation:</b> Fisheries planning- Economic factors influencing development and co-operation in fisheries- Fisheries management- Role of fisheries in rural development and Policy initiatives - Economic planning in fisheries- Problems of development Planning-Fishing policies and economic growth- Planning and policy analysis- Fisheries project planning
<b>UNIT V</b>	<b>Fisheries legislation:</b> Fisheries legislation in India- background, Indian Fisheries Act of 1897 and subsequent amendments; Marine capture fisheries, comparative study of Marine Fishery Regulation, Acts of coastal Indian States – licensing/registration of vessels and mechanization –declaration of closed season, protection of endangered species, prohibition of destructive fishing methods, regulation of mesh size, filing of return on fish catch and income. Features of MPEDA Act and Rules, 1972
<b>UNIT VI</b>	<b>Legislative policies:</b> Guidelines for operation of Indian deep sea fishing vessels in Indian EEZ – Maritime Zone of India (regulation of fishing by foreign vessels) Act 1981 - aquatic exotics and quarantine regulations - Marine Fisheries Policy, 2004. Coastal Aquaculture authority; Aquaculture Guidelines under CRZ notification of 1991 and its Amendments, land leasing policies - regulations on use of chemicals and antibiotics - features of Central/state legislative provisions of Environmental, Wildlife, Water, Biodiversity: (riverine, reservoir and aquaculture), processing in different States.
<b>Practical</b>	-
<b>FEC 513</b>	<b>FISHERIES PROJECT MANAGEMENT</b>
<b>Objective</b>	To highlight the different institutions financing fisheries projects
<b>Theory</b>	
<b>UNIT I</b>	<b>Finance and management:</b> Sources of long term finance and cost of capital; concepts of components of working capital, managing working capital - cash management, dividend decision; capital budgeting, appraisal criteria.
<b>UNIT II</b>	<b>Financing system in India:</b> Financing system in India- money and capital markets, national, regional and global financial institutions; insurance; risk management; micro-credit.
<b>UNIT III</b>	<b>Project formulation:</b> Elements of project cycle: Identification, preparation, appraisal, financing and implementation of projects. Project Appraisal techniques: Undiscounted measures, ranking by inspection, pay-back period, average annual proceeds per unit of

	outlay, Time value of money
<b>UNIT IV</b>	<b>Project Evaluation:</b> Identification, preparation, appraisal, financing and implementation of projects. Project Appraisal technique- Undiscounted Measures. Time value of money, Use of discounted measures – B-C ratio, NPV and IRR. Agreements, supervision, monitoring and evaluation phases in appraising fisheries investment projects. Net worth Techniques–PERT and CPM.
<b>Practical</b>	Rural Lending Programmes of Commercial Banks, Lead Bank Scheme; Insight on District Credit Plan; Preparation of financial statements using farm/firm level data; Farm credit appraisal techniques and farm financial analysis through financial statements; Different case studies on fisheries cooperative societies in India; Visit to marine and inland cooperatives to analyse performance; Practical and Case studies: Ratio analysis, valuation of project inventories; Project appraisal techniques– undiscounted and discounted measures.

### e. Bachelor Programmes: B. F. Sc

Course No.	Title of the course offered by the department	Credits
EES 111	INFORMATION AND COMMUNICATION TECHNOLOGY	1+1=2
EES 112	ELEMENTS OF STATISTICS	0+1=1
EES 113	COMMUNICATION SKILLS AND PERSONALITY DEVELOPMENT	0+1=1
EES 124	FISHERIES BUSINESS MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT	1+0=1
EES 125	FISHERIES EXTENSION EDUCATION	2+1=3
MAT 231	MATHEMATICS	1+1=2
EES 236	FISHERIES ECONOMICS	2+1=3
EES 247	STATISTICAL METHODS	1+1=2
EES 358	PROJECT FORMULATION AND FINANCE	1+1=2
EES 369	FISHERIES POLICY AND LAW	1+0=1
EES 3610	FISHERIES CO-OPERATIVES AND MARKETING	1+1=2

#### Course Curricula and syllabi of each subject:

EES 111	INFORMATION AND COMMUNICATION TECHNOLOGY	1 + 1 = 2
<b>Theory</b>		
1	IT and its importance, IT tools, IT-enabled services and their impact on society.	
2	Computer fundamentals; hardware and software; input and output devices.	
3	Word and character representation; features of machine language, assembly language, high-level language and their advantages and disadvantages.	
4	Principles of programming- algorithms and flowcharts.	
5 - 10	Operating systems (OS) - definition, basic concepts, introduction to WINDOWS and LINUX Operating Systems; Local area network (LAN), Wide area network(WAN), Internet and World Wide Web, HTML and IP	
11 - 12	Introduction to MS Office - Word, Excel, Power Point.	
13 - 14	Audio visual aids - definition, advantages, classification and choice of A.V aids; cone of experience and criteria for selection and evaluation of A.V aids; video conferencing.	
15 - 16	Communication process, Berlo's model, feedback and barriers to communication.	

<b>Practical</b>		
1	Exercises on binary number system.	
2	Algorithm and flow chart.	
3 - 7	MS Word; MS Excel; MS Power Point; Internet applications.	
8 - 9	Web browsing, Creation and operation of E-Mail account; Analysis of fisheries data using MS Excel.	
10	Handling of audio visual equipments-tape recorder.	
11	Public address system, overhead projector, LCD projector.	
12 - 13	Planning, preparation, presentation of posters, charts, overhead transparencies and slides.	
14 - 16	Organization of an audio visual programme; preparation and presentation of a radio script and T.V. talk.	
<b>EES 112</b>	<b>ELEMENTS OF STATISTICS</b>	<b>0 + 1 = 1</b>
<b>Practical</b>		
1 - 3	Basic concepts of population and sample, random sampling. Collection of data; census enumeration and sample surveys, their advantages and disadvantages. Preparation of interview schedules and questionnaires.	
4 - 5	Construction of frequency table; cumulative frequency table.	
6 - 8	Diagrammatic and graphical representation of data - bar diagrams, pie-diagram, histogram, frequency polygon, frequency curve and Ogive.	
9 - 10	Important measures of central tendency – different arithmetic means, medians and mode, relative merits and demerits of these measures.	
11 - 13	Important measures of dispersion - range, mean deviation, variance and standard deviation, relative merits and demerits of these measures.	
14 - 16	Relative measures of dispersion -coefficient of variation; Measures of skewness and kurtosis.	
<b>EES 113</b>	<b>COMMUNICATION SKILL AND PERSONALITY DEVELOPMENT</b>	<b>0+1 = 1</b>
<b>Practical</b>		
1	Structural and functional grammar; meaning and process of communication	
2 - 5	Functional communication, models, elements of communication; verbal and non-verbal communication; Listening, active listening and note taking; Writing skills, oral presentation skills	
6 - 8	Field diary and lab record; Indexing; Footnote and bibliographic procedures	
9 - 11	Reading and comprehension of general and technical articles; Précis writing; Summarizing, abstracting	
11 - 13	Individual and group presentations, impromptu presentation; Public speaking; Group discussion	
14 - 16	Organizing seminars and conferences; Communication process, Berlo's model, feedback and barriers to communication; Computer based communication aids.	
<b>EES 124</b>	<b>FISHERIES BUSINESS MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT</b>	<b>1 + 0 = 1</b>
<b>Theory</b>		
1	Concept of entrepreneurship; entrepreneurial and managerial characteristics; managing an enterprise; motivation and entrepreneurship development;	
2 - 3	Importance of planning, monitoring, evaluation and follow up; managing competition; entrepreneurship development programs; Generation, incubation and commercialization	



	of ideas and innovations. Government schemes and incentives for promotion of entrepreneurship.
4 - 6	Preparation of enterprise budget for integrated fish farming; Fiscal and monetary policies and its impact on entrepreneurship. Infrastructural and other financial requirements for fishery entrepreneurship; Government policy on Small and Medium Enterprises (SMEs) / SSIs. Venture capital. Contract farming and joint ventures, public-private partnerships.
7 - 8	Overview of fisheries inputs industry. Characteristics of Indian fisheries processing and export industry; Introduction to fish business management- Concept of management
9 - 10	Management process (planning, organising, staffing, leading and controlling); Organizational behaviour, human resource planning
11 - 12	New dimensions in fish business environment and policies; Accounting procedures of fish business entity.
13 - 14	Emerging trends in fish production; Processing, marketing and exports
15	Assessing overall business environment in the Indian economy. Overview of Indian social, political and economic systems and their decision making by individual entrepreneurs.
16	Globalisation and the emerging business /entrepreneurial environment. Social Responsibility of Business.
<b>EES 125</b>	<b>FISHERIES EXTENSION EDUCATION</b> <span style="float: right;"><b>2 + 1 = 3</b></span>
<b>Theory</b>	
1 - 2	Basic concepts in rural sociology and psychology and their relevance in fisheries extension; social change, social control, social problems and conflicts in fisheries; Gender issues in fisheries; theories of learning, learning experience, learning situation.
3 - 4	Rural urban difference; family group, community; structure and function of society; Social stratification, social interaction, social institutions, social system norms.
5 - 6	Introduction to extension education and fisheries extension - concepts, objectives; Principles of extension education and fisheries extension
7	Extension education, formal and informal education;
8	History and role of fisheries extension in fisheries development; Early extension efforts.
9 - 10	Fisheries extension methods- individual, group and mass contact methods and their effectiveness; Transfer of technology process
11	Important TOT programs in fisheries
12	Role of NGOs and SHGs in fisheries, fisheries co - management.
13 - 14	Adoption and diffusion of innovations, adoption and diffusion process; Adopter categories and barriers in diffusion of fisheries innovations.
15 - 16	Concepts of extension administration; Scope and Principles of extension administration
17 - 18	Organizational structure of fisheries extension systems. First line extension system; Extension programme planning - principles, steps in planning
19 - 21	Involvement of people in planning. Objectives of having a programme; Concept of need and need assessment; Importance of extension programme.
22 - 23	Characteristics of good programme. Participation of organization; Involvement of people in planning, Why programme fails?
24 - 25	Planning; definition, effective planning, levels of planning, elements of planning, contingency plan; Organizing; definition, effective organizing, line and staff functions, coordination
26 - 28	Input management and common mistakes in organizing; Training and education; Types of training; Current trends in training; Skill development training, Identification of training needs.

29 - 30	Community development programme objectives, principles and coordination; Training centers available in fisheries sector in India.
31 - 32	Participatory methods, team building, PRA/RRA, SSI, ranking; Diagramming, group discussion, participatory evaluation.
<b>Practical</b>	
1 -2	Collection of socio-economic data from fishing villages; Study of social issues/problems, stake holders analysis and needs assessment
3 - 5	Assessment of development needs of community; Role of formal and non - governmental organizations through stakeholder analysis; Case studies on social / gender issues
6 – 9	Social conflicts in fisheries; Case studies on extension programs and Success stories; Practical exercises on conducting fish farmers meet; Exercises in PRA/RRA
10 – 11	Identification of training needs of fishers; Preparation and evaluation of fisheries development programmes.
12 – 13	Case study of fishing villages; fish farms
14 – 16	Fisheries organization such as BFDA / FFDA; NGOs / state department of fisheries; Evaluation of ongoing fisheries development programmes.
<b>EES 227</b>	<b>FISHERIES ECONOMICS</b> <span style="float: right;"><b>2+1 = 3</b></span>
<b>Theory</b>	
1	Introduction to fisheries economics.
2	Basic economic terminologies - micro and macro-'economics, positive and normative economics, environmental economics, resource, scarcity, farm-firm relationships, production etc.
3	Contribution of fisheries sector to the economic development of the country.
4	Micro-economics: theories of demand, supply
5	Market - equilibrium price
6	Consumption, utility, consumer's surplus.
7	Elasticity -price, income, cross
8	Application of elasticity in fisheries managerial decision.
9	Farm production economics - production functions in capture
10	Farm production economics - production functions in culture fisheries.
11	Costs and returns - breakeven analysis of fish production system.
12	Concepts of externalities and social cost.
13	Factors of production
14	Marginal cost and return
15	Law of diminishing marginal return
16	Returns to scale.
17	Economies of scale and scope, revenue, profit maximization.
18	Measurement of technological change
19	Farm planning and budgeting. Significance or importance of marginal cost.
20	Introduction macroeconomics.
21	Introduction to GATT.
22	WTO. WTO Framework – Key Subjects
23	Agreement on Sanitary and Phytosanitary Measures (SPS)
24	Seafood Export Regulations;
25	Non-Tariff Barriers (NTBs)
26	Agreement on Anti-Dumping Procedures.
27	Fisheries Subsidies and WTO

28	Fisheries Trade and Environment
29	Protests against globalization and WTO
30	Protests against globalization and WTO
31	Overview of Patents in Indian fisheries sector.
32	Overview of Patents in Indian fisheries sector.
<b>Practical</b>	
1	Demand and supply functions of fish market
2	Determination of equilibrium price for fish and fisheries products.
3	Calculation of price, income
4	Calculation of cross elasticity's
5	Production function - production with one or two variable inputs.
6	Production function - production with one or two variable inputs.
7	Shifting demand and its importance in fish price.
8	Surplus curve and its importance in fish price.
9	Economic analysis on cost, return and breakeven of fish farm
10	Economic analysis on cost, return and breakeven of fish farm
11	Economic analysis on cost, return and breakeven of shrimp farm
12	Economic analysis on cost, return and breakeven of shrimp farm
13	Economic analysis on cost, return and breakeven of seed production unit
14	Economic analysis on cost, return and breakeven of seed production unit
15	Economic analysis on cost, return and breakeven of fish processing plant
16	Economic analysis on cost, return and breakeven of export unit.
<b>MAT 236</b>	<b>MATHEMATICS (Deficiency course) <span style="float: right;">1 + 1 = 2</span></b>
<b>Theory</b>	
1	Definition of quadratic equation, Method of perfect square (Statement only) for solving quadratic equation, Nature of roots, sum and product of roots
2	Definition of logarithm, laws of logarithm(statement only)
3	Definition of second order and third order determinates (statements) minors, Expansion of determinant, Elementary properties of determinant(statement only)
4	Co-ordinate axes, origin quadrants, Distance between two point of rectangular axes, section formulae (statement)
5	Definition of locus, equation to locus, equation to axes and straight line parallel to axes statements of equations, straight line having slope intercept form, Statements of equation , only of St. line passing through two points form two general equation angle between two straight lines (formula)
6	Define angle of elevation and angle of depression with examples
7	Definition of circle, radius, centre, Equation to circle centre and radius form, general equation, its radius and centre (formulae only)
8	Ordinates and common distance between them.
9	Simpson's rule statement and its application for measuring areas of irregular field and other illustrations
10	Definition of function, different types of function,. Viz Algebraic, logarithmic, trigonometric, Inverse Exponential (illustrations only)
11	Definition of limits and continuity, theorems and standard limits (only statement)
12	Definition of differentiation, list of standard formulae
13	Theorems of differentiation, Composite functions and chain rule
14	Definition of Integral of a function, Integrand, process of integration.,
15	Constant of integration, Integration as inverse process of differentiation, illustration by

	list of simple examples	
16	Definition of definite integral, Integration by decomposition method	
<b>Practical</b>		
1	Exercise on quadratic equation	
2	Exercise on Logarithm	
3	Exercise on Determinants	
4	Exercise on Point	
5	Exercise on Distance between two points	
6	Exercise on section formulae	
7	Exercise on Locus of a point	
8	Exercise on different forms of straight lines	
9	Exercise on Trigonometry	
10	Exercise on circle	
11	Exercise on Mensuration	
12	Exercise on Function limit	
13	Exercise on Differential calculus	
14	Exercise on theorems of differentiation'	
15	Concept of indefinite integral	
16	Exercise on Integral calculus	
<b>EES 247</b>	<b>STATISTICAL METHODS</b>	<b>1 + 1 = 2</b>
Lectures	<b><i>THEORY :</i></b>	
1 - 2	Definitions of probability, mutually exclusive and independent events, conditional probability, addition and multiplication theorems.	
3 - 6	Random variable, concepts of theoretical distribution; Binomial, Poisson and Normal distributions and their use in fisheries.	
7	Basic concept of sampling distribution; standard error and central limit theorem.	
8	Introduction to statistical inference, general principles of testing of hypothesis - types of errors	
9 - 11	Tests of significance based on normal, t, chi-square and F distributions.	
12 - 14	Bivariate data, scatter diagram, simple linear correlation, measure and properties; simple linear regression, equation and fitting;	
15 - 16	Linear and non-linear regression, equation and fitting; Relation between correlation and regression.	
<b>Practical</b>		
1 - 2	Exercises on probability; Conditional probability	
3 - 7	Additional and multiplication theorem; Binomial distributions; Poisson distributions; Normal distributions; Area of normal curve	
8 - 12	Confidence interval for population mean; Central limit theorem; Test of hypothesis based on normal; Test of hypothesis t; Test of chi-square.	
13 - 16	Test of F distributions; Test of Z distributions; Computation of regression; Computation of regression.	
<b>EES 358</b>	<b>PROJECT FORMULATION AND FINANCE</b>	<b>1 + 1 = 2</b>
<b>Theory</b>		
1	Finance: meaning, sources, types. Financial management	
2	Fiscal and monetary policies and its impact on entrepreneurship.	
3	Infrastructural and other financial requirement for fishery entrepreneurship.	

4	Venture capital. Contract farming and joint ventures,.
5	public-private partnerships
6	Introduction to project and fisheries projects.
7	Relationship between projects and plans.
8	Project planning. Stages of project planning.
9	Project formulation. Stages of project formulation.
10	Financial and economic aspects of projects
11	Feasibility analysis – undiscounted measures of project worth.
12	Discounted measures–discounted pay back period, derivation of incremental net benefit, net present worth, BC ratio, IRR, net benefit investment ratio, project alternatives, risk and uncertainties, sensitivity analysis
13	Farm planning, budgeting – complete and partial budgeting
14	Farm business analysis and appraisal techniques – ratio analysis, asset valuation and depreciation
15	Financial analysis-balance sheet, cash flow analysis, profit loss statements
16	Guidelines for project preparation report – objective, rational, area, organization, production, markets and financial results, benefits.
<b>Practical</b>	
1	Traditional methods of appraising Capital expenditure Proposals
2	Exercises on Time value of money
3	Discounted techniques of appraising capital expenditure proposals
4	Depreciation – How to calculate it?
5	Exercise on Loan amortization schedule
6	Exercise on Equated Monthly installment: (EMI):
7	Ratio analysis
8	Appraisal of Investment proposal on open sea cage culture
9	Appraisal of Investment proposal on fish processing industry
10	Appraisal of Investment proposal on Composite fish culture
14	Appraisal of Investment proposal on fish meal plant- wet rendering process
15	Appraisal of Investment proposal on Shrimp Hatchery
16	Appraisal of recent government schemes for financial assistance and welfare of fishers.
<b>EES 369</b>	<b>FISHERIES POLICY AND LAW</b> <span style="float: right;"><b>1 + 0 = 1</b></span>
<b>Theory</b>	
1	Introduction to public administration.
3	Central and State responsibilities for fisheries development,
4	Organizational set up of fisheries administration at the Centre
5	Organizational set up of fisheries administration at the state levels.
6	Functions and powers of functionaries of department of fisheries, corporations and cooperatives
7	Role of Central and State Government in the regulatory activities of Aquaculture and fisheries.
8	International agencies / organizations for promotion of fisheries worldwide
9	Fisheries legislation: Overview of fisheries and aquaculture legislations in India.
10	Overview of aquaculture legislations in India.
11	Indian Fisheries Act, 1897.
12	UNCLOS
13	Objectives, functions and authority of fishery regulatory agencies like Coastal Regulatory Zone (CRZ) and Aquaculture Authority of India.

14	Aquaculture Authority of India.
15	Laws related to Brackish water aquaculture.
16	Marine fisheries policy. International commissions on fisheries and their impact.
<b>EES 3610</b>	<b>FISHERIES CO-OPERATIVE AND MARKETING</b> <b>1 + 1 = 2</b>
<b>Theory</b>	
1	Principles and objectives of co-operation, co-operative movement in fisheries in India.
2	Structure, functions, status and problems of fisheries co-operatives management in relation to resources, production and marketing.
3	Role of credit for fisheries development, credit requirements of fishers, source and type of credit/finance. Introduction to marketing management; core marketing concepts:
4	market structure, functions and types, marketing channels and supply chain, marketing margins, marketing environment, marketing strategies,
5	Product development and product mix,.
6	consumer behavior and marketing research
7	Fish markets and marketing in India
8	Demand and supply of fish
9	Market structure and price formation in marine and inland fish markets;;
10	Cold storage and other marketing infrastructure in India
11	export markets and marketing of fish and fishery products;
12	Trade liberalization and fisheries markets.
13	Integrated marketing approach in fisheries.
14	Sea food export case study on product and market diversification- export and import policies (fisheries).
15	New product development and market segmentation.
16	Export and import policies relevant to fisheries sector.
<b>Practical</b>	
1	Developing questionnaire and conducting market surveys
2	Fish retail market
3	Fish wholesale market
4	Fish retailers/wholesalers/commission agent/auctioneer
5	Analysis of primary and secondary market data.
6	Visit to co-operative societies
7	Commercial banks and fish markets dealing with marketing of fish and fishery products
8	Organizations dealing with marketing of fish and fishery products
9	Exercises on equilibrium price for fish and fishery products.
10	Analysis of price-spread.
11	Estimation of demand and supply using simple regression.
12	Analysis of credit schemes of banks and the government.
13	Case studies of cooperatives.
14	Pattern and Performance of India's Seafood Exports
15	Case studies on product and market diversification.
16	Case studies on competitiveness of Indian fish and fish products.

#### 4. Infrastructure

**a. Laboratories: Computer Laboratory**


**b. Name of the important instruments/facilities:**


Computer laboratory with 12 Desktop computers. SMART classroom

**c. Activities:** Conducting UG and PG practical on Information and communication Technology, Computer Programming etc. Analysis of data of PG students with software such as SYSTAT, SAS, SPSS.


#### 5. Faculty


**Academic staff:**

	Name of the Faculty	<b>Dr. Ketankumar Jagannath Chaudhari</b>
	Post Held	Professor and I/c Head
	Date of Birth	08 <sup>th</sup> July 1967
	Qualification	Ph.D. (Aquaculture)
	Area of Specialization	<ul style="list-style-type: none"><li>• Fisheries Economics</li><li>• Extension Education</li></ul>
	Experience (Years)	28 years
	Research Projects guided PhD M.F. Sc.	As Major Advisor: 10 ; As Advisory committee member : 15
	Present area of research	<ul style="list-style-type: none"><li>• Aquaculture Economics</li><li>• Fisheries Economics</li><li>• Fisheries Extension</li></ul>
Contact details		
Land line No.	02352 232241 (office)	
Mobile	09422441178	
Fax	02352 232987 (office)	
Email	<a href="mailto:chaudhari.ketan@gmail.com">chaudhari.ketan@gmail.com</a>	


	Name of the Faculty	<b>Dr. Suhas Mahadeo Wasave</b>
	Post Held	Associate Professor (CAS)
	Date of Birth	11/06/1975
	Qualification	Ph.D. (Fisheries Extension)
	Area of Specialization	<ul style="list-style-type: none"> <li>• Fisheries Extension</li> <li>• Fisheries Economics</li> </ul>
	Experience (Years)	19 years
	Research Projects guided PhD M.F. Sc.	As Major Advisor: 04 ; As Advisory committee member : 15
	Present area of research	<ul style="list-style-type: none"> <li>• Fisheries Marketing</li> <li>• Fisheries Cooperatives</li> <li>• Fisheries extension</li> </ul>
Contact details Land line No. Mobile Fax Email	02352 232241 (office) 9421138383 02352 232987 (office) suhaswasave@gmail.com	
Awards	<ul style="list-style-type: none"> <li>• <b>“Best Oral Presentation”</b> award under the theme “Synergizing ITK and Modern Approaches for Transfer of Technology” in First National Convention of ISASaT on “Emerging Trends in Agricultural and Allied Sciences” organized by Dr. BSKKV, Dapoli during 16<sup>th</sup> – 18<sup>th</sup> March, 2017.</li> <li>• <b>“Best Poster Presentation”</b> award under the theme in Socio-Economics and Livelihood (SEL) - Fisheries Extension and Capacity Building (ECB) of International Conference on Challenges and Opportunities for Sustainable Fisheries and Aquaculture Development (COSFAD 2019) held at COF, Ratnagiri during 17<sup>th</sup> – 20<sup>th</sup> January, 2019.</li> <li>• <b>Second Rank</b> in the <b>National PowerPoint Presentation Competition – 2020</b> organized by Department of Agricultural Engineering, College of Agriculture, Dr. BSKKV, Dapoli during August 2020.</li> <li>• <b>Best Fisheries Extension Scientist Award 2021</b> – Society of Fisheries and Life Sciences, College of Fisheries, Mangaluru, Karnataka, India. (08/08/2021)</li> <li>• <b>Best Teacher Award 2021</b> – Lions Club of Ratnagiri (05/09/2021)</li> </ul>	



	Name of the Faculty	<b>Dr. Bharat Mahadev Yadav</b>
	Post Held	Associate Professor (CAS)
	Date of Birth	01-01-1977
	Qualification	Ph.D. (Fisheries Extension)
	Area of Specialization	<ul style="list-style-type: none"> <li>• Fisheries Extension</li> <li>• Fisheries Economics</li> <li>• Fisheries Statistics</li> </ul>
	Experience (Years)	17 years
	Research Projects guided PhD M.F. Sc.	As Major Advisor: 02 ; As Advisory committee member : 13
	Present area of research	Fisheries extension
Contact details Land line No. Mobile Fax Email	02352 232241 (office) 7028466783 02352 232987 (office) cpbharat@gmail.com	
Award:	<b>Best Scientist Award – 2022, Society of Fisheries and Life Sciences, College of Fisheries, Mangaluru, Karnataka, India.</b>	

	Name of the Faculty	<b>Dr. Sandesh Vitthal Patil</b>
	Post Held	Associate Professor (CAS)
	Date of Birth	17/11/1977
	Qualification	M. F. Sc. (Aquaculture) Ph.D. (Fisheries Extension)
	Area of Specialization	Fisheries Extension Fisheries Economics Aquaculture
	Experience (Years)	17 years
	Research Projects guided PhD M.F. Sc.	As Major Advisor: 02 As Advisory committee member: 04
	Present area of research	Fisheries Extension Fisheries Economics Aquaculture
Contact details Land line No. Mobile Fax Email	02352 232241 (office)  02352 232987 (office) sandeshpatil17@gmail.com	
Awards:	<ul style="list-style-type: none"> <li>• <b>Best Oral Presentation award in National Seminar on “Empowerment of Rural Communities Through Aquaculture”</b> organized by College of Fisheries Dr. BSKKV, Dapoli Ratnagiri during 9<sup>th</sup> - 10<sup>th</sup> February, <b>2018</b>.</li> </ul>	

	<ul style="list-style-type: none"> <li>• <b>Best Oral Presentation award in National Conference of Maharashtra Society of Agricultural Economics</b> held at Dr. BSKKV, Dapoli, Ratnagiri during 13<sup>th</sup> -14<sup>th</sup> February, 2021.</li> <li>• <b>Prof Ravindranath Krothapalli International Travel Award</b> 2017-18 from ICAR-CIFE, Mumbai.</li> <li>• <b>Best Article of the Month Award</b> from Vigyan Varta- An International e Magazine for Science Enthusiasts, Odisha.</li> <li>• <b>Young Scientist Award in Fisheries Science</b> from Vigyan Varta- An International e Magazine for Science Enthusiasts, Odisha.</li> <li>• <b>Adarsh Vidya Saraswati Rashtriya Puraskar (National Award of Excellence)</b> from Global Management Council, Ahmedabad, Gujarat</li> <li>• <b>Dr. C. V. Kulkarni Gold Medal Best PhD Student Research Award-2020-21</b> from ICAR-CIFE, Mumbai.</li> <li>• <b>Dr. Rajendra Prasad Excellence Scientist Award-2021</b> from Society of Tropical Agriculture.</li> <li>• <b>Best Extension Scientist Award-2022</b> from Society of Fisheries and Life Sciences, Mangalore, Karnataka.</li> <li>• <b>Outstanding Faculty in Fisheries Extension Award-2022</b> from Venus International Foundation, Chennai.</li> <li>• <b>Young Researcher Award-2022</b> from Institute of Scholars (InSc), Bengaluru, Karnataka.</li> </ul>
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	Name of the Faculty	<b>Shri. Bhalchandra Vilas Naik</b>
	Post Held	Assistant Professor
	Date of Birth	25/12/1978
	Qualification	M. F. Sc. (Fisheries Extension)
	Area of Specialization	<ul style="list-style-type: none"> <li>• Fisheries Extension</li> <li>• Fisheries Economics</li> </ul>
	Experience (Years)	As a Senior Technical Assistant (9 years 8 months and 9 days) As an Assistant professor (1 Year 8 months)
	Research Projects guided PhD M.F. Sc.	As Major Advisor: Nil As Advisory committee member : Nil
	Present area of research	<ul style="list-style-type: none"> <li>• Fisheries Extension</li> <li>• Fisheries Economics</li> </ul>
	Contact details Land line No. Mobile Fax Email	02352 232241 (office) 09405310069 02352 232987 (office) naikbv97@gmail.com

## B) RESEARCH:

### RESEARCH ACTIVITIES AND ACHIEVEMENTS

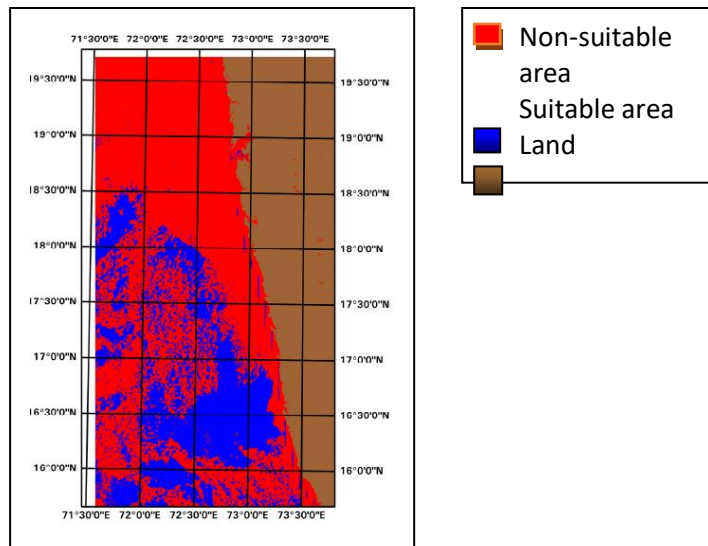
#### A) COMPLETED RESEARCH PROJECTS / PROGRAMMES / SCHEMES EXTERNALLY FUNDED PROJECTS:

<b>Title:</b>	<b>Identification of the potential sites for sea farming along the Maharashtra coast using Remote Sensing data</b>	
<b>Objectives:</b>	a) To study the temporal and spatial Sea Surface Temperature (SST) variation patterns b) To study the spatio-temporal variations in chlorophyll-a concentrations. c) To map the Suspended Sediments Concentrations (SSC) patterns d) To know the physical oceanographic features of the study area e) To develop a model based on above inputs using RS and GIS to identify potential sites for mariculture.	
<b>Name of PI/ Co-PI</b>	Dr. M. M. Shirdhankar Dr. S. V. Patil	
<b>Sponsoring Agency:</b>	Space Application Centre, Ahmadabad	
<b>Duration:</b>	2008-2012	
<b>Total Outlay:</b>	1.840/- (Rs. In Millions)	
<b>Summary of Achievements:</b>	Spatial and temporal <i>in situ</i> data of required parameter such as temperature (°C), Chlorophyll-a (mg/m <sup>3</sup> ), transparency (m), depth (m), salinity (ppt), pH and current speed (m/sec) were recorded all along 720 km long coastline of Maharashtra during the four years period of project . Local Area Coverage (LAC) finished product of chlorophyll-a, suspended solid concentration and transparency (inverse of attenuation coefficient) with a resolution of 360 m of sensor OCM of Oceansat-II satellite recorded during the period of sampling were procured and processed to be input for the model development. Similarly, radiance recorded by AVHRR data of NOAA-19 was converted to Sea Surface Temperature in degree Celsius and further 1.1 sq km resolution images were converted to 360 m resolution. All the imagery processed for chlorophyll-a, suspended solid concentration and transparency (inverse of attenuation coefficient) of OCM of Oceansat-II as well as of Sea Surface temperature derived from AVHRR data of NOAA-19 of various months were averaged over a period for its respective pixel value. Mean Images of average values of chlorophyll-a, suspended solid concentration, transparency (inverse of attenuation coefficient), Sea Surface Temperature and surface generated of depth were	

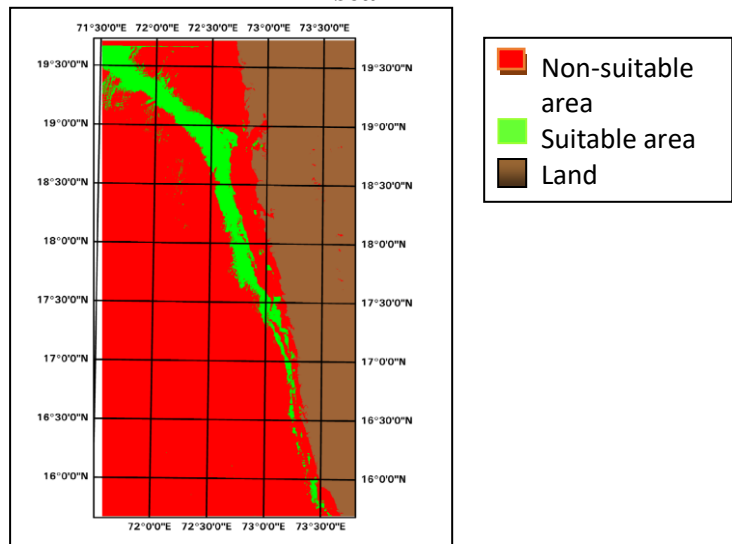
used to as input to model to generate maps of indentified sites for sea farming. Thematic maps were developed on the basis of special descriptive scoring developed for each parameter under study. Further these thematic maps were merged together after taking weighed mean to generate single image to identify potential sites each for culture of phytoplanktonivore filter feeding bivalve and for carnivore fish. Land was masked and further sites were classified as suitable and non-suitable for culture of phytoplanktonivore filter feeding bivalve and for carnivore fish by using threshold value. Subset for each districts were taken from the final image generated after classification.

Relevant Photographs:



**Map 1. Identified sites for culture of finfish in open**

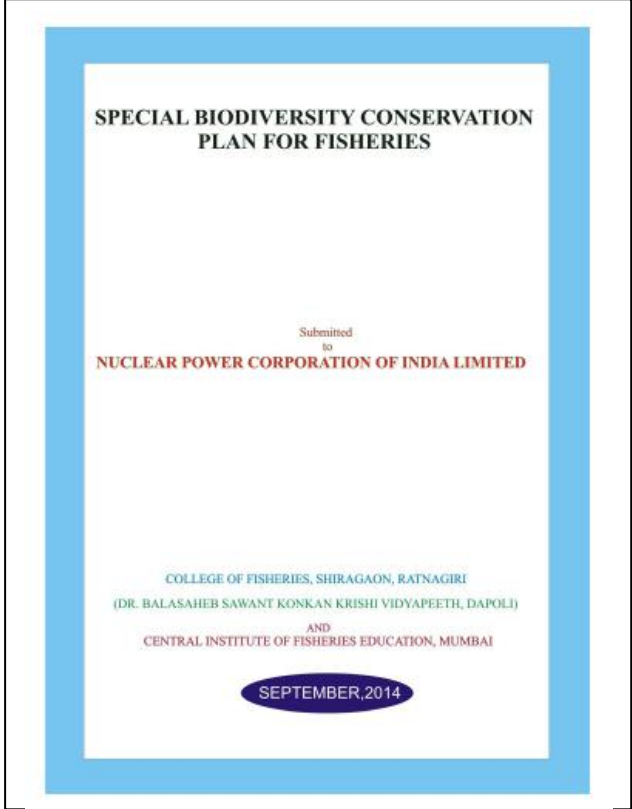


**Map 2. Identified sites for culture of bivalve in open sea**



<b>Title:</b>	<b>Euphotic zone production estimation using satellite data as an input to assess potential yield of pelagic herbivores in the Indian EEZ</b>	
Objectives:	<ol style="list-style-type: none"> <li>1) Recording of fish catch statistics of pelagic herbivores (Sardines/other clupeids) to estimate stock density.</li> <li>2) Gut content analysis and recording of other biological parameters of selected species as well as environmental parameters like temperature, salinity, pH and dissolved oxygen.</li> <li>3) To perform qualitative and quantitative analysis of <i>in-situ</i> phytoplankton.</li> <li>4) Gut content analysis and relationship of food composition with different year-class to determine food selectivity.</li> <li>5) Recording of biological parameters of fish such as length, weight, age structure of population, Gonado-Somatic Index (GSI) etc.</li> <li>6) Establishment of relationship between primary production – fish stock.</li> </ol>	
Name of PI/ Co-PI	Dr. M. M. Shirdhankar Dr. B. M. Yadav	
Sponsoring Agency:	Space Application Centre, Ahmadabad	
Duration:	2008-2012	
Total Outlay:	2.580/- (Rs. In Millions)	
Summary of Achievements:	<ol style="list-style-type: none"> <li>1. Most of the time the sardine shoals were observed in the area with salinity more than 34.0 ppt and less than 35.0 ppt with temperature range of 24.1 to 30°C and in the depth range of 3.10 to 18 m.</li> <li>2. Transparency of sardine occurring water was in the range of 30 to 480 cm, while pH values of water varied between 7.90 to 8.3.</li> <li>3. Dissolved oxygen values in sardine residing areas were in the range of 1.10 to 4.98 ppm, while net primary productivity was 21.09 to 156.25 mg C/m<sup>3</sup>/hour estimated by light and dark bottle method.</li> <li>4. Purse seine and ring seine fished sardine in length range of 8.0 to 21.6 cm and with weight range of 6.2 to 71.33 g</li> <li>5. Higher gonad weights Gonado Somatic Indices were recorded during the month of October and December indicating commencement of breeding season.</li> <li>6. Sardine fishery throughout year mainly consist of zero age year class whereas, second year age class was seen in fishery during months of October, December as well as March and first year age class was seen only in the month of March.</li> <li>7. Major varieties of phytoplankton observed in gut</li> </ol>	

	<p>content of sardine were <i>Coscinodiscus</i>, <i>Rhizosolenia</i>, <i>Chaetoceros</i>, <i>Biddulphia</i>, <i>Ceratium</i> and <i>Eucampia</i> as well in the surrounding water from where the sardines samples were collected.</p> <p>8. Organic carbon content of fish body varied between 36.96 to 37.20% on dry weight basis.</p> <p>9. Sardine catch fished in terms of weight per haul at sampling station and amount of Chlorophyll-a concentration recoded in water sample of that region did not show any trend.</p> <p>10. Catchability coefficient is the efficiency of purse seine of ring seine to catch fish was estimated at 0.2811.</p> <p>11. Ecological efficiency estimated was 0.0912 i. e. 9.12%.</p>	
<p>Relevant Photographs:</p>	<div data-bbox="724 763 1259 1088" style="text-align: center;">  <p><b>Photo 1. Ring-seine</b></p> </div> <div data-bbox="724 1173 1265 1480" style="text-align: center;">  <p><b>Photo 2 Purse-seine</b></p> </div>	
<p><b>Title:</b></p>	<p><b>Consultancy service contract for conducting co-ordinated studies and development of Biodiversity conservation plan (Coastal microbiology and flora and fauna of freshwater) for the region around Jaitapur Nuclear Power Park, Dist. Ratnagiri, Maharashtra</b></p>	
<p><b>Objectives:</b></p>	<ul style="list-style-type: none"> <li>• To assess and prepare the database of the coastal microbes.</li> <li>• To assess the seasonal variations in marine plankton composition &amp; productivity in relation to water quality.</li> <li>• To map the bottom trawling and traditional fishing grounds.</li> <li>• To evolve conservation plan for the finfish and shell</li> </ul>	

	fish resources.	
Name of PI/ Co-PI	Dr. M. M. Shirdhankar Dr. K. J. Chaudhari	
Sponsoring Agency:	NPCIL	
Duration:	2012-14	
Total Outlay:	7.446/- (Rs. In Millions)	
Summary of Achievements:	Special Biodiversity Conservation Plan for Fisheries was prepared and submitted	
Relevant Photographs:		

<b>Title:</b>	<b>Open sea cage culture at Ratnagiri</b>	
Objectives:	To demonstrate the open sea cage culture along the coast of Maharashtra	
Name of PI/ Co-PI	Dr. M. M. Shirdhankar Dr. Hukam Singh Dr. K. J. Chaudhari Dr. S. V. Patil Dr. B. M. Yadav Shri. N. D. Chogale Shri. Ravindra Bondre	
Sponsoring Agency:	In Collaboration with MFDC, Mumbai	
Duration:	2012-14	
Total Outlay:	10.010/- (Rs. In Millions)	
Summary of Achievements:	Demonstrated the open sea cage culture of Asian sea Bass and Cobia	

Relevant Photographs:	 <p data-bbox="695 719 1326 748">Photo : Circular cages with single mooring point</p>	

<b>Title:</b>	<b>Capacity building of local fisher community in sustainable fishing practices along the coast of Sindhudurg district, Maharashtra state, India." UNDP funded project</b>	
Objectives:	<ol style="list-style-type: none"> <li>1. To generate awareness among the fisher community belonging to 30 fisher's co-operative societies in the Sindhudurg district with respect to CCRF (Code of Conduct for Responsible Fishing), EAF (Ecosystem-based Approach to Fisheries) and MMFRA (Maharashtra Marine Fishing Regulation Act) through training programmes.</li> <li>2. To gauge the fisher's receptiveness of the implementation of CCRF, EAF and MMFRA.</li> <li>3. Suggest measures to improve the situation with respect to acceptability and implementation of CCRF, EAF and MMFRA</li> </ol>	
Name of PI/ Co-PI	Dr. M. M. Shirdhankar Dr. K. J. Chaudhari Dr. N. H. Sawant Dr. R. A. Pawar Dr. S. V. Patil	
Sponsoring Agency:	UNDP through Chief Conservator of Forest, GoM	
Duration:	2014-16	
Total Outlay:	1.460/- (Rs. In Millions)	
Summary of Achievements:	<ol style="list-style-type: none"> <li>1. Training manual in Marathi and English entitled "Capacity building of local fisher community in sustainable fishing practices along the coast of Sindhudurg district, Maharashtra state, India" were printed, distributed and used in knowledge assessment.</li> <li>2. Thirty training programmes in three blocks viz. Malvan (14), Vengurla (10) and Devgad (6) were conducted.</li> <li>3. Altogether 1,282 fishers were trained (749 male and 543 female).</li> </ol>	



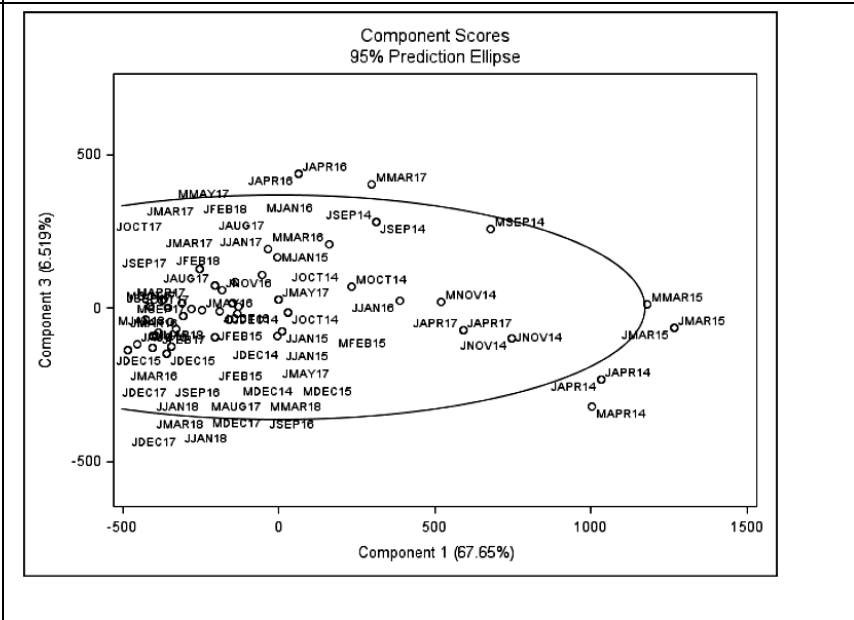
	<p>4. Knowledge gain of fisher was assessed through pre and post test. Average total knowledge gain observed was 19.34%, while knowledge gain of CCRF, EAF, Sustainable Fisheries and MMFRA was 19.73, 20.66, 18.80 and 18.94%, respectively.</p> <p>5. Content analysis was performed of suggestion given by fisher to understand the views of fisher towards the Sustainable Fisheries.</p>	
<p>Relevant Photographs:</p>	<div data-bbox="715 499 1233 837" style="text-align: center;"> </div> <p style="text-align: center;"><b>Photo 1 Release of course manual on sustainable fisheries</b></p> <div data-bbox="715 943 1249 1290" style="text-align: center;"> </div> <p style="text-align: center;"><b>Photo 2 Training programme</b></p>	

<p><b>Title:</b></p>	<p><b>Modeling bio-geochemical Cycles in Coastal Oceans</b></p>
<p>Objectives:</p>	<p>To study the carbon pools (organic carbon components), fluxes (the rates of primary, new and export production) and organic nitrogen components involved in the biogeochemistry of coastal oceans around Indian subcontinent using satellite data.</p>
<p>Name of PI/ Co-PI</p>	<p>Dr. M. M. Shirdhankar Dr. S. V. Patil Dr. S. M. Wasave</p>
<p>Sponsoring Agency:</p>	<p>Space Application Centre, Ahmadabad</p>
<p>Duration:</p>	<p>2013-17</p>
<p>Total Outlay:</p>	<p>3.445/- (Rs. In Millions)</p>
<p>Summary of Achievements:</p>	<p>The relationships between the various parameter such as temperature, pH, salinity transparency, dissolved oxygen, nitrate, nitrite, phosphate, silicate, chlorophyll-a, phytoplankton and zooplankton were established at various depth as 10m, 15m, 20m and 25m. Most of the relationships in 10m depth were plosive except the relationship of phytoplankton with</p>


nitrate and phytoplankton with Phosphate. It clearly indicated that the phytoplankton cell number decreased as the nitrate and phosphate level decrease. In 15 m depth zone the phytoplankton production was restricted by availability of nitrate and phosphate, while the zooplankton reduced in relation to phosphate availability. Thus, the phosphate availability restricted the phytoplankton production and the phytoplankton availability reduced zooplankton. In 20 m depth zone Phytoplankton showed a negative relationship with nitrate and nitrite. while Chlorophyll-a levels decreased with increase in silicate and phosphate levels. In 25 m depth zone relationship between Phytoplankton on Phosphate, Silicate on pH and Dissolved Oxygen on pH were negative, while rest all the relationships were positive.

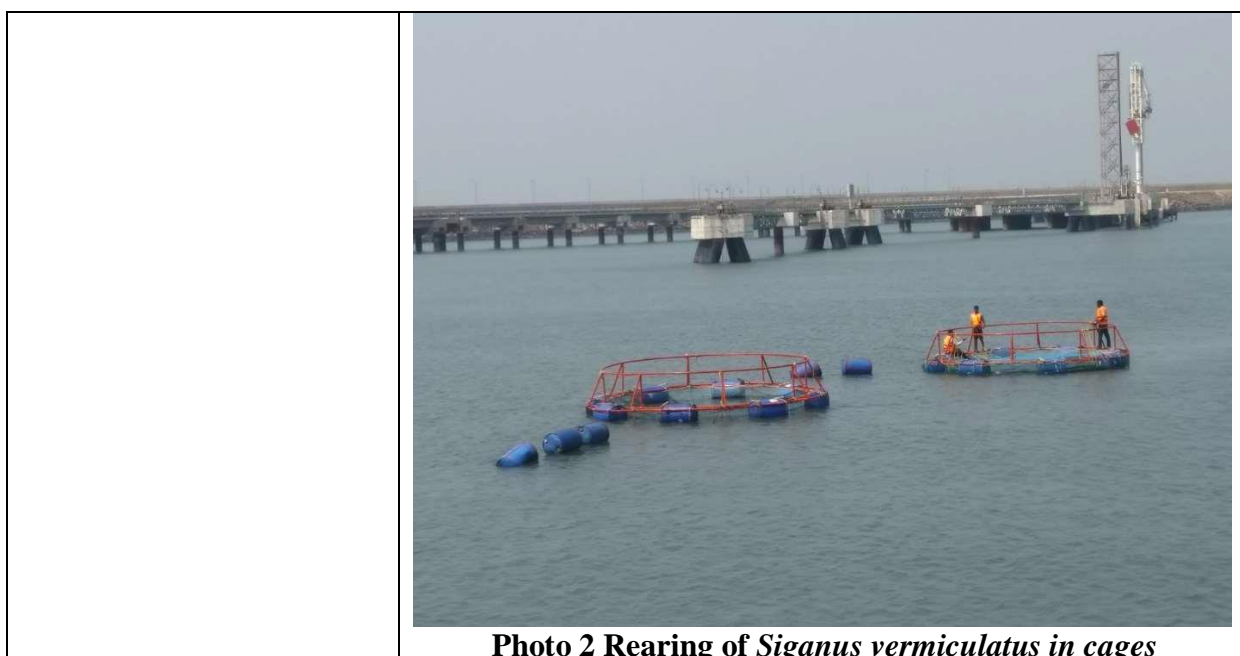
Principal Component Analysis (PCA) showed that the water parameters of May 17 (Malvan), April 16 (Jaigad), March 17 (Malvan), March 16 (Malvan), March 16 (Jaigad), April 14 (Jaigad), April 14 (Malvan), March 18 (Jaigad), December 17 (Jaigad), and December 17 (Malvan) were different from all other observation and at these locations in respective period occurrence of HAB in the near coastal waters were recorded.

Relevant Photographs:





<b>Title:</b>	<b>Development of brood stock of Silver pomfret (<i>Pampus argenteus</i>, Euphrasen, 1788) and rabbit fish (<i>Siganus vermiculatus</i>, Valenciennes, 1835)</b>
<b>Objectives:</b>	<ul style="list-style-type: none"> <li>➤ To develop brood stock</li> <li>➤ Seed survey for grow out culture technology</li> </ul>
<b>Name of PI/ Co-PI</b>	Dr. Hukam Singh Dr. M. M. Shirdhankar Dr. S. V. Patil Dr. D. I. Pathan

Sponsoring Agency:	AINP-Mariculture ICAR, New Delhi
Duration:	2015-2017
Total Outlay:	8.350/- (Rs. In Millions)
Summary of Achievements:	<ol style="list-style-type: none"> <li>1. Seed calendar for Ratnagiri and Sindhudurg district was developed as reference document</li> <li>2. <i>Siganus vermiculatus</i> is herbivorous fish mainly feeds on seaweed initially and on algae in latter phases of life. Majority of matured fish occurred with empty stomachs or with little food during active spawning.</li> <li>3. The highest monthly GSI was observed during month of February and March for Female and December to March for Male. Sex ratio of Males and Females was significantly different and number females were always more than the male throughout the year. The length at first maturity of male and female was estimated to be 30.73 cm and 33.08 cm respectively. <i>Siganus vermiculatus</i> was with high fecundity and fecundity ranged between 6.8 to 12.5 lakh eggs.</li> <li>4. The brood stock of <i>Siganus vermiculatus</i> can be reared in cages in pond, circular cages in open sea as well as in Recirculatory Aquaculture System with 42% protein incorporated feed.</li> </ol>
Relevant Photographs:	 <p><b>Photo 1 Matured <i>Siganus vermiculatus</i> female</b></p>



**Photo 2 Rearing of *Siganus vermiculatus* in cages**

<b>Title:</b>	<b>Strengthening of Fisheries Extension by Establishment of Fisheries Training cum Information Technology Centre at College of Fisheries, Shirgaon, Ratnagiri, Maharashtra</b>
<b>Objectives:</b>	<ul style="list-style-type: none"> <li>• To impart training to the fishermen and fish farmers.</li> <li>• To demonstrate the different recent technologies to the fishermen and fish farmers.</li> <li>• To create a strong linkage between different colleges, research divisions / units and users of the technology i. e. fishermen and fish farmers and entrepreneurs.</li> <li>• To create awareness among fisherman about Responsible Code of Conduct.</li> </ul>
<b>Name of PI/ Co-PI</b>	Dr. M. M. Shirdhankar Dr. B. M. Yadav Dr. K. J. Chaudhari Dr. S. V. Patil Dr. S. M. Wasave
<b>Sponsoring Agency:</b>	RKVY, Govt of Maharashtra
<b>Duration:</b>	2014-18
<b>Total Outlay:</b>	36.045/- (Rs. In Millions)
<b>Summary of Achievements:</b>	<ol style="list-style-type: none"> <li>1. Classroom</li> <li>2. Information and communication Technology laboratory</li> <li>3. Fish processing laboratory</li> <li>4. Wet laboratory</li> <li>5. Conference room</li> <li>6. Staff rooms &amp; Trainees room, 10 nos.</li> <li>7. Trainer's room, 2 nos.</li> <li>8. Kitchen and dining</li> </ol>

Relevant Photographs:	 <p style="text-align: center;"><b>Photo 1 RKVY building</b></p>  <p style="text-align: center;"><b>Photo 2 Training Room</b></p>
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**B) ON GOING PROJECTS / SCHEMES:  
EXTERNALLY FUNDED PROJECTS:**

<b>Title:</b>	<b>Demonstration of fisheries and aquaculture based interventions for livelihood and empowerment of fisherwomen in Konkan region of Maharashtra with an approach of entrepreneurship development</b>
Objectives:	<ul style="list-style-type: none"> <li>➤ To undertake awareness and training activities on ornamental fish culture and carp farming in community pond with integrated farming, value addition and product development through participatory approach.</li> <li>➤ To develop entrepreneurial skill among the selected women SHGs.</li> <li>➤ To extend benefits to 300 direct beneficiaries through SHG approach and 1000 participants through awareness programmes.</li> </ul>
Name of PI/ Co-PI	Dr. B. M. Yadav Dr. S. T. Indulkar, Dr. R. M. Tibile & Shri. S. T. Sharandhar
Sponsoring Agency:	Department of Biotechnology (DBT)
Duration:	2019-2022
Total Outlay:	Rs. 39.83 lakhs

<b>Title:</b>	<b>Rehabilitation of marine fishers through alternative livelihood options</b>
<b>Objectives:</b>	<ul style="list-style-type: none"> <li>➤ Identification of skill enhancement programs for the fishers on the basis of livelihood capitals</li> <li>➤ Suggestion of Resource and finance specific alternative livelihood options</li> <li>➤ Sustainable livelihood framework comprising five capitals i.e. natural, physical, financial, human and social capital given by DFID will be used to study the livelihood of marine fishers in Maharashtra state.</li> <li>➤ Inputs for restructuring of schemes or else for the formulation of new policies.</li> </ul>
<b>Name of PI/ Co-PI</b>	Dr. B. M. Yadav Dr. S. V. Patil Dr. S. M. Wasave Dr. K. J. Chaudhari Dr. M. M. Shirdhankar
<b>Sponsoring Agency:</b>	Indian Council of Social Science Research (ICSSR), New Delhi
<b>Duration:</b>	2019-2021
<b>Total Outlay:</b>	Rs. 7.00 lakhs

### C) RESEARCH REVIEW COMMITTEE (RRC) PROJECTS:

<b>Sr. No.</b>	<b>Title of RRC/ University Project</b>	<b>Year</b>	<b>Name of Principal Investigator / Co- Principal Investigator</b>
	<b><i>Completed Institutional Projects</i></b>		
<b>1</b>	Indigenous Traditional Knowledge (ITK) among marine fishers of South coastal districts of Maharashtra with special reference to climate	2018-2020	Dr. S. M. Wasave Dr. M. M. Shirdhankar, Dr. K. J. Chaudhari Dr. B. M. Yadav, Dr. S. V. Patil
<b>2</b>	Risk perceptions and risk management strategies in shrimp aquaculture industry of Maharashtra	2014-2016	Dr. B. M. Yadav Dr. M. M. Shirdhankar, Dr. K. J. Chaudhari Dr. S. M. Wasave, Dr. S. V. Patil
<b>3</b>	Assessment of impact of ornamental fish culture training programmes in development of an enterprise	2012-2014	Dr. S. V. Patil Dr. M. M. Shirdhankar, Dr. K. J. Chaudhari Dr. S. M. Wasave, Dr. B. M. Yadav
<b>4</b>	An Appraisal of Marine Fisher's Cooperative Societies of Maharashtra	2010-12	Dr. S. M. Wasave Dr. M. M. Shirdhankar, Dr. K. J. Chaudhari Dr. B. M. Yadav, Dr. S. V. Patil
<b>5</b>	Assessment and prioritization of training needs of fishers of Ratnagiri tahsil	2006-08	Dr. M. M. Shirdhankar Dr. K. J. Chaudhari, Dr. S. M. Wasave Dr. B. M. Yadav, Dr. S. V. Patil
<b>6</b>	Participatory rural appraisal of selected villages of Ratnagiri block	2005-09	Dr. K. J. Chaudhari Dr. M. M. Shirdhankar, Dr. S. M. Wasave

			Dr. B. M. Yadav, Dr. S. V. Patil
7	Economic analysis of white legged shrimp <i>Litopenaeus vannamei</i> farming in Ratnagiri district, Maharashtra	2020-21	Dr. B. M. Yadav Dr. K. J. Chaudhari, Dr. S. M. Wasave Dr. S. V. Patil, Shri. B. V. Naik
8	Indigenous Traditional Knowledge (ITK) among marine fishers of South coastal districts of Maharashtra with special reference to climate	2020-21	Dr. S. M. Wasave Dr. K. J. Chaudhari, Dr. B. M. Yadav Dr. S. V. Patil, Shri. B. V. Naik

#### D) RESEARCH RECOMMENDATIONS FROM RRC PROJECTS:

Sr. No	Name of the Research projects	Research recommendation
1	Assessment and prioritization of training needs of fishers of Ratnagiri tahsil	It is recommended to conduct awareness program about importance of fish finding devices and potential fishing zone for purse-seines and trawl owner, respectively while the state government scheme for fisheries and role of financing institute to be explained to gill net, trawler and purse-seins owner by the government and non - government organization. <b>(Joint Agresco-2008).</b>
2	Participatory rural appraisal of selected villages of Ratnagiri block	On the basis of PRA analysis, it is recommended to initiate the efforts to reduce number of fishing fleets and regulate mesh size of nets used for fishing on scientific basis as well as to establish fish landing centers along with all the necessary infrastructural facilities in all the coastal fisher villages. <b>(Joint Agresco-2010).</b>
3	Assessment of impact of ornamental fish culture training programmes in development of an enterprise	It is recommended to alter the documents requirement after reviewing the necessity of documents required for establishment of ornamental fish business under the subsidy schemes of Marine Product Export Development Authority (MPEDA) and National Fisheries Development Board (NFDB). <b>(Joint Agresco-2014).</b>
4	Risk perceptions and risk management strategies in shrimp aquaculture industry of Maharashtra	It is recommended to organize training programme for the shrimp farmers to acquaint them with the concepts of selection of proper site, stock the farm with certified seed, adopt proper feed and feeding management practices for sell the produce at highest price as per the market price fluctuations. <b>(Joint Agresco-2016).</b>

#### E) RESEARCH FINDINGS FROM RRC PROJECTS:

Sr. No	Name of the Research projects	Research Outcome/Findings
1	Present status of price spread and its possible impact on fishermen share in Ratnagiri fish market.	One member, two member and three member channels were identified in the Ratnagiri market and with increasing number of middlemen the percentage share received by producer was observed to be declined.

2	Socio-economic aspects of fishermen community of Mirya village.	Income level of fishermen community can be enhanced by forming Self Help Groups (SHGs). To undertake low investment fisheries business.
3	An appraisal of marine fishermen co-operative societies of Maharashtra.	1) It seems that the roles performed by the fishermen cooperative society are not up to the mark, except the distribution of funds received under different packages. 2) An improper infrastructure facility at landing centre and nearby areas has affected the functioning of cooperatives. 3) Most of the centrally and state government sponsored schemes for fishers are given to the members of the cooperative society. The awareness about the schemes, documentation required to be submitted to avail the benefits of the scheme and eligibility of members to avail the scheme severely affected implementation of government schemes for fishermen cooperative society.

### ABSTRACTS OF THE PG DISSERTATION:

Sr. No.	Name of the Discipline	No. of students completed
1.	Fisheries Resource Management and Extension (FRME)	<b>26</b>
2.	Fisheries Business Management (FBM)	<b>04</b>
3.	Fisheries Extension (FEX)	<b>14</b>
4.	Fisheries Economics (FEC)	<b>01</b>

### FRME 1 : Efficacy and constraints in adoption of improved aquaculture techniques by shrimp farmers in South Konkan Region

Degree: M.F.Sc.	Subject: Fisheries Resource Management and Extension (FRME)
Name of the Student: Shri. M. M. Gawade	Registration No.: 71
Year of thesis submission: 2004	
Research Guide: Dr. M. S. Chandage	Designation: Professor and Head

It can be concluded from the present study that the shrimp farmers of this region have learnt lesson from the mistakes of earlier entrepreneurs who have faced heavy losses during mid-nineties due to break out of WSSV disease in Andhra Pradesh and Tamil Nadu. The adoption quotient of the shrimp farmers along the South Konkan region ranged from 50 to 96.86 with a mean of  $76.18 \pm 2.3637$ . All the farmers of the South Konkan region were categorized into high and medium adopters. A constraint of unavailability of soil and water testing laboratory in near by area was a problem faced only by 22.5% of farmers. But from the study of extent of adoption of improved aquaculture techniques revealed that establishment of soil and water-testing laboratory would enhance the level of adoption of farmers residing in the South Konkan region. So, shrimp farmers from the South Konkan region showed



better adoption of most of the improved techniques for development of eco-friendly and sustainable aquaculture practices.

### **FRME 2: Catch composition and economic analysis of trawler operation off Ratnagiri coast**

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Degree: M.F.Sc.	Subject: Fisheries Resource Management and Extension (FRME)
Name of the Student: Shri. S. N. Kunjir	Registration No.: 72
Year of thesis submission: 2004	
Research Guide: Dr. S. K. Barve	Designation: Associate Professor (Retd)

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The present study revealed that trawling was economically viable business along the Ratnagiri coast. In this business shrimps catches play an important role in the economic viability of this business. In addition to shrimps, certain varieties of fishes caught during trawling were also significantly contributing in revenue generation. Among finfishes, ribbonfish and threadfin bream were found to be more important as these fishes have gained lot of importance in the export market.

### **FRME 3: Catch composition and economic analysis of gill netters operating off Ratnagiri coast**

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Degree: M.F.Sc.	Subject: Fisheries Resource Management and Extension (FRME)
Name of the Student: Shri. A.T. Markad	Registration No.: 74
Year of thesis submission: 2004	
Research Guide: Dr. M. M. Shirdhankar	Designation: Associate Professor

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The finding of the present study showed that the gillnet fishing was profitable business which competes with other fishing gear operated along the Ratnagiri coast. Among the fishes caught by this gear, Indian mackerel and seer fish were the major contributors of the OBM and IBM gill-netters respectively. Seer fish was available throughout the year in IBM gillnetter and for OBM gillnetter it was available only during initial period of fishing season. This indicates shifting of seerfish population from deeper waters to shallow waters during the months of September to November.

### **FRME 4: Characterisation of *Sillago sihama* (Fursskal, 1775) of Ratnagiri by truss morphometric analysis**

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Degree: M.F.Sc.	Subject: Fisheries Resource Management and Extension (FRME)
Name of the Student: Shri. G. B. Wani	Registration No.: 77
Year of thesis submission: 2005	
Research Guide: Dr. M. M. Shirdhankar	Designation: Associate Professor

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Comparison of mean values for variables of both conventional and truss morphometric data sets as well as canonical discriminate analysis of both data sets have indicated that the sample of Kalbadev are different from the samples collected from Mirya bay, Kajali bay and Jaitapur Creek. Canonical discriminate analysis of

conventional and truss morphometrics complete data set as well as shear analysis of both data sets showed probability of segregation, but the Mirya bay specimens showed intermixing with other populations. This may be due to the migration of species, but this aspect was not in the preview of the present study, thus cannot be confirmed. The results of the present study need to be confirmed through techniques available in molecular biology.

#### **FRME 5: Efficacy and constraints in adoption of improved aquaculture practices by shrimp farmers in Thane district of Maharashtra**

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Degree: M.F.Sc.	Subject: Fisheries Resource Management and Extension (FRME)
Name of the Student: Shri. M. S. Rawool	Registration No.: 87
Year of thesis submission: 2005	
Research Guide: Dr. R. Pai	Designation: Associate Professor

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Farmers of this area observed not to have any problem with respect to quality medicine, chemicals required for treatments and nutritionally balanced feed. Technicality of these aspects were taken care by the input dealers. However, the farmers of this area were mainly concerned with the cost of above inputs. Similarly, required knowledge about other aspects of farming was also obtained by input dealers, because of which farmers did not face the need of separate extension agency to transfer the knowledge.

#### **FRME 6: Efficacy of sampling design to study macro faunal assemblage on exposed sandy beach**

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Degree: M.F.Sc.	Subject: Fisheries Resource Management and Extension (FRME)
Name of the Student: Shri. R. H. Rathod	Registration No.: 88
Year of thesis submission: 2005	
Research Guide: Dr. S. K. Barve	Designation: Assistant Professor

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Mandovi beach was sandy dissipative beach. Macrofaunal richness and abundance has shown spatial and temporal heterogeneity. Maximum macrofaunal richness was observed in winter in the month of October, as where minimum macrofaunal abundance was recorded in the month of April. Total 27 macrofaunal organisms were recorded of which 15 were purely sandy inhabiting, 10 were rocky and two were sandy-muddy inhabitant. Genus *Umbonium* in molluscan group was recorded throughout the Year: with higher magnitude. Sampling design with 0.25 sq. m quadrat size and with 12 m interval has recorded 96.60% of macrofaunal richness and 97.10% of macrofaunal abundance. The amount of effort required to sample exposed sandy beach was quite less than the effort exercised in sampling continuous strip of quadrats. Therefore, it is recommended that to sample macrofaunal richness and abundance on exposed sandy beach 0.25 sq. m quadrat with 12 m interval is to be used for better results.

### **FRME 7: Marketing structure and price behaviour of seer fish in and around Ratnagiri of Maharashtra state**

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Degree: M.F.Sc.	Subject: Fisheries Resource Management (FRM)
Name of the Student: Shri. Md. Abdul Salam	Registration No.: 90
Year of thesis submission: 2005	
Research Guide: Dr. M. S. Chandage	Designation: Professor and Head

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The present study was carried out to understand the present seer fish marketing pattern in and around Ratnagiri. There were five marketing channels observed in marketing of seer fish. The marketing cost incurred in channel I, II, III and IV were 5.40, 5.41, 5.19 and 2.99 percent of the consumer rupee respectively. The price of seer fish at the landing centre and retail market were subjected to wide fluctuations.

### **FRME 8: Design features of trawls operated along the Ratnagiri coast of Maharashtra state**

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Degree: M.F.Sc.	Subject: Fisheries Resource Management and Extension (FRME)
Name of the Student: Shri. V. G. Yewale	Registration No.: 93
Year of thesis submission: 2005	
Research Guide: Dr. M. M. Shirdhankar	Designation: Associate Professor

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An attempt was made to give average design for each type of trawl net operated along the coast of Ratnagiri by identifying the cluster of net trough principle co-ordinate analysis. Most of the measurements of cluster net were nearby. Average number of meshes along the length as well as breath and mesh sizes were rounded to unit place and specification of net were computed as per this rounded average. The suggested nets need to be tested in actual field for its efficiency

### **FRME 9: Morphometric relation to quantitative meat indices in *Nemipterus japonicus* (Boch 1791)**

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Degree: M.F.Sc.	Subject: Fisheries Resource Management and Extension (FRME)
Name of the Student: Shri. H. B. Pawar	Registration No.: 99
Year of thesis submission: 2006	
Research Guide: Dr. M. M. Shirdhankar	Designation: Associate Professor

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*Nemipterus japonicus*, the Japanese threadfin beam, available along the Ratnagiri, Mumbai and Panaji coast is used on large scale in the production of surimi. The morphometric relationships established between various length-length, length-weight and weight-weight measurements were positive and highly correlated. The nomographs were developed on the basis of established morphometric relationship for

the 5-10, 10-15 and 15-21 cm length groups. Nomograph developed can be used as ready reference to find out quantity of meat yield, scale waste and other waste produced from the batch procured raw material by the managers of surimi processing industry.

#### **FRME 10: Adoption of innovation by purse-seine operators of Ratnagiri coast of Maharashtra state**

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Degree: M.F.Sc.	Subject: Fisheries Resource Management and Extension (FRME)
Name of the Student: Shri. S. S. Ghatage	Registration No.: 96
Year of thesis submission: 2006	
Research Guide: Dr. R. Pai	Designation: Associate Professor

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Cent per cent adoption was observed regarding practices such as vessel construction and material, correct type of fasteners, engine horse power, type of netting material, depth of operation, net preservation techniques, sinker material, ice ratio, navigational equipments and signaling system. The purse seine operators reported problems such as conflicts with non-mechanised fishermen, lack of co-ordination with different institutes and inconvenient fishing regulations.

#### **FRME 11: Marketing structure and price behaviour of ribbon fish in and around Ratnagiri of Maharashtra state**

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Degree: M.F.Sc.	Subject: Fisheries Resource Management and Extension (FRME)
Name of the Student: Miss. S. R. Shinde	Registration No.: 106
Year of thesis submission: 2006	
Research Guide: Dr. R. Pai	Designation: Associate Professor

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The present study was carried out to understand the present ribbon fish marketing scenario in and around Ratnagiri. There were seven and six marketing channels observed in marketing of fresh ribbonfish and dried ribbonfish respectively. Price spread analysis revealed that fishermen's share in consumer's rupee was highest in zero Members: channel while it was nearly same between one member and two member channels. The fishermen's share in consumer's rupee for dried ribbonfish marketing was almost same in channels I, II, V and VI while that for remaining channels it was of lower magnitude.

#### **FRME 12: Characteristics and behavioural pattern of fish consumers in and around Ratnagiri city, Maharashtra state**

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Degree: M.F.Sc.	Subject: Fisheries Resource Management and Extension (FRME)
Name of the Student: Miss. K. Shanta Devi	Registration No.: 107
Year of thesis submission: 2006	
Research Guide: Dr. K. J. Chaudhari	Designation: Assistant Professor

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Most of the fish consuming families were nuclear, heads of fish consuming households were middle aged and most of them were serving in private or government sector, while monthly income of fish consuming households varied between Rs. 3,000 to 49,000/-. Being a coastal city number of fish consuming households were more than non-fish consuming households and the preferred fishes were of marine source. The most preferred varieties were seer and mackerel fish. The most common source of purchase of fish was retailer or vender. Consumption of fish was strictly avoided on certain days of week or during certain period due to religion customs. Fish consuming households preferred to consume fish in fried or curry form and were generally preferred fish in both meals. The estimated annual per capita consumption of fish was around 12.54 kg and major constraints faced by the fish consuming households were non-availability of fish during closed season and price of fish at the time of purchase. Creating awareness about the value added fish products or processed fish products can increase the per capita consumption of fish. This will help in marketing the fish available to the consumer during the period when fishing is closed.

**FRME 13: Efficacy and constraints in adoption of improved aquaculture practices by shrimp farmers in Raigad district of Maharashtra.**

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Degree: M.F.Sc.	Subject: Fisheries Resource Management and Extension (FRME)
Name of the Student: Shri. Y.T. Mohite	Registration No.: 84
Year of thesis submission: 2007	
Research Guide: Dr. K. J. Chaudhari	Designation: Assistant Professor

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The present study concluded that farmers of Raigad district were well educated, young and majority of them belongs to joint type of family. They were highly dependent upon consultant, neighbour and successful farmers for knowledge. Knowledge of the shrimp farmers had positive and significant relationship with adoption behaviour. Price fluctuation and lack of remedy to white spot disease were the major problems to the farmers of Raigad district.

**FRME 14: Marketing structure and price behaviour of Pomfrets in and around Ratnagiri**

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Degree: M.F.Sc.	Subject: Fisheries Resource Management and Extension (FRME)
Name of the Student: Shri. S. P. Ponkshe	Registration No.: 86
Year of thesis submission: 2007	
Research Guide: Dr. R. Pai	Designation: Associate Professor

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The present study was carried out to understand the present pomfret marketing pattern in and around Ratnagiri. There were 7 marketing channels observed in marketing of pomfrets. Price spread analysis revealed that fishermen share in consumer's rupee for black pomfret varied from 56.44 to 61.36 per cent as where for silver pomfret it varied from 55.83 to 62.62 per cent. It is clear from the present study that the fishermen were getting a better share for selling the quality fishes like pomfrets.

### **FRME 15: Adoption of innovations by Gillnet operators of Ratnagiri, Maharashtra**

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Degree: M.F.Sc.	Subject: Fisheries Resource Management and Extension (FRME)
Name of the Student: Shri. Rohit Patel	Registration No.: 104
Year of thesis submission: 2007	
Research Guide: Dr. Satish Keshav Barve	Designation: Assistant Professor

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Cent percent motorized gill net owners operating Fiber Reinforced Plastic vessels were with moderately high level of knowledge while knowledge level of motorized gill net owners operating wooden or FRP coated wooden vessels was between medium and moderately high level. Adoption quotient of cent percent-motorised gill net owners was between the medium and moderately high level of adoption. Average adoption quotient recorded among non-motorized gill net owners ranged between 42.16 to 43.59 percent.

All the gill net owners operating motorized as well as non-motorized vessels sought information from neighbour as well as input dealers among localite individual source of information and radio as mass communication source while co-operative societies as a cosmopolite source of information.

### **FRME 16: Adoption of improved practices by trawl net operators of Ratnagiri coast of Maharashtra State**

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Degree: M.F.Sc.	Subject: Fisheries Resource Management and Extension (FRME)
Name of the Student: Shri. U. A. Suryawanshi	Registration No.: 110
Year of thesis submission: 2007	
Research Guide: Dr. K. J. Chaudhari	Designation: Assistant Professor

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Maximum trawler owner fishermen (56.33 %) had adopted recommended practices at high level and only 43.67 % trawler owner fishermen found at medium level. Trawler owner fishermen or Mirkarwada landing center had good knowledge of all recommended practices. It was found that 95.40 % trawler owner fishermen fall under the category of high knowledge. The major constraints found were pollution, price fluctuation and inadequate financial support at initial stages.

### **FRME 17: Validation of potential fishing zone forecast along the Ratnagiri coast of Maharashtra**

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Degree: M.F.Sc.	Subject: Fisheries Resource Management and Extension (FRME)
Name of the Student: Shri. A. U. Thakare	Registration No.: 128
Year of thesis submission: 2007	
Research Guide: Dr. M. M. Shirdhankar	Designation: Associate Professor

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Present study was undertaken to validate potential fishing zone forecast generated by Indian National Center for Ocean information Services which revealed that catches recorded in notified PFZs were significantly higher than non PFZs along with 43.90% enhancement in catches throughout the season ( $P < 0.05$ ) except in the month of March. The relationship established between total catch on number of hauls of purse-seines fished in PFZ ( $Y=1353.9X$ ) was better than the relation established for purse-seines fished in non-PFZ ( $Y=866.41X$ ) whereas fishing success rate in PFZ was 72.79% throughout the season. Therefore, it can be consider that potential fishing zone forecast were trustworthy and help fishers to procure additional catches and the fishers of Ratnagiri district need to be educated with regard to PFZ charts or to improve their earnings by increasing the success rate.

### **FRME 18: Socio-economic survey of fishers along the Dharamtar creek in Pen taluka of Raigarh district, Maharashtra**

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Degree: M.F.Sc.	Subject: Fisheries Resource Management and Extension (FRME)
Name of the Student: Miss. A. B. Waskar	Registration No.: 129
Year of thesis submission: 2007	
Research Guide: Dr. M. M. Shirdhankar	Designation: Associate Professor

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Study of socio-economic aspect and constraints faced by fishers residing along the dharamtar creek was carried out in different villages viz. Shirki Chal, Ghodabandar, Bhal, Urnoli and Dadar. It was observation that the basic achievements like drinking water, medical services, transportation facility, educational facilities, well established fish market were not up to the mark. The majority of head of family were in the age group of 20-60 years. The male female ratio of all the villages was almost 1:1. The average rate of literacy observed among the fishers residing along the Dharamtar creek was 72.05%. Educational status according to age group showed that maximum literate individuals were in younger age group. The most of the male (48.77%) and female (38.23%) fishers were educated maximum up to secondary level. The most of the fisherman family have nuclear family and the total numbers of member in those families were observed five or less than five.

Maximum fisherman having *pucca* house without tiles (45.69%) followed by *pucca* house with tiles (35.34%). Very less houses were seen with more than four rooms (6.90%) and one room (9.48%). Fishers of all villages except Dadar were owner of agricultural land and pond. Among the movable asset, television (60.34%) was the most common asset observed, followed by refrigerator (18.10%) and more of the fishers was possessing any kind of automobile. Only 42.33% of the fishers were earner. Among the earner 67.18% were active fishers and 21.37% were involved in fish trading, while 6.87, 3.82 and 0.76% were servicemen, wages earner and businessmen respectively

Almost 53.45% fishers were members of fishermen co-operative society. Fishers having membership in grampanchayat and school *panch* committee were only 0.65 and 0.32% respectively. The percentage of female fishers having membership in *mahil mandal* and *mahila bachat gat* were 6.48 and 3.41 respectively. Almost 5.82% of fishers were members of different associations in the villages. The average per capita income of fishers operating traditional vessel was Rs. 12,359/-. The average per capita income of fishers operating motorized vessel was Rs. 15,146/-. The earning of

fishermen by the operation of gill net, dol net, barrier net and pagoli trap in a year was Rs. 53,494/-, 94,865/-, 66205/- and 52,874/- respectively. The major problems reported by fishers were proposed Special Economic Zone (SEZ), water pollution in fishing area, damage of nets due to cruising barges and delay payment of diesel subsidies.

### **FRME 19: Design and catch composition of *Dol* net operated along the Ratnagiri Coast Maharashtra**

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Degree: M.F.Sc.	Subject: Fisheries Resource Management and Extension (FRME)
Name of the Student: Shri. B. V. Solanki	Registration No.: 145
Year of thesis submission: 2009	
Research Guide: Dr. K. J. Chaudhari	Designation: Associate Professor

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In Ratnagiri *Dol* net is operated in Jaigarh estuary (16<sup>o</sup> 47' to 17<sup>o</sup> 17' North latitude and 73<sup>o</sup> 17' to 73<sup>o</sup> 12' East latitude). The total number of *dol* net operated along Ratnagiri district were 61 during the year 2007-2008. The data was collected during the 15<sup>th</sup> August 2007 to 31<sup>st</sup> March 2008 which was considered as a one fishing season. The overall length (OAL), breadth, depth of operation, tonnage, VRC number, base harbor, engine specification and accessories of vessel was measured. The highest percentage 34.43% of *dol* net owners were in age group of 50-60 whereas, 40-50 was the next dominant age group with 29.50% of the total *dol* net owners. The highest number of *dol* net owners (47.54%) observed to have primary education. It was observed that the *dol* net owners of Ratnagiri to be living in nuclear families (60.66%). The majority of *dol* net owners having an experience of 10-20 years (40.98%). *Dol* net were operated along Ratnagiri coast by two types of vessel; traditional boat (dugout canoe with outrigger) locally called as *Pagar* and motorized boat locally called *Depco*. The total two numbers of sinkers and two numbers of floats were used for vertical opening of *dol* net. The floats were made up of rectangular shaped (60X60 cm) thermocoal and stone used as sinkers. Five numbers of anchors were used for mooring the net. Overall 13 varieties of fish shellfish were recorded in the catch composition of *dol* net. Lesser sardine was the major constituent with the percentage share of 25.78. Catch composition of *dol* net according to full moon days and new moon days was 50.44% and 49.56% respectively.

### **FRME 20: Adoption of shrimp health management practices in the North Konkan region of Maharashtra**

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Degree: M.F.Sc.	Subject: Fisheries Resource Management and Extension (FRME)
Name of the Student: Shri. A. R. Sathe	Registration No.: 126
Year of thesis submission: 2008	
Research Guide: Dr. R. Pai	Designation: Associate Professor

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The present study was carried along the north konkan coast of Maharashtra. Extent of knowledge and adoption related to shrimp health management practices was studied among a group of 94 respondents. Interview schedule method was used for



collection of data. The average knowledge and adoption quotient was observed to be 54.10 and 58.93 per cent showing medium level of knowledge regarding the shrimp health management practices. High knowledge was observed regarding practices such as healthy seed selection and packing, seed transportation, acclimatization, stocking and its evaluation whereas all practices showed medium and moderately high adoption levels.

### **FRME 21: Adoption of shrimp health management practices in the South Konkan region of Maharashtra**

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Degree: M.F.Sc.	Subject: Fisheries Resource Management and Extension (FRME)
Name of the Student: Shri. P. C. Randive	Registration No.: 125
Year of thesis submission: 2008	
Research Guide: Dr. R. Pai	Designation: Associate Professor

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The present study was carried out in the south konkan region comprising two districts, viz. Ratnagiri and Sindhudurg. A total 33 numbers of farms were observed in operational condition during study period. Information related to shrimp health management practices was collected from such operational farms from study area. Average knowledge quotient of farmers in the south konkan region of Maharashtra was 63.81, whereas more than half (57.58 %) were found in the medium range. In the present study, effect of factor such as age, education, experience, farm size and adoption level on knowledge of health management practices have positive relationship with adoption ( $r = 0.7070$ ,  $p < 0.05$ ). The average adoption quotient of overall practices was found as 68.06 with more than half of the shrimp farmers (60.61 %) were observed in medium adoption level and 39.39 % were in high adoption level. In the south konkan region of Maharashtra, disease incidence was the major constraint reported by 81.82 % and non-availability of good quality seed in nearby areas and long route of transportation by 60.61 and 81.82 %, respectively of farmers.

### **FRME 22: Appraisal of fisherwomen activities in the coastal villages of Palghar tahsil of Thane district, Maharashtra**

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Degree: M.F.Sc.	Subject: Fisheries Resource Management and Extension (FRME)
Name of the Student: Shri. V. P. Sankhe	Registration No.: 127
Year of thesis submission: 2009	
Research Guide: Dr. S. K. Barve	Designation: Associate Professor

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The present study is an attempt to study the role of fisherwomen in the fisheries related activities. This study was conducted in the coastal villages of Palghar Tahsil, Thane District, Maharashtra. A total of five coastal Tahsils consisting of 82 fishing villages from Thane District were selected. A total of 265 samples were selected to represent the population. Pre-structured interview schedule method was used for collection of data from the fisherwomen. The cost and return analysis of the fresh fish wholesaler showed an annual profit of Rs. 94,289/- whereas that of fresh fish retailer, fresh fish vendor, dry fish processor, dry fish retailer and dry fish vendor was observed to be Rs. 33,468.95/-, Rs. 26,958/-, Rs. 39,407/-, 25,977.75/- and

15,082.50/- respectively. The Engel's coefficient of standard of living was observed to high in retailer (36.15%) followed by wholesaler (34.53%) and vendor (33.76%) indicating sufficient income to meet their food needs.

### **FRME 23: Production of ice and it's extent of utilization in fishery industry of Ratnagiri**

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Degree: M.F.Sc.	Subject: Fisheries Resource Management and Extension (FRME)
Name of the Student: Shri. S.S. Jadhav	Registration No.: 144
Year of thesis submission: 2009	
Research Guide: Dr. M. M. Shirdhankar	Designation: Professor & Head

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Mirkarwada is one of the important minor fishing harbours situated in the Ratnagiri block, in addition to this there are 18 fish landing centres and 19 ice plants situated in various villages of the block. It was noted that importance of utilization of ice was recognized by producers as well as marketing agents. All the types of vessels were observed with the arrangement to carry ice for on-board preservation of fish. The marketing agents were also observed to be using ice regularly for preservation of fish. In all 19 ice plants with production capacity of 2,01,491 tonnes were operating in the Ratnagiri block. The total ice used by fishery industry during the year 2007-08 was 97,046 tonnes, which indicated under utilization (48%) of present production capacity of ice plants. The expected requirement of ice of Ratnagiri block is 1,57,377 tonnes and existing ice plants are with appropriate production capacity to suffice the present expected requirement of the fishery industry.

### **FRME 24: Shoreline change detection of Ratnagiri block using Remote Sensing and GIS**

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Degree: M.F.Sc.	Subject: Fisheries Resource Management and Extension (FRME)
Name of the Student: Shri.S. S. Markad	Registration No.: 159
Year of thesis submission: 2009	
Research Guide: Dr. M. M. Shirdhankar	Designation: Associate Professor

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Ratnagiri block, with 57 km shoreline stretch, was studied for the shoreline changes using remote sensing and GIS techniques. The temporal and multispectral satellite images of the year 1989, 1999, 2004 and 2009 taken from different satellite sensors were used processed through ERDAS Imagine 9.1 image processing software for mapping of shoreline and associated changes pertaining to erosion and deposition. The satellite images were preprocessed to curtail geometric, radiometric as well as spatial errors. Different image processing techniques such as histogram threshold, unsupervised classification of multi-spectral images as well as principal components were used for shoreline mapping and shoreline changes were estimated for the time intervals between 1989 to 1999, 1999 to 2004 and 2004 to 2009 by image subtraction. The accuracy assessment showed no any significant difference among the accuracies of shoreline mapping by different image processing techniques. The study revealed deposition of 160 ha during study period between 1989 to 2009 with prominent

deposition during 1989 to 2004 and erosion for the time period between 2004 to 2009. Mirkarwada minor fishing harbour showed navigational difficulties due to deposition of sand material eroded from Mirya beach during 1989 to 2009 whereas Dhamankhol bay showed accretion during 2004 to 2009 due to land filling activity carried out for port construction. Study revealed formation and changes in the sandbars at mouth region of rivers along the shoreline during last couple of decades. Dhamankhol bay, Kachare, Varvade, Ganpatipule, Areware, Kalbadevi, Mandovi, Bhatye, Ranpar and Gaonkhadi were the major areas of deposition whereas, erosion was prominent along Nandivade, Kachare, Ganpatipule, Mirya and Mandovi beach areas during 1989 to 2009.

### **FRME 25: Mapping and change detection of mangrove coverage of Ratnagiri block using Remote Sensing and GIS.**

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Degree: M.F.Sc.	Subject: Fisheries Resource Management and Extension (FRME)
Name of the Student: Shri.A. D. Nakhwa	Registration No.: 160
Year of thesis submission: 2009	
Research Guide: Dr. M. M. Shirdhankar	Designation: Associate Professor

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Mangrove mapping and change detection of Ratnagiri block last couple of decades was undertaken through remote sensing and GIS techniques. The multi-spectral satellite images acquired by different satellite sensors at different years (1989, 1999, 2004 and 2009) were used. This digital satellite data set was processed through ERDAS Imagine 9.1 image processing software for mapping and change detection of mangrove areas along study area. The satellite images were corrected for geometric, radiometric as well as spatial errors. Different classification techniques such as supervised and unsupervised classification of multi-spectral as well as principal component imageries were used for mangrove mapping. Unsupervised classification of principal component imageries showed better accuracies in mangrove mapping. Therefore, images classified with this technique were used for estimation of sequential changes in mangrove area for the time intervals between 1989 to 1999, 1999 to 2004 and 2004 to 2009. The mangrove coverage of Ratnagiri block in 2009 was about 9.49 sq. km, while mangrove coverage in 1989, 1999 and 2004 were 7.17, 7.56 and 6.52 sq. km respectively. The large reduction in the mangrove forest was observed in Purnagad estuary during 1989-1999 and Jaigad estuary during 1999-2004 due to construction of embankment in the estuarine region, while massive increase in the mangrove coverage was observed on the mudflats of the Sakhartar estuary during 2004-2009. The net increase in mangrove coverage observed was 231.84 ha for time period between 1989 and 2009.

### **FRME 26: ECONOMIC ANALYSIS OF PURSE-SEINE FISHING ALONG RATNAGIRI COAST, MAHARASHTRA STATE**

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Degree: M.F.Sc.	Subject: Fisheries Resource Management and Extension (FRME)
Name of the Student: Shri. S. C. Kamble	Registration No.: 158
Year of thesis submission: 2009	
Research Guide: Dr. K. J. Chaudhari	Designation: Associate Professor

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Purse-seine vessels which were operating along the Ratnagiri coast during 15<sup>th</sup> August 2008 to 31<sup>st</sup> May 2009 (fishing period of year) were considered for collection of primary data related to catch composition, costs and returns. Detailed information on craft including engine and gear was collected from the purse-seine units. In catch composition, Indian oil sardine (28.58%) and cat fish (24.30%) contributed more compared to other species in the fish catches of purse-seine landed at Ratnagiri. Average total landing recorded per purse-seine unit for one fishing season of 41 weeks was 2,46,247 kg and 3,02,603 kg in quantity and revenue generated was Rs. 65,72,814/- and Rs. 74,84,111/- respectively for cluster I and cluster II. Purse-seine operation earned a profit of Rs. 20,74,558/- for cluster I and Rs. 29,83,551/- for cluster II. Though the major species caught were not high priced, the quantity of catch was enough to earn adequate revenue and to make purse-seine operation profitable. Considering the variable cost, cost of fuel and labour charges contributed more compared to other components of variable cost. Capital turnover ratio was estimated at 2.01 and 2.16 which measure the efficiency of purse-seine owner in managing and utilizing fixed assets gross ratio, operating cost ratio and fixed cost ratio were 0.68, 0.50 and 0.19 for cluster I whereas, 60, 43, and 0.17 for cluster II respectively. From this study it was concluded that the purse-seine fishing along Ratnagiri coast was highly profitable and economically viable business during the fishing season August 2008 to May 2009.

### **FBM 1: ENTREPRENEURSHIP BEHAVIOUR OF FISHERWOMEN IN RATNAGIRI BLOCK OF RATNAGIRI DISTRICT, MAHARASHTRA STATE**

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Degree: M.F.Sc.	Subject: Business Management (BM)
Name of the Student: Amrapali Manohar Gajbhiye	Registration No.: FRRTM0100201
Year of thesis submission: 2012	
Research Guide: Dr. K. J. Chaudhari	Designation: Associate Professor

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A study on entrepreneurship behaviour of fisherwomen in the Ratnagiri block of Ratnagiri district, Maharashtra state was conducted during 2011-12 with a sample size of 105 fisherwomen from 10 villages of Ratnagiri block in Ratnagiri district.

Majority of the respondents (55.24%) exhibited medium level of entrepreneurial behaviour. The components of entrepreneurial behaviour were innovativeness, risk orientation, decision making, economic motivation, management orientation and self-confidence. Among all these components majority of respondents belong to medium entrepreneurial behaviour but in innovativeness and achievement motivation respondents exhibited low and high entrepreneurial behaviour category.

The rank correlation technique was applied and found that the characteristics such as education, family size, house type and social participation were positively and significantly ( $P < 0.05$ ) correlated with entrepreneurial behaviour. Principal component analysis was performed to find out the major components of entrepreneurial behaviour of the sampled fisherwomen. The first three principal components accounted for almost 58.97 per cent of the total variance. Canonical correlation analysis was used to examine the potential relationship between socio-personal variables and entrepreneurship behaviour variables. Results of the analysis showed that there was no relationship between set of socio-personal variables and entrepreneurial behaviour variable.

## **FBM 2: AN ASSESMENT OF ENTREPRENEURSHIP BEHAVIOUR OF THE SHRIMP FARMERS IN MAHARASHTRA STATE**

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Degree: M.F.Sc.	Subject: Business Management (BM)
Name of the Student: Palav Kedar Vishwas	Registration No.: FRRTM0100203
Year of thesis submission: 2013	
Research Guide: Dr. K. J. Chaudhari	Designation: Associate Professor

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The present study was carried out in four coastal district of Maharashtra to find out entrepreneurship behaviour of shrimp farmers and their socio-personal, socio-economic, communication characters and also barriers faced by farmers in their farming activity. Amongst the sampled shrimp farmers 52.94% were of middle (36 to 50 years) age. Twenty nine per cent were old (above 50 years) age category and only 17.65% farmers were in young (Up to 35 years) age category. Majority of the respondents (64.71%) had medium innovativeness, followed by low (20.00%) and high (15.29%) innovativeness, respectively; 61.18% were under medium achievement motivation category and only 5.88% farmers were under low achievement motivation category. More than half of the sampled shrimp farmers (51.76%) were with medium decision-making ability. With respect to economic motivation, majority of the respondents (44.71%) were in medium economic motivation category, followed by 36.47 and 18.82% of the respondents belonged to high and low economic motivation categories respectively; most of the farmers (88.24%) of the four districts in Konkan region showed medium level of risk taking ability. Almost 62.35% of the sampled shrimp farmers were under medium leadership ability category; about 64.71% farmers were having high level of management orientation category and only 2.35 per cent farmers were having low level of management orientation. More than half (52.94%) of the sampled shrimp farmers had high level of entrepreneurship behaviour. Entrepreneurial behaviour index (EBI) analysis showed that 59 farmers were in high (71-80 per cent) EBI category, fourteen farmers in moderate (61-70 per cent), eight farmers in very high (Above 80 per cent) and only four farmers in low (51-60 per cent) EBI category. The correlation coefficient ( $r_s$ ) indicated that the characteristics such as farming experience, annual income, number of crops per year and social participation were positively and significantly correlated with entrepreneurial behaviour ( $P < 0.05$ ). The first three principal components accounted for 66.72% of the total variance. Leadership ability and economic motivation showed maximum factor loading (0.4996 and 0.636 respectively) with principal component I, which showed 34.34 per cent variance. Canonical correlation coefficient estimated was 0.4300 for first variable whereas; next two canonical variables were with coefficient of 0.3265 and 0.2918. The first canonical variable accounted 47.85% variability, subsequently second and third canonical variable accounted for 25.17 and 19.63% variability respectively and total together first three canonical variable expressed 92.65% variability. Lack of co-operation among farmers (80.00%) was the major barriers faced by farmers, followed by lack of extension education (78.82%) and high price of seed (76.47%).

## **FBM 3: Characteristics and Structure of Ornamental Fish Enterprise in Ratnagiri District, Maharashtra State**

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Degree: M.F.Sc.	Subject: Business Management (BM)
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Name of the Student: Bhatkar Hrishikesh R.      Registration No.: FRRTM0100200

Year of thesis submission: 2013

Research Guide: Dr. B. M. Yadav

Designation: Assistant Professor

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The present study was carried out to document the characteristics and to analyse the present status of ornamental fish enterprise in the Ratnagiri District of Maharashtra State. A total of 71 ornamental fish enterprises were surveyed. Ornamental fish industry of Ratnagiri District was dominated by men and majority of them belong to one religion. The ornamental fish enterprises were found to be the primary source of livelihood for these people. Maximum units were established in less than 0.01 ha land. The retail shops were small with an area of 10-20 sq. m. The major items of non-recurring expenditure were tanks, water supply and electrical items, water treatment equipments, building for housing the tanks, water quality parameter analysis equipments, aerators, blowers and hosing for aquarium tanks. Major items of recurring expenditure were dry feed, electricity charges and communication charges. Goldfish and angelfish were the most preferred groups due to the demand in market. Monsoon crops were mostly taken by ornamental breeding and rearing units. Dry feed was commonly used by the enterprise for feeding and salt as chemical for treating fish while oxytetracycline was the common antibiotic used by ornamental fish entrepreneurs. The maximum breeding and rearing unit holders were those who got trained as beneficiaries of the Rainbow Revolution Scheme of the Marine Products Export Development Authority (MPEDA).

#### **FBM 4: Fisheries Resource Mapping of Ratnagiri District Using Remote Sensing and Geographical Information System**

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Degree: M.F.Sc.

Subject: Business Management (BM)

Name of the Student: Lokhande Prashant C.

Registration No.: FRRTM0100202

Year of thesis submission: 2013

Research Guide: Dr. M. M. Shirdhankar

Designation: Professor & Head

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The present study envisages use of Remote Sensing and Geographical information System to map the fisheries resources such as landing centres, ice plants, fish processing plants, Fish markets, Fisherman co-operative societies, creeks, shrimp farms, shrimp hatcheries, rivers, reservoirs, mangrove and fisheries related organization of Ratnagiri district. Fisheries resources were identified and mapped using land cover pattern of the area. The maps of various fisheries resources of Ratnagiri district were prepared using digital satellite Image of IRS P6 LISS III and LISS IV (only for Ratnagiri block) and Landsat-Multi-spectral scanner, the Enhanced Thematic mapper plus (ETM+) images of the study area. The software used for remote sensing was ERDAS 9.1 and for GIS was Arc Map 9.3 software. Almost 49 fish landing centers were observed along the 167km coastline of Ratnagiri district. Altogether 47 ice plant, nine fish processing and two fish meal plants were supplying the fish processing industry of Ratnagiri district. The 81 numbers of fisherman co-operative societies were observed in Ratnagiri district of which 79 were in marine sector and two were in fresh water sector. Only 40 shrimp farms with 129.51 ha of constructed area were seen in Ratnagiri district, while only two shrimp seed hatcheries were observed. In addition to this 24 creek support brackish water fisheries and 65 reservoirs as well as 10 rivers in the district support freshwater fisheries. The

estimated mangrove area was 2435.16 ha in Ratnagiri district. All the nine fisheries related organizations were in Ratnagiri block Ratnagiri district.

### **FEX 1: AN ASSESSMENT OF MARINE FISHERMEN CO-OPERATIVE SOCIETIES IN SOUTH KONKAN REGION OF MAHARASHTRA STATE**

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Degree: M.F.Sc.	Subject: Fisheries Extension (FE)
Name of the Student: Mr. Sandeep H. Borgaonkar	Registration No.: FRRTM 0100206
Year of thesis submission: 2013	
Research Guide: Dr. S. V. Patil	Designation: Assistant Professor

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Fisheries cooperative movement is considered to be the most effective way to develop the fisheries sector and improve the standards of living of the poor fishermen. Large number of fisheries cooperatives have been formed both in marine and inland sectors of Maharashtra and contributing to the socio-economic development of fishers. Realizing the importance of marine fishermen co-operative societies in the development of fisheries and fisher community, the present study has been conducted in South Konkan region (i.e. Ratnagiri and Sindhudurg districts) of Maharashtra with the objective of studying the various activities and major constraints of primary marine fishermen co-operative societies. The data was collected from 93 primary marine fishermen co-operative societies (Ratnagiri-67 and Sindhudurg-26) through direct interview with the chairman / secretaries of the co-operative societies. Most of the societies were operating in single village and were headed by middle aged chairmen with assistance of middle aged secretaries with higher secondary education. Maximum number of societies provided diesel to members at subsidized rate. Fishermen co-operative societies were not at all involved in direct marketing of fishes and were providing market prices of fishes to their members. Majority of societies were involved in implementation of welfare and other schemes such as group accident insurance for active fishermen, supply of on HSD oil on rebate and promotion of mechanization and motorization program. Most of the fishermen co-operatives societies did not take the benefit of Government schemes for the development of infrastructure like ice plant, cold storage, fish drying yard / platforms. The major constraint faced by the co-operative societies of South Konkan region was lack of resources / infrastructure facilities due to lack of funds for infrastructure development. In addition to this other constraint faced societies were lack of training in co-operation and marketing, lack of organizational skill know-how, lack of co-operation among the members and lack of knowledge about new schemes.

### **FEX 2: COMPETITIVENESS OF INDIAN SHRIMPS IN INTERNATIONAL MARKET**

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Degree: M.F.Sc.	Subject: Fisheries Extension (FE)
Name of the Student: Miss. Komal Vishvas C.	Registration No.: FRRTM 0110238
Year of thesis submission: 2014	
Research Guide: Dr. K. J. Chaudhari	Designation: Associate Professor

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Shrimp is the world's most important seafood commodity accounting for about 19 percent of international seafood trade in terms of value. In India's seafood export trade shrimp contributed about 23 percent in quantity and 50 percent in value in the

year 2010. In present study an attempt to critically examine compound growth rate and competitiveness of Indian shrimp in international seafood market based on the data collected from FAO fisheries statistics database, MPEDA statistics and globe fish commodity update. The results indicated that India has been quite competitive in the shrimp trade, although there is a decline in the competitiveness of Indian shrimp in recent years.

### **FEX 3: DOCUMENTATION OF INDIGENOUS TRADITIONAL KNOWLEDGE ABOUT FISHING METHODS ALONG SOUTH KONKAN COAST OF MAHARASHTRA**

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Degree: M.F.Sc.	Subject: Fisheries Extension (FEX)
Name of the Student: Miss. S. S. Waghmare	Registration No.: FRRTM0160357
Year of thesis submission: 2018	
Research Guide: Dr. M. M. Shirdhankar	Designation: Professor & Head

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The study was undertaken for documentation of indigenous traditional knowledge about fishing methods of fisher along the South Konkan coast of Maharashtra. The aim of the present study was to record the fishing practices and to document indigenous traditional knowledge involved in fishing practices. Ratnagiri and Sindhudurg districts were selected for sampling. A total 83 traditional fishers of 30 villages were interviewed using semi-structured interview schedule, group discussions were held with group of fisher and required information was collected by observation. Most of the fishers (42.17%) were having an experience of more than 30 years in fishing. Commonly observed fishing methods in both the districts were ten types of gill nets, two types of cast nets, *Wan*, *dol* net, *Rampan*, hook and line with multiple hook and long line fishing. Certain exclusive fishing methods such as drag net, *Pishvi*, crab catching by using *Akada* and *Batti*, *Zila*, hand picking of bivalves *Konda*, bucket/ *badli* and *Jholani* were observed in Ratnagiri district, while *Pasa* for crab collection, cuttle fishing with *Suru* branches and fishing with scare line was observed in Sindhudurg district. Various ITKs documented in the present study were validated by the scientists from Faculty of Fisheries. The overall analysis showed that all the practices were rational except identification of fish shoal, effect of water colour on availability of fish and effect of tide on availability of fish. Principle Component Analysis identified three practices distinctly and identified traditional practices were water depth measurement, *pishvi* and bucket/ *baldi*.

### **FEX 4: SOCIO-ECONOMIC STUDY OF FRESH FISH RETAILERS OF RATNAGIRI, MAHARASHTRA**

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Degree: M.F.Sc.	Subject: Fisheries Extension (FEX)
Name of the Student: Miss. P. C. Khode	Registration No.: FRRTM0150327
Year of thesis submission: 2018	
Research Guide: Dr. K. J. Chaudhari	Designation: Associate Professor

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The study is related to the Scio-economic status of women fresh fish retailers of Ratnagiri. The objective for the study was Scio-economic status of women fresh fish retailers, health and nutritional status and problem faced by women fresh fish



retailers. Data for the study were obtained from 90 women fresh fish retailers selected through random sampling with the help of well-structured interview pre-tested schedule. Statistical tool such as normal distribution chi-square, correlation, regression, Gini coefficients, ranking techniques and percentage analysis was employed to analyse the data. From the study it was revealed that 95.56% women fresh fish retailers had primary occupation as fish selling while majority of them were middle age group (34-42). Literacy rate of women fresh fish retailer was 72.22%. Maximum (50%) of retailers were studied up to secondary education and very few (2.22%) up to higher secondary. Most of the women fresh fish retailers (56.67%) were Muslim followed by Hindu (41.11%) and Buddhist (2.22%) religion. The average family size of the retailers was 5.9 of the sampled retailers, 53.33% had *pucca* house, followed by *semi-pucca* (22.89%) and 97.78% have their own house. It was also observed that social participation of women was very poor. Average quality of fish traded per day by women fresh fish retailers was 9.29kg with average purchase price of Rs.148 per kg and selling price of Rs.211.95 per kg. The average market margin was 44.03 per kg for all fish varieties. Health status analysis revealed that women were suffering from joint pain, skin infection, obesity, back pain, diabetes and asthma. Nutritional status was poor and required calories are not fulfilled. Major problems faced by women fresh fish retailers were price fluctuation, unhygienic market place and high transportation costs.

#### **FEX 5: SOCIO-ECONOMIC STATUS OF DRY FISH RETAILERS OF RATNAGIRI, MAHARASHTRA**

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Degree: M.F.Sc.	Subject: Fisheries Extension (FEX)
Name of the Student: Miss. R. B. Kandhare	Registration No.: FRRTM0150326
Year of thesis submission: 2018	
Research Guide: Dr. M. M. Shirdhankar	Designation: Professor and Head

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The study was carried out with objective to study the socio-economic status of dry fish entrepreneurs of Ratnagiri block. Data were collected from dry fish vendors, dry fish processors cum retailers and from dry fish wholesalers. They were collectively considered as dry fish entrepreneurs. Most of the dry fish entrepreneurs were between 48-58 years age group. Very few dry fish entrepreneurs (17.65%) were with educational status up to secondary level and more than fifty percent of them were found illiterate. Most of the dry fish entrepreneurs were living in semi *pucca* (48.24%) houses and remaining were living in *pucca* (43.53%) and *kachcha* (8.24%) houses. Only three numbers of dry fish entrepreneurs were living in one room house and rest were living in more than one room house. Most of them were living in three room houses. The study revealed that the dry fish entrepreneurs were earning very less from their business which helped them to complete their daily requirements and very less amount from their income was saved. Dry fish entrepreneurs were facing many problems like unavailability of fishes, timely availability of public and transportation facility, improper place for drying, lack of well constructed fish market and weather problems. Morbidity status of dry fish entrepreneur was studied and it was concluded that the most of them were facing joint pain (35.29%), acidity (22.35%), pain in legs (21.18%) and body pain (18.82%). About 61.18% of the dry fish entrepreneurs were with normal BMI and remaining were overweight. Nutritional status of women in dry fish enterprise was analysed and it was concluded that most of

them were taking less than 1900 calories per day. So it was concluded that socio-economic status of dry fish entrepreneurs of Ratnagiri is very low.

### **FEX 6: CAPACITY UTILIZATION OF SEAFOOD PROCESSING INDUSTRY IN KONKAN REGION OF MAHARASHTRA**

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Degree: M.F.Sc.	Subject: Fisheries Extension (FEX)
Name of the Student: Mr. A.W. Gajbhiye	Registration No.: FRRTM0160358
Year of thesis submission: 2019	
Research Guide: Dr. M. M. Shirdhankar	Designation: Professor and Head

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The study was undertaken to examine the capacity utilization of seafood processing industry and constraints faced by industry in Konkan region of Maharashtra. Information was collected by using interview schedule from 21 seafood processing plants out of 24 functional plants in Konkan region of Maharashtra. All processing plants were well equipped with various kinds of freezers and cold storage. Altogether 5028 employees were observed in processing plant of which 4771 were labours and 257 were technical staff. The total annual installed capacity of processing plants was 541149, 444780 and 403832 tonnes for 365, 300 and 260 working days respectively. The total seafood production during 2016-17 of all the 21 processing plants was 75,819.67 tonnes. The estimated utilization capacity was 14.01, 17.04 and 19.67% with a considering of 365, 300 and 260 working days respectively. The maximum utilization was observed in the month of October (11767.93 tonnes) with a percentage value of 31.70%, while maximum utilization was observed in winter season (36819 tonnes) with percentage value of 24.32%. The major constraint faced by the processing plant was non-availability of raw material and non-availability of labours. The seafood processing plants seems to be underutilization due to non-availability of raw material. The least percentage utilization observed was 1.94%. if this situation persist for longer period, this may lead to closes of industry and subsequently loss of employment.

### **FEX 7: SOCIO-ECONOMIC STATUS OF *RAMPAN* OPERATORS OF SINDHUDURG DISTRICT OF MAHARASHTRA**

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Degree: M.F.Sc.	Subject: Fisheries Resource Management and Extension (FRME)
Name of the Student: Mr. D.N.Toraskar	Registration No.: FRRTM0150329
Year of thesis submission: 2018	
Research Guide: S.M.Wasave	Designation: Assistant Professor

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*Rampani* fishing is an ethnic occupation of the coastal communities Sindhudurg district of Maharashtra. The aim of the present study was to access the socio-economic status of *rampan* operators. In all total 83 respondents were selected from three tehsils of Sindhudurg district and interviewed with pre-tested structured interview schedule. The results revealed that, basic facilities like transportation, medical and education were available in the study area. It was found that, 55.43% of the head of *rampan* operators belonged to middle-old age (44-60), 90.36% had family size of less than or equal to 5 members. Cent percent *rampan* operators had their own houses among them, 73.49% *rampan* operators had semi-*pucca* type of house

followed by *pucca* (22.89%) houses. In the study area about 75.90% of the *rampan* operators had completed middle school education. A total of 56.63% of *rampan* operators were members in fishermen co-operative society. There were 60% active fishers and 16.87% of *rampan* operators maintain poultry as livestock. The *rampan* operators spent highest annual expenditure on grocery (10.85%) and less on liquor and bidi (0.47). As far as health of the *rampan* operators is concerned, 61.45% were in the normal category, while 28.92% in overweight category. *Rampan* operators suffered from back pain (15.56%) were the major health problem followed by body pain (13.25%). Among the constraints, faced by *rampan* operators uncontrolled purse-seine fishing and increasing the rate of mechanised fishing were the major constraints followed by declining fish catch and increasing operations of other state fishers. Therefore, it can be concluded that socio-economic condition of *rampan* operators of Sindhudurg district is needed to be improved with policy support.

### **FEX 8 : EFFICACY AND CONSTRAINTS IN ADOPTION OF *PENAEUS (LITOPENAEUS) VANNAMEI* (BOONE, 1931) CULTURE PRACTICES BY THE FARMERS OF NORTH KONKAN REGION OF MAHARASHTRA**

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Degree: M.F.Sc.	Subject: Fisheries Extension (FEX)
Name of the Student: Mr. A. B. Salunkhe	Registration No.: FRRTM0150328
Year of thesis submission: 2018	
Research Guide: Dr. S.M.Wasave	Designation: Associate Professor

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Coastal aquaculture in India was predominantly focused on tiger shrimp farming (*Penaeus monodon*) but was inflicted with disease outbreaks leading to the introduction of SPF pacific white shrimp *Penaeus (Litopenaeus) vannamei* in the year 2009. In order to assess the shrimp farming, shrimp farmers need to have adequate knowledge and adopt the scientific technique of shrimp farming for successful production. In view of this the present work was taken up in the North Konkan Region of Maharashtra to study the extent of adoption of improved farming practices of *Penaeus (Litopenaeus) vannamei* by shrimp farmers and to study the constraints faced by the shrimp farmers while adopting improved aquaculture practices. Data were collected from 53 shrimp farmers by using structured interview schedule Descriptive score sheets for each of recommended practice was constructed with zero, one and two scores. The 83.02% of farmers were found with high knowledge for all recommended aquaculture practices, while 16.98% shrimp farmers had medium knowledge. The majority 88.68% of farmers were in medium and (11.32%) of farmers in high adoption level groups for all the recommended aquaculture practices. It was found that 88.68% of shrimp farmers had high level of knowledge regarding to biosecurity measures to avoid entry of crab. The highest level of knowledge was observed in shape of pond (94.34%). The highest extent of adoption was observed in the stages of pond preparation for removal of sludge (81.13%). The major constraint faced by the farmers in shrimp farming was lack of disease diagnosis lab (90.57%) in North Konkan Region of Maharashtra. Though knowledge of farmers for the recommended practices was high on the other adoption of the recommended practices on that scale was not observed during the present study.

## **FEX 9: PARTICIPATION OF WOMEN IN MARINE FISHERIES COOPERATIVE SOCIETIES OF RATNAGIRI DISTRICT, MAHARASHTRA**

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Degree: M.F.Sc.	Subject: Fisheries Extension (FEX)
Name of the Student: Miss. N.P.Sonkamble	Registration No.: FRRTM0160355
Year of thesis submission: 2019	
Research Guide: Dr. S.M.Wasave	Designation: Associate Professor

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Cooperative is an organization in which individual come together to meet their economic, social and cultural needs. The present study has been conducted in the Ratnagiri district of Maharashtra to study the participation of women in cooperative, institutional support to women members through fisheries cooperatives and to study the constraints faced by women as a member of cooperatives. The data were collected from total 125 women respondents by random sampling. The information was collected by using pre-tested semi structured interview schedule. Statistical tools such as normal distribution, chi-square, frequency, percentage analysis and Garrett ranking technique was employed to analyse the data. The result revealed that majority (42.40%) of the women members were in the older age (48-53), 68 percent educated up to secondary education level, 97.6 percent of women were married, 82.40 percent women maintain small family of less than five members. Around 65.60 percent women belonged to Muslim religion and 34.40 percent belonged to Hindu religion, 70.40 percent women belonged to OBC followed by 29.60 percent belonged to SBC categories. Majority (80-92%) of the women had membership as general members; almost 68.80 percent attended annual general meeting, while only 24.80 percent of members hardly participate in decision making process. A total of 87.20 percent women members were provided with insulated boxes, 12.80 percent women members availed transportation facilities and 38.40 percent availed drying ramps/racks through cooperatives. Only 23.20 percent of women attended the training programmers and around 57.60 percent women availed financial assistance through cooperative. Major constrains faced by women members were household restrictions, lack of education, unawareness about government schemes and lack of awareness about cooperative activities. Therefore, it can be concluded that there is need for improving the services of the cooperatives in terms of credit availability, input provision, infrastructure development, implementation of government schemes and increase training access for women members, so as to get active participation of women members in cooperative activities.

## **FEX 10: GENDER ROLES ANS LIVELIHOOD ANALYSIS OF DRY FISH RETAILERS OF RATNAGIRI, MAHARASHTRA**

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Degree: M.F.Sc.	Subject: Fisheries Extension (FEX)
Name of the Student: Miss. A. D. Swami	Registration No.: FRRTM0160356
Year of thesis submission: 2019	
Research Guide: Dr. M. M. Shirdhankar	Designation: Professor and Head

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The gender roles, livelihood status and gender based constraints of dry fish entrepreneurs of Ratnagiri block were studied. Altogether 107 dry fish entrepreneurs

were interviewed with the help of interview schedule. Basic amenities such as educational, medical, transportation, electricity and drinking water were available to certain extent but business related amenities such as drying platforms, well-constructed market with basic facilities such as toilet, drinking water and storage facilities were lacking. Most of the dry fish retailers were in 34-42 years age group, while most of the dry fish processor-cum-retailers were in 42-50 years age group. Maximum women dry fish entrepreneurs had primary level education (25.51%), while men dry fish entrepreneurs had secondary level education (33.33%). Women dry fish retailers were contributing cent percent in productive activities and were also carrying out most of the reproductive activities whereas, the male retailers were only contributing in productive activities and processor-cum-retailers were contributing in both the activities. Men and women, both dry fish retailers had good access and control over the business and finance related resources. Physical capitals were average with 0.47 component score, while component scores for other capitals such as financial, social, human and natural were 0.47, 0.35, 0.15 and 0.91 respectively. The women dry fish retailers spent 16 hours and three minutes in productive and reproductive activities, while men dry fish retailers spent 12 hours and 57 minutes in productive activities. The processor-cum-retailers spent 18 hours and 48 minutes in productive and reproductive activities. The major gender based constraints faced by dry fish entrepreneurs were toilet facility at market place as well as financial and social constraints.

#### **FEX 11: SOCIO-ECONOMIC STATUS OF FRESH FISH RETAILERS OF MORMUGAO, SOUTH GOA**

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Degree: M.F.Sc.	Subject: Fisheries Extension (FE)
Name of the Student: Shweta Mahesh Chavan	Registration No.: FRRTM0170382
Year of thesis submission: 2020	
Research Guide: Dr. B. M. Yadav	Designation: Associate Professor

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The study was carried out with objective to study the socio-economic status of fresh fish retailers of Mormugao Taluka, South Goa. Data was obtained from 74 retailers selected through random sampling. Most of the retailers (31.08%) were in the age group 42-50 years. Very few (17.57%) of the retailers had secondary level of education and majority (75.67%) of the fresh fish retailers were illiterate; most of the fresh fish retailers belonged to the Hindu religion (66.22%), followed by Christian (32.43%) and Muslim (1.35%). Most of the fish retailers families lived in semi-*pucca* houses (78.37%), followed by *pucca* houses (17.58%) while very few lived in apartment (4.05%) and maximum fish retailers lived in their own house 71.62%. Most (29.73%) of the fresh fish retailers had 3 rooms followed by two rooms (25.67%). About 20.27% retailers had 1 room, 17.57% had four rooms and very few had 5 rooms (6.76%). The social participation of fresh fish retailers was observed to be very poor. Quantity of fish sold by retailers per day was 5.85 kg with average purchase price was ₹155/- per kg and selling price was ₹197/- per kg. Average market margin was 41.71 per kg for all fish varieties. Health status showed that retailers suffered from back pain, joint problems, blood pressure, obesity, stomach gas problems, headache, diabetes and asthma. Major constraints faced by retailers were spoilage during storage, high transportation cost, no proper facility for disposal of waste, no proper sanitary facility and unclean surrounding area.

## **FEX 12: AWARENESS AND PERCEPTION ABOUT CLIMATE CHANGE AMONG ESTUARINE FISHERS OF RATNAGIRI, MAHARASHTRA**

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Degree: M.F.Sc.	Subject: Fisheries Extension (FE)
Name of the Student: Miss.S.B.Telang	Registration No.: FRRTM0170382
Year of thesis submission: 2019	
Research Guide: Dr. K.J.Chaudhari	Designation: Professor and Head

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The present study was carried out with objectives to study the awareness and perception about climate change among the estuarine fishers of Ratnagiri. Data was obtained from 73 estuarine fishers selected through random sampling method. An interview schedule was used for data collection. Maximum percentage (27.40%) of estuarine fishers were in the 31-40 age group. Majority of the estuarine fishers (78.08%) were educated up to secondary level education. Most of the estuarine fishers belonged to Muslim (84.93%) religion and very few were Hindu. About 2.74% of the fishers had yellow ration card and 97.26% orange ration card. About 71.23% of the estuarine fishers have heard about climate change, 28.77% of fishers did not hear about climate change. The main source of information on climate change was through own experience (92.30%). The estuarine fishers experienced extreme changes in weather, temperature has increased, decreased rainfall, irregular seasonal transition, decreased fishing days, decreased number of species caught and deposition of the beach. 'Avoiding pollution, was found the most important practice for prevention of climate change. About 46.58% of the estuarine fishers have moderate knowledge about climate change and 24.66% of fishers have excellent knowledge about climate change. The estuarine fishers perceived that average temperature, changing rainfall pattern, frequency of extreme climatic events like floods, cyclones, landslides has increased, fish stock, fishing point, migration of fishes, change in species availability, reduction in income, increased cost of fishing, habitat destruction, monsoonal fluctuation and seawater inundation has impacts of climate change. Estuarine fishers have medium level of awareness (71.23%) about climate change.

## **FEX 13: AWARENESS AND PERCEPTION ABOUT CLIMATE CHANGE AMONG THE TRAWL NET OPERATORS OF RATNAGIRI, MAHARASHTRA**

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Degree: M.F.Sc.	Subject: Fisheries Extension (FE)
Name of the Student: Miss. A. R. Kaniche	Registration No.: FRRTM0170384
Year of thesis submission: 2019	
Research Guide: Dr. S.M. Wasave	Designation: Assistant Professor

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Present study has been conducted in Ratnagiri, Maharashtra to study awareness and perception about climate change among trawl net operators. Data were collected from 70 trawl net operators by random sampling. The information were collected with a pre-tested structured interview schedule. Statistical tools such as Garrett ranking, Likert scale and percentage analysis were used wherever required.

The result revealed that majority (31.43%) of the trawl net operators was in 41 to 50 years age group. Most of the trawl net operators (81.43%) were educated up to secondary level. All the trawl net operators observed in Ratnagiri block were males. About 52.86 per cent trawl net operators belonged to Hindu and 47.14 per cent belonged to Muslim religion. All the trawl net operators in Ratnagiri block possessed orange ration cards. Most of the trawl net operators were having nuclear families (70%) and 60 per cent of the families were having less than or equal to five members in their families. Majority of respondents were trawl owner (48.35%), followed by tandel (38.46%) and crew (13.19%). Total 70 per cent of trawl net operators had heard about climate change in Ratnagiri. About 48.57 per cent of respondents had moderate knowledge about local climate change. Majority (73.41%) of the trawl net operators' main source of information was own experience. Almost 91.43 per cent of trawl net operators reported increased temperature. Trawl net operators perceived decreased rainfall, decreased fish availability, decreased number of species caught, decreased fishing days, decreased fish catch, extreme change in weather and irregular seasonal transition in Ratnagiri. Availability of water as normal and regular fish species were perceived by respondents. The most preferred practice for preventing climate change by trawl net operators was mangrove protection. Trawl net operators perceived that, fishing point, fish stock, migration of fishes, reduction in income, increased cost of fishing, monsoonal fluctuation, habitat destruction and extreme weather events as impacts of climate change. It can be concluded that, awareness creation about climate change impact and coping strategies is a key measure to address the impact of climate change.

#### **FEX 14: ADOPTION OF BETTER MANAGEMENT PRACTICES BY SHRIMP FARMERS ALONG SOUTH KONKAN COAST OF MAHARASHTRA**

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Degree: M.F.Sc.	Subject: Fisheries Extension (FE)
Name of the Student: Shri. Bhalchandra Vilas Naik	Registration No.: FRRTM0180402
Year of thesis submission: 2020	
Research Guide: Dr. S. V. Patil	Designation: Assistant Professor

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Brackishwater shrimp farming is one of the important economic activity in Coastal Maharashtra. However, shrimp farmers are facing a lot of challenges mainly due to disease incidence. Disease is the major threat to shrimp farming. Production, profitability and sustainability in shrimp farming is questionable. It is, therefore very much essential to adopt Better Management Practices in shrimp farming right from the stage of pond preparation till post-harvest activities to achieve sustainability in shrimp farming. Therefore, it is necessary to understand the practices followed by shrimp farmers. Considering this situation, the present study has been undertaken in South Konkan region of Maharashtra to study the knowledge and extent of adoption of Better Management Practices by the shrimp farmers and constraints faced by shrimp farmers in order to achieve sustainable yield in shrimp farming. Information was collected from 59 shrimp farmers by using structured interview schedule. It was found that the maximum 47.97 % shrimp farmers were observed with medium knowledge, whereas 41.40 % of shrimp farmers were with high knowledge and only 10.63 % of shrimp farmers had low knowledge about better management practices in shrimp farming along South Konkan coast of Maharashtra. The most of the shrimp

farmers (43.18 %) in the South Konkan region had low adoption while, 37.03 % of shrimp farmers had medium adoption and only 19.79 % of shrimp farmers were found with high adoption about overall better management practices in shrimp farming. The adoption ratio between the knowledge and adoption about better management practices in shrimp farming, along the South Konkan region of Maharashtra was less than one. It can be concluded that all better management practices were less adopted than knowledge. Shrimp price fluctuation (weighted average 39.00), non-availability of crop insurance (weighted average 39.33), and high cost of feed (weighted average 34.67), less availability of good quality seed (weighted average 31.67), prevalence of disease outbreak (weighted average of 31.33) and high cost of seed (weighted average of 31.33) were the major constraint faced by shrimp farmers. It is suggested to address all the identified constraints and immediate preventive measures to be taken to sustain the shrimp culture in South Konkan region, Maharashtra.

### **FEC 1: CHARACTERISTICS AND BEHAVIOURAL PATTERN OF FISH CONSUMERS IN AND AROUND NAGPUR CITY, MAHARASHTRA**

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Degree: M.F.Sc.	Subject: Fisheries Economics (FEC)
Name of the Student: Miss. A. R. Tajne	Registration No.: FRRTM0160353
Year of thesis submission: 2019	
Research Guide: Dr. K. J. Chaudhari	Designation: Professor and Head

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The study is related to characteristics and behavioural pattern of fish consumers in and around Nagpur city. Total 500 non-veg consuming households from 10 NMC zones were interviewed to identify fish consuming households of which, 300 households were surveyed to collect the information on characteristic and behaviour of fish consumption pattern and problems related to fish consumption. Statistical tools such as percentage and relative frequency, normal distribution, chi-square, RBQ, linear multiple regression, logit model was applied to analyse the data. The average family size of Nagpur city was  $4.16 \pm 0.09$ . The propensity of fish consumers (92.33%) towards maintaining nuclear family was more in overall zones of Nagpur city. One third family head (34.00%) and family members (32.55%) were educated up to graduation level. The calculated value of coefficient of skewness was -0.09, reflects that the household head of Nagpur city were middle aged, whereas the positive skewness value 0.12 reflects young aged family members of fish consuming households of Nagpur city. Almost 45.00% family head were involved in service sector. The average monthly income of total sampled population was  $\text{₹}49,654.46 \pm 1912.14/-$ . Total 70.00% of sampled population was fish consumer. Almost 50.33% households were consuming fish only with dinner. Majority of fish consumers follows no-fish consumption day on Monday and Thursday. About 96.33% fish consumers preferred freshwater fish over marine water (3.33%) and estuarine water fish (0.33%). Awareness about the value added fish product was poor in fish consuming households of Nagpur city. Cent per cent consumers of fish consuming households prefer fresh fish and 95.00% fish consumers preferred Rohu for consumption. About 34.67% of fish consuming households were observed consuming fish once a week. It was observed that 63.67% of family heads of fish consuming households of Nagpur city were purchasing fish for family. Higher percentage of decision maker for fish purchase was family head (61.00%) and very few were family members (39.00%). Majority of fish consumers were purchasing fish from retail market (93.33%). The more number of households of the Nagpur city were in the



proximity to fish purchase source 0-1.0 km (41.67%). Unhygienic condition of fish market was the major constraint faced by fish consumers. The maximum contribution for per cent willingness to pay was of family income (FI) 0.4087, which indicates that 41% variation in willingness to pay extra was only because of family income.

#### RESEARCH PUBLICATIONS:

Sr. No	Name of the author/co-author	Title of research article	Name of the Journal	Publication Year, Vol. No. and page no.
1	<b>Dr. K. J. Chaudhari, Professor &amp; Head</b>			
1	<b>K. J. Chaudhari</b> and D.R. Jalihal	A field key to the seed of penaeid prawns along the Konkan coast (west coast of India )	<b>Crustaceana</b>	1993,65 ( 3 ) 318 – 335
2	<b>K. J. Chaudhari</b> and D.R. Jalihal	Morphometric studies on the seed of penaeid prawns of Ratnagiri coast ( Maharashtra, West coast of India )	<b>India J. Mar. Sci.</b>	1998, Vol, 27(3&4), 378 – 388 pp.
3	S, K, Barve, P.C.Raje, M.M. Shirdhankar, <b>K. J. Chaudhari</b> & M. M. Gavade	Cost and Earning analysis of gillnet and Trawl net operation along the Ratnagiri coast	<b>Ecology and Fisheries</b>	2009 Vol 2(2):91-94
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5	Sushil Kamble, <b>Ketan Chaudhari</b> , Mangesh Shirdhankar, and Sandip Markad	Economics of purse-seine fishing along Ratnagiri coast of Maharashtra State	<b>Indian Veterinary Journal</b>	June 2013, 90(6): 74-76 pp,
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10	Sandip Markad Nakhawa A , Kamble S , Shirdhankar M , Mohite A , <b>Chaudhari K</b> , 2014	Detection of Shoreline Changes in Ratnagiri Block, Maharashtra, India using Remote Sensing and GIS Techniques.	<b>Fishery Technology</b>	2014, 51 (4), 229- 233
11	S.S.Patil, A.U.Pagarkar, <b>K. J. Chaudhari</b> , A.S.Desai and S. M. Shaikh	Organoleptic and Biochemical quality changes in fish pickle prepared from freshwater catfish Panagasius	<b>Indian Veterinary Journal</b>	<b>2014, 91(07): 12- 14 pp.</b> <b>ISSN: 0019-6479</b>
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29.	Prioritizing Alternative Livelihood Options for Fishers of Ratnagiri District, Maharashtra	<b>S. V. Patil</b> , B. M. Yadav, S. S. Mandavkar, S. M. Wasave, M. M. Shirdhankar, K. J. Chaudhari, B. V. Naik and V. G. Yewale	Journal of Indian Fisheries Association	2021; 48(1): 44-48.
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<b>V. Shri. B. V. Naik, Assistant Professor</b>				
1	B. V. Naik, <b>S. V. Patil*</b> , M. M. Shirdhankar, B. M. Yadav, R. M. Tibile, K. J. Chaudhari, S. M. Wasave & V. G. Yewale	Socio-Economic Profile of Shrimp Farmers of South Konkan Region, Maharashtra, India.	International Journal of Current Microbiology and Applied Sciences.	2020 9 (9):1371-1380
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**Full length research papers published in Proceedings of Seminar / Symposia / Conference /Workshop:**

**Proceedings: Full papers**

**(i) International: Nil**

**(ii) National**

No.	Co-author[s] if any	Title of the publication	Year of publication	Name of the Journal
1	P. E. Shingare, A. S. Chaudhari and <b>K. J. Chaudhari</b>	Status and Management practices of Inland Fish Farming in North-west Maharashtra	Dec 2013	<b>Proceedings of the seminar on “Role of Applied Zoology in Sustainable Development”</b>
2	H. Singh, P. E. Shingare and <b>K. J. Chaudhari</b>	Role of Aquaculture in Rural Development of Maharashtra	2014	<b>Recent Trends in Zoology</b>
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**(iii) State level:**

<b>Sr. No.</b>	<b>Co-author[s] if any</b>	<b>Title of the publication</b>	<b>Year of publication</b>	<b>Name of the Journal</b>
<b>1</b>	P. E. Shingare, A. S. Chaudhari and K. J. Chaudhari	Status and Management practices of Inland Fish Farming in North-west Maharashtra	Dec 2013	Proceedings of the seminar on “Role of Applied Zoology in Sustainable Development” pp 16-22. ISBN: 978-81-928760-1-6

**iii Technical articles published not covered above.**

<b>No.</b>	<b>Name of Author (s)</b>	<b>Title</b>	<b>Year</b>	<b>Details</b>
<b>1</b>	<b>K. J. Chaudhari</b>	Concept of sustainability in fisheries	<b>2010</b>	Training Manual on Sustainable Development of Marine Fisheries 4-9 pp
<b>2</b>	<b>K. J. Chaudhari and S. V. Patil</b>	Participatory SWOT analysis of marine fisheries of India	<b>2010</b>	Training Manual on Sustainable Development of Marine Fisheries 21-26 pp
<b>3</b>	<b>K. J. Chaudhari</b>	Marine fisheries regulations: National and States	<b>2010</b>	Training Manual on Sustainable Development of Marine Fisheries 36-41 pp
<b>4</b>	<b>K. J. Chaudhari</b>	Ecolabelling: Concepts and Practices	<b>2010</b>	Training Manual on Sustainable Development of Marine Fisheries 82-89 pp
<b>5</b>	<b>K. J. Chaudhari</b>	Constitution for the seas: UNCLOS III	<b>2010</b>	Training Manual on Sustainable Development of Marine Fisheries 151-156 pp
<b>6</b>	<b>K. J. Chaudhari</b>	Integrated coastal Zone Management for sustainable development of marine fisheries	<b>2010</b>	Training Manual on Sustainable Development of Marine Fisheries 165-169 pp
<b>7</b>	<b>M. M. Shirdhankar and K. J. Chaudhari</b>	Fisheries Scenario of Sindhudurg District	<b>2014-15</b>	Capacity Building of local Fisher Community in Sustainable Fishing: Book
<b>8</b>	<b>K. J. Chaudhari</b>	Sustainable development: Concept and Practices	<b>2014-15</b>	Capacity Building of local Fisher Community in Sustainable Fishing: Book

<b>9</b>	<b>K. J. Chaudhari</b>	DPR on Aqua clinic center	<b>2019-20</b>	<i>In Training Manual on Aquaclinic and aquapreneurship development Programme (AC &amp; ADP) Published by College of Fisheries, Ratnagiri, MANAGE, Hyderabad and NFDB, Hyderabad</i>
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**Books:**

<b>No.</b>	<b>Co-author[s] if any</b>	<b>Title of the publication</b>	<b>Year of publication</b>	<b>Name of the Publisher</b>
1	M. M. Shirdhankar, K. J. Chaudhari, Sandesh V. Patil, Ravindra Pawar, Nitin Sawant, Subir Ghosh	<b>Capacity Building of Local fish Community in Sustainable Fishing</b>	2014	Associate Dean, College of Fisheries, Rtnagiri, 68p
2	Prashant Lokhande, Mangesh Shirdhankar, <b>Ketan Chaudhari</b>	<b>Fisheries Resources Mapping of Ratnagiri District using RS and GIS</b>	2017	Published by LAMBERT Academic Publishing ISBN: 978-613-9-82570-7

**Souvenir/Proceedings of Seminar/Conference/Workshop Organized-**

1. Proceedings and recommendations of International Conference on Challenges and Opportunities for Sustainable Fisheries and Aquaculture Development (COSFAD-2019), Eds. Dhakar H.S., Shirdhankar, M.M. and B. M. Yadav (ISBN:978-81-938864-4-1) 1-38pp.

### C) EXTENSION:

#### EXTENSION ACTIVITIES

##### A. Training Programmes Organized:

Sr. No	Title	Sponsorer	Date & Duration	Type of participants & numbers
1.	Enhancing income through sustainable marine fisheries in post Covid 19 era (VTC)	-----	5-14 May 2020 Five days	B.F.Sc. Students - 40
2.	Demonstration of aquarium fish culture and value-added fish products preparation	Scheduled Caste Sub Plan, ICAR, New Delhi	13/03/2020 One day	Women's of SHGs -50, Youth - 10
3.	Value added fish product preparation	DBT (Women's) Project	3/2/2020 One day	Women's of SHGs -75 Youth - 10
4.	Value added fish product preparation	DBT (Women's) Project	10/07/2019 One day	Women's of SHGs -30
5.	Trainers' Training Programme for Matsyasakhi on employment opportunities in Fisheries	UMED, Ratnagiri and DBT (Women's) Project	23 – 25 September 2019 Three days	Women's of SHGs -40
6.	Ecofriendly Sustainable Shrimp/Prawn farming and diversification of aquaculture	Marine Product Export Development Authority	12 <sup>th</sup> to 14 <sup>th</sup> July 2016	Fish farmers- 21
7.	Capacity building of local fisher community in sustainable fishing practices along the coast of Sindhudurg district, Maharashtra (30 Training Programs)	UNDP through Chief Conservator of Forest, Mangrove Cell, Govt of Maharashtra	(21/11/2014 to 30/07/2015) One day Malvan -14 Vengurla –10 Devgad – 6	Marine fishers – 1282 in 30 trainings (749 male and 543 female)
8.	Value added fish products preparation	--	22/9/2013 One day	Fishers - 30
9.	Self-employment generation training	--	12/07/2013 One day	Fishermen- 12
10.	Ornamental fish breeding & Marketing (on the occasion of Krishi Din)	--	1/7/12 One day	Ornamental fish farmers & breeders - 15
11.	Fisheries & Aquaculture	Chaitanya, Pune	23/5/12 One day	Trainees -6
12.	Potential fishing zone and fishing technology	--	20/3/12 One day	Fishermen -28
13.	Fish culture in saline water & farm ponds	ATMA, Sangli	13 -15/2/12 Three days	Farmers - 12

14.	Ornamental fish breeding	Parivartan sanstha, Chiplun & BOI	23/8/11 - 27/8/11 Five days	Members of Parivartan sanstha - 20
15.	Ornamental fish breeding	MPEDA	1/7 - 5/7/11 , Five days	Ornamental fish rearers - 20
16.	Capacity building to enhance competitiveness of Indian Fisheries	FISHCOPFED, New Delhi	30/12/10 - 1/1/11 Three days	Trainees -30
17.	Development of Fisheries in Maharashtra	MFDC, Mumbai	23/8/10 - 27/8/10 Five days	Fish farmers - 12
18.	Fingerling production in rearing pond	NAIP	3/8/10 One day	Fish farmers - 19
19.	Ornamental fish breeding & culture	--	14/6/10 - 20/6/10 Seven days	Trainees -39
20.	Sustainable development of marine fisheries	Ministry of Agriculture, GOI	26/10/09 - 4/11/09 Ten days	Fishermen - 19
21.	Recent Extension Approaches for Effective Transfer of Technologies	Extension Education Institute (EEI), Anand, Gujarat and College of Fisheries, Ratnagiri	3 days, 22/09/2021 to 24/09/2021	30
22.	Presentation Skills for Professional Excellence	Extension Education Institute (EEI), Anand, Gujarat and College of Fisheries, Ratnagiri	3 days, 29/09/2021 to 01/10/2021	30
23.	Video Editing and Conferencing	Extension Education Institute (EEI), Anand, Gujarat and College of Fisheries, Ratnagiri	3 days, 10/01/2022 to 12/01/2022	30
24.	Fundamentals of Freshwater Aquaculture and Composite Fish Culture	College of Fisheries, Ratnagiri	Three days 14/03/2022 to 16/03/2022	50
25.	Capacity Building Training on Seaweed Farming	College of Fisheries, Ratnagiri	Three days 14/03/2022 to 16/03/2022	25
26.	Training on Value Added fish Product Preparation	College of Fisheries, Ratnagiri	One day, 07/01/2022	40



**B. Seminar/Symposia/Conference/Workshop organized:**

<b>Sr. No</b>	<b>Title</b>	<b>Sponsorer</b>	<b>Date &amp; Duration</b>	<b>Type of participants &amp; numbers</b>
	State level workshop on Development of aquaculture in Konkan region: Status, Problems and Prospects during	Directorate of Extension, Dr. B.S. K. K. V., Dapoli	29-30 November 2019, Two days	Fishers, fish farmers, women's - 70
1.	Open Sea cage culture - Navi Disha.	ATMA, JSW & SBI	24/01/13 One day	Fishermen- 176
2.	Sindhudurg Bio- diversity project	Mangrove Cell, Department of Forest, Govt. of Maharashtra	21/12/12 One day	Officer and fishermen - 15
3.	Work shop on ornamental fish breeding and marketing	--	01/7/2012 One day	Ornamental fish farmers - 18
4.	Fresh water fish culture (on the occasion of Fish Farmers day)	--	10/7/12 One day	Villagers - 20
5.	Development of fresh water aquaculture in Western Maharashtra	M. P. K. V., Rahuri	25/8/11 One day	Farmers - 27
6.	Value added fish product demonstrations	NAIP	8/3/11 One day	Womens from nearby villages - 30
7.	Ornamental Fish Diseases	MPEDA	4/9/10 One day	Ornamental fish breeders & rearers from state - 86
8.	Tuna fishing	MPEDA	11/1/10 One day	Fishermen - 22
9.	Potential fishing zone & fisheries technology	----	4/8/09 One day	Fishermen - 18
10.	Sustainable fisheries	----	5/6/09 One day	Fishermen - 14

**C. Farmer's Rally (Melava) organized:**

<b>Sr. No</b>	<b>Title</b>	<b>Sponsorer</b>	<b>Date &amp; Duration</b>	<b>Type of participants &amp; numbers</b>
1.	Reservoir Fisheries Management: problems & Solutions	Association of Reservoir Fish Farmers, Ratnagiri	10/7/2010 One day	Fish farmers - 22
2.	Ornamental fish breeding & culture- Problem & Solution	--	1/7/2010 One day	Ornamental fish rearers - 23
3.	Employment opportunities in fisheries	Matsyagandha fishermen	19/3/2010 One day	Fishermen - 19

		society, Kasarveli, Ratnagiri		
4.	Employment opportunities in fisheries	Abhar Sanskrutik, Kala ani Krida Mandal, Ratnagiri	14/3/2010 One day	Fishermen - 24
5.	Employment opportunities in fisheries	Fishermen society, Harnai- Paj, Dapoli	8/3/2010 One day	Fishermen - 23
6.	Protection & Management of marine biological resources	NBFGR, Lucknow	25/2/2009	Fishermen - 60
7.	Reservoir fish culture	---	10/7/08	Fish farmers - 20

**D. Other Extension Activities (Awareness programmes / Group Discussions / Farmer Field School etc.)**

<b>Sr. No.</b>	<b>Subject</b>	<b>Duration &amp; date</b>	<b>No. of trainees</b>	<b>Place of organization</b>
1.	Awareness programme on Blue Revolution schemes and self-employment opportunities in fisheries	One day, 8/03/2020	47	Chiplun, Ratnagiri
2.	Awareness programme on Blue Revolution schemes and self-employment opportunities in fisheries	One day, 30/01/2020	45	Lanja, Ratnagiri
3.	Farmers Field School (FFS): Site selection for setting ornamental fish production unit: Planned designing, resource availability and construction	One day, 21/11/2019	18	Juve, Rtanagiri
4.	Farmers Field School (FFS): Seed procurement, transportation, acclimatization and stocking of candidate ornamental fish to culture environment	One day, 21/12/2019	15	Juve, Rtanagiri
5.	Farmers Field School (FFS): Commercial production of ornamental fish: Development of brood stock, breeding techniques, successful rearing	One day, 30/01/2020	19	Juve, Rtanagiri
6.	Awareness campaign on Code of conduct for responsible Fisheries	21/03/2013	17	Deogad, Sindhurg
7.	Awareness campaign on Code of conduct for responsible Fisheries	21/03/2013	15	Malvan, Sindhurg
8.	Awareness programme on 'Code of conduct for responsible fisheries'.	21/3/13 - One day	15	Malvan, Sindhurg
9.	Awareness programme on 'Code of conduct for responsible fisheries'.	21/3/13- One day	17	Deogad, Sindhurg
10.	Awareness programme on 'Code of conduct for responsible fisheries'.	20/3/13- One day	19	Nivati, Sindhurg
11.	Awareness programme on 'Code of conduct	20/3/13-	19	Shiroda,

	for responsible fisheries'.	One day		Sindhudurg
12.	Awareness programme on 'Code of conduct for responsible fisheries'.	9/11/12- One day	29	Bhatye, Ratnagiri
13.	Awareness programme on 'Code of conduct for responsible fisheries'.	12/9/12- One day	17	Waravde, Ratnagiri
14.	Awareness programme on 'Code of conduct for responsible fisheries'.	14/7/12- One day	39	Karla, Ratnagiri
15.	Awareness programme on 'Code of conduct for responsible fisheries'.	6/7/12- One day	22	Kalbadevi, Ratnagiri
16.	Sustainable fisheries	4/12/11 - One day	101	Shivar- Ambere, Ratnagiri
17.	Sustainable fisheries	30/9/11 - One day	43	Sakhartar, Ratnagiri
18.	Demonstration of By Catch Reduction Device	17/2/09 - One day, 14/4/08 - One day, 13/4/08 - One day, 12/4/08 - One day	79	Harne, Kasarveli, Mirkarwada, Veldur
	Value Added fish Product Demonstration	07/01/2022	40	Varawade, Ratnagiri

#### E. Farmer-Scientist Forum: Nil

#### F. Webinars organized:

Sr. No.	Webinar title	date	No. of participants	Place of organization
1.	Present status and future prospectus of freshwater aquaculture in Maharashtra	10/07/2020	135	COF, Ratnagiri
2.	Entrepreneurship development from sustainable fisheries	04/08/2020	150	COF, Ratnagiri
3.	Pradhan Mantri Matsya Sampada Yojana (PMMSY): Peoples Perspectives	31/08/2020	180	COF, Ratnagiri
4.	E launching programme of Vikel Te Pikel and PMMSY	10/09/2020	30	Juve, Ratnagiri
5.	Business opportunities in freshwater fisheries sector of Maharashtra	25/09/2020	132	COF, Ratnagiri
6.	PMMSY schemes for Brackishwater Aquaculture	11/06/2021	187	COF, Ratnagiri
7.	PMMSY schemes for Marine Fisheries	30/06/2021	221	COF Ratnagiri
8.	Schemes for Brackishwater	11/06/2021	129	COF, Ratnagiri

	Aquaculture under PMMSY (Online Webinar)			
9	Schemes for Marine Sector under PMMSY (Online Webinar)	30/06/2021	155	COF, Ratnagiri
10	Schemes for Inland fisheries under PMMSY (Online Webinar)	10/07/2021	283	COF, Ratnagiri
11	Schemes for Ornamental Fisheries Development under PMSSY (Online Webinar)	27/01/2022	181	COF, Ratnagiri
12	Recent Advances in Brackishwater Aquaculture (Online Webinar)	10/02/2022	190	COF, Ratnagiri
13	State level awareness programme on PMMSY (Online Webinar)	03/03/2022	161	COF, Ratnagiri

### G. Special Days Celebration:

No.	Name of Special day	Date	Place of organization
1	Celebration of Birth Anniversary of Dr. B. R Ambedkar	14/04/2021	COF, Ratnagiri
2.	Celebration of College Foundation Day	04/08/2021	COF, Ratnagiri
3.	Celebration of Shivjayanti	19/02/2022	COF, Ratnagiri

### H. Radio/TV Talks delivered by the staff members of the Department/Section:

Sr. No	Topic	Date of Broadcast on AIR, Ratnagiri
<b>1.</b>	<b>Dr. K. J. Chaudhari, Professor &amp; Head</b>	
1	Dol Net Fisheries	18.01.1997
2	Nauka Kinaryavar Ghenyache Kaushalya	20.07.1996
3	Matsya Prakriya Ya Malet: Masalichi Frizing Prikriya	19.07.1997
4	Naukache samudratil Apghat Kase Talal?	31.07.1999
5	Masemari Bandaravaril Swachateche Mahatva	06.11.1999
6	Matsya Prakriya Tantradyan: Sadyastiti	01.01.2000
7	Godyapanyatil Matsyasavardhachi Purva Tayari	09.09.2000
8	Matsyotapadanateel Ghat: : Karane ani Upay	06.12.2002
9	Masali Hataltana Swacchteche Mahatwa	28.02.2003
10	Matsya Prekriyetil Aadhunik Tantatrdynan	22.01.2004
11	Masemari Vyavasayatil Aadhunik Tantradyan	27.05.2005
12	Matsyavyavasay pairchay	05.02.2005
13	Dharanat matsyasanvardhan karatana gyavayachi kalaji	12.08.2005
14	Nimkharya panyatil kolambi sanvardhan ya mallet: Kolambi savardhanche Arthshatra and prakalp ahaval	12.01.2006
15	Shashvat Masemarisathi Upay-yojan	06.11.2007
16	Nimkharya panyatil Khekada sanvardhan ya mallet: Khekada savardhanche Arthshatra and prakalp ahaval	25.07.2008
17	Thet Masali Vikriche Fayade	02/01/2009
18	Pavasalyatil Masemari bandiche Mahatva	12/06/2009

19	Shashvat Masemari: Kalachi Garaj	11/12/2009
20	Pavasalyatil Masemari bandi Aavashyak	09/07/2010
21	Matsyavyavasayatil Svayamrojagar Sandhi	11/02/2011
22	Matsyavyavasayatil Svayamrojagarchya Sandhi	25/11/2011
23	Matsyavyavasayasathi Shasanacya Vividh Yojana	26/10/2012
24	Shashvat Masemari: Kalachi Garaj	28/06/2013
25	Shashvat Masemari-Sankalpana aani Uddhishte	18/09/2015
26	Shobhivant mashachya sanvardhantil arthshastra	03/02/2017
27	Matsyavyavasayatil arthkaran	15/12/2017
28	Shobhivant matsya sanvardhanatil arthshastra	21/09/2018
29	Matsyavyavasatil nilkranti	21/03/2020
30	Pradhan Mantri Matsya Sampada Yojana	15/01/2021
<b>2.</b>	<b>Dr. S. M. Wasave, Associate Professor (CAS)</b>	
1	Participated in Rupak: Neelkrantichee navi disha, Swayanrojgarachi navi aasha	1998
2	Masemaree Naukanchi durusti ani Niga	21/01/2005
3	Matsyodyogat Yuvakanna sandhi	03/06/2005
4	Sagari Kolambi Sanvardhan	11/11/2005
5	Nimkharya panyatil kolambi savanrdhan Malet : Kolambichya khadyache vyavsthapan	01/12/2006
6	Mase ani manavi aharateel mahatva	11/04/2008
7	Jababdar Masemarisathi acharsanhit	13/2/2009
8	Matsyavyavasayachya Bhavitavyasathi Kandalvan Sanrakshan	15/01/2010
9	Sagari Jaiv Vividhata ani tiche Mahatva	27/08/2010
10	Shobhivant Matsya Vyavasayat Rojgarachya Sandhi	20/01/2012
11	Matsyamahavidyalayache matsyavyavasay vistar vishayak upakram	18/7/2012
12	Matsyavyavasayatil Rojgar Sandhi	27/10/2017
13	Matsyavyavasay vikasasathi Neelkranti yojana	2/11/2018
14	Paryavaran ani masemari	19/9/2019
15	Matsya vyavasayachya vikasat matsya sahkari sansthanchi bhumika	21/9/2020
16	Matsyavyavasayachya vikasasathi Kendra Shasan Purskrut Pradhan Mantri Matsya Sampada Yojana	
<b>3.</b>	<b>Dr. B. M. Yadav, Associate Professor (CAS)</b>	
1	Kolambi beej upalabhdhata ani vyavassthapan.	27-10-2006
1	Samudratil matsyasatha olakhanyacyha vividh paddhati	16-11-2007
2	Kolambi snavardhanachya vividh paddhati.	06-06-2008
3	Sagari utpadan vikas pradhikaran ani vividh yojana.	26-12-2008
4	Naisargik apatti ani masemari vyavasthapan	23-07-2010
5	Naisargik apatti ani Matsyavyavsay	15-03-2013
6	Matya Vyavsay and Appatti Vyavasthapan	04-04-2014
7	Shobhivant matsya vyavsay	04-03-2016
8	Matsya vyavsayat mahilanche yogdan	12-12-2018
9	Shahsvat Matsyasanvardhan	18-08-2019

<b>4.</b>	<b>Dr. S. V. Patil, Associate Professor (CAS)</b>	
1	Kolambichi Kadhani Ani Panan	18/12/2006
2	Karp Mashyanche Nursery Vyavasthapan	10/08/2007
3	Sagari Jaivikteche Mahatva	27/05/2009
4	Jababdar Masemarisathi Karavayachi Achar Sanhita	09/03/2010
5	Shobhivant Matsya Vyavasay Ek Uttam Rojagar	12/03/2013
6	Carp Mashyanche Nursery Prabhandhan	14/08/2018
7	Carp Mashayanchi Nursery	08/7/2019
8	Shobhivant Matsyavyavasay Ek Swayamrojagar Sandhi	15/01/2022
9	Jababdar Masemarikarita Acahrsanhita	22/09/2022
<b>5.</b>	<b>Shri. B. V. Naik, Assistant Professor</b>	
1	Shobhivant matsyashettil swayamrojgar sandhi	08/08/2022

### I. Extension Publications:

#### Training Manuals: 03

- 1) Capacity Building of Local Fisher Community for Sustainable Marine Fisheries (English)
- 2) Sustainable Development of Marine Fisheries (English)
- 3) शाश्वत मासेमारी करिता मच्छिमारांचा क्षमता विकास (मराठी भाषेत)

#### Booklet/Bulletin: 01

- 1) Godya Panyatil Carp Masaliche Sanvardhan (in Marathi)

#### Folders/Leaflets- 02

- 1) Jababdar Masemarisathi Achar Sanhita.(in Marathi)
- 2) Cage Culture: Ek Navi Disha (in Marathi)

### J. Extension / Technical Publications / News Coverage:

Sr. No.	Subject	Name of Newspapers/ Journal/Magazine	Scientist involved
1.	Matsyavyavasayatil Arthkaran	Daily Sakal	Dr. Prakash Shingare, Associate Dean Dr. K. J. Chaudhari, Professor and Head
2.	Maharashtrachi Sagari Sadhansampatti	Daily Sakal	Dr. S. M. Wasave, Associate Professor
3.	Matsya Vidnyan Shetratil Vividh Sandhi	Daily Sakal	Dr. S. V. Patil, Associate Professor
4.	Samudra Shaival Sheti	Daily Sakal	Dr. K. J. Chaudhari, Professor and Head
5.	Shashvat Matsya Savardhan	Daily Sakal	Dr. B. M. Yadav, Associate Professor
6.	Rashtriy Matsyasanvardhak divas	Ratnagiri Express & Tarun Bharat	Dr. K. J. Chaudhari, Professor and Head & Dr. S. M. Wasave, Associate Professor

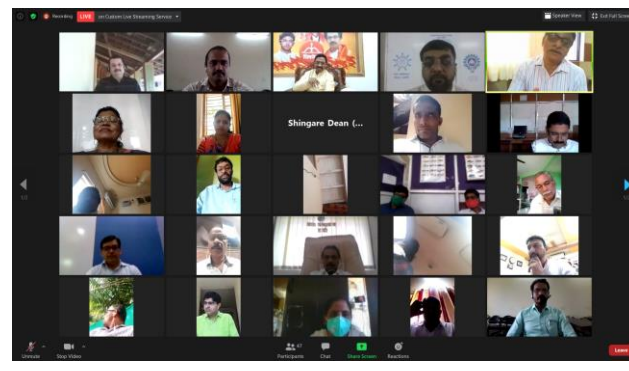
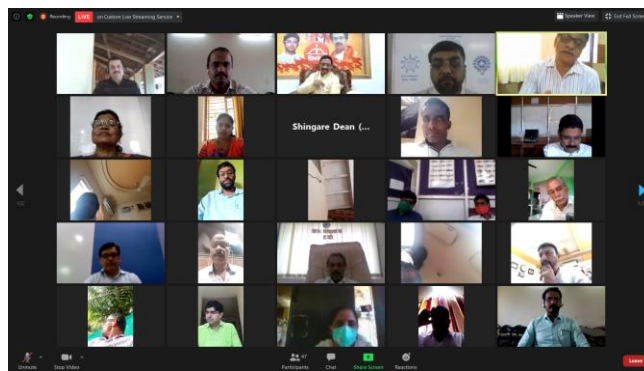
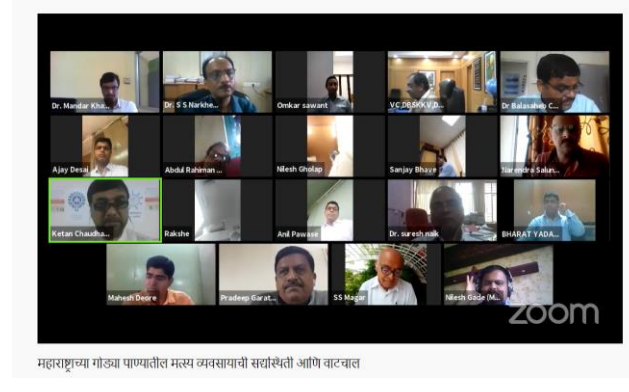
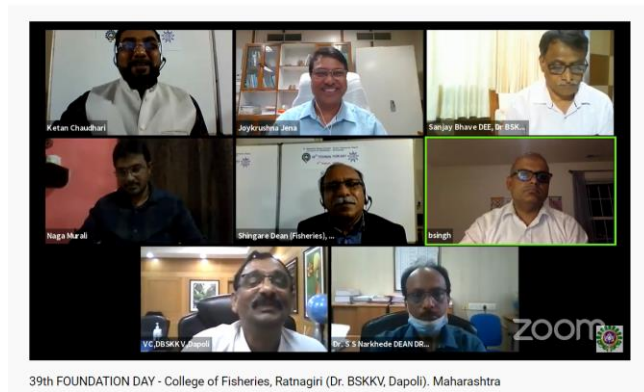
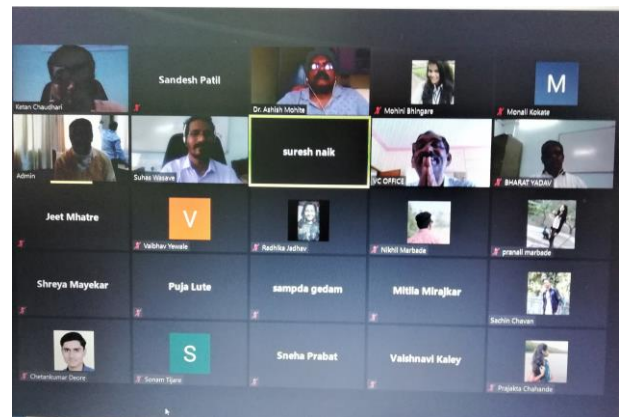
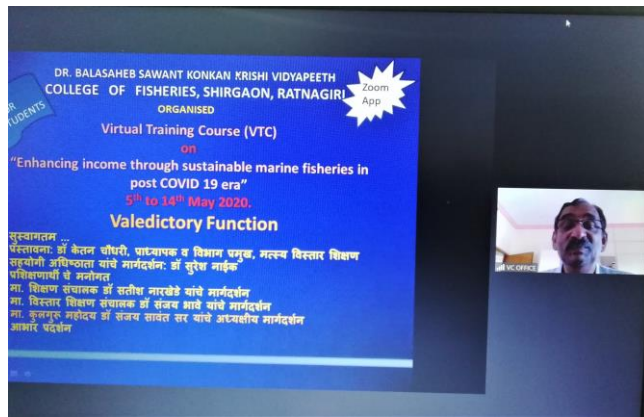
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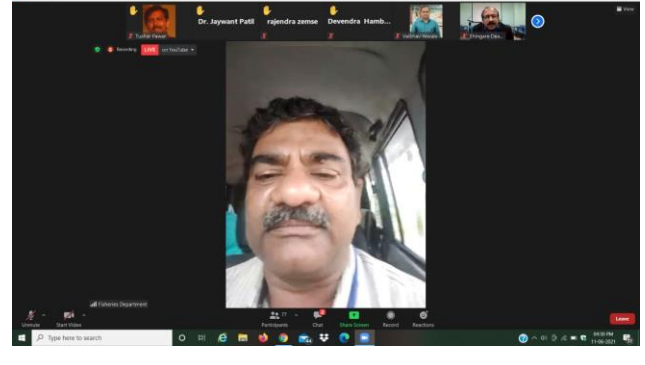
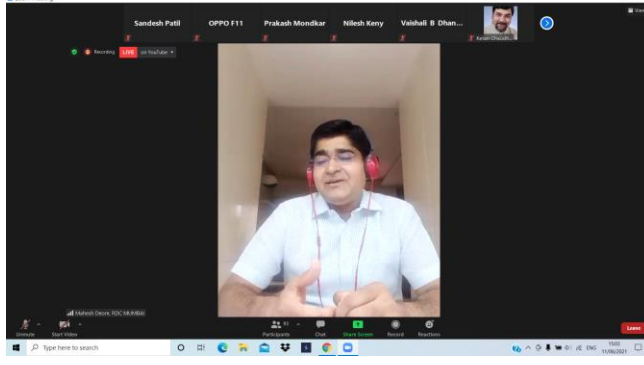
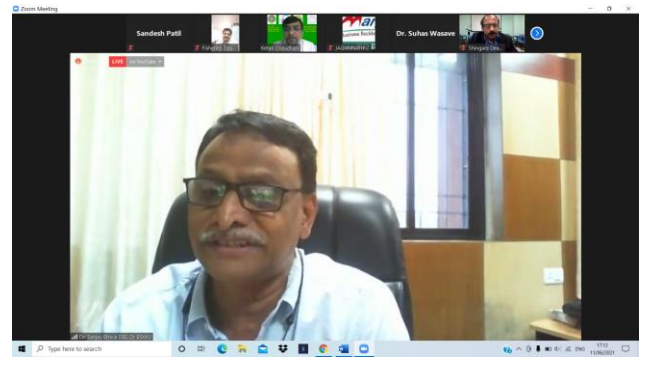
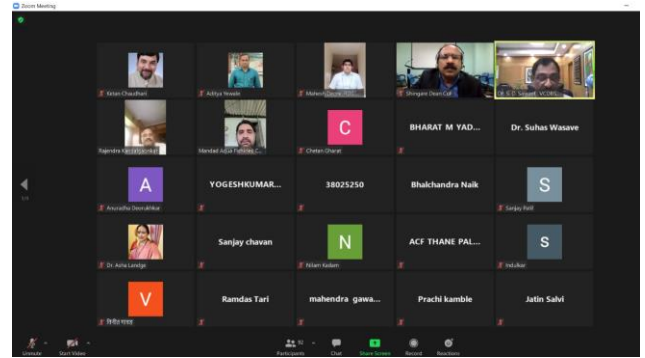


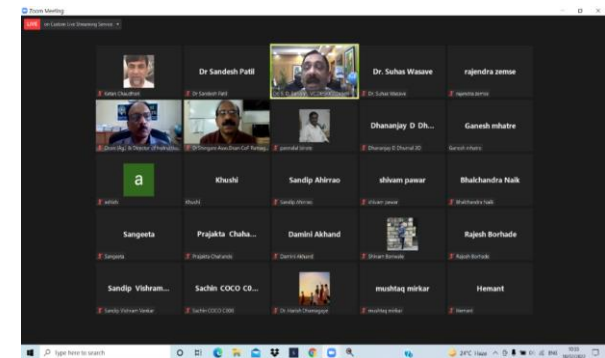
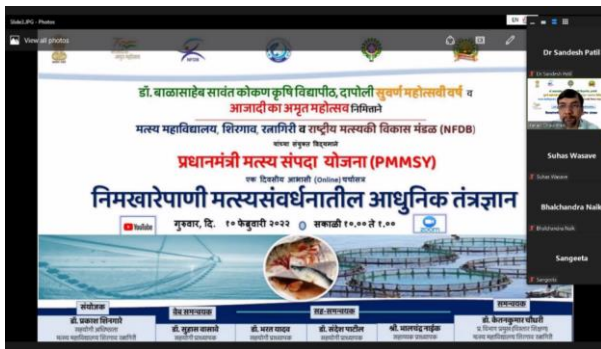
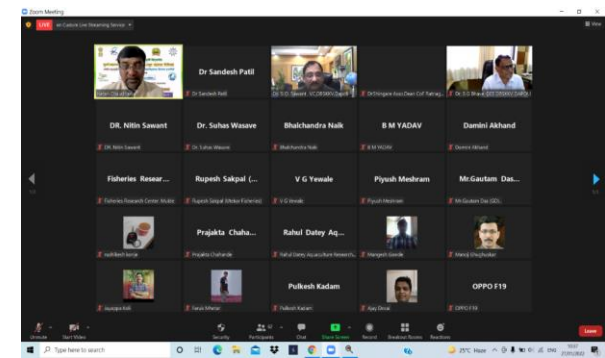
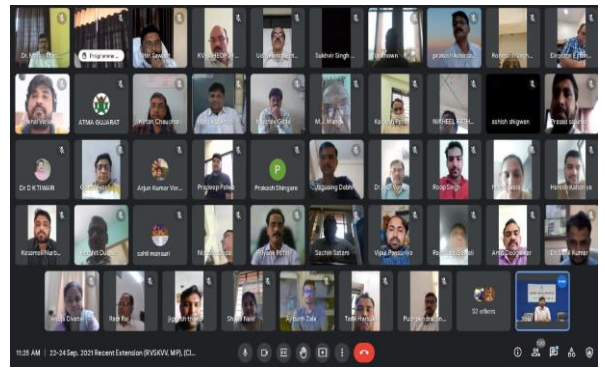
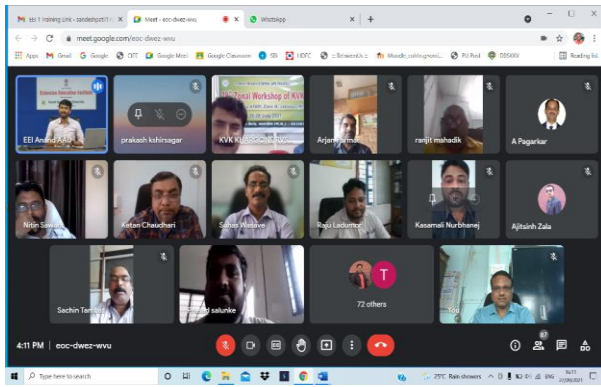


## Virtual Extension Activities:



# Webinar on PMSSY:





डॉ. बाळासाहेब सावंत कोंकण कृषि विद्यापीठ, दापोली **सुवर्ण महोत्सवी वर्ष** व **आजारी का अग्रत महोत्सव** निमित्त **मत्स्य महाविद्यालय, शिरगाव, रत्नागिरी व राष्ट्रीय मत्स्य विकास मंडळ (NFDB), हैदराबाद** यांच्या संयुक्त विद्यमाने **एक दिवसीय आजारी (Online) चर्चासत्र**

**प्रधानमंत्री मत्स्य संपदा योजना (PMMSY) राज्यस्तरीय जनजागृती कार्यक्रम**

**गुरुवार, दि. ३ मार्च २०२२ सांवाळी १०.०० ते १३.००**

**मुख्य अतिथी**

डॉ. अ. के. जेठा NFDB महासंचालक (राज्यातील) मुंबई	डॉ. संजय सावंत भा. सुवर्ण	डॉ. संजय भास्कर मत्स्य विकास विभाग	डॉ. सुनील पारनेरे मत्स्य विभाग	डॉ. प्रकाश विठ्ठलकर मत्स्य विभाग
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११.३० - ११.४० : आजारीची संपदा आणि राष्ट्रीय आदर्शिक मासेपट्टी

११.४० - १२.३० : आजारीची महत्त्वाची संपदा आणि राष्ट्रीय आदर्शिक मासेपट्टी

१२.३० - १२.४० : आजारीची महत्त्वाची संपदा आणि राष्ट्रीय आदर्शिक मासेपट्टी

१२.४० - १२.५० : आजारीची महत्त्वाची संपदा आणि राष्ट्रीय आदर्शिक मासेपट्टी

१२.५० - १३.०० : PMMSY: अजारीची महत्त्वाची संपदा

<https://bit.ly/3teZuTG> <https://bit.ly/3itukhr>

डॉ. बाळासाहेब सावंत कोंकण कृषि विद्यापीठ, दापोली **सुवर्ण महोत्सवी वर्ष** निमित्त **राष्ट्रीय मत्स्य विकास मंडळ (NFDB) व मत्स्य महाविद्यालय, शिरगाव, रत्नागिरी** यांच्या संयुक्त विद्यमाने **प्रधानमंत्री मत्स्य संपदा योजना (PMMSY) सागरी मत्स्यव्यवसाय विकास योजना**

**एक दिवसीय आजारी (Online) चर्चासत्र** **गुरुवार, दि. ३ मार्च २०२२ सांवाळी १०.०० ते १३.००**

**सागरी मत्स्यव्यवसाय योजना** **श्री संजय पाटील यांचे अध्यक्षत्व निमित्त**

**समूही वीवाळ संवर्धन** **डॉ. नीताजी देवगुडे** (भा. सुवर्ण, ICAR-CIFE)

**योजना: प्रकल्प आराखडा व आवेक्यक कामाद्वारे** **डॉ. केतन चौधरी** (मत्स्य विभाग, भा. सुवर्ण, रत्नागिरी)

**निमज्याच्या पाण्यातील पिंजरा मत्स्य संवर्धन** **श्री. प्रकाश विठ्ठलकर** (मत्स्य विभाग, भा. सुवर्ण, रत्नागिरी)

संयोजक: डॉ. प्रकाश विठ्ठलकर

डॉ. बाळासाहेब सावंत कोंकण कृषि विद्यापीठ, दापोली **सुवर्ण महोत्सवी वर्ष** निमित्त **राष्ट्रीय मत्स्य संवर्धन दिन (१० जुलै)** अधिवर्तने

**राष्ट्रीय मत्स्य विकास मंडळ (NFDB), मत्स्यव्यवसाय विभाग, महाराष्ट्र शाखा व मत्स्य महाविद्यालय, शिरगाव, रत्नागिरी** यांच्या संयुक्त विद्यमाने **राज्यस्तरीय वेबिनार**

**प्रधानमंत्री मत्स्य संपदा योजना (PMMSY) योजनेतर्गत** **गोडया पाण्यातील मत्स्यव्यवसाय विकासासाठी योजना**

**दिनांक: १० जुलै २०१९**

**सांवाळी १०.०० ते १३.००**

**मुख्य अतिथी**

डॉ. अ. के. जेठा	डॉ. संजय सावंत	डॉ. संजय भास्कर	डॉ. सुनील पारनेरे	डॉ. प्रकाश विठ्ठलकर
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१०.३० - १०.४० : आजारीची महत्त्वाची संपदा आणि राष्ट्रीय आदर्शिक मासेपट्टी

१०.४० - ११.३० : आजारीची महत्त्वाची संपदा आणि राष्ट्रीय आदर्शिक मासेपट्टी

११.३० - १२.३० : आजारीची महत्त्वाची संपदा आणि राष्ट्रीय आदर्शिक मासेपट्टी

१२.३० - १२.४० : आजारीची महत्त्वाची संपदा आणि राष्ट्रीय आदर्शिक मासेपट्टी

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१२.५० - १३.०० : PMMSY: अजारीची महत्त्वाची संपदा

डॉ. बाळासाहेब सावंत कोंकण कृषि विद्यापीठ, दापोली **सुवर्ण महोत्सवी वर्ष** व **आजारी का अग्रत महोत्सव** निमित्त **मत्स्य महाविद्यालय, शिरगाव, रत्नागिरी व राष्ट्रीय मत्स्य विकास मंडळ (NFDB), हैदराबाद** यांच्या संयुक्त विद्यमाने **एक दिवसीय आजारी (Online) चर्चासत्र**

**प्रधानमंत्री मत्स्य संपदा योजना (PMMSY) सागरी मत्स्यव्यवसाय विकास योजना**

**गुरुवार, दि. ३ मार्च २०२२ सांवाळी १०.०० ते १३.००**

**मुख्य अतिथी**

डॉ. अ. के. जेठा	डॉ. संजय सावंत	डॉ. संजय भास्कर	डॉ. सुनील पारनेरे	डॉ. प्रकाश विठ्ठलकर
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**समूही वीवाळ संवर्धन** **डॉ. नीताजी देवगुडे** (भा. सुवर्ण, ICAR-CIFE)

**योजना: प्रकल्प आराखडा व आवेक्यक कामाद्वारे** **डॉ. केतन चौधरी** (मत्स्य विभाग, भा. सुवर्ण, रत्नागिरी)

**निमज्याच्या पाण्यातील पिंजरा मत्स्य संवर्धन** **श्री. प्रकाश विठ्ठलकर** (मत्स्य विभाग, भा. सुवर्ण, रत्नागिरी)

संयोजक: डॉ. प्रकाश विठ्ठलकर

❖ **CONTACT INFORMATION**

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Statistics and Extension Education

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