

**:Department of Marine Living Resources  
Andhra University**

**M.Sc. Marine Biology & Fisheries – I Semester Syllabus  
Paper 1.1 : Marine Ecology**

**Physical parameters of sea: tides, waves, light, temperature, currents, density & pressure.**

**Chemical parameters of sea: salinity, dissolved oxygen, pH and nutrients.**

**Shore Environment: Distribution of life on rocky shore, sandy shore and muddy shore ; Zonation and adaptations of organisms.**

**Zoogeography of marine environment with special reference to Indo-west Pacific region.**

**Ecology of coral reefs and mangrove habitats; their special features.**

**Benthos: Distribution of shallow water benthic organisms; Fauna of deep sea and hadal regions – their adaptations.**

**Larval Ecology: Types of larvae and their distribution. Chemical communications and settlement of larvae of marine benthic organisms.**

**Marine animal associations: Commensalism, symbiosis and parasitism.**

**References**

<b>Svedrup et al</b>	<b>The Oceans</b>	<b>Prentice Hall</b>
<b>Tait RV</b>	<b>Elements of marine ecology</b>	<b>Butterworths</b>
<b>Riley &amp; Skirrow</b>	<b>Chemical Oceanography</b>	<b>Academic Press</b>
<b>Newell RC</b>	<b>Biology of intertidal animals</b>	<b>Logos Press</b>
<b>Kinne O (Ed)</b>	<b>Marine ecology</b>	<b>John Wiley &amp; Sons</b>
<b>Marshall NB</b>	<b>Aspects of Deepsea Biology</b>	<b>Hutchinson</b>
<b>Ekman S</b>	<b>Zoogeography of the sea.</b>	<b>Sidgwick &amp; Jackson</b>

**Department of Marine Living Resources  
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**M.Sc. Marine Biology & Fisheries – I Semester Syllabus  
Paper 1.2 : Biological Oceanography – I**

**The sea as a biological environment.**

**Classification of marine environment: general characters of the populations  
of the primary biotic divisions (plankton, nekton and benthos).**

**Introduction to plankton: general classification and composition of plankton.  
Floating mechanisms in plankton.**

**Collection of plankton: general account of instruments and nets employed.  
Methods of fixation and preservation; Analyses of samples.  
Standing crop estimation methods.**

**Plankton in relation to fisheries: general account.**

**Distribution of plankton in space and time:  
Horizontal distribution: neretic and oceanic plankton; geographical  
distribution and indicator species.  
Vertical distribution: vertical migrations  
Seasonal changes in plankton.  
Phytoplankton and Zooplankton relationships.**

**References:**

<b>Angel MV</b>	<b>Biological Oceanography</b>	<b>Methuen</b>
<b>Friedrich H</b>	<b>Marine ecology</b>	<b>S &amp; J</b>
<b>Raymont JEG</b>	<b>Plankton &amp; Productivity</b>	<b>Pergamon</b>
<b>Ekman S</b>	<b>Zoogeography of the sea</b>	<b>S &amp; J</b>
<b>Parsons et al</b>	<b>Biological Oceanographic processes</b>	<b>Pergamon</b>

**Department of Marine Living Resources  
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**M.Sc. Marine Biology & Fisheries – I Semester Syllabus  
Paper 1.3 : Biology of Marine Organisms – I**

**Nutrition :** Types of food, general mechanisms of feeding, transport of food through gut; digestion and digestive enzymes.

**Excretion:** Nitrogen excretion, mode of nitrogen excretion and elimination of nitrogenous wastes.

**Respiration:** Respiratory mechanisms; factors affecting respiration ( salinity, temperature and oxygen tension); Respiratory pigments –their role in transport of oxygen and carbondioxide.

**Osmotic regulation and ion regulation:** mechanisms and general account.

**General survey of pigments and colour in marine animals; Colour changes—  
Chromatophores;**

**Bioluminescence:** luminescent glands and organs;  
Production of light and its biological significance.

**References:**

<b>Nicol JAC</b>	<b>The Biology of marine animals</b>	<b>Pitman</b>
<b>Prosser CL</b>	<b>Comparative animal physiology</b>	<b>Saunders</b>
<b>Barnes RD</b>	<b>Invertebrate zoology</b>	<b>Saunders</b>
<b>Newell RC</b>	<b>Biology of intertidal animals</b>	<b>Logos press</b>
<b>Newell RC (Ed)</b>	<b>Adaptation to environment</b>	<b>Butterworth</b>
<b>Palmer JD</b>	<b>Biological clocks in mar. organisms</b>	<b>Wiley Eastern</b>

**Department of Marine Living Resources  
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**M.Sc. Marine Biology & Fisheries – I Semester Syllabus  
Paper 1.4 : Biostatistics**

**Introduction to statistics : Sampling and sampling design**

**Collection of primary and secondary data**

**Classification and tabulation of data.**

**Diagrammatic (one dimensional & two dimensional) representation of data.**

**Graphical representation ( histogram, frequency polygon, frequency curve,  
and ogive curve) of data**

**Measures of central tendency ( mean, median and mode).**

**Measures of dispersion: standard deviation, standard error, variance,  
Skewness, kurtosis and moments.**

**Correlation and regression analyses**

**Probability and distributions.**

**Estimation and testing of hypotheses; Tests of significance: Z test, t test,  
F test, Chi-square test, ANOVA (one way and two way),  
ANCOVA, multi-variate analyses**

**Computer applications: Analyses of data using Microsoft Excel**

**Applications of statistics in marine biology and fisheries: data collection analyses**

**References:**

<b>Arora &amp; Malhan</b>	<b>Biostatistics</b>	<b>Himalaya</b>
<b>Ramakrishnan</b>	<b>Biostatistics</b>	<b>Saras</b>
<b>Gupta SC</b>	<b>Statistical methods</b>	<b>Sultan chand</b>
<b>Sokal &amp; Rohlf</b>	<b>Biometry</b>	<b>Freeman</b>
<b>Jorgenson SE</b>	<b>Fundamentals of ecological modelling</b>	<b>Elsevier</b>

**Department of Marine Living Resources  
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**M.Sc. Marine Biology & Fisheries – II Semester Syllabus  
Paper 2.1 : Estuaries & Coastal Zone Management**

**Estuarine environment: Physico-chemical properties of estuaries;  
Classification of estuaries**

**Distribution of estuarine plankton, nekton and benthos.**

**Estuarine plants : Distribution of mangroves**

**Estuarine birds and estuarine foodweb.**

**Coastal Zone Management : Coastal resources : finfish, shellfish and non-living  
Resources and their management.**

**Coastal Zone Regulations**

**Remote sensing applications in coastal zone management**

**References:**

<b>Mc Lusky DS</b>	<b>Ecology of estuaries</b>	<b>Hinmann</b>
<b>Green J</b>	<b>Biology of estuarine animals</b>	<b>S &amp; J</b>
<b>Carter RWG</b>	<b>Coastal environments</b>	<b>Academic Press</b>
<b>Kinne O</b>	<b>Marine Ecology</b>	<b>John Wiley</b>

**Department of Marine Living Resources  
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**M.Sc. Marine Biology & Fisheries – II Semester Syllabus  
Paper 2.2 : Biological Oceanography – II**

**Primary production: General account of productivity in different oceans.**

**Factors affecting primary production: nutrients, light, temperature, organic micro-nutrients and inhibitors, grazing.**

**Particulate & dissolved organic matter in the sea**

**Secondary production (Zooplankton) of the sea.**

**Phytoplankton – Zooplankton inter-relationships.**

**Distribution of particulate and dissolved organic matter in the sea.**

**General survey of marine food chains: Pelagic food chains; Benthic food chains.  
Pelagic food pyramid and factors affecting its production & stability.**

**Mass-mortality in the seas.**

**Marine bacteria: general account on their distribution & their role in the sea**

**References:**

<b>Angel MV</b>	<b>Biological Oceanography</b>	<b>Methuen</b>
<b>Raymont JEG</b>	<b>Plankton &amp; productivity in Oceans</b>	<b>Pergamon</b>
<b>Parsons TR et al</b>	<b>Biological Oceanographic processes</b>	<b>Pergamon</b>
<b>Friedrich H</b>	<b>Marine Biology</b>	<b>S &amp; J</b>

**Department of Marine Living Resources  
Andhra University**

**M.Sc. Marine Biology & Fisheries – II Semester Syllabus  
Paper 2.3 :Biology of Marine organisms – II**

**Endogenous rhythms: Biological clocks; Lunar periodicity**

**Physiology of sense organs: types of organs and functions.**

**Physiology of nervous system: structure and functions**

**Physiology of endocrine system: hormones; neuro-hormones-controlled  
Functions; hormone-induced colour changes.**

**General account of reproduction in marine animals.**

**General account of larval forms of Crustacea, Mollusca, Echinodermata &  
Finfish.**

**References:**

**Nicol JAC      The biology of marine animals  
Barnes RD      Invertebrate Zoology  
Newell RC      Biology of Intertidal animals**

**Pitman  
Saunders  
Logos**

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**M.Sc. Marine Biology & Fisheries – II Semester Syllabus  
Paper 2.4 : Biochemistry & Physiology**

**Introduction to Biochemistry: Proteins – structure, isolation, purification and denaturation; Amino acids; Fish proteins. Fish lipids— auto-oxidation, rancidity, anti-oxidants .**

**Enzymes: Classification; Factors influencing enzyme activity. Role of enzymes in metabolic activity.**

**Biological Oxidation: Metabolism of carbohydrates, proteins and lipids with reference to fishes,**

**Physiology of digestion and reproduction.**

**Neuro-secretions in finfishes and shellfish.**

**Moulting and growth in decapod crustaceans; regulating factors.**

**Neuro-hormones, endocrine glands and their functions in finfish and shellfish.**

**References:**

**Bardach JE et al  
Conn & Stump  
Halver JE**

**Aquaculture  
Outlines of Biochemistry  
Fish nutrition**

**Wiley Interscience  
Wiley Eastern  
Academic press**



**Department of Marine Living Resources  
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**M.Sc. Marine Biology & Fisheries – III Semester Syllabus  
Paper 3.1 : Fishery Science**

**General account of systematic classification of fishes. Classification based on degrees of movement, zones inhabited and manner of reproduction.**

**Economically important groups of fishes: general and brief account of elasmobranchs, clupeoids, salmonoids, scombroids, gadoids, heterosomata, sciaenids, carangids, trichiurids, catfish, crustaceans and mollusks.**

**Natural populations or stocks as biological entities: factors limiting abundance of stocks. Criteria for distinguishing units or multi-stock species. Idea of unit stock- its relevance to tropical marine fish.**

**Population dynamics: recruitment, growth and mortality. Length-weight relationship. Condition factor.**

**General account of life history of Indian fishes: oil sardines, Indian shad, mackerel, Bombay duck and Malabar sole.**

**General account of : food and feeding habits of fishes; reproduction and spawning and fish eggs and larvae.**

**Age determination of fishes.**

**General account of movement and migration in fishes: eels, salmon, Indian shad.**

**General account of Marking and Tagging of fishes.**

**References:**

<b>Cushing DH</b>	<b>Fisheries biology</b>	<b>Wisconsin U. Press</b>
<b>Cushing DH</b>	<b>Marine ecology &amp; Fisheries</b>	<b>Cambridge U. Press</b>
<b>Jhingran VG</b>	<b>Fish and fisheries of India</b>	<b>Hindusthan</b>
<b>Nelson JS</b>	<b>Fishes of the world</b>	<b>John Wiley</b>
<b>Royce WF</b>	<b>Introduction to fishery sciences</b>	<b>Academic Press</b>

**Department of Marine Living Resources  
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**M.Sc. Marine Biology & Fisheries – III Semester Syllabus  
Paper 3.2 : Aquaculture**

**Significance of aquaculture. Criteria for selection of species for aquaculture.**

**Technical and non-technical considerations in site selection.**

**Design & construction of ponds, cages, pens, racks, rafts and long lines.**

**Selection of material and equipment for aquaculture.**

**Monoculture, polyculture and integrated farming.**

**Seed production through finfish and shellfish hatcheries.**

**Culture practices of finfish (carps and mullets), crustaceans (shrimps and prawns), mollusks (gastropods and edible oysters, cephalopods) and seaweeds .**

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**References:**

<b>Bardach JE et al</b>	<b>Aquaculture</b>	<b>Wiley Interscience</b>
<b>Pillay &amp; Dill</b>	<b>Advances in aquaculture</b>	<b>FAO</b>
<b>Stickney RR</b>	<b>Principles of Warmwater aquaculture</b>	<b>Wiley Interscience</b>
<b>Pillay TVR</b>	<b>Aquaculture: principles &amp; practices</b>	<b>FNB</b>
<b>Alilis AE</b>	<b>Fish and shellfish pathology</b>	<b>Academic Press</b>

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**M.Sc. Marine Biology & Fisheries – III Semester Syllabus  
Paper 3.3 : Biotechnological Applications in Aquaculture**

**Role of Biotechnology in aquaculture.**

**Nutritional biotechnology: Principles of nutrition – nutritional requirements of cultivable finfish and shellfish at different stages of life.**

**Energetics of food conversion. Growth promoters.**

**Sources of food: natural and artificial feeds.**

**Live feeds: collection, culture and their utilization.**

**Artificial feeds: feed formulations, methods & strategies.**

**Importance and use of anti-oxidants and antibiotics in feeds,**

**Feed storage**

**Reproductive Biotechnology: Breeding biology and endocrine control of reproduction in finfish and shellfish.**

**Induced breeding, Egg incubation and Larval rearing.**

**Principles of genetics: fish cytogenetics; Application of genetics in aquaculture:**

**genetic selection, hybridization, inbreeding, and cross-breeding, sex**

**control, cryopreservation, IN VITRO fertilization, artificial**

**insemination, polyploidy and transgenesis..**

**Development of disease-resistant and high quality strains.**

**References:**

**Halver JE**

**Hoar & Randall**

**Bardach JE et al**

**Conn & Stump**

**Fish Nutrition**

**Fish physiology**

**Aquaculture**

**Outlines of biochemistry**

**Wiley Interscience**

**Academic Press**

**Wiley Interscience**

**Wiley Eastern**

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**M.Sc. Marine Biology & Fisheries – III Semester Syllabus  
Paper 3.4 : Marine Pollution and Biodeterioration**

**Sources of marine pollution, its dynamics, transport paths and agents.**

**Composition of domestic, industrial and agricultural discharges. Their fate in the marine environment. Toxicity and treatment methods.**

**Oil pollution: Sources, composition and its fate in marine habitats. Toxicity and treatment methods.**

**Thermal and radioactive pollution: sources, effects and remedial measures.**

**Solid dumping, mining and dredging operations: their effects on marine ecosystem.**

**Role of biotechnology in marine pollution control.**

**Biofouling and biodeterioration: Agents and protection methods.**

**Global environmental monitoring methods: status, objectives and limitations.**

**References:**

<b>Nielsen SE</b>	<b>Tropical pollution</b>	
<b>Kinne O</b>	<b>Marine Ecology Vol. V</b>	<b>John Wiley</b>
<b>Johnson R (Ed)</b>	<b>Marine pollution</b>	<b>Academic Press</b>
<b>Patin SA</b>	<b>Pollution and boil. Resources of oceans</b>	<b>Butterworths</b>

**Department of Marine Living Resources  
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**M.Sc. Marine Biology & Fisheries – IV Semester Syllabus  
Paper 4.1 : Fishing Technology & Fisheries Management**

**Evolution of Fishing craft: boat types and their classification. Boats used in India.**

**Evolution of Fishing gear: Classification of fishing gear; Descriptions of hand-line, troll line and pole line. Description, design and fabrication of trawl nets, purse-seine and gill nets.**

**Fisheries Oceanography: General account of effects of environmental parameters like temperature, currents, light and salinity on fish biology, behaviour and abundance.**

**Stock assessment: Collection of basic data; stock size, yield models.**

**The effects of exploitation: The over-fishing problem. Management techniques. Fishing regulations.**

**The future of fisheries research: development and management strategies.**

**References:**

<b>Aitikin A</b>	<b>Fish handling &amp; processing</b>
<b>Baranov F I</b>	<b>Selected works on fishing gear</b>
<b>Brandt AV</b>	<b>Fish catching methods of the world</b>
<b>Cushing DH</b>	<b>Marine ecology &amp; fisheries</b>
<b>Sanisburry JC</b>	<b>Commercial fishing methods</b>

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**M.Sc. Marine Biology & Fisheries – IV Semester Syllabus  
Paper 4.2 : Fish Processing Technology**

**Chemical composition of fish and shellfish: moisture, protein, fat, carbohydrates and ash.**

**Microbiology of fresh and processed fish: Morphology of bacteria; growth and reproduction of bacteria; effect of environmental factors like temperature, pH, oxygen, moisture etc.**

**Common bacteria present in fish; identification and isolation. Bacteria of sanitary significance.**

**Handling of fish: spoilage of fish and shellfish; effect of temperature on fish spoilage; Use of ice; Solid carbon dioxide and liquid nitrogen in fish preservation; Containers for packaging and transportation of fish; Use of chemical preservatives. And irradiation in extending shelf-life finfish and shellfish.**

**Canning: principles of canning; canning materials; handling and preparation of fish and shellfish for canning; spoilage of canned fish; chemical and microbiological spoilage and their prevention.**

**Curing: principles and practices of salting the fish; pickling; smoking of fish; Spoilage of cured fish.**

**Freezing of fish: techniques of freezing; types of freezers; changes during Freezing and storage of fish; Bacterial spoilage of frozen fish and shellfish. Protection of frozen fish: glazing and wrapping; use of anti-oxidants; Thawing of frozen fish; double freezing of fish; Storage, transportation and distribution of frozen fish; Industrial Methods of freezing of fish;**

**By-products: processing of low cost fish; minced meat, fish oil, fish meal, Fish sausages, isinglass, glues, fish silage, chitosan, chitin pearl essence; Alginates, agar and corals.**

**References:**

<b>Aitikin A</b>	<b>Fish handling &amp; processing</b>	
<b>Borgstorm G</b>	<b>Fish as food</b>	<b>Academic press</b>
<b>Connell JJ</b>	<b>Advances in fish science &amp; technology</b>	<b>FNB</b>

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**M.Sc. Marine Biology & Fisheries – IV Semester Syllabus  
Paper 4.3 : Management of Aquaculture Systems**

**Description of Culture Systems : Ponds, pens, cages, rafts .**

**Seed production : shrimp hatchery and finfish hatchery.**

**Management of water quality in the culture systems.**

**Viral, bacterial, fungal, nutritional and environmental diseases of carps and Shrimp; disease prevention & control.**

**Aquaculture pollution: sources and remedies.**

**Harvesting and post-harvesting technologies; marketing management.**

**Ecofriendly aquaculture practices.**

**Basic concepts of Coastal Regulatory Zones.**

**Extension activities in aquaculture.**

**References:**

<b>Pillay TVR</b>	<b>Aquaculture: principles &amp; practices</b>	<b>FNB</b>
<b>Milne PH</b>	<b>Fish &amp; shellfish farming in coastal waters</b>	<b>FNB</b>
<b>Stickney RR</b>	<b>Principles of aquaculture</b>	<b>Wiley &amp; sons</b>
<b>Imai T</b>	<b>Aquaculture in shallow seas</b>	<b>Amerind</b>