SPECIFIC PAPER SYLLABUS FOR THE POST OF SENIOR ASSISTANT DIRECTOR IN THE DEPARTMENT OF FISHERIES

1. Aquatic ecosystem - food chain, food web, energy flow, nutrient cycles and productivity. Animal associations- symbiosis, commensalisms, parasitism, prey-predator relationship, host parasite relationship. Aquatic biodiversity- species diversity, genetic diversity and habitat diversity. Eutrophication and red tides causes and consequences. Mud banks and upwelling - formation, characteristics, importance in fisheries.

2. Marine environment- pelagic, benthic, euphotic, aphotic regions. Marine fouling. Aquatic pollution- types, characteristics and effects on fisheries. Biological assessment of pollution and remedial measure. Role of pollution control boards. Thermocline and SST in relation to fish and fisheries.

3. Present status of Inland and marine fisheries, commercially important fish and shellfish species contributing to inland and marine fisheries. Effect of environmental factors on the growth and metabolism in fish and shellfish. Food and feeding habits, growth and age determination, spawning and reproduction in fish and shellfish.

4. Potential marine fishery resources of India's EE. Fish stock assessment. Maximum sustainable yield (MSY) and maximum economic yield (MEY). Symptoms of under-fishing and over-fishing. Growth over-fishing and recruitment over-fishing. Potential fishing zones. Fish aggregating devices. Need and methods for fisheries management. Licensing, monitoring, surveillance and control in fisheries.

5. Impact of fishing on the environment, fish communities, birds and marine mammals. Mangrove swamps, lagoons, coral reefs, flood plains, bheels and oxbow lakes -ecological features and importance. Measures for the management of fishery resources in inland water bodies. Methodology for the estimation of marine and inland fish landings in India and problems encountered. National and International fisheries regulations. GIS and remote sensing in marine capture fisheries.

6. Conservation- environment impact assessment, eco-labeling, marine reserves, sanctuaries, economics of conservation, conservation policy and legislation. Strategies and action plan for the conservation of fisheries resources in marine and inland waters. Karnataka Marine Fisheries Regulation Act 1986. Inland Fisheries Act 1996. Disposal of fishing rights in inland water bodies with respect to Karnataka. Coastal Regulation Zone (CRZ) Act, Coastal Zone Management (CZM) and Integrated Coastal Zone Management (ICZM) and environmental legislations in India.

7. Global and national scenario of aquaculture. Principles of aquaculture. S. aquaculture - pond culture, pen culture, cage culture, running water culture, zero exchange system, etc. Extensive, semi-intensive, intensive and super intensive aquaculture in different types of water bodies. Candidate fish and shellfish species for aquaculture- characters and criteria for selection. Monoculture, polyculture, integrated and waste water fed culture systems. Fish farms-types and classification. Design and construction of farms, site selection, soil and water quality, water budgeting, water seepage, evaporation loss and their control. Use of aerators in aquaculture. Feeding and nutrition of cultured animals. Live fish food organisms and economics of fish production.

8. Productivity and carrying capacity of culture systems, factors affecting productivity and carrying capacity. Hatchery, nursery, rearing and grow-out ponds for fish and shellfish. Preparation and management of ponds. Exotic fish and shellfish species introduced in India and status and impact on indigenous species. Seaweed culture, pearl culture and sea ranching. Feed formulation and preparation Types of feeds and feeding techniques. Micro-particulate and micro-encapsulated diets. Sustainable aquaculture. Waste disposal and management of environment.

9. Broodstock management of fish and shellfish. Transportation of brooder fish and shellfish. Induced breeding of cultured finfish and shellfishes. Environmental factors affecting spawning. Use of synthetic hormones in induced breeding of carps. Breeding techniques and different types of fish hatcheries. Cryopreservation of fish gametes and its application to aquaculture. Transportation and acclimatization of seed. Sea farming and shore-based aquaculture systems including cage culture. Ornamental fish production, breeding of egg layers and live bearers and their management. Aquatic plants, ornamental fish trade, and maintenance of freshwater and marine aquarium.

10. Population genetics-Hardy-Weinberg law and its significance, selection, crossbreeding, mutation and genetic drift. Inbreeding and its consequences. Genetic manipulation in fish. Hormonal manipulation of sex. Hybridization in fishes. Alagal biotechnology for aquaculture. Biofertilization, Biosensor and Biofilters in aquaculture. Transgenics and its application in aquaculture.

11. Fish and shellfish immune system. Pathogens of cultured fish and shellfish. Role of stress in disease development. Host, pathogen and environment interaction under culture and natural conditions. Health management in hatcheries and culture systems. Antibody (ELISA, Immunodot, Western Blot, Immunofluorescence) and nucliec acid based (PCR and DNA hybridization) diagnostics. Application of hybridoma technology in fishereies. Principles and methods of vaccine production, immunization and methods of

ministration. Crop rotation, polyculture and use ofimmunostimulants, probiotics bioremediator as strategies for health management. Quarantine and health certification in aquaculture.

12. Composition of fish with special emphasis on aminoacid and fattyacid profile. Post-mortem changes in fish. Spoilage of fish- physical, chemical and microbial spoilage, factors affecting spoilage. Fish preservation methods – use of low temperature, high temperature, chemicals, radiation, drying etc. Spoilage and shelf-life of processed fish and fishery products. Methods of thawing frozen foods.

13. Fish muscle structure and myofibrillar protein. Suitability of different varieties of fishes for the preparation of fish paste products. Surimi production and use of cryoprotectants in surimi production and quality characteristics. Taste and flavour components in fish and shell fishes. Role of various additives in the preparation of fish paste products. Preparation, characters and uses of fish meal, fish oil, liver oil, ensilage, fish solubles, chitin, chitosan, maws, gelatin, fin rays and seaweeds. Biomolecules and neutraceuticals from fish and fish processing industry waste.

14. Pre-harvest and post harvest factors determining seafood quality. Packaging and labeling – importance, types of packaging material for fish and fishery products. Importance of sanitation, disinfection and total quality management in fish processing industry. Indices of quality of fresh and processed fish and fishery products. Application of HACCP concept in quality assurance programmes for raw and processed seafood.

15. Food laws in India. Seafood standards for domestic and international markets. Infective and intoxication type of food poisoning – causative organism, characteristics, symptoms and control. Algal toxins- types, characteristics and effects. Mycotoxins in foods. Indicator organism in foods. Processing industry waste- characteristics, treatment and disposal.

16. FAO classification of fishing gear and methods. Fishing craft and gears used for the exploitation of pelagic and demersal fisheries resources. Maintenance of fishing crafts. Preservation of netting and other gear material. Selectivity of fishing gear. Modern commercial fishing methods - trawling, purse seining, gill netting, line fishing, squid jigging etc. Deck layout for trawlers, purse-seiners, long liners, gill netters and for combination fishing vessels.

17. Fish finders, GPS, sonar, net sonde, gear monitoring and communication equipments. Otter boards, floats, buoys, hooks and sinkers –types and uses. Life jacket and life buoy. Fishing

harbours, major and minor fish landing centers. Layout of typical fishing harbours for deep sea, mechanized inshore and traditional fishing vessels.

18. Demand, supply and market for fish and fishery products. Economic theory of common property resources. Contribution of fisheries to Indian Agriculture, total GDP, GNP and employment. Anthropologic history of fishermen communities. Socio-economic conditions and demographic profile of fisher folk community and their relationship with fishery resources. Theory of market structure. Trade liberalization and fishery resources.

19. Central and State responsibilities for fisheries development. Implementation of community based resource management plans. International Law of the Seas and International Commissions on Fisheries and their impact. Role of cooperatives and sources of credit facility for fishermen. Role of agencies like NFDB, NABARD, MPEDA, CAA in fisheries development.

20. Role of extension in fisheries development. Fisheries extension methods- individual, group and mass contact methods and their effectiveness Adoption and diffusion of innovations and barriers. Characteristics and process involved in technology transfer. Participatory extension approaches – importance and steps involved. Public private partnership in fisheries. Role of KVK, NGOs and SHGs in fisheries. Role of local leaders in fisheries development. Addressing social problems, fisheries conflicts, gender issues and globalization in fisheries.

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