

# POSTGRADUATE INSTITUTE OF SCIENCE

## UNIVERSITY OF PERADENIYA



### **M.Sc. in Fish and Wildlife Management**

#### **1. INTRODUCTION**

Fish and wildlife have been important natural resources of the inhabitants of Sri Lanka from the historical days and perhaps even in pre-historic days. The management of fish and wildlife resources of Sri Lanka is of immense importance to us at present. Today there is much concern of the need to conserve and manage our wildlife resources in Sri Lanka for the benefit of the present and future generations. The emphasis on the fish resources however, except for the inland endemic species, is on exploitation.

The island has a coastline of about 1,500 km, including lagoons, estuaries and bays. Fisheries play a central role in supplying about 65% of the animal protein consumed by Sri Lankans. The coastal fishery provides the major portion of this, the inland irrigation reservoir fishery also adding a significant percentage. Fishery also generates export earnings, mainly through the export of captured and farmed shellfish such as shrimp. With the rapidly increasing human population, the island's fish resources are being exploited at an ever-increasing rate. This will lead to over-exploitation, which will result in the depletion of stocks. Thus, proper scientific management of these resources should be given pride of place.

Wildlife always played a significant role in the life of the Sri Lankan, the elephant being the flagship species of Sri Lanka. Harvesting wildlife from land and seas is one of the earliest forms of land use known to man, but wildlife resources have never been exploited in any significant manner in Sri Lanka, although poaching for meat and other animal products was always endemic. On the other hand, the forest resources are over-exploited. The forest cover in Sri Lanka was estimated to be 84% of the total land area in 1881 and 70% in 1900 and only about 20% at present. With the disappearance of the forest, the wildlife will dwindle. Wildlife is a resource comparable with forests, and so could be sustainably utilized to generate financial benefits to the people who co-exist with it. If a population that is not small or declining can be exploited in such a way as to take from it a sustained yield, and if this yield can benefit mankind, then such sustained yield harvesting need not conflict with the goals of conservation biology. Game management is the art of making land produce better sustainable yields.

The aquaculture of fish and shellfish (and other species) will increase the current fish harvest. Ranching of some wildlife species could also be profitably carried out.

The present M.Sc. programme is designed to provide the interested graduate student with the necessary theoretical and practical background in Fish and Wildlife management. It will provide the necessary background to the fish and wildlife managers as well as to those who are involved in research in these fields.

## 2. PROGRAMME ELIGIBILITY

Applicants for admission to this programme must have successfully completed a B. Sc. Degree (Science, Agriculture or Veterinary Science) or any other equivalent qualification acceptable to the Postgraduate Institute of Science, University of Peradeniva.

## 3. PROGRAMME FEE

*(N.B. The programme fees given below may be revised.)*

	M.Sc. programme fee
local candidates	Rs. 125,000/-
foreign candidates	Rs. 250,000/-

Students registered for the M.Sc. degree shall pay the Programme fee in full or in two (*1/2 at the registration and the balance at the end of the first semester*) or three (*1/3<sup>rd</sup> at the registration, another 1/3<sup>rd</sup> after 4 months from the date of registration and the balance after 8 months from the date of registration*) installments. Other payments including registration fee, medical fee, library subscription, examination fee and deposits (science and library) should be paid according to the procedure stipulated by the PGIS. (N.B. The Programme fees given above may be revised as per recommendation of the Board of Management of the PGIS.)

## 4. PROGRAMME STRUCTURE AND DURATION

This is a full-time programme consisting of course work and a research project. Course work will be conducted over a period of two semesters of 15 - weeks each (*during weekends and/or weekdays*). The entire programme duration will be about 15-18 months inclusive of six months for the research project. Satisfactory completion of a minimum of 24 credits of course work (excluding preliminary courses) and seminar is required for the programme in addition to the six credits allocated for the full-time research project. Continuous attendance is compulsory during the period of research work. In order to proceed to the research project he/she shall obtain a GPA of not less than 3.0 from the compulsory and optional courses and the seminar. If the student obtains a GPA in the range 2.75 to 2.99, then he/she is eligible for the Diploma in Fish and Wildlife Management but not the M.Sc. Degree. After successfully completing the research project, the student is eligible for the award of the M.Sc. Degree.

## Programme Summary

Course Code	Course Title	Lecture hrs	Practical/Fieldwork hrs	No of credits
<b>Semester I</b>				
ZL 501	Biodiversity of Sri Lankan Wildlife and Fish Species	30	30	3
ZL 502	Ecosystem Structure and Function	20	20	2
ZL 503	Population Ecology and Human Population Dynamics and Control*	15	-	1
ZL 504	Field Sampling and Assessment of Diversity and Population Density	20	20	2
ZL 505	Behavioural Ecology of Wildlife and Fish	20	20	2
ZL 506	Extinction of Species	15	-	1
ZL 507	Management and Conservation	35	20	3
<b>Semester II</b>				
ZL 516	Biogeography, Reserve Design and Conservation Law	20	20	2
ZL 517	Conflicts with people and Socio-economics of People Affected	20	20	2
ZL 518	Principles of Fish Farming and Ranching of Wildlife*	15	--	1
ZL 519	Protected Area and Habitat Management	25	10	2
ZL 520	Management of Large Mammal Species*	25	10	2
ZL 521	Forestry and Forest Management	20	20	2
ZL 522	Coastal Habitat Management	20	20	2
ZL 523	Wildlife Management, Economics, Ethics and Politics	25	10	2
ZL 524	Marine and Inland Fisheries*	20	20	2
ZL 525	Fishing Methods, Gear and Craft*	20	20	2
ZL 526	Fish Production Dynamics and Fish Stock Assessment*	10	10	1
ZL 527	Fisheries Administration and Fisheries Management*	15	--	1
ZL 528	Aquaculture*	30	30	3
ZL 597	Seminar*	-	-	1
ZL 599	Research Project	6 months		6

*\*Optional courses*

## 5. PROGRAMME CONTENTS

### **ZL 501: Biodiversity of Sri Lankan Fish and Wildlife Species (3 credits)**

Development of biodiversity as a concept; aims and criteria for recognition of Biodiversity hotspots; Major wilderness areas; Western Ghats-Sri Lanka Biodiversity hotspot and Wallace's Ceylonese Biogeographic region; Relict and endemic species of Sri Lanka and their major ecological correlates.

### **ZL 502: Ecosystem Structure and Function (2 credits)**

Biosphere structure; Biogeochemical cycles; Populations and communities; Ecosystem structure; Ecological niche concepts, fundamental and realized niche, niche differentiation, competitive exclusion principle; Fitness landscape; Energy flow and nutrient cycling; Trophic levels and Food webs; Productivity; Individuals, populations, communities and ecosystems; Competition; Specialists and Generalists; Limiting factors; Ecological indicators; Tolerance ranges; Productivity; Biomes and biogeographic regions; Species diversity; Species succession; Biosphere and the major biomes of the World; Major ecosystems of the Earth; Major ecosystems of Sri Lanka.

### **ZL 503: Population Ecology and Human Population Dynamics and Control (1 credit)**

Principles of Population Ecology; Natality and mortality; Immigration and emigration; Fecundity and fertility; Age structure; Survivorship curves and life-tables; Expectation of life; Net reproductive rate, generation time, and intrinsic rate of increase; Population growth and carrying capacity; Population dispersal; Population regulation; Life history strategies; *r* and *K* selection; Keystone species; Cyclic populations; Interaction among organisms; Intraspecies and interspecies competition; Mutualism; Predation and co-evolution; Host Parasite Interactions; Plant-herbivore Interaction; Population models; Breeding systems; Species richness; Rarity of species; Metapopulation ecology; Evolution of populations; The Human population, its dynamics and control.

### **ZL 504: Field Sampling and Assessment of Diversity and Population Density (2 credits)**

Standard techniques for inventory and monitoring: eg. complete species inventories, visual encounter surveys, quadrat sampling, transect sampling, patch sampling, trap-sampling, tracking; Measurements of diversity; Indirect methods of sampling: acoustical monitoring, bone, tooth and hair analysis, pug marks and other wildlife signs, Field craft; Remote sensing; Tissue sampling and molecular analysis; Preparation of specimen and reference collections; Data analysis: estimating population size, species richness, species abundance, species diversity.

### **ZL 505: Behavioural Ecology of Wildlife and Fish (2 credits)**

Evolution of animal behaviour; Ultimate and proximate factors; Learning; Cultural transmission of behaviour; Sexual selection; Mating systems; Cooperation; Foraging; Communication; Habitat selection, Territoriality and migration; Aggression; Play; Social organization; Social behaviour; Predator-prey interaction; Methods for sampling behaviour in the field.

### **ZL 506: Extinction of Species (1 credit)**

Extinctions in geological time and mass extinctions; Background rates of extinction; human caused extinctions; Effective Population Size (EPS); Inbreeding and inbreeding depression; Outbreeding and hybrid vigour; Theory of Island Biogeography and Species-Area considerations; Effect of habitat fragmentation and forest corridors; Viability of populations and Extinction of species: Deterministic and stochastic extinctions, Demographic and environmental stochasticity; Concept of Minimum Viable Population (MVP) and Population Viability Analysis (PVA); Rescue and recovery of near extinctions. IUCN categories of threatened species; Endemic, relict and endangered species of Sri Lanka. Evolutionarily Significant Units (EUSs); Conserving the processes that generate and maintain biodiversity; Effective Population Size (EPS); Inbreeding and inbreeding depression.

### **ZL 507: Management and Conservation (3 credits)**

Principles of management; Resource inventory, Resource dynamics; Resource partitioning; Categories of wildlife protected areas, (Nature Reserve and Sanctuaries), forest reserves; Conservation within and outside protected areas and reserves; International conservation; Protected

area management planning ; Species management, Ecosystem management; Management of threatened and endangered species Keystone species; Development Vs conservation; *In-situ* and *Ex-situ* (Parks, Zoological Gardens, etc.) conservation; Management for multiple uses and community outreach; Education and awareness for conservation, Research in conservation management; Ecotourism; Human wildlife conflict management; Translocation; Re-introduction of species; Management planning; Steps in management process; Participation of people of peripheral communities in management planning and implementation; Management Plan for decision making; Case studies on the management of habitats and ecosystems and threatened or endangered populations and species. Use of maps, aerial photographs, satellite imageries; GIS, its capacity and application.

**ZL 516: Biogeography, Reserve Design and Conservation Law (2 credits)**

Biogeography; Island biogeography; Theories of World Biogeography; Protected area design; Protected areas and indigenous people; Role of local people, NGOs and private sector in management; Regional development programmes and conservation ; Use of protected areas and buffer zones for human needs; Conservation law (FFPO, FO, EA etc.); Organizational framework for enforcing legislation and prevention of smuggling wildlife and wildlife products; Development of policy and human and biotic needs; Benefit sharing; Exploitation of wildlife and wildlife products including plants (eg. for ayurveda) and ensuring sustainability; Regulation of access to natural resource; Legal aspects of conservation; Legislation on trading (import and export) wildlife (including ornamental species) and wildlife products, Basic techniques of the EIA process, Development in the vicinity of PAs; International conventions CITES, RAMSAR, CBD, etc. and their relevance to Sri Lanka; Ethics in biodiversity and wildlife research; Impact of biotechnology on the conservation.

**ZL 517: Conflicts with people and Socio-economics of People Affected (2 credits)**

Demographic parameters; People in the zones of influence of protected areas and people involved and associated with fishing and NTFC collection: Socio-economic surveys; Settling of conflicts related to fishing; Human wildlife conflict and conflict mitigation practices.

**ZL 518: Principles of Fish Farming and Ranching of Wildlife (1 credit)**

Aquaculture principles; Aquatic environment-water quality criteria; Species cultured in South and Southeast Asia; Status of aquaculture in Sri Lanka, South and South-east Asia; Resource Assessment and economics of farming and ranching; Harvest and yield; Wildlife harvesting; Maximum Sustainable Yield (MSY); Recreational and commercial harvesting; Ranching and farming of wildlife.

**ZL 519: Protected Area and Habitat Management (2 credits)**

Wildlife Ordinance of Sri Lanka; Categories of Protected Areas (Global and local); History of Protected Areas in Sri Lanka; Core areas and Buffer Zones; Genetic, Species and ecosystem considerations in habitat management; Criteria for selection of Protected Areas: Zoning criteria; Forestry, Wildlife and Land use policies; Management of water sources and wetlands. Management of micro habitat and macro habitat. Invasive species, Economic valuation of conservation,

**ZL 520: Management of Large Mammal Species (2 credits)**

Globally threatened species, keystone species; Food and nutrition, Reproduction and its seasonality; Health; Wildlife diseases and their prevention, epidemiology, treatment and control; Conservation status in Sri Lanka; Effect of habitat degradation, fragmentation and loss; Control of poaching and illegal trade of wildlife products; Roles of the WWF, IUCN, NGOs and the conventions; Conservation of large mammals of Sri Lanka with special attention to the elephant.

**ZL 521: Forestry and Forest Management (2 credits)**

Vegetation classification; Plant diversity; Identification of plants species; Vegetation sampling; Forest and grassland types of Sri Lanka; Vegetation dynamics; Alien invasive species and their management; Forest dieback; Deforestation & its socio-ecological impacts; Reforestation and forest plantations; Forest policy of Sri Lanka; Management of natural and plantation forests; Field visits and practical activities related to above topics

**ZL 522: Coastal Habitat Management (2 Credits)**

Coastal zone; Coastal habitats: coral and sandstone reefs; estuaries and lagoons; mangroves, sea-grass beds, salt marshes and sand dunes; Reef builders and associated flora and fauna; Flora and fauna and zonation in mangroves; Importance of coral reefs and mangroves; Effect of global climatic change on coral reefs and mangroves; Major coral reefs and mangroves of Sri Lanka and their distribution and status of conservation. Coastal erosion; Impact of human activities on coral reefs and mangroves; Sand mining, coral mining and removal of coastal vegetation; Management conservation of coral reefs and mangroves; Coastal zone developmental activities and the EIA required for the activities; Tourism, research and education; Role of the Coast Conservation Department.

**ZL 523: Wildlife Management, Economics, Ethics and Politics (2 credits)**

Human population growth and its implications for wildlife management; Economics, ethics and politics of management and conservation of wildlife and wildlife habitats; Cost of wildlife management; Impact of Global exchange economy on wildlife management; Use of wood and non-wood produce from protected areas; Wildlife education; Mitigation of conflicts with wildlife; Impact of civil unrest on wildlife. Conflict and conflict mitigation.

**ZL 524: Marine and Inland Fisheries (2 credits)**

Marine Fisheries: Finfish and shellfish species of major economic importance with special reference to species harvested from the territorial waters of Sri Lanka; Coastal, inshore and offshore fisheries; Pelagic and demersal fisheries; Inland fisheries of the world.–Inland Fisheries of Sri Lanka; Inland finfish and shellfish of economic importance. Fishing methods, gear and crafts.

**ZL 525: Fishing Methods, Gear and Crafts (2 credits)**

Small scale fishing methods such as water drawdown, use of hand implements, concussion, Electro-fishing, impounding, brush-file fishing; Traditional fishing methods in Sri Lanka: Large scale fishing methods: seining, trawling, gill-netting. Types of fish nets such as haul seine, purse seine, cast nets, gill nests, trammel nets, hoop and fyke nets, trap nets; Types of craft such as canoes, outriggers, motorised boats, trawlers; Fishing methods and crafts used in Sri Lanka.

**ZL 526: Fish Production Dynamics and Fish Stock Assessment (1 credit)**

Age and growth of fish; Fish fecundity and juvenile development; Age and recruitment; Growth parameters; Age determination; Fish production systems and methods; Stock assessment: Analytical and holistic models; Age-based and Length-based stock assessments.

**ZL 527: Fisheries Administration and Fisheries Management (1 credit)**

Fisheries regulation at provincial, district and regional levels in Sri Lanka. Department of Fisheries and associated organisations; Fisheries Co-operative Societies. Exotic fish introductions; Genetics of fish and prawns and stock improvement; Use of biotechnology in stock improvement; Fisheries legislation.

**ZL528: Aquaculture (3 credits)**

Culture facilities; Culture systems; Integrated fish farming; Pond culture of freshwater fish and penaeid prawns; Fish stocking and stock manipulation; Feeding; Control of pests and predators; Harvesting; Hatchery design and operation; Brood stock maintenance; Artificial propagation; Induced spawning; Nutrition and Artificial Feeding; Feed formulation and Feeding regimes; Fish diseases; Shellfish Culture; Ornamental fish culture; Culture of non-fish taxa; Aquaculture economics.

**ZL 597: Seminar (1 credit)**

Each student is required to present a literature seminar based on the current developments in the area of fish and wild life management.

**ZL 599: Research Project (6 credits)**

The candidates will be given the option of selecting a research problem in a preferred area that falls within the disciplines of courses undertaken. The project could be conducted at the Department of Zoology, University of Peradeniya or at any other institution where facilities are available with the consent of the PGIS. However, in the latter case the work has to be supervised by an external supervisor at the work place, in addition to the supervisor attached to the Postgraduate Institute of Science. At the end of the research project the candidates are required to present their results in the form of a dissertation and a seminar.

**6. PROGRAMME EVALUATION**

Programme evaluation will be as stipulated in the PGIS Hand Book.

**PROGRAMME COORDINATOR**

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