

**National Research Priorities on
Aquatic Resources**

2017-2021

**National Committee on
Aquatic Resources**

**Ministry of Agriculture
Sri Lanka Council for Agricultural Research Policy
114/9, Wijerama Mawatha
Colombo 07
Sri Lanka
2017**

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Message from the Chairman

Aquatic Resources Sector assumes a predominant role in Sri Lanka ensuring food and nutrition security of the nation. Similarly, its share in economic development particularly in the coastal economy is very substantial. During the last decade Aquatic Resources Sector has expanded many folds generating employment at coastal belt and significantly contributing to nutritional security.

Well-coordinated Research and Development (R & D) activities undertaken during the last 5 years by the research institutes under the Ministry of Fisheries and Aquatic Resources has generated many valuable outcomes contributing to the rapid development of this sector.

Sri Lanka Council for Agricultural Research Policy (SLCARP) among other mandates has been constantly involved in facilitating the process of R & D prioritization, including the preparation of just completed research priorities over the last five years. Having re-visited the previous R & D prioritization, SLCARP is pleased to publish the National Research Priorities on Aquatic Resources 2017 – 2021 prepared with the participation of all relevant stakeholders including the private sector.

The document articulates background, rationale, focus and scope of the research, overall objectives and sub-themes in the following thematic areas: (1) Environmental conservation and management (2) Inland Aquatic Resources and Aquaculture (3) Post Harvest Technology and Value addition (4) Marine Biological Resources (5) Fishing Technology (6) Socio- Economic and Marketing (7) Hydrography (8) Oceanography

Adherence to the recommendations of this strategic document will certainly improve the quality of the National Agricultural Research Plan (NARP) in the ensuing years in which situation, the Treasury will be in a more convincing situation that limited financial resources can be utilized in a more focused and effective manner, and the benefit will flow to the general public of this country which is the ultimate objective of SLCARP.

Dr. S D G Jayawardena
Chairman
Sri Lanka Council for Agricultural Research Policy
01st January 2017

Message from the Secretary/Director

The main function of the Sri Lanka Council for Agricultural Research Policy (SLCARP) is to advise the Government on all matters regarding the organization, co-ordination, planning and execution of agricultural research in Sri Lanka. Research in the agricultural sector comprises research in the plantation, non-plantation, forestry, livestock and fisheries sectors.

Aquatic Resources research activities are mandated with the National Aquatic Resources Research & Development Agency (NARA), which is responsible for planning and implementation of research programmes according to the national needs of the Aquatic Resources sector. Several University Faculties and Departments, and private sector organizations also undertake research on Aquatic Resources sector. Therefore, it is necessary for all those institutions, which are involved in Aquatic Resources research, to join hands to develop long-term research programmes to improve this important sector.

The National Committee on Aquatic Resources at SLCARP has decided on research projects, concepts, formats and research review formats as tools to monitor and evaluate Treasury granted research in order to minimize research duplication and to accelerate in undertaking of priority research projects to derive tangible research outputs.

The Council gratefully acknowledges the unstinted co-operation received from the members of the National Committee and Chairs of the Sub-Committees in the development of the document, and Prof. U. S. Amarasinghe, Editor-in-Chief and the Editorial Board in editing this document. The Council also greatly appreciates the contribution made by the Chairman, Director General and Deputy Director General (Research) of NARA for hosting the Stakeholder seminar at NARA and assisting in preparation of this document. Service rendered by Dr. Frank Niranjana, Secretary of this National Committee in producing this document is greatly appreciated.

Dr. J D H Wijewardena
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Abbreviations

BGA	-	Blue-Green Algae
CFHC	-	Ceylon Fishery Harbour Corporation
CKDU	-	Chronic Kidney Disease of Unknown etiology
DCC	-	Department of Coast Conservation and Coastal Resource Management
DFAR	-	Department of Fisheries and Aquatic Resources
EEZ	-	Exclusive Economic Zone
ETP	-	Endangered, Threatened and Protected
FRP	-	Fibre Reinforced Plastic
GDP	-	Gross Domestic Product
IUU	-	Illegal, Unreported, and Unregulated
KKS	-	Kan Kasanthurai
MDBs	-	Multi-Day Boats
MEPA	-	Marine Environment Protection Authority
MFARD	-	Ministry of Fisheries and Aquatic Resources Development
NARA	-	National Aquatic Resources Research and Development Agency
NCP	-	North Central Province
NERD	-	National Engineering Research and Development
NHO	-	National Hydrographic Office
SLCARP	-	Sri Lanka Council for Agricultural Research Policy
SPF	-	Specific Pathogen Free
TED	-	Turtle Excluder Devices

1. Introduction

The fisheries sector in Sri Lanka plays a key role in social and economic life with respect to provision of direct and indirect employment opportunities for about 560,000 people and livelihood for 2.6 million people, generation of income, foreign exchange earnings and provision of reasonably affordable animal protein for the rural and urban masses in the country. The fisheries sector in Sri Lanka has been considered as one of the major potential areas for expansion of the national economy. Except for a small number of large commercial operators with modern facilities, the fisheries sector in Sri Lanka comprises mostly small scale operators.

The fisheries sector constitutes three major sub sectors viz. Coastal Fisheries, Offshore/Deep Sea Fisheries and Inland Fisheries and Aquaculture. The marine resources of Sri Lanka are based on fishery resources of its Exclusive Economic Zone (EEZ) of 517,000 km². In addition, there are 45 major brackish water lagoons and estuaries, and 489,000 ha of inland water bodies including irrigation reservoirs, perennial tanks, seasonal tanks and villus which possess great potential for expansion of inland fish production. However, coastal fishing depends on monsoonal climate patterns and some fishers migrate between the country's major fishing areas as seasons change.

Fish and fishery products are an important source of animal protein for the human population and the sector contributes nearly about 2 percent to Gross Domestic Product (GDP). The total export value and quantity of fish and fish products in 2015 has been reported as Rs. mn 18,458 and 12,982 mt respectively. To ensure that the Sri Lankan population enjoys an acceptable nutrition intake it is required to maintain a protein requirement level through a per capita fish consumption of 22 kg per year. To achieve this target, the Ministry of Fisheries and Aquatic Resources Development has targeted at increasing the national fish production up to 685,700 mt. According to the Fisheries Sector Development Strategy for the period 2013-2016, fish production as well as exports should be increased to achieve the set targets. The expansion potential of the fisheries sector has improved considerably with the end of the three decades long conflict which prevailed in the country which adversely affected the harvesting of fishery resources in the Northern and Eastern regions of the country. The advent of peace has increased investors' confidence along with the recovery of the global economy.

2. National Priorities in Aquatic Resources

2.1 Background and Rationale

Fisheries sector directly impacts upon the economy and more importantly the livelihoods of about 2.6 million people in the country. National Aquatic Resources Research and Development Agency (NARA) is dealing with research and development in this sector in many ways in terms of advising the Ministry of Fisheries and Aquatic Resource Development with respect of fisheries issues, setting action plans annually, undertaking research studies based on priorities.

With a view to identifying new research areas in the fisheries sector for short, medium and long terms NARA in collaboration with Sri Lanka Council for Agricultural Research Policy (SLCARP) has organized a stakeholder workshop to identify research areas and priorities based on the current status of fisheries sector and future requirements.

2.2 Focus and Scope

SLCARP National Committee on Aquatic Resources has identified eight research thrust areas to carry out research as follows:

- Marine Biological Resources;
- Inland Aquatic Resources and Aquaculture;
- Post-Harvest Technology and Value Addition;
- Fishing Technology;
- Oceanography;
- Environmental Conservation and Management;
- Hydrography; and
- Socio-Economics and Marketing.

2.3 Overall Objectives

The overall objectives are to identify research priorities of the eight themes in compliance with national development policies to achieve the following specific objectives.

- To increase the national fish production and per capita availability of fish;
- To improve the quality of fish landed and eliminate post-harvest losses or reduction to insignificant levels;
- To promote value addition to aquatic resources and fishery products and increase exports;
- To strengthen fisheries management to ensure long-term sustainability of the resources;
- To improve social security and living standards of the fishing community;
- To ensure responsible fishing and sustainable aquaculture;
- To achieve sustainable utilization and conservation of aquatic resources; and
- To encourage more environmentally friendly fishing practices.

2.4 Research Thrust Area I: Marine Biological Resources

2.4.1 Scope

- Sustainable management of marine living resources in Sri Lanka
- Sensitive marine habitat protection and enhancement
- Conservation and management of endangered, threatened and protected species

2.4.2 Objectives

- To identify current status/ issues (biological and socio-economic) in small scale fisheries and proposing possible solutions for emerging issues;
- To identify the resource status and potential of export oriented fisheries;
- To identify, monitor and mitigate the possible impacts on marine environment and species due to new development activities in Sri Lanka;
- To identify environmental, spatial, temporal and operational effects on the catch rates/ abundance/ distribution of key species;
- To monitor and assess the impacts by harmful fishing gears and fishing activities on the habitats and resources, and identify possible means to minimize the damage;
- To provide management recommendations for sustainable utilization of key fishery resources;
- To assess the impact on coral reefs/ reef fishes and fishing community due to coral bleaching and anthropogenic activities;
- To investigate the present status of coral reefs and reef associated species and to study the biology and ecology of reef associated fishes for conservation and management;
- To identify the current status and trends in marine fisheries subsector (small pelagic fish, large pelagic fish and demersal fish);
- To identify current stock status of commercially important fisheries resources through fisheries independent assessments;

- To monitor and conserve Endangered, Threatened and Protected (ETP) species;
- To identify the relationship between seasonal migration pattern, distribution and abundance of ETP species with the oceanographic conditions; and
- To determine the stock structure of key species.

2.4.3. Research Needed to Achieve Specific Objectives

Research Need	Subject Area
Issues relating to the beach seine fisheries (socio economic and biological studies)	Marine Biology
Impact of night diving for lobsters and spearing for fish	Marine Biology
Environmental impacts on marine environment due to the Lakvijaya power house	Marine Biology
Management of crab stocks including native species and blue swimming crab	Marine Biology/Aquaculture
Conservation of the mangrove ecosystem in Kalpitiya	Estuarine Biology
Bolgoda Lake – Sand mining, declining biodiversity	Biodiversity
Problems created due to the impediment - Break waters	Marine Biology

Research Need	Subject Area
Use of prohibited fishing gears (Bottom set gill net, Gill net 5/8), By catch	Marine Biology
Dynamiting – Mannar, Vankalei reef	Marine Biology
Stake nets (Fyke net) use in the sea	Marine Biology
Impacts of long line with small hooks on fishery resources	Marine Biology
Bottom trawling and poaching, assessment of by-catch	Marine Biology
Sea cucumber fishery – Resource assessment in the North coast	Marine Biology
Bottom set gillnet/ bottom long line on coral reefs and rocks	Marine Biology
Technological development for catching fish during the off season	Marine Biology
Biology and ecology of reef fishes (Demarsal)/Coral Reefs; Investigation of coral reef and associated organisms and sea grass.	Marine Biology
Research on spawning and recruitment seasons of threatened/commercially exploited species	Marine Biology

Research Need	Subject Area
Reassessment of the marine resources (sea cucumber, chank, lobster and shrimp etc.) using fisheries independent surveys	Marine Biology
Drying and processing methods of sea cucumber species and estimation of dry pieces/kg of sea cucumber	Marine Biology
High sea fishing – Replacement of gillnet to prevent by catch, incidental catch.	Marine Biology
Turtle study: Estimation of the rate of entanglement and investigation to get reduced the rate of entanglement e.g., development of technology such as Turtle Excluder Devices (TED).	Marine Biology
Studies on marine mammals: Estimation of Incidental catches in commercial fishery	Marine Biology
Investigation of the impact of the efforts for prevention of IUU fishing	Marine Biology
Investigation of feasibility of introduction of electronic data verification modules for deep sea/off shore fisheries	Marine Biology
Investigation of the possibility of introducing drift gillnets made of biodegradable materials to prevent ghost fishing	Marine Biology

Impact of flotsam (floating objects) associated fisheries on pelagic fish stocks	Marine Biology
Studies on seasonal fishery resources (flying fish, cuttle fish, squids and jellyfish)	Marine Biology

2.4.4 Expected Output

- Scientific recommendations for formulation of management and development plans/policies for offshore and coastal fisheries
- Scientific recommendations for conservation and management of coral reefs and reef associated species
- Scientific recommendations for conservation and management of ETP species

2.5 Research Thrust Area II: Inland Aquatic Resources and Aquaculture

2.5.1 Scope

Development of inland fisheries and aquaculture industry in Sri Lanka

2.5.2 Objectives

- To increase alternative sustainable livelihood opportunities for coastal communities and increase the supplementary income of the targeted groups;
- To encourage sustainable utilization of underutilized fresh water and marine resources;
- To reduce the pressure on coastal and inland capture fisheries;
- To develop and transfer new technologies to suit local aquaculture;
- To encourage and strengthen the community participation in the inland management of aquatic resources;
- To increase GDP by enhancing export of non-traditional fishery resources;
- To encourage and develop public-private partnerships in the fisheries and aquaculture sector;
- To increase aquaculture production through better health management of aquatic cultured organisms and habitats; and
- To control alien aquatic invasive species.

2.5.3 Research Needed to Achieve Specific Objectives

Research Need	Subject Area
Production of low cost feed for mono-sex tilapia culture targeting small scale farmers	Fish/ Shrimp Feed Formulation
Development of feeds for sea cucumber and mud crab farming	Fish/ Shrimp Feed Formulation
Continuation of development of seaweed incorporated fish feeds	Fish/ Shrimp Feed Formulation
Development of feed standards through screening process	Fish/ Shrimp Feed Formulation
Production of polychaete-based Specific Pathogen Free (SPF) feed for shrimp brood stock	Fish/ Shrimp Feed Formulation
Development of broodstock feed for shrimps	Fish/ Shrimp Feed Formulation
Development of tissue culture techniques for exotic, endemic and endangered aquatic plant species	Seaweed and Aquatic Plants
Continuation of production of good quality seed stock development <i>Kappaphycus alvarezii</i> culture	Seaweed and Aquatic Plants
Introduction of technology for seaweed drying	Seaweed and Aquatic Plants

Research Need	Subject Area
Development of seaweed and aquatic plant incorporated edible products (Yogurts, buns etc.) and nonedible products (bio-fertilizer and liquid fertilizer from extracts and residuals thereby replace cold water seaweed products by native varieties	Seaweed and Aquatic Plants
Development of <i>Spirulina</i> Blue-Green Algae (BGA) culture techniques for commercial product development	Sea weed and Aquatic Plants
Continuation of bivalve culture development other than oyster culture (mussels, clams, cockles and fresh water pearl oysters)	Aquaculture
Exploration of the possibility of multiple uses of water resources for integrated aquaculture–model farm	Aquaculture
Site survey for aquaculture	Aquaculture
Baitfish culture e.g., milk fish	Aquaculture
Improvement of cultured seabass flesh quality	Food Technology/ Post-Harvest Technology
Development of induced breeding techniques for breeding valuable endemic and exotic fish varieties	Ornamental Fish Culture
Identification and mapping of suitable sites for the development of ornamental fish culture	Ornamental Fish Culture
Continuation of development of marine fish breeding technology through public-private partnership	Ornamental Fish Culture

Research Need	Subject Area
Exploring alternative treatments for ornamental fish diseases to avoid the use of Neguan and Dipterax	Ornamental Fish Culture/ Health Monitoring
Development of protocols for improving existing quarantine procedure to maintain international standards (Aquaculture and marine products)	Health Monitoring
Development of proper surveillance programmes and screening methods for ornamental fish disease management	Health Monitoring
Monitoring Koi-carp disease and investigation of remedial measurements using local methods i.e., neem extracts	Health Monitoring
Expansion of the laboratory facilities for common viral diseases of shrimps in the region before introducing Specific Pathogen Free (SPF) varieties	Health Monitoring
Identification of diseases in shrimp farming not monitored regularly	Health Monitoring
Investigation of the effect of temperature on shrimp broodstock fertility rate	Health Monitoring
Identification of heavy metal accumulation in inland food fishes	Post Harvest
Study on carrying capacity of perennial and seasonal tanks for enhancement and management of culture-based fisheries	Inland Fisheries and Aquaculture

Research Need	Subject Area
Exploration of methodologies for eradication of aquatic weeds from reservoirs and the banks i.e. <i>Salvinia</i> , <i>Eichhornia crassipes</i> and Giant Mimosa	Inland Biodiversity
Investigation of impact of exotic aquatic organisms on freshwater biodiversity	Inland Biodiversity
Preventive measures of pollution of inland aquatic environment and building awareness with special reference to insecticides and pesticides	Environmental Studies
Development of Tilapia mini hatchery system through “Self Sustained Reservoir” concept	Aquaculture
Increased cage culture of Tilapia for <i>in situ</i> breeding inside the lake	Aquaculture
Environmentally friendly cage culture of filter feeding fish	Aquaculture
Investigation of the status of native aquatic resources and commercialization of small indigenous fish species in reservoirs	Inland Fisheries
Valuation and modeling of inland aquatic ecosystems including optimal allocation of inland water resources for multiple uses for the development of inland fisheries	Inland Fisheries

Research Need	Subject Area
Culture of crab species in Lagoons	Aquaculture
Development of giant freshwater prawn culture	Aquaculture
Improvement of reproductive performance of captive breeding of commercially important freshwater fishes	Aquaculture
Marine ornamental fish propagation	Aquaculture

2.5.4 Expected Output

- Increased livelihood opportunities
- Increased supplementary income of the fishers
- Increased GDP from the aquaculture sector

2.6 Research Thrust Area III: Post Harvest Technology and Value Addition

2.6.1 Scope

Establishment of technologies to gain optimum nutritional and economic benefits from aquatic resources

2.6.2 Objectives

- Minimization of post-harvest losses;
- Improvement of nutritional level in food security; and
- Improvement of quality of life of the fishers and increase foreign exchange through maximizing exports.

2.6.3 Research Needed to Achieve Specific Objectives

Research Need	Subject Area
Development of infrastructure facilities/Human Resources required for establishment of high tech Pilot Plant for processing of aquatic resources	Product Development using Aquatic Resources
Preparation of semi purified fish oil (capsules) using fish resources	Product Development using Aquatic Resources
Development of post-harvest fishery products of economic importance using less valuable fishery resources and invasive species (e.g., collagen, surimi, fish balls, fish paste)	Post-Harvest Technology
Extraction of pharmaceutical and medicinal compounds from fishery products and value addition of low-valued aquatic organisms and fish/shrimp wastes	Post-Harvest Technology

Research Need	Subject Area
Value added products: canned fish/ smoked fish- Collaboration with fish processing industries	Product Development using Aquatic Resources
Freeze drying of prawns, lobsters, and fish fillets suitable packaging materials for export -Collaboration with Universities	Product Development using Aquatic Resources
Utilization of fish wastes generated in main fish landing places to produce fish silage – Collaborative project with CFHC	Product Development using Aquatic Resources
Development of infrastructure facilities/Human Resources for establishment of high tech laboratory for microbiological and chemical analysis of aquatic resources	Quality and Safety of Aquatic Resources
Monitoring current fish quality along supply chains to provide scientific recommendations for stakeholders regarding reduction of post harvest losses along supply chain	Quality and Safety of Aquatic Resources
Establishment of scientific monitoring system and protocols assuring quality of natural and cultured bivalve mollusks	Quality and Safety of Aquatic Resources
Assessment of safety of aquatic products: Pesticide residues, antibiotic residues, and algal biotoxins etc.	Quality and Safety of Aquatic Resources
Investigation of histamine formation trends in selected small fish during chill storage e.g., mackerel, other small pelagic fish	Quality and Safety of Aquatic Resources
Assessment of seasonal variations of toxic heavy metals such as Hg, Cd, Pb levels in large pelagic fish landings	Quality and Safety of Aquatic Resources

Research Need	Subject Area
Development of infrastructure facilities/Human Resources to establish a mobile training unit with trained staff for conducting regularly scientific surveys/ monitoring post harvest quality losses of different fishery resources and for providing trainings on post-harvest quality	Extension Programme and Training
Training programme on post-harvest technology for fishermen of multi-day boats, other boats, fish handlers and other stakeholders along the supply chain, maintaining handling tables, establishing conveyor belts, etc.	Extension Programme and Training
Transfer of technology on processing of Maldivian fish, dried fish/ smoked fish	Extension Programme and Training
Value addition and post- harvest application for fishery and aquaculture product	Value Addition and Post-Harvest Technology
Development of low cost feeds	Feed Technology

2.6.4 Expected Output

- Scientific information and recommendations to mitigate rapid quality losses of fish in Multi-Day Boats (MDBs)
- Transferable technology to reduce post-harvest quality losses of MDBs
- Transferable technology on value added food products using aquatic resources
- Technology to upgrade quality of already established traditional fishery products
- Scientific information on toxic trace metals and antibiotic residues accumulated in aquatic food resources
- Upgraded infrastructure facilities with new equipment required for sample analysis

2.7 Research Thrust Area V: Fishing Technology

2.7.1 Scope

- Development and introduction of new environmentally friendly fishing technology to enhance the fish production and uplift the livelihood of fishermen
- Studying climate change and its impact on coastal and off-shore fishery for future planning and policy making process

2.7.2 Objectives

- To increase the longline efficiency by introducing light emitting artificial baits while reducing the cost for bait;
- To enhance habitats for squids;
- To understand the effects of climate changes on coastal and offshore fishery; and
- To develop strategies for harnessing fishery potential in the pelagic zones of deep reservoir.

2.7.3. Research Needed to Achieve Specific Objectives

Research Need	Subject Area
Long line efficiency enhancement	Fishing Technology
Climate change impacts on fisheries	Fishing Technology
Marine habitat enhancement for squids	Fishing Technology
Investigation of fishery potential of pelagic species in deep reservoirs	Fishing Technology
Feasibility of reviving purse seine fisheries without using light attraction	Fishing Technology

Research Need	Subject Area
Feasibility of introducing troll line fisheries for small tuna using small FRP boats with low powered engines	Fishing Technology
Investigation of feasibility of incorporating turtle extruders in the shrimp trawlers	Fishing Technology
Deployment of fish aggregation devices and socioeconomic impacts	Fishing Technology
Analyzing the quality of fishing nets using standard methods	Fishing Technology
Enhancement of lagoon fisheries	Fishing Technology

2.7.4 Expected Output

- Introduce new technology and increase tuna fish production
- Increase underutilized squid production and foreign exchange
- Introduce new technology for exploiting under-exploited fishery resources (eg. shell funs, rainbow runner)
- Policy recommendations

2.8 Research Thrust Area V: Oceanography

2.8.1 Scope

Comprehensive studies on coastal habitats by way of integrated physical oceanographic studies, sonar techniques, and visual observations. In addition mineral sand exploration survey will be carried out in coastal areas

2.8.2 Objectives

- To identify morphological features and characterization of seafloor;
- To carryout seafloor mapping of the area;
- To identify fisheries habitats in the area;
- To identify and quantify mineral sand deposits; and
- To investigate the effect of climate change on oceanographic events.

2.8.3 Research Needed to Achieve Specific Objectives

Research Need	Subject Area
Geology floor characteristics and habitat mapping	Marine Geology and Geophysics
Mineral deposit exploration and Marine geochemistry	Marine Geology and Geophysics
Climatic change on oceanic currents and temporal variation in thermocline	Oceanography
Plankton abundance and distribution in relation to temperature and schooling fish	Biological Oceanography

2.8.4 Expected Output

- Habitat and seafloor characterization maps of the area
- Physical Oceanographic parameter study maps of the area
- Mineral sand and grain size distribution maps of the area
- Recommendations on adjustment of fishing strategies for optimal utilization of fishery resources under climate change scenarios
- Research report and publications

2.9 Research Thrust Area VI: Environmental Conservation and Management

2.9.1 Scope

Conservation and monitoring of aquatic environment

2.9.2 Objectives

- To assess the present pollutant levels including nutrients and heavy metals of aquatic water bodies in Sri Lanka;
- To evaluate biological significance of the contaminants in drinking water sources through toxicity screening by plant and fish based bioassays;
- To transform the present laboratory into a fully-fledged accredited water quality and environmental laboratory through a series of improvement programmes on step by step basis;
- To assess and investigate the causes for emergency situations in terms of water pollution, oil spills, fish kill incidents and algae blooms etc.;
- To establish climatic monitoring systems in all districts; and
- To conserve and manage aquatic resources

2.9.3 Research Needed to Achieve Specific Objectives

Research Need	Subject Area
Restoration study for aquatic health depleted and polluted inland water bodies including lagoons for fisheries and aesthetic activities (eg. Bolgoda lake, Beira lake)	Inland Fisheries
Genotoxicity Screening of selected reservoirs and drinking water wells located in the Northern and North Central Province (NCP) of Sri Lanka using Plant and Fish Based Bioassays	Inland Fisheries
Impact of climatic variations and associated water quality parameters on diversity and abundance of macro benthos, fish and plankton species (Initial Case study: Tabbowa Wewa and Koggala Lagoon in Sri Lanka)	Environmental Studies
Behavioural impact of toxic material and pollutants; development of possible methodologies and treatment technologies to improve inland water resources including river basins	Environmental Studies
Emergency studies related to aquatic resources e.g., fish kills, CKDU, etc.	Environmental Studies/Coastal Ecosystems

Research Need	Subject Area
Improvement of the ESD laboratory for carrying out test services and advisory services in the aquatic sector	Coastal and Marine Fisheries Aquaculture/Coastal Ecosystem
Preparation of a zoning plan based on the identification of areas suitable for the tourism development, industrial activities and other developments (farms etc) and their impacts on fishing community, aquatic environment etc. (e.g. Kalpitiya tourism development area, Norochcolai wind power, KKS project)	Inland Fisheries/Coastal and Marine Fisheries/Coastal Ecosystem
Thermal stratification, eutrophication, ocean productivity and water quality changes with climate change in Sri Lankan EEZ and Indian ocean	Coastal and Marine Fisheries/ Oceanography
Collaborative research on coastal water quality and pollution studies including lagoons system in Sri Lanka (e.g., MEPA, DCC, NARA)	Coastal and Marine Fisheries/Coastal Ecosystem/ Oceanography
Studies on river basins, inland waters and estuaries in relation to biodiversity conservation, pollution prevention and mechanisms, economic importance, conservation and management etc. (e.g., Bolgoda river, Kelani River, Benthara River)	Inland Fisheries/ Oceanography

Research Need	Subject Area
Studies on wetlands and artificial wetlands in relation to biodiversity, climate change impacts, pollution prevention and mechanisms, conservation and management etc.	Environmental Studies/Coastal Ecosystem
Surface and ground water quality and pollution in Jaffna and Mannar areas	Environmental Studies
Assessment of impact of marine litter and anthropogenic substances on fisheries and aquatic sector in Sri Lanka	Coastal Ecosystems/ Environmental Studies
Studies on eco-toxicity and microbial based problems related to aquatic environment	Environmental Studies/Coastal Ecosystem/Microbiology
Environmentally friendly cage aquaculture of filter-feeding fish to reduce toxic algae especially in drinking water reservoirs	Inland Fisheries and Aquaculture
Environmental impacts due to power plants	Environmental Studies
Conservation of the mangrove ecosystems	Environmental Studies
Sand mining, Declining bio diversity e.g. Bolgoda Lake	Environmental Studies
Fish-waste management-Technology	Environmental Studies

Environmental impacts on marine environment due to the Lakvijaya power house	Environmental Studies
Introduction of ecosystem approaches for coastal aquaculture	Coastal Aquaculture
Introduction of ecosystem approaches for inland fisheries in selected major reservoirs	Inland Fisheries
Introduction of ecosystem approaches for culture-based fisheries	Inland Fisheries

2.9.4 Expected Output

- Report of status of aquatic environment
- Report on threats and vulnerabilities in aquatic environment
- Restoration and remediation techniques of degraded aquatic environments and recommended management measures
- Ecosystem approaches to fisheries and aquaculture

2.10 Research Thrust Area VII: Hydrography

2.10.1 Scope

- Nautical chart of Kankasanthurai (KKS), fulfillment of prime requirement to approaches to Kankasanthurai
- Nautical chart from Negambo to Beruwala; Coastal composite Nautical chart for West coast of Sri Lanka
- Updating of bathymetric data base of NHO: Safe and efficient navigation, make available bathymetric data for coastal infrastructure development (Fishery Harbours, anchorages etc.), Coast Conservation, Environmental protection and monitoring activities

2.10.2 Objectives

To provide necessary charts and maps to variety of end users, for ocean and seabed research, environment protection, exploration activities and naval requirement etc.

2.10.3 Research Needed to Achieve Specific Objectives

Research Need	Subject Area
Collection and compilation of hydrographic data to produce following Nautical charts under National Charting Programme (Norochochulai Nautical Chart, KKS harbour and Approaches, Oluwil Harbour and Approaches, Puttalam Lagoon)	Hydrographic Study
Collection and compilation of hydrographic data to produce following Nautical charts under National Charting Program (Weligama to Colombo Coastal Chart in the scale of 1:150,000, Chart (Trincomalee to Point Calimere)	Hydrographic Study

2.10.4 Expected Output

- Production of Nautical chart-approaches to Kankasanthurai harbour; approaches to Oluwil harbour
- Production of of Coastal Nautical Chart- Beruwala to Negambo
- Production of Coastal Nautical Chart - Weligama to Colombo Coastal Chart in the scale of 1:150,000,
- Production of Coastal Nautical Chart - Trincomalee to Point Calimere
- Production of Nautical Chart - Puttalam Lagoon

2.11 Research Thrust Area VIII: Socio- Economics and Marketing

2.11.1 Scope

- Policy insights, policy analysis and evaluation
- Fisheries cost of production and price analysis
- Socio economic impact assessments
- Enterprise development

2.11.2 Objectives

The overall objective is to identify research priorities under the board areas in accordance with the national development policies with respect to fisheries and aquatic resources to achieve following specific objectives.

- To make appropriate policy recommendations to the government for the sustainable development of fishing industry;
- To compile fisheries statistics in respect to cost, prices and trade and marketing in order to develop a computerized database;
- To enhance the socio-economic status of fishing community and industry stakeholders; and
- To provide investor facilitation by providing fisheries industry analysis.

2.11.3 Research Needed to Achieve Specific Objectives

Research Need	Subject Area
Study on social and economic impact of Indian Sri Lanka fishing dispute.	Socio-economics
Socio-economic impacts of aquaculture development in North and East of Sri Lanka for the livelihoods and economy of people	Socio-economics
Study on user acceptance and affordability of new technology development in fisheries industry of Sri Lanka	Socio-economics
Study on optimization of traditional knowledge in fisheries management of Sri Lanka.	Socio-economics
Study on identification of institutional barriers in development of aquaculture industry of Sri Lanka.	Organizational Study
Study on innovative financial mechanisms for suitability of fisheries industry of Sri Lanka.	Financial Mechanisms
Value chain analysis of fish and fishery products of Sri Lanka	Value Chain Analysis
Review and analysis of existing policy framework for the sustainable development of fisheries industry of Sri Lanka.	Policy Analysis
Study on fishers' response to new technology and management measures in the fisheries industry of Sri Lanka.	Sociological Study

Research Need	Subject Area
Territorial user rights in fisheries	User Rights
Management of lobster fishery resources in conservation zones (e.g. wildlife sanctuaries)	Fishery Resource Management
Conflict resolution between traditional non-mechanized trawl fisheries and mechanized trawl fisheries for shrimps in Negombo	Conflict Resolution
Investigation of the impact of subsidy schemes on fisheries and aquaculture development	Socio-economics

2.11.4 Expected Output

- Improvement of nutritional and socio-economic status of fisher communities, stakeholders and consumers
- Establishment of investor friendly environment
- Access to reliable information on cost price and marketing Increased export earnings
- Long lasting solution for Indo-Sri Lanka fishing dispute
- Reinforcement of traditional community based management strategies through government investment for establishing co-management strategies
- Identification of suitable strategies to replace subsidy schemes
- Minimization of resource use conflicts between conflicting resource users
- Achieving balance between modern technology in fisheries industry and sustainability of the resources

3. List of Participants at the Stakeholder Workshop held on 22nd July 2016 at NARA

Name	Designation
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