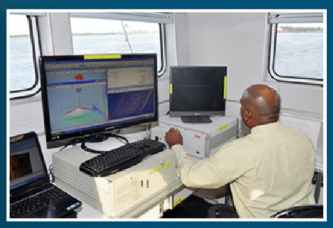
ANNUAL REPORT & ACCOUNTS




2015 NARA

National Aquatic Resources Research and Development Agency
Crow Island, Colombo 15
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MINISTRY OF FISHERIES & AQUATIC RESOURCES DEVELOPMENT

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NATIONAL AQUATIC RESOURCES RESEARCH & DEVELOPMENT AGENCY

1. CORPORATE INFORMATION

The National Aquatic Resources Research and Development Agency (NARA) is the principal national institution charged with the responsibility of carrying out and co-coordinating research development and management activities on the subject of aquatic resources in Sri Lanka. NARA was established in the year 1981 by restructuring the Research Division of the Department of Fisheries. In the restructuring process Research Division was amalgamated with the institute of Fish Technology which existed in the present premises of NARA at Crow Island, Mattakkuliya, Colombo15 to establish a fully fledged research agency, under an Act of Parliament, National Aquatic Resources Agency Act No. 54 of 1981 and amended subsequently by National Aquatic Resources Research and Development Agency Act No. 32 of 1996. The following Vision, Mission, Goals/Objectives as the highlights of the NARA functions as a statutory body under the Ministry of Fisheries and Aquatic Resources Development are as follows.

Our Vision

To be the premier institution for scientific research in conservation, management and development of aquatic resources in the region.

Our Mission

To provide innovative solutions for national development issues in the aquatic resources sector utilizing scientific and technological knowledge & resource base.

The main objectives and functions of the Agency:

- To ensure application and utilization of Scientific and Technological expertise for the implementation of national development programs.
- To promote and conduct research activities directed at identification, assessment, management and development of living and non-living aquatic resources.
- To co-ordinate and provide advisory and consultancy services on matters relating to exploitation, management and development of aquatic resources.
- To undertake collection, dissemination and publication of scientific research information on aquatic resources & related subjects.
- To provide training related to fisheries and aquatic resources fields.

Governing Board

The Governing Board consists of Eight (08) Appointed Members and Eight (08) Ex officio members in accordance with the Section 6 of the National Aquatic Resources Research & Development Agency Act No 54 of 1981 as amended by Act No 32 of 1996. The following members served as the members of the Governing Board during the year 2015 and five Board Meetings were held during the year.

Appointed Members

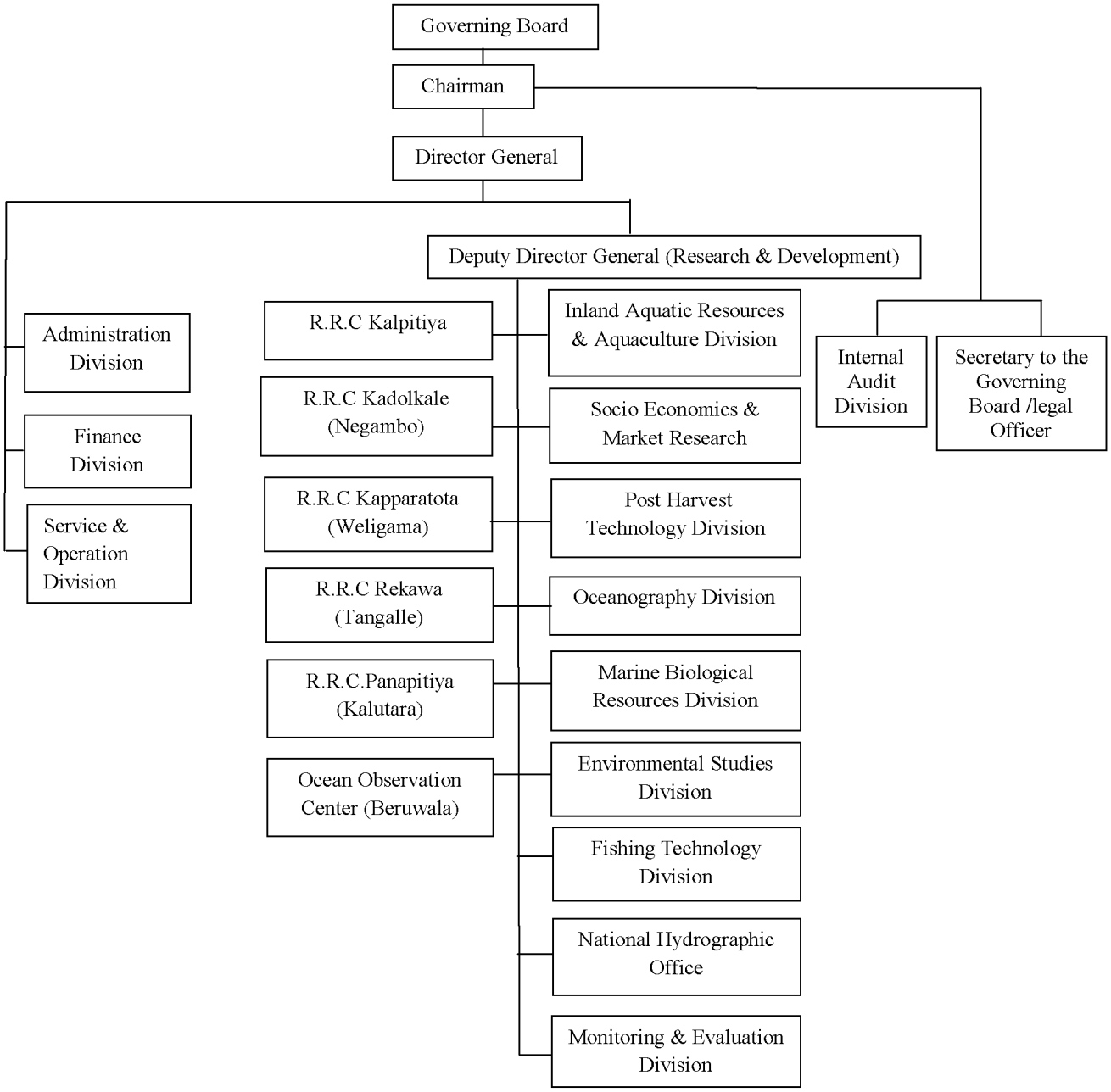
Professor T S G Fonseka (From 26.01.2015 to 09.04.2015)	Chairman
Mr.Prasanna Silva (From 10.04.2015 to 12.08.2015)	Chairman
Mr.Abdul Majeed (From 13.08.2015 to 29.10.2015)	Chairman
Dr.Anil Premarathne (Since 30.10.2015)	Chairman
Mr.M.LF.Rathnasiri Fernando (From 26.01.2015 to 09.04.2015)	Member
Mr.L.K.D.Silva (From 26.01.2015 to 09.04.2015)	Member
Mr.S.M.N.S.Seneviratne (From 26.01.2015 to 09.04.2015)	Member
Mr.K.D.Karunaratne (From 26.01.2015 to 09.04.2015)	Member
Mr.W.M.U.Wijesinghe (From 26.01.2015 to 09.04.2015)	Member
Mr.E.A.D.B.Gamini Perera (From 10.04.2015 to 31.12.2015)	Member
Mr.M.A.Jayasena (From 10.04.2015 to 29.10.2015)	Member
Mr.Nimal Punchihewa (From 10.04.2015 to 29.10.2015)	Member

Mr.Wajira Wickramasingh (From 10.04.2015 to 29.10.2015)	Member
Mr.Sarath Paranamana (From 10.04.2015 to 29.10.2015)	Member
Mr.T.M.Nihal (30.10.2015 to 31.12.2015)	Member
Professor W M T B Wanninayake (30.10.2015 to 31.12.2015)	Member
Prof.T.S.G.Fonseka (30.10.2015 to 31.12.2015)	Member
Mr.Noel Palliyagura AAL (30.10.2015 to 31.12.2015)	Member

Ex –officio Members

Mr.V.Sathyanandan From 26.01.2015 to 29.10.2015)	Director General, NARA
Mr.B.C.W.Iddamalgoda (From 30.10.2015)	Director General, NARA
Mr.R.Semasinghe (From 25.02.2015)	Director General, Department of Public Enterprises
Ms.T.B.Fahmiya (From 24.02.2015)	Senior Assistant Secretary, Ministry of Ports Shipping and Aviation
Rear Admiral N.B.J. Rosairo (From 01.01.2015 to 04.08.2015)	Director General /Operations, Sri Lanka Navy
Rear Admiral S Jayakody (From 05.08.2015 to 31.12.2015)	Director General /personnel, Sri Lanka Navy
Mr.P.M.U.Udayakantha (From 01.01.2015 to 31.12.2015)	Survey General, Department of Survey.
Mr.M.C.L.Fernando	Director General, Department of Fisheries & Aquatic Resources

Organizational Structure



Organization

Professor T S G Fonseka, Mr.Prasanna Silva, Mr.Abdul Majeed and Dr.Anil Premarathne functioned as the Chairman and Mr.V.Sathyanandan and Mr.B.C.W.Iddamalgoda functioned as the Director General during the year under review. In order to perform the mandated functions of the Agency the organization had been designed to constitute nine Research and Technical/Services Divisions, Environmental Studies, Fishing Technology, Hydrographic Office, Inland Aquatic Resources & Aquaculture, Monitoring & Evaluation, Marine Biological Resources, National Institute of Oceanography & Marine Sciences, Socio-Economic and Market Research, Institute of Post Harvest Technology divisions. Supported divisions were, Administration, Services & Operations and Finance Divisions.

Following officials officiated as Heads of Divisions during the year 2015.

Research Divisions

Mr. S. A. M. Azmy	Environmental Studies Division
Mr. N. B. P. Punyadeva	Fishing Technology Division
Mr. A.N.D.Perera	Hydrographic Office Division
Dr. V. Pahalawattaarachchi	Inland Aquatic Resources & Aquaculture Division
Dr. R. R. P. Maldeniya	Marine Biological Resources Division
Mr.S.U.P.Jinadasa(Actg.)	National Institute of Oceanography & Marine Sciences
Dr.G.J.Ganegamaarachchi	Institute of Post Harvest Technology
Mr. K. H. M. L.Amaralal	Socio Economics & Market Research Division
Mr. A. B. A .K. Gunaratne	Monitoring & Evaluation Division

Support Services Divisions

Mrs.R.A.L.T. Rupasinghe(Actg.)	Administration Division
Mr.N.M.K.S.Ranjith	Finance Division
Mr.A.J.G.S.Dahanayake	Services & Operation Division
Mr. M. D. Senarathne	Internal Audit Division

2. RESEARCH HIGHLIGHTS

Dr.H.M.P.Kithsiri, Deputy Director General (Research and Development)

Aquaculture and Inland Fisheries

The feed development was done using locally available ingredients and the optimum protein requirements for seabass cultured in cages were app 40-45%. Cage culture system was introduced for the abandoned clay pits in Gampaha district is another endeavor. With this, culture of Tilapia, Indian Carps and fresh water prawn has been popular among the community in the area. Aquaculture possibility was explored in abandoned ponds at Hambantota district. Catch composition of invasive Knife Fish were identified as 20% to 22 % in the tanks of Kalutara district while value addition was conducted incorporating knife fish for fish feed development at Panapitiya station. Woman participatory oyster farming at Kalpitiya showed an apparent increase of the family income. Site specific factors were determined by onsite monitoring of culture sites for oyster at Puttalam lagoon and for seaweed culture/ nursery keeping at Killinochchi and Dondra. A depuration plant is being established at Kalpitiya to oyster cleaning while seed garden at Dondra provided seeds to initiate community based seaweed farming at Silawathrei, Mannar and Iranathivu, Killinochchi. Studies on *Holothuria scabra* breeding and culture were continuing in respect of awareness among fishing communities on sea cucumber farming, developing and integration of different kind of breeding methods, studying processing techniques and nutritional analysis Induced breeding of *Barbonyms schwanenfeldii* (Tin Foil barb) and *Puntius denisonii* (Denisonii Barb) were successful and technology transfer was carried out. Marine recirculatory hatchery system has been setup for development of technology for breeding of seahorse, Clown fish and fire shrimps. The 4mg/l BAP and 1mg/l IAA were the best concentration of hormone which gives the shoots from the rhizomes in *Cryptocoryne* tissue culture.

Horizontal transmission of WSSV in shrimps has been recorded through number of carriers such as mud crabs and sand white ghost crabs (Coyotequadrata).Studies on use of probitics in shrimp culture reveled that ammonia levels at less than 0.05mg/l throughout the culture cycle although nitrate and phosphate levels were high during the latter part of the culture cycle. The disease survey of community based ornamental fish culture at Hambantota district exposed that high mortality in Gold fish tanks were due to parasitic diseases such as *Tricodina*,

Dactylogyrus. Recommendations for brush park fishery in Negombo lagoon is much interest to management planners and holistic approach of management of the traditional fishery.

Marine Biological Resource

The large pelagic and small pelagic data collection programme was carried out in order to produce statistical reports to the Department of Fisheries. A report with the comprehensive recommendations for encircles nets (ie. Laila nets) was submitted to the Department of Fisheries and Aquatic Resources in order to conserve fish resources and minimise the fishing disputes.

Recommendations were made to the Department of Fisheries and Aquatic Resources to include gear type in the licences which issued to the ornamental fish collectors, as a result of fishery dependency survey on biodiversity in reef habitats in Mannar. In accordance with the study on small pelagic fishery in Weligama bay, it was revealed that fish nets should be limited in the Weligama bay. The *Cistopustaiwanicus* has newly recorded octopus species as reported by the molecular identification of commercially important Cephalopods and chondrichthyes. DNA barcodes were developed for several species of rays at simultaneously.

The heavy metal analysis on Silky shark is shown that favorable conditions are available for human consumption. The highest catch of spiny dog fish has been recorded in Beruwala. According to the sea turtles study there were 15 operational sea turtle hatcheries identified along the coastal belt from Mount Lavinia to Kosgoda. The turtle refugee center which was established in Kalpitiya is served as a rehabilitation center for sick and injured turtles.

Spawning season of Indian Mackerel in the Western and Southern waters of Sri Lanka was found to be in the months of May and June. The genotyping analysis indicated that the Indian mackerel resources around Sri Lanka consist of one stock according to the study on population biology and fishery of the blue swimming crab (*Portunus pelagicus*) in Jaffna district.

Fishing Gear Technology Development

The Experiments with three types of newly constructed traps were carried out at sea in Hambantota in order to harvest deep sea lobsters. The trap 1 is a circular type and upper part consist a shade and with a two big mouth opening between lower and upper shade. The trap 2 is also circular type and has a curvature towards the middle area. The shape of the trap 3 is

half cylindrical and have wide mouth opening at both ends. Those three traps are net knitted by trammel net. Total catch of above three traps was recorded as 40%, 23% and 37%, respectively. Trap 2 shows the lowest catch efficiency at both locations. However, the efficiency of the traps depends on the abundances of the lobster availability at the area. *P.homarus* was the highest caught species about 85% of total harvest. *P.penicilatus* and *P.ornatus* was recorded in low percentage in both locations.

Four types of traps were introduced to Kalawewa and Huruluwewa reservoirs with community participation in order to eradicate the tank cleaner fish. The shape of the trap 1 is a half cylindrical with two openings in both sides. The trap 2 is like a big carpet, the trap 3 rectangular shape with one side mouth opening. The trap 4 is a circular type and has a curvature towards the middle area. Those four traps are net knitted by trammel net. Catching rates of above four traps were 12%, 18%, C 23% and 25% respectively during the experiment period.

Totally three aggregating devices (FADs) were constructed and deployed at three locations in the Kalametiya fishing area with community participation. The depth of the area is about 250 feet. The FADs were constructed by using Bamboo trees and size is about 20' x 20' foot.

The experimental shrimp trap was constructed and the effectiveness and the favorable bait were assessed at shrimp trawl ground in Poruthota, Negombo. Further, a trap has been designed to catch *Macrobrachium* spp. in the seasonal tanks. A Fishing gear and craft catalogue was prepared for the Puttalama and Mannar lagoon. A dispute among the fishing communities at Ambakadawila was resolved and report was submitted with comprehensive recommendations.

Post-Harvest Technology

Quality of fish, water used to clean fish, ice and fish contact surfaces at Mulathivu, Jaffna, Mannar and the Central fish market in Peliyagoda were investigated for microbiological and chemical quality. Samples of Mannar and Thalai-Mannar were contaminated with *Salmonella* and unacceptable levels of *E. coli* counts.Thirteen fish samples from Central Fish Market in Peliyagoda were in unacceptable quality.

According to the survey on handling temperatures of fish at retailing places (Gampaha and Colombo Districts), It is required to maintain temperature of fish at least around 0-2 °C along fish handling chain.Fish displayed in chill cabinets in supermarkets were found 0-1 ^{o}C. In about 40% of other normal fish retailing stalls, fish is kept with ice under electrical lighting bulbs and temperature of fish was recorded 0-6 ^{o}C. However in about 60% of stalls, fish is

kept without ice under electrical lighting bulbs and fish temperature was unacceptably high as recorded between 4 -17 ^{o}C.

Fish base biscuit using tank cleaner fish (Orinoco Sale Fin Catfish /*Pterygoplichthys multiradiatus)* was developed. Orinoco Sailfin Catfish (OSC) flour was incorporated to the biscuits recipe and compared with the biscuits made without OSC flour for Proximate, sensory evaluation, nutritional value and shelf life. The protein percentage of non-fish base biscuit was about 11% and which was increased up to 29% with Orinoco Sailfin Catfish (OSC) flour. The cost of 100g of product was 40.48 LKR.

Based on the analysis of mineral composition of seaweed products, Seaweed based soups (Carrageenan and agar incorporated vegetable soups) samples were compared with a commercial vegetable soup sample for dietary mineral contents including Ca, Na, Mg and K. The nutritional data showed dried vegetarian soup mixture had significant amount of required nutrients particularly macro and micro elements.Dietary mineral content of different jam types prepared using seaweed agar was assessed. The Jam prepared by Agar and carageenan contained high amount of Ca, Na, K, Mg, Iodine (I_2). The commercial market jams indicated very lowest levels of iodine content. Therefore jams with agar and carageenan can be extensively used as a health food.

Low levels of micro-elements were found in crude extract of seaweed based bio-fertilizer compared with the commercial fertilizer. The Seaweed extracts prepared by incorporating *Ulvalactuca,Kappaphycus alvarezii* and *Gracilaria verrucosa* could be used to enhance NPK levels of chemical fertilizers. The Extraction of Alginic acid from locally grown Sargassum species have been tested at laboratory scale using analytical grade chemicals. Semi purified aliginic acid could be used in textile industry.

Attention should be taken to depurate oysters harvest from Gangewadiya and Kandakuliya areas efficiently before consumption according to the assessment of safety of oysters and clams as water of the Gangewadiya and Kandakuliya were contaminated with high densities of Coliforms, Faecal coliforms, *E.coli* and *Faecal streptococci.*

The collagen of skin, bones and fins of yellowfin tuna (*Thunnus albacarces*), tank cleaner fish (*Pterygoplichthys multiradiatus*) and Pothubari (*Sufflamemn fraenatus)* were separated and characterized. The results suggest that collagen of fish waste such as skin, bones and fins have the potential to be used as an alternative source of collagen for various applications.

Environmental Studies

Negombo Lagoon study revealed that Northern part of the lagoon has been critically affected by human intervention. The water quality is below the limits of the recommended levels in Pitipana and Munnakkare area. Hence, this lagoon area needs to be dredged to improve circulation of water, which helps to increase fish production. Accumulated plastics and other waste materials have significant effect to the water quality, lagoon productivity and scenic beauty. Therefore, dumping of solid waste and liquid waste should be controlled. Two monitoring projects have completed to monitor water quality in North Western and Eastern Provinces. Kattankudy Pradeshiya Sabha is using lagoon reservations to dump their solid waste. Therefore, necessary action needs to be taken to find alternative sites for this purpose. Batticoloa lagoon fishery is affected by Jellyfish. Therefore, ecological studies need to be done to identify environmental and ecological conditions to control them. Specially, Planktons and water quality were recorded after 30 years in the Eastern province, which will cover the important baseline data gaps in the eastern province. Therefore, data could be used for development activities of the eastern province and North Western Province. Furthermore, waste disposal system should be strengthened in Oluvil and Valachchenai fisheries habours for their sustainability and regular Marine Litter collection should be done within the Harbours.

There was a project to cater the emergencies such as fish kills and oil spills. The cause of fish kill recorded in Maduru oya reservoir in June 2015 was due to toxins from increased growth of cyanobacteria (*Mycrocystis* sp) as a result of eutrophication. This is a very critical issue for drinking water for around 7000 families in the command area, we have decided to do further investigations through a project in 2016. Another project was done focusing on fishery harbour pollution, water quality and aquatic biodiversity in coastal waters from Batticoloa to Akkaraipattu in Eastern province. The results obtained from those research projects have been used to provide technical advice to related organisations and the government, in order to improve decision making process and implement sustainable environmental management strategies.

According to the study carried out in North Western province, Puttalam Lagoon (Close to Puttalam town), Chilaw fishery harbour, Daduru oya, Sengal oya, Battulu Oya, Gange wadiya locations were contaminated with fecal coliform. There for necessary action has to be taken by the local authorities immediately.

Oceanography

The information of fishing ground is disseminated twice a week (Monday and Thursday) to major fishery harbors by FAX and email. The ocean observation center (OOC) operation 24x7 basis and monitoring and gathering real time ocean information data in the Indian Ocean especially around Sri Lanka. The center produces updated version of ocean information and provides it to coastal communities, maritime professionals and scientific communities to meet their needs. The data and information are available in free access data base for intended users. The currently available products are sea level, sea surface topography, ocean wind, sea surface temperature, salinity and vertical temperature profiles, chlorophyll, wave climate, and deep ocean pressure data. The data are available as ASCII data as well as the map format. Upwelling areas and period of occurrence are identified using R/V Samudrika. Water quality report is prepared for the Puttalam Lagoon. The water quality data will be useful to identify the suitable sites for aquaculture such as shrimps, oyster, sea cucumber and seaweeds etc.Sand deposits and mineral deposits are investigated and estimated the quantity of sand available for exploration.

Hydrography

Near shore bathymetric data acquisition for Nautical Chart of "Approaches to KKS" was done utilizing medium size survey boat "Tharanga" and small boat "Bar Reef". Totally 100 sq km covered. Bathymetric data acquisition for nautical chart Colombo to Weligama (Nautical Chart equivalent to small scale "British Admiralty" Nautical Chart 3700 (BA 3700) was carried out under National Charting Program. Totally 1000 sq km covered by the survey. Near shore data collection was done utilizing medium size boat "Tharanga" and offshore data collection was done utilizing RV "Samuddrika". In addition, Bathymetric Surveys were carried out to thePort City Development Project, Mt.Lavinia for Vincent BEC, Delft Pier for Northern Provincial Council, Norochcholai for Ceylon Electricity Board First Season Survey for Zhen- He joint Project.

Socio-economic and marketing

According to the socio-economic survey at the Puttalam lagoon, High cost of the fishing gears, practice of the illegal nets, low support from the government and inaccessibility of credit are the major issues of the lagoon fishers. Trap nets *(kudu nets)* push nets, sangili nets were mentioned as more harmful fishing gears operating in lagoon. Motorized fishing craft in

the Puttalm lagoon does not show significant profit differences with compared to the non-motorized craft due to higher negative externalities (fuel consumption) affect on motorized craft. Therefore the study recommends to promotenon-motorized craft for the lagoon fishery.

Women participation in Sri Lankan with special reference to Kaluthara, Gampaha and Colombo districts were assessed. Average income of the fishing family in the Gampaha, Kaluthara and Colombo districts were Rs. 43,688, 47,223 and 49,014 per month respectively. Even though women do not participate directly in fish catching, 39% of them provide support through net cleaning, net repairing, net lording and fish sorting activities and dry fish processing.

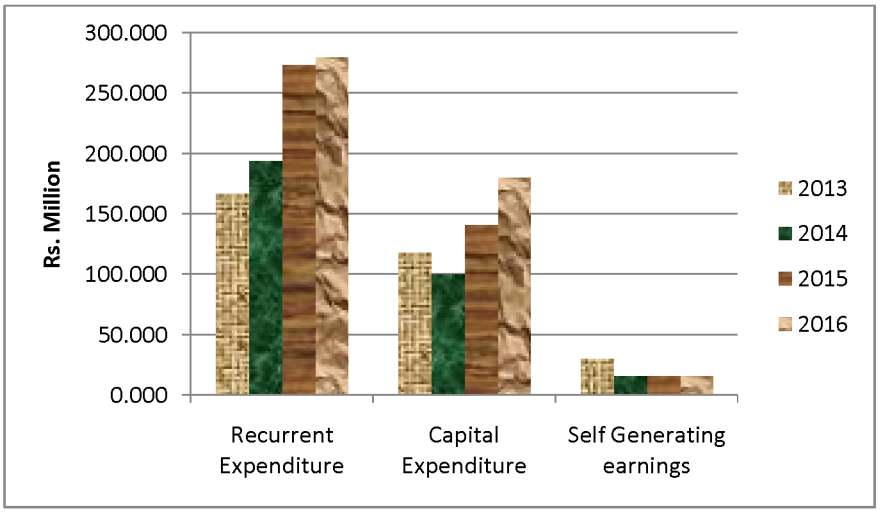
3. FINANCIAL PERFORMANCE AT A GLANCE

Estimated Budget

Rs.(Million)

Description	2013	2014	2015	2016 Estimated
Recurrent Expenditure	166.894	194.260	273.583	280.000
Capital Expenditure	118.272	100.000	141.000	180.000
Self Generating earnings	30.000	16.000	16.000	16.000
Total	**315.166**	**310.260**	**357.000**	**476.000**

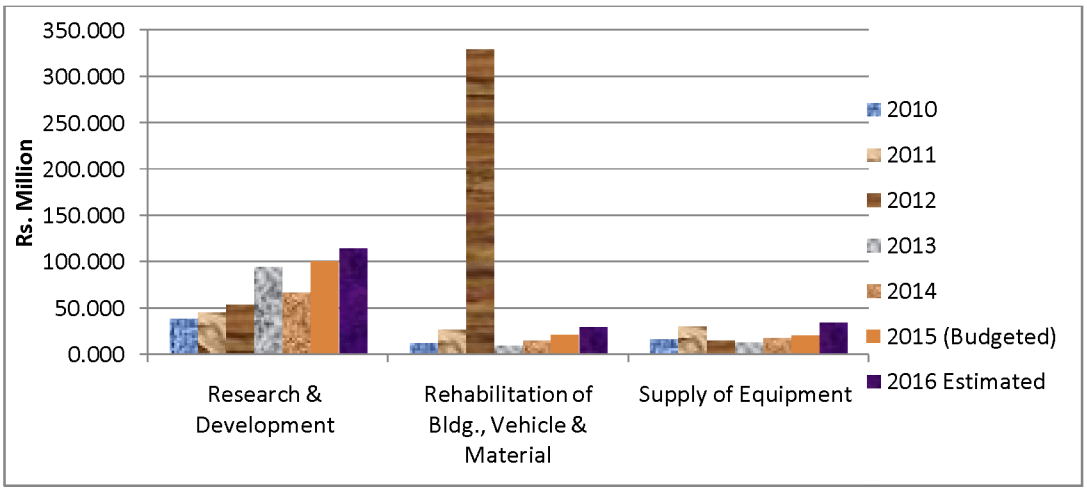
Self generated income was increased due to starting of major projects & consultancy in the year 2013. However, in 2014, 2015 & 2016 it was constant since there are no such special major projects in these years. On the other hand recurrent expenditure was increased due to new recruitment based on the new SOR and salary revision in the year 2016.



Capital Expenditure

Rs.(Million)

Description	2010	2011	2012	2013	2014	2015 (Budgeted)	2016 Estimated
Research & Development	38.727	45.666	54.053	95.000	67.000	100.000	115.000
Rehabilitation of Bldg., Vehicle & Material	12.599	26.762	330.060	10.000	15.000	21.000	30.000
Supply of Equipment	16.856	30.842	15.161	13.000	18.000	20.000	35.000
Total	**68.182**	**103.27**	**399.274**	**118.000**	**100.000**	**141.000**	**180.000**

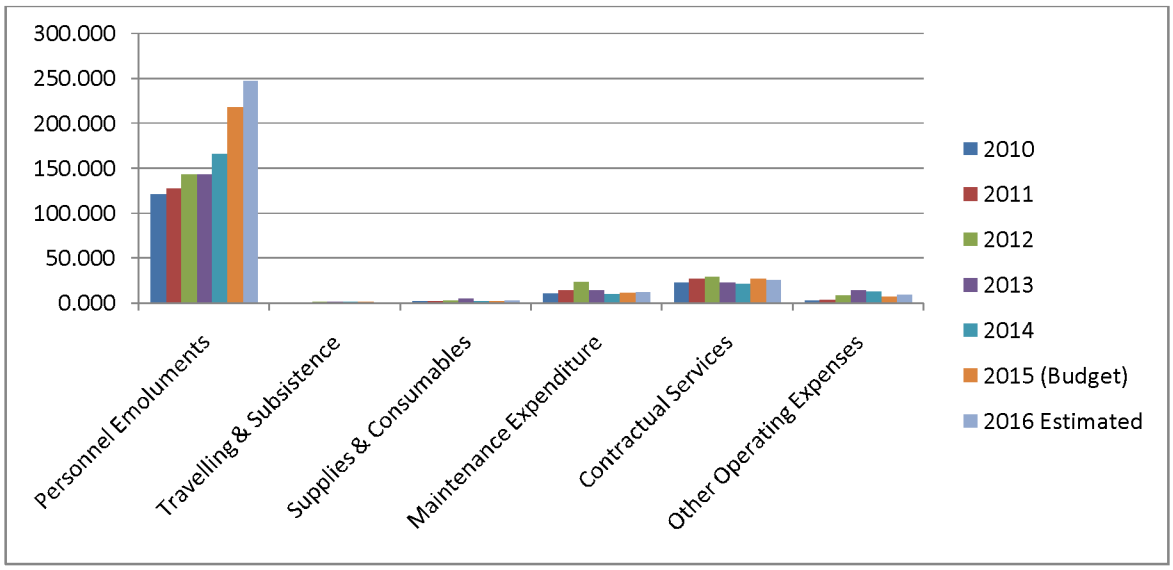


Considerable amount in rehabilitation of buildings, vehicle maintenance & material was increased due to high price in the open market.

Recurrent Expenditure

Rs.(Million)

Description	2010	2011	2012	2013	2014	2015 (Budget)	2016 Estimated
Personnel Emoluments	120.500	127.402	142.392	142.376	165.114	217.925	247.035
Travelling & Subsistence	0.897	0.823	1.364	1.602	1.400	1.200	0.750
Supplies & Consumables	1.770	1.833	2.629	4.353	2.050	2.075	2.500
Maintenance Expenditure	10.549	14.272	23.38	14.064	9.700	11.700	11.950
Contractual Services	22.863	26.909	28.464	22.443	21.150	26.800	25.175
Other Operating Expenses	2.650	3.229	8.017	13.950	12.557	7.025	8.590
Total	**159.229**	**174.468**	**206.246**	**198.788**	**211.971**	**266.725**	**296.000**



During the last years the other recurrent grant has increased by very little percentage by the Treasury whereas personnel emoluments has increased in considerable amount due to new recruitment and the salary revision in 2016.

4. HUMAN RESOURCES INFORMATION

Recruitments

No	Name	Designation	Permanent/Contract	Appointment Date
1	Mr.T.S.G.Fonseka	Chairman	Contract	2/2/2015
2	Mr.V.Sathyanandan	Director General	Contract	2/2/2015
3	Mrs.S.Amaraweera	Asst. Project Monitoring Officer	Permanent	16/2/2015
4	Mr.Indratissa Chandrasekara	Helper	Permanent	23/2/2015
5	Mr.S.D.G.Kumara	Driver	Contract	1/3/2015
6	Mrs.W.D.C.D.M.Weragoda	Management Assistant	Permanent	1/3/2015
7	Mrs.T.A.I.Tennakoon	Helper	Contract	19/3/2015
8	Mr.A.A.D.S.M.A.Adhikaram	Helper	Contract	19/3/2015
9	Mrs.M.P.M.T. Karunarathne	Helper	Contract	19/3/2015
10	Mr.K.A.P.Danushka	Field Research Assistant	Contract	24/03/2015
11	Mr.V.Sathyanandan	Director General	Contract	16/4/2015
12	Mr.Prasanna Silva	Chairman	Contract	16/4/2015
13	Mr.K.A.S.Madushanka	Research Assistant	Permanent	2/7/2015
14	Ms.D.I.Amarasinghe	Research Assistant	Permanent	2/7/2015
15	Ms.K.W.A.K.Madusha	Research Assistant	Permanent	2/7/2015
16	Ms.T.Maduka	Research Assistant	Permanent	2/7/2015
17	W.A.K.D.Madurangika	Research Assistant	Permanent	2/7/2015
18	D.Senevirathne	Research Assistant	Permanent	2/7/2015
19	G.S.Chathurika	Research Assistant	Permanent	2/7/2015
20	J.R.A.W.Nilmini	Development Officer	Permanent	2/7/2015
21	R.K.M.Malshanee	Development Officer	Permanent	2/7/2015
22	R.A.N.Kumari	Development Officer	Permanent	2/7/2015
23	H.T.R.Sureshika	Development Officer	Permanent	2/7/2015
24	D.A.D.Champika	Development Officer	Permanent	2/7/2015
25	P.L.D.D.Nisansalee	Development Officer	Permanent	2/7/2015
26	A.C.Madushani	Development Officer	Permanent	2/7/2015
27	W.K.E.Sanjeewa	Development Officer	Permanent	2/7/2015
28	A.M.G.V.Gunasekara	Development Officer	Permanent	2/7/2015
29	Y.T.Wijesekara	Development Officer	Permanent	2/7/2015

30	R.Manori	Development Officer	Permanent	13/7/2015
31	E.M.P.Kumara	Development Officer	Permanent	2/7/2015
32	R.Pushpakumara	Helper	Permanent	13/7/2015
33	S.A.N.Chamara	Helper	Permanent	2/7/2015
34	P.B.N.Kaveesha	Helper	Permanent	2/7/2015
35	H.A.P.Madushanka	Helper	Permanent	2/7/2015
36	T.D.Ajith kumara	Helper	Permanent	2/7/2015
37	L.Hashini	Helper	Permanent	2/7/2015
38	M.N.Sameera de silwa	Helper	Permanent	2/7/2015
39	W.C.N.Priyadarshani	Helper	Permanent	2/7/2015
40	Asela Nuwan Jayaweera	Helper	Permanent	2/7/2015
41	Tekla sudarshani	Helper	Permanent	2/7/2015
42	M.Viraj	Helper	Permanent	2/7/2015
43	V.G.I.Upul kumara	Helper	Permanent	2/7/2015
44	A.W.G.Nuwan chamara	Helper	Permanent	2/7/2015
45	W.H.Iranga lakmal	Helper	Permanent	2/7/2015
46	K.M.T.M.Kuruppu	Helper	Permanent	2/7/2015
47	L.Dilukshini	Helper	Permanent	2/7/2015
48	K.M.Ruwan sampath	Helper	Permanent	2/7/2015
49	W.A.N.Pradeep	Helper	Permanent	2/7/2015
50	Tharindu pushpakumara	Helper	Permanent	2/7/2015
51	S.P.Senevirathne	Helper	Permanent	3/7/2015
52	H.M.A.Herath	Helper	Permanent	2/7/2015
53	A.L.D.S.Milinda Appu	Helper	Permanent	6/7/2015
54	W.N.K.S.Fernando	Helper	Permanent	8/7/2014
55	K.P.P.Kumara	Driver	Permanent	2/7/2015
56	W.W.Siriwardane	Driver	Permanent	2/7/2015
57	W.A.S.Kelum	Assistant Bungalow Keeper	Permanent	16/07/2015
58	Mr.A.A.Majeed	Chairman	Contract	18/9/2015
59	Mr.P.S.A.Fernando	Skipper	Contract	16/10/2015
60	Dr.Anil Pemarathne	Chairman	Contract	16/11/2015
61	Mr.B.C.W.Iddamalgoda	Director General	Contract	14/12/2015

Departures of the Service

No	Name	Designation	Departure Date	Remarks
1	Mr.E.A.Darmasiri	Helper	28/02/2015	Pension
2	Ms.H.A.D.N.Leelananda	Landscaping Officer	28/01/2015	Resigned
3	Mr.P.D.L.Wickramasinghe	Driver	2/2/2015	Vacation of Post
4	Ms.G.M.G.Ranjanee	Management Assistant	1/3/2015	Resigned
5	Mr.A.A.D.S.M.A.Adikaram	Helper	25/3/2015	Vacation of Post
6	Prof.T.S.G.Fonseka	Chairman	23/3/2015	Resigned
7	Mr.V.Sathyanandan	Director general	23/3/2015	Resigned
8	Mr.Indratissa Chandrasekara	Helper	15/3/2015	Resigned
9	Mr.E.C.N.Silva	Coxwain	9/3/2015	End of service
10	Mr.O.V.Pemachndra	Cartographer	18/4/2015	Retirement
11	Mr.P.B.Rathnapala	Cartographer Data Analyst(Nautical)	4/5/2015	Retirement
12	Mr.S.P.Wijesinghe	Photocopy Machine Operator	28/05/2015	Retirement
13	Mr.S.Aravinth	Land Survey	20/8/2015	Resigned
14	Mr.Prasanna Silva	Chairman	13/8/2015	Resigned
15	Mr.V.Sathyanandan	Director general	13/8/2015	Resigned
16	Mr.K.A.D.S.Nilanga	Helper	16/9/2015	Vacation Post
17	Mr.A.A.Majeed	Chairman	15/11/2015	Resigned
18	Ms.R.K.Malshani	Development Officer	20/11/2015	Resigned
19	Ms.D.I.Amarasinghe	Research Assistant	31/12/2015	Resigned

Unfilled Vacancies

Srl No.	Designation	Salary Code	Vacant
1	Director (Admin/HR)	HM1-3	1
2	Senior Scientist	AR-2	1
3	Senior Hydrographic surveyor	AR-2	1
4	Deputy Hydrographer	AR-2	1
5	Scientist	AR-1	40
6	Sociologist	AR-1	1
7	Economist	AR-1	1
8	Hydrographic Surveyor	AR-1	1
9	Senior Cartographer	MM 1-2	1
10	Senior System Analyst/ Programmer	MM 1-2	1
11	Data Analyst	MM 1-2	1

12	Asst. Director (Service & Operation)	MM 1-2	1
13	Asst. Director (Admin)	MM 1-2	1
14	Asst. Director (Information Technology)	MM 1-2	1
15	Senior Extension Officer	MM 1-2	1
16	Assistant Director (Vessel Operation & Maintenance)	MM 1-2	1
17	Assistant Information Technology Officer	JM1-2	1
18	Technical Officer (Mechanical)	JM1-2	1
19	Cartographer Data Analyst (Nautical)	JM1-2	1
20	System Analyst /Programmer	JM1-2	1
21	Technical Officer (Civil)	JM1-2	1
22	Land Surveyor	JM1-2	1
23	Cartographer	JM1-2	1
24	Landscaping Officer	JM1-2	1
25	Diving Officer	JM1-2	1
26	Translator	MA 4	3
27	Development Officer (Project)	MA 3	3
28	Assistant Network Administrator	MA 2-2	1
29	Field Research Assistant	MA 2-2	3
30	Research Assistant	MA 2-2	19
31	Catographic Draughtsman	MA 2-2	2
32	Coxwain	MA 2-2	2
33	Head Driver/Marine	MA 2-2	1
34	Multi Media Designer	MA 2-2	1
35	Management Assistant (Transport)	MA 2-2	1
36	Draughtsman	MA 2-2	1
37	Diver	MA 2-2	1
38	Diver Assistant	MA 2-2	1
39	Technical Assistant (Electrical)	MA 2-2	1
40	Management assistant. (Library)	MA 2-2	2
41	Ocean Observation Technician	MA 2-2	1
42	Assistant Skipper	MA 2-2	1
43	Geological information System Technician	MA 2-2	1
44	Radio Officer	MA 2-2	1
45	Hydrographic Assistant	MA1-2	1
46	Boatswain	MA1-2	1
47	Book-Binder	PL-3	1
48	Plumber	PL-3	1
49	Carpenter	PL-3	1

50	Mason	PL-3	2
51	Motor Mechanic	PL-3	1
52	Driver	PL-3	1
53	Deck Hand	PL-3	1
54	Marine Mechanic	PL-3.	1
55	Vedio Editor	PL-3	1
56	Caretaker/Cook	PL-2	2
57	Helper	PL-1	7
	Total		**131**

Promotions

No	Name	Designation	Appointment Date
1	Ms.H.D.C.Prasanna	Research Assistant	7/2/2015
2	Mr.M.M.C.Karunarathne	Development Officer	7/2/2015
3	Ms.G.R.H.Rupika	Development Officer	7/2/2015
4	Mr.Milan Indika	Lab Attendant	19/11/2014

Local training

	Name	Date	Course	Venue	Amount (Rs.)
1	Ms.B.G.S Kariyawasam	21/01/2015	Public relations and communication for organizational development in the knowledge era	Sri Lanka Library Association	1500.00
2	Ms.R.S Liyananarachi	21/01/2015	Public relations and communication for organizational development in the knowledge era	Sri Lanka Library Association	1500.00
3	Dr.Wasantha Rajapakse	22/12/2014 - 22/09/2015	Computer Training Programme	National Institute Of Fisheries & Nautical Engineering (NIFNE)	10000.00
4	Ms.Pradeepa Ediriweera	22/12/2014- 22/09/2015	Computer Training Programme	National Institute Of Fisheries & Nautical Engineering (NIFNE)	10000.00
5	Ms.Wasantha Kumudu Kumari	22/12/2014- 22/09/2015	Computer Training Programme	National Institute Of Fisheries & Nautical Engineering (NIFNE)	10000.00

6	Dr.J Ganegamaarachi	02,03/03/2015	Workshop on Applied Cheical & Physical Metrology	Sri Lanka Accreditation Board or Conformity Assessment	25000.00
7	Ms.Thilini Jayasinghe	02,03/03/2015	Workshop on Applied Cheical & Physical Metrology	Sri Lanka Accreditation Board or Conformity Assessment	25000.00
8	Ms.Achala Gunathilka	18/03/2015	Workshop of Tax Implication on Salary (Payee) for HR & accounts Professionals	Sri Lanka Institute of Development Administration (SLIDA)	7500.00
9	Mr.L.K.G.T. Buddika	2015	Diploma in Journalism	University of Colombo	19750.00
10	Ms.R.S Liyananarachi	2014-2016	Post Graduate Diploma in Library & Information Science	National Institute of Library and Information	750,000.00
11	Ms.R.A.L.T. Rupasinghe	13/05/2015	Recruitment Procedure	PRAG Service	6000.00
12	Mr.C. Samantha Peiris	13/05/2015	Recruitment Procedure	PRAG Service	6000.00
13	Ms.S.R.C.N.K. Narangoda	16/05/2015	SLAFAR Pre-Symposium Workshop	Sri Lanka Association for Fisheries and Aquatic Resource.	2000.00
14	Ms.S.H.U Chaturani	6/5/2015	SLAFAR Pre-Symposium Workshop	Sri Lanka Association for Fisheries and Aquatic Resource.	2000.00
15	Ms.J.K.P.C. Jayawardana	23/06/2015	Writing a High Impact Research Article.	National Science & Technology Commission	3500.00
16	Ms.S.R.C.N.K. Narangoda	23/06/2015	Writing a High Impact Research Article.	National Science & Technology Commission	3500.00
17	Ms.N.D. Hettige	23/06/2015	National workshop on Scientific Data Handling , Analysis & Interpretation	Postgraduate Institute of Science	2000.00
18	Ms. B.G.S.Kariyawasam.	2/7/2015	International Conference on strengthening Co-Operation among National Libraries in South Asia.	National Library & Documentation	3500.00
19	Dr.A.D.W.R. Rajapaksha	2/7/2015	Writing a High Impact Research Article.	National Science & Technology Commission	3500.00

20	Ms. S.N.P.M.G.D.D.D. Wearagodathenna	2/7/2015	Writing a High Impact Research Article.	National Science & Technology Commission	3500.00
21	MS.M.A.J.C. Mallawarachchi	2/7/2015	Writing a High Impact Research Article.	National Science & Technology Commission	3500.00
22	Mr.G.S.C.Perera	2/7/2015	Writing a High Impact Research Article.	National Science & Technology Commission	3500.00
23	Ms.A.M.A.N. Adikari	2/7/2015	Writing a High Impact Research Article.	National Science & Technology Commission	3500.00
24	Mr.M.M.A.S. Maheepala	2/7/2015	Short Course on "GIS and Applications.	Postgraduate Institute of Science	30.000
25	MR. S.A.R. Rasanga	08/07/2015	Professionals Development of Clerical & Allied grade	Skills Development Fund Limited.	8500.00
26	Mr.L.K.G.J. Buddika	08/07/2015	How to be a Brilliant Manager.	Skills Development Fund Limited.	5000.00
27	MRS. Kumudu Samaraweera	08/07/2015	Project Management	Skills Development Fund Limited.	8500.00
28	Mr. Wijitha Kodikara	20/07/2015	Workshop For Drivers	Construction Equipment Training	2500.00
29	Mr. Nalaka Fernando	20/07/2015	Workshop For Drivers	Construction Equipment Training	2500.00
30	Mr. Samantha Gunathilaka	20/07/2015	Workshop For Drivers	Construction Equipment Training	2500.00
31	Mr. T.M.N.S. Thennakoon	20/07/2015	Workshop For Drivers	Construction Equipment Training	2500.00
32	MRS. G.W.N. Pavithra	2015	Master of Business Studies	University of Colombo	202, 500
33	Mr. M.Gammanpila	2015	Degree of PhD	University of Kelaniya	50.000.00
34	MS. U.D.C. Udawaththa	18/07/2015	Construction of cost effective House	Construction Industry Development	3000.00

35	Ms. W.A.A.A.P. Wijesundara	30/07/2015	International Conference on Social Colombo.	The International Institute of Knowledge Management Pvt. Ltd.	18000.00
36	Mr. R.K.A. Ariyarathna	30/07/2015	International Conference on Social Colombo.	The International Institute of Knowledge Management Pvt. Ltd.	18.000.00
37	MR. Vijith Kodikara	30/07/2015	Safe Scientific & Economical Driving.	Construction Equipment Training Center	25.000.00
38	Mr. M.K.N. Samantha Gunathilaka	30/07/2015	Safe Scientific & Economical Driving.	Construction Equipment Training Center	25.000.00
39	Mr. T.M.N.S. Thennakoon	30/07/2015	Safe Scientific & Economical Driving.	Chairman Construction Equipment Training Center	25.000.00
40	Mr. M.G.C.R. Wijesinghe	24/08/2015	Data Handling, Analysis & Interpretation	PGIS Auditorium	2000.00
41	Ms. B.G.S. Kariyawasam	25/08/2015	International Conference on LIS	Sri Lanka Library Association	6000.00
42	Ms. R.S. Liyanaarachchi	25/08/2015	International Conference on LIS	Sri Lanka Library Association	6500.00
43	Mr.R.A.I.T. Rupasinghe	28/08/2015	E- Government & Basic IT Office Management Practices	Skills Development Fund Limited.	76500.00
44	P.D.D. Weeragoda	04/09/2015	Sri Lanka Arc GIS User Conference	Sri Lanka Foundation	2500.00
45	Mr. B.L.S. Wimalasinghe	17/09/2015	Transport Management	Construction Equipment Training Centre	3500.00
46	Mr. K.A. Wimal Kumara	01/10/2015	How to be a professional Driver.	Skills Development Fund Limited.	12500.00
47	Mr. Nalaka Fernando	01/10/2015	How to be a professional Driver.	Skills Development Fund Limited.	12500.00
48	Mr.S.G. Kumara	01/10/2015	How to be a professional Driver.	Skills Development Fund Limited.	12500.00
49	Mr.C. Samantha Peris	12/10/2015	Advance Analysis Tools	Andrea Ann Fay Adams	6500.00

50	Dr. V. Phalawaththarachchi	12/10/2015	Advance Analysis Tools	Andrea Ann Fay Adams	6500.00
51	Mr. D.A. Athukorala	12/10/2015	Advance Analysis Tools	Andrea Ann Fay Adams	6500.00
52	Mr. R. Weerasingha	12/10/2015	Advance Analysis Tools	Andrea Ann Fay Adams	6500.00
53	Mr. E.D.M. Epasinghe	12/10/2015	Advance Analysis Tools	Andrea Ann Fay Adams	6500.00
54	Ms. M.H.S. Ariyarathna	12/10/2015	Advance Analysis Tools	Andrea Ann Fay Adams	6500.00
55	Mr. P.N. Darmarathne	12/10/2015	Advance Analysis Tools	Andrea Ann Fay Adams	6500.00
56	Ms. Hemali Rupika	12/10/2015	Advance Analysis Tools	Andrea Ann Fay Adams	6500.00
57	Mr. M.D.M. Asanka	12/10/2015	Advance Analysis Tools	Andrea Ann Fay Adams	6500.00
58	Mrs. M.D.C. Jayanthi	12/10/2015	Advance Analysis Tools	Andrea Ann Fay Adams	6500.00
59	Mrs. A.A.N. De Alwis	12/10/2015	Advance Analysis Tools	Andrea Ann Fay Adams	6500.00
60	Ms. G.L.A. Nilmini Mendis	12/10/2015	Advance Analysis Tools	Andrea Ann Fay Adams	6500.00
61	Ms. W.G.D. C.D.M. Weeragoda	12/10/2015	Advance Analysis Tools	Andrea Ann Fay Adams	6500.00
62	Ms. H.D.A. Gunawardhana	12/10/2015	Advance Analysis Tools	Andrea Ann Fay Adams	6500.00
63	Ms. H.E.A.R. De Zoysa	12/10/2015	Advance Analysis Tools	Andrea Ann Fay Adams	6500.00
64	Ms. C. Rathnayaka	12/10/2015	Advance Analysis Tools	Andrea Ann Fay Adams	6500.00

65	Ms.M.K.Chandrani	12/10/2015	Advance Analysis Tools	Andrea Ann Fay Adams	6500.00
66	Mr. K.P.G.L. Sandaruwan	13/10/2015	Computer Based Data Analysis	University of Sri Jayawardenapura.	30.000.00
67	Mr. K.W. Indika	20/10/2015	MSc. Programme in Disaster Analysis	Institute of Human Resource Advancement. University of Colombo	160.000.00
68	NARA DRIVERS	23/10/2015	Environmental Friendly and Safe Driving Techniques.	NARA AUDITORIUM	8 000.00
69	Mr. N.B. Sooriyaarachi	28/10/2015	Short Course on Data Analysis	Postgraduate Institute of Agriculture	10.000.00
70	Mr.K.R. Dalpathadu	28/10/2015	Short Course on Data Analysis	Postgraduate Institute of Agriculture	10.000.00
71	Mr.S.S. Gunasekara	28/10/2015	Short Course on Data Analysis	Postgraduate Institute of Agriculture	10.000.00
72	Mr.K.A.D.A.T. Harishchandra	28/10/2015	Short Course on Data Analysis	Postgraduate Institute of Agriculture	10.000.00
73	Mr.H.D. Wimalasena	28/10/2015	Writing a Research Paper in Social Science & Humanities	National Science Foundation	2000.00
74	Ms.K.G.L. Irangani	28/10/2015	Internal Auditing	PRAG Service	6000.00
75	Ms.K.H.T.M.Kuruppu	28/10/2015	Internal Auditing	PRAG Service	6000.00
76	Ms.K.K.Thamali Khatapitiya	2015	High Diploma in bussinece Programme	University of Kelaniya	65.000.00
77	Ms. K.A.W.S. Weerasekara	03/11/2015	PHD Degree in Environment Management	University of Kelaniya	40.000.00
78	Mr. M.Gammanpila	2015	Degree of PhD	University of Kelaniya	40.000.00
79	Ms.P.A.M.J. Wijepala	2015	Degree of MSc	University of Sri Jayawardanapura	50.000.00

80	Mr. C.S.C. Perera	16/11/2015	Effective proposal Writing	National Science Foundation	1500.00
81	Mr.V.S. Gunarathne	2015	Degree of MSc	University of Kelaniya	75.000.00
82	Dr. G.J. Ganegama Arachchi	2015	Training Program on Laboratory Practices	University of Kelaniya	90.000.00
83	NHO Division	03,04/12/2015	Global Position system	University of Sbaragamuwa	80.000.00
84	NARA STAFF	07,08/12/2015	Microsoft word & Excel	NARA Auditorium	30.000.00
85	Ms.K.A.W.S. Weerasekara	15/12/2015	Training on Basic Data Analysis Using.	Colombo Science and Technology Center	12.000.00
86	Ms.D.R. Herath	2015	Degree of PhD	University of Colombo	99.500.00
87	Ms.B.G.S Kariyawasam	2015	Degree of MSc	National Institute of Library	81.000.00
88	Ms.B.R.C. Mendis	2015	Degree of PhD	University of Colombo	199,500.00
89	Mr. J.K. Rajapakshe	2015	Degree of PHD	University of Peradeniya	74 ,800.00

Foreign Trainings / Workshops

Serial No.	Name & Designation	Country	Purpose	Period
01	Mrs S.N.P.H.G.D.D.D. Weragodathenna Scientist	India	Short Course on Remote Sensing with special emphasis on Digital Image Processing	04.01.2015 - 28.02.2015
02	Mrs D.R.Herath Senior Sientist Mrs D.N.A. Ranmadugala Senior Scientist	Thailand	BOBLME Indian Mackerel Genetics Data Analysis Workshop	16.02.2015 - 19.02.2015
03	Ms A. T. P. Kumari De Silva Purchasing & Supply Officer	Malaysia	Second Country Study Visit - Diploma in Public Procurement and Contract Administration (DIPPCA)	21.02.2015 - 27.02.2015

04	Mr A.N.D. Perera Chief Hydrographer	Oman	Attendance at the 15th North Indian Ocean Hydrographic Commission (NIOHC) Meeting	14.03.2015 - 19.03.2015
05	Dr R.R.P. Maldeniya Principle Scientist (Marine Biology)	Korea	Invitation to participate in the 19th Session of the Indian Ocean Tuna Commission (S 19), and the 12th Session of the Compliance Committee and Standing Committee on Administration and Finance.	18.04.2015 - 02.05.2015
06	Mr S.U.P. Jinadasa Principle Scientist	Thailand	Tenth Intergovernmental Session of the IOC Sub – Commission for the Western Pacific (WESTPAC – X)	11.05.2015 - 16.05.2015
07	Ms K.H.K. Bandaranayake Scientist	Tanzania	5th Working Party on Neritic Tunas	25.05.2015 - 30.05.2015
08	Ms D.N.A. Ranmadugala Senior Scientist	New Zealand	For a PHD (Paid leave)	28.05.2015 - 01.06.2018
09	Mr J.S Jayanatha Scientist Mr R. Weerasinghe Scientist	Korea	2015 KOICA Fellowship (Training) Programs to Sri Lanka. Fellow –up Management for KOICA – PKNU Scholarship Program	20.06.2015 - 05.07.2015
10	Ms P.P.M. Heenatigala Senior Scientist	Panama	Invitation to participate in the Inter – Regional Workshops under the FAO TCP/INT 3502 "Reducing and Managing the Risks of Acute Hepatopancreatic Necrosis Disease (AHPND) of cultures shrimp" from 21st to 27th June 2015, Farallon, Panama.	20.06.2015 - 30.06 2015
11	Mr B.K.K.K. Jinadasa Senior Scientist	France	Application to the ANSES 2015 Summer School on total diet studies	27.06.2015 - 05.07.2015
12	Ms M.H.S. Ariyarathna Principle Scientist	Japan	The 3rd International Conference on Duckweed Research and Application (3rd ICDRA)	02.07.2015 - 07.07.2015
13	Mr D.S. Ariyarathna Senior Scientist Mr M.R. Perera Research Asst Mr S.P. Jayasooriya Research Asst.	China	Seminar on Value – added fishery development and market system construction for developing Countries -	15.07.2015 - 06.08.2015
14	Mr K.A.D.A .T. Harischandra Scientist	India	Freshwater Cycle in the Bay of Bengal and Hydrology of the adjoining continent (FRECH)"	01.08.2015 - 16.08.2015
15	Ms R.R.A.R. Shirantha Senior Scientist	USA	For PHD – Half salary	15.08.2015 up to 03 years
16	Dr S.S.K. Haputhantri Principle Scientist	Portugal	13th Working Party on Billfish (WPB13)	30.08.2015 - 07.09.2015
17	Dr H.M.P. Kithsiri	Thailand	GSSI/Thai DOF Workshop on Awareness Building in Fisheries Ecolabelling	30.08.2015 - 02.09.2015

	Deputy Director General (Research & Development)		Aquaculture Certification, Conformity Assessment and Benchmarking	
18	Mr R.A.M. Jayathilaka Scientist	Portugal	The 11th Working Party on Ecosystem and Bycatch (WPEB11)	06.09.2015 - 13.09.2015
19	Mr B.K.K.K. Jinadasa Senior Scientist	Spain	Bivalve Shellfish Safety Management	20.09.2015 - 26.09.2015
20	Mr M.M.C. Karunarathna Development Officer (Project)	China	Professional Science Master's Programme in Fishery	10.09.2015 - 01.08.2017
21	Mr R.K.A. Ariyarathne Hydrographic Surveyor	China	Meeting on Zhen He's second season survey	01.10.2015 - 06.10.2015
22	Dr R.R.P. Maldeniya Principle Scientist (Marine Biology)	France	06th Working Party on Methods (WPM 06) and 11th Working Party on Data Collection and Statistics (WPDCS 11)	18.10.2015 - 24.10.2015
23	Dr H.A.C.C. Perera Senior Scientist	France	17th Working party on Tropical Tunas (WPTT 17)	21.10.2015 - 30.10.2015
24	Mr K.A.D.A.T. Harischandra Scientist	Thailand	Sixth WESTPAC Summer School on the Monsoon Onset Monitoring and its Social & Ecosystem Impacts (MOMSEI Summer School – VI)	25.10.2015 - 31.10.2015
25	Mr S.U.P. Jinadasa Principle Scientist Ms W.A.A.P. Wijesundara Hydrographic surveyor	Malaysia	IOC/IODE/Ocean Teacher Global Academy: Marine GIS Training Workshop	24.10.2015 - 30.10.2015
26	Ms P.P.M. Heenatigala Senior Scientist	China	For PHD – Full Pay Study leave	26.10.2015 - 26.10.2018
27	Ms L.A.R. Sunethra Librarian	India	The 18th International Symposium on Theses and Dissertations ETD 2015	03.11.2015- 09.11.2015
28	Dr S.S.K. Haputhanthri Principle Scientist	Thailand	Final BOBLME Project Steering Committee Meeting	16.11.2015 - 19.11.2015
29	Mr S.S. Gunasekara Scientist	China	IODE Training Course on Global Temperature and Salinity Profile Programme (GTSPP)	06.12.2015 - 12.12.2015
30	Mr L.S.C. Siriwardana Hydrographic Surveyor	Malaysia	IMO/IHO Multi – beam Training Course for the Safety of Navigation on Port Operations	06.12.2015 - 12.12.2015
31	Ms M.A.J.C. Mallawaarachchi Scientist	Spain	Advance Training Course on Re-Circulation Systems and Their Application in Aquaculture	13.12.2015 - 20.12.2015
32	Dr S.S.K. Haputhanthri Principle scientist	India	Ninth Meeting of the Technical Advisory Committee of the BOBP -IGO	20.12.2015 - 22.12.2015

33	Dr Anil Premarathne Chairman (Nara) Dr H.M.P. Kithsiri Deputy Director General (Research & Development) Dr K. Arulananthan Principle Scientist	China	Invitation to China – South Asian Countries Marine Cooperation Meeting in Guangzhou,	16.12.2015 - 22.12.2015
34	Dr Anil Premarathne Chairman (NARA)	China	Official visit of Hon. Minister of Fisheries and Aquatic Resources Development	23.12.2015 - 31.12.2015

Court Cases

(1.) **Case No - 3894/10/DMR - Distric Court -Colombo**

Case was filed against Mr N.H.Dassanayake, research Officer and his two Sureties on the grounds of breach of Agreement/Bond entered into with the institution. Steps have been taken to issue Summons through the Ministry of Justice since the 1st Defendedant is residing in Canada. This case was called on 28/08/2015finaly.

(2.) **Case No. 05151/08/ DMR - Distric Court -Colombo**

Case was filed againstms. S.Thalakada, Chief Librarian and her two sureties on the grounds that she has not reported for duty after completion of no-pay leave period abroard. Steps has been taken to issue summonthrough the Ministry of Justice since the 1st Defendedant is residing in New Zealand.

Welfare activities

Annual New Year festival celebrated. In addition to thattransport facilities provide to the staff to make easy.

5. RESEARCH DIVISIONS

5.1 ENVIRONMENTAL STUDIES DIVISION

Head of the Division: Mr. S. A. M. Azmy

Overview of the year

The Environmental Studies Division (ESD) focuses mainly on research related to environmental aspects of aquatic resources with special reference to water quality and aquatic ecology. The results obtained from those research projects are used to provide technical advice to related organisations and the government, in order to improve decision making process and implement sustainable environmental management strategies.

Scientists in ESD conduct research, develop technology, and perform analyses to understand and assess responses of environmental systems at the environment-human interface and the consequences of alternative energy and environmental strategies. Moreover, they seek to understand how natural and anthropogenic factors (e.g., regional changes, environmental stress, and energy production and use) interact to influence environmental systems and society. The divisional methods integrate field and laboratory methods with new theory, modelling, data systems, policy analysis, and evaluation to create solutions to complex environmental challenges.

Divisional staff consists of four senior scientists including head of the division, five scientists, a development officer, two research assistants, a management assistant, two laboratory assistants, and a helper. During 2015, the division carried out six research projects which mainly focused on environmental related topics and for the development of the fisheries industry including a project to cater the emergency situations such as fish kills and oil spills, and also a project to improve the quality of the laboratory.

Programe		Project		Allocation (Rs.)	Officer Responsible	Period	
						From	To
1	Conservation and Management	2.1	Assessment of water pollution status of lagoons and marine environments - Eastern coast of Sri Lanka.	300,000	S.A.M. Azmy K.A.W. S. Weerasekara W.D.N.Wickramaarachchi N.D.Hettige M.D.S.R.Maddumage J.K.P.C.Jayawardane S.R.C.N.K. Narangoda	Jan 2015	Dec 2015
2	Conservation and Management	2.2	Investigation of causes for emergency incidents such as oil spills, algal blooms and fish kills (emergency studies).	200,000	K.A.W. S. Weerasekara S.A.M. Azmy W.D.N.Wickramaarachchi N.D.Hettige M.D.S.R.Maddumage J.K.P.C.Jayawardane S.R.Chandima N.K. Narangoda	Jan 2015	Dec 2015
3	Conservation and Management	2.3	Development of Methodologies and technologies to improve inland water resources including river basins	1,300,000	A.A.D. Amarathunga S.A.M. Azmy K.A.W. S. Weerasekara W.D.N.Wickramaarachchi N.D.Hettige M.D.S.R.Maddumage J.K.P.C.Jayawardane S.R.Chandima N.K. Narangoda	Jan 2015	Dec 2015
4	Conservation and Management	2.4	An application of different bio-indicators for assessing water quality in the selected estuarine system in Sri Lanka	400,000	N.D.Hettige S.A.M. Azmy K.A.W.S.Weerasekara A.A.D.Amarathunga M.D.S.R.Maddumage J.K.P.C.Jayawardane S.R.Chandima N.K. Narangoda	Jan 2015	Dec 2015
5	Conservation and Management	2.5	Assessment of bioaccumulation of heavy metals in water, sediments and muscle tissues of selected edible fish and crabs species from Negombo estuary, Sri Lanka.	400,000	B.R.C. Mendis S.A.M. Azmy	Jan 2015	Dec 2015
6	Conservation and Management	2.6	A comprehensive study on coastal waters in Eastern Province of Sri Lanka with special reference to Fisheries harbors pollution, water quality, aquatic biodiversity, and disease management.	1,100,000	W.D.N.Wickramaarachchi K.A.W.S.Weerasekara S.A.M. Azmy N.D.Hettige M.D.S.R.Maddumage J.K.P.C.Jayawardane S.R.Chandima N.K. Narangoda	Jan 2015	Jan 2015

PROJECT NO: 2.1

ASSESSMENT OF WATER POLLUTION STATUS OF LAGOONS AND MARINE ENVIRONMENTS - EASTERN COAST OF SRI LANKA.

Lagoons and the marine environment in the North Western province of Sri Lanka are highly affected by the increasing urbanization and industrialization activities. Anthropogenic activities will increase the amounts of organic and inorganic waste input into the marine habitats and would have an impact on the health of the whole ecosystem. Hence this project was initiated to assess the spatial and seasonal variations of the water quality of lagoons and the Dutch canal in North Western province.

Eighteen sampling locations including Chilaw lagoon, Mundel Lake, Puttalam lagoon, Dutch canal and some of the fresh water sources (Deduruoya, Battuluoya, Meeoya and Kala oya) were selected for the study and analysed the water quality status including physical, chemical and biological parameters. Data were collected for 8 months from May, 2015 to December, 2015. Data were collected for 8 months from May, 2015 to December, 2015. According to the results, high COD (>600 mg/l) and BOD (>20 mg/l) values were recorded from June to August 2015 in most of the locations. Monthly salinity values were ranged from 8 ppt to 36 ppt in brackish water habitats and it was 0 to 6 ppt in fresh water habitats. The fecal coliform levels and *Escherichia coli* levels were very high and beyond the limits (<3 MPN/ml for Nature Conservation). The fecal coliform levels were recorded as >16 MPN/ml for several months during the study period in Puttalam town, Chilaw Fishery Harbor, Deduru oya, Sengal oya, Serakkalliya, Gangewadiya and Battuluoya. Furthermore, *E. coli* levels were >16 MPN/ml for several months during the study period in Puttalam town, Chilaw Fishery Harbor and Gangewadiya.

Project Highlights

Project Highlights

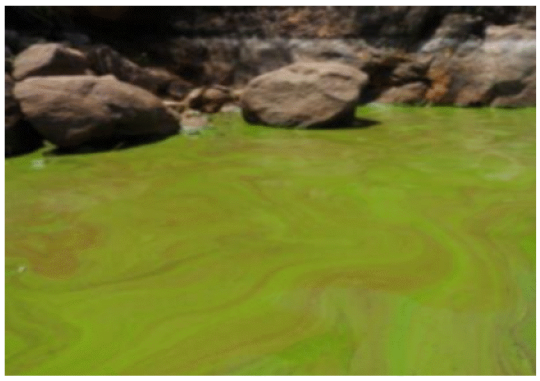
Progress (%) : Financial: 107.8% Physical: 93%

PROJECT NO: 2.2
INVESTIGATION OF CAUSES FOR EMERGENCY INCIDENTS SUCH AS OIL SPILLS, ALGAL BLOOMS AND FISH KILLS (EMERGENCY STUDIES).

The major objective of this study is to assess and investigate the causes for environmental emergencies such as water pollution, oil spills, fish kill incidents and algal blooms etc..and finally give recommendations to overcome the situation. During the 2015, four fish kill incidents were recorded and they were as fish mortality in fish pond near Olympus house, MahawewaWennappuwa, Padakadawewa, and Kandy Lake. The results obtained from both field investigations and laboratory experiments were used to find out the major causes for those fish kill incidents and investigation reports were submitted to relevant authorities with recommendations. Public awareness of such fish kill incidents were also given through the media. Another emergency situation were recorded at Maduru Oya reservoir due to high growth of algal blooms and the results identified that, there were excessive growth of blue-green Cyanobacteria (*Mycrocystis*sp) which totally covered the most parts of the MaduruOya.

Fish kill observed at Wennapuwawewa

Dead fish observed at Kandy Lake



Fish carcasses dumping site MaduruOya algal bloom incident

Project Highlights

Progress (%) : Financial: 91.77% Physical: 93 %

Water body	Investigation date	Causes	Remedies
1. Padakadawewa fish kill	2nd January 2015	Low oxygen availability	Identification and control of wastes added to the water
2. fish kill in Mahawewa	13th February 2015	Fluctuations of temperature created a stressful condition to the fish Release toxic gasses like NH_3, H_2S and CH_4 and generate a dissolved oxygen depletion in the water column	Increase awareness of the people Best land use practices in the catchments of the area Enforce existing environmental regulations as required to overcome discharge of waste by the house holds into the natural water bodies
3. fish pond near Olympus house	7th April 2015	Poor water quality in the pond Overcrowding of *Tilapia niloticus*,	Remove all dead fish carcasses, improve water quality by mechanical aeration pumps, control overcrowding of fish
4. MaduruOya reservoir	10th June 2015	Increased growth of cyanobacteria in the MaduruOya.	Control the algae growth in the lake by minimizing the nutrients sources Identify the sources of nutrients. Proper investigation of algal growth. A study regarding this will be carried out in 2016.
5. Kandy Lake	8th July 2015	high concentrated algae in the lake, depleted the oxygen in the water at night and thrive the stress condition for fish in the water	Control the algae growth in the lake Aerate the water artificially

From October to January, there were three field visits were conducted for demographic data collection for Chronic Kidney Disease affected stations in Madawachchiya divisional secretariat divisions. Met relevant government officials including Divisional Secretary Madawachchiya, MOH, District medical officer Madawachchiya and obtained relevant data related to CKDu data.

PROJECT NO: 2.3
DEVELOPMENT OF METHODOLOGIES AND TECHNOLOGIES TO IMPROVE INLAND WATER RESOURCES INCLUDING RIVER BASINS

Population increases, rapid industrialization, agricultural activities and drinking water requirement are multiplying every day and our understanding of possible contributions to water pollution is very important. Therefore study focused to assess the toxicological impact from agrochemicals to aquatic resources specially developed, to elucidate the pollutant behavior in the tropical environment and development of new methodologies.

For the first year, Mahaweli upper catchment and Galoya basin water quality monitor to understand the existing environment to impact from farming system. In addition to that, it is very important to develop a model. Many different models were developed to understand the different process of the environment in the world. Also, various models were used to simulate the downstream toxicity by applying upstream pesticide concentration. However, there is poor attention on land use on pesticide loading, photo degradation of pesticide under high concentrated suspended sediment for degradation process as a model parameter. Therefore, this study focused on to elucidate the downstream pesticide toxicity using land use, photo-degradation effect, farmer's attitude with other parameters based on mass balance theory to estimate downstream toxicity by pesticide (Chlorpyrifos). The model simulated pesticide (Chlorpyrifos) concentrations in downstream water are 0.119µg/l, 0.518µg/l, and 0.461µg/l in three different seasons (February to May, June to September and October to January) respectively. In addition, photo-degradation under suspended sediment are 11.4%, 23.1% and 5.5% in three seasons respectively. These levels are exceeding the acute and chronic toxic level to aquatic invertebrate. This model needs to be improved further and validate by using the existing concentrations. Therefore, data will be collecting in 2016. Furthermore, the toxicological impact to aquatic invertebrate need to assess in future and most of the chemicals were purchase for future testing.

Progress (%) : Financial: 82.72% Physical: 93 %

PROJECT NO: 2.4

AN APPLICATION OF DIFFERENT BIO-INDICATORS FOR ASSESSING WATER QUALITY IN SELECTED ESTUARINE SYSTEMS IN SRI LANKA

Biological assessment is a process of evaluating the health of a water body through the use of biological indicators and it is a valuable assessment tool that could be used in water quality monitoring programe. Monitoring of biological communities is an important tool for assessing water quality. Hence, it could be used as the measurements of the degradation of habitats for the economically important fish species.

The objective of the project is to, assesses water quality of the estuarine systems and its changes with the use of different biotic and abiotic parameters: physicochemical variables, macro-invertebrates and diatoms

- To apply biotic indices for the macro-invertebrates in order to estimate water quality.
- To elucidate the sensitivity of bio indicator to water quality parameters (selected parameters)

Panadura estuary, Nilwala, Walawe and KiridiOya estuary were selected for the study. Aquatic invertebrates, plankton and water quality analysis were carried out selected estuaries. Also diversity of benthic macro invertebrates was identified in Panadura estuary and Walawe estuary. 64% Gastropods, 35% Bivalves, 1% Crustacean were recorded in Pandura estuary. Pollution Tolerance Index (PTI) was less than 20 in all the sampling locations selected in Panadura estuary. It is indicated poor water quality in Panadura estuary. Benthic macro-invertebrate diversity was higher in Panadura estuary compare to Walawe estuary. Phytoplankton namely *Melosira sp* and *Pediastrum* sp and Zooplankton namely Copepod nauplii and *Acrocalanus sp* are the common plankton recorded in each estuaries. One undergraduate student from Uwawellassa University was supervised for their final year project using this project.

Project Highlights

Progress (%) : Financial: 77.42% Physical: 93%

PROJECT NO: 2.5

ASSESSMENT OF BIOACCUMULATION OF HEAVY METALS IN WATER, SEDIMENTS AND MUSCLE TISSUES OF SELECTED EDIBLE FISH AND CRABS SPECIES FROM NEGOMBO ESTUARY, SRI LANKA.

The study was focused on assessment of bioaccumulation of heavy metal in water, sediment and muscle tissues of selected edible fish species of Negombo estuary. The Negombo estuary, covering 3,164 hectares where over 3,000 fishermen are engaged in their livelihood is heavily silted, endangering its continuity. Project was initiated with the objectives of to determine the heavy metal concentrations in water, sediments and fish tissues in the ecosystem and to evaluate the seasonal variations in the bioaccumulation patterns of heavy metals in selected edible fish species and to determine the bioaccumulation factor. Altogether Eight sampling locations were selected for this study, which included points in the estuary, effluent from most of the industries in Ja-ela and Katunayeke free trade zones, the large number of boats using the area for anchoring and wastewater from houses are discharged into estuary. Samples were analyzed for important pollutions parameters including physical, chemical and biological parameters in water during the study period. The results for the most parameters indicate that, the BOD, COD and heavy metals (Pb, Cd, and Hg) levels are highest in Northern part of the estuary. The values obtained on BOD 23.6 ±7.1 mg/L and COD 469.0 ±36.5 mg/L levels were much higher than the permissible threshold limits.

The results revealed that the mean concentrations (ppm) of Pb, Cd and Hg in dissolved phase of water varied from 0.005, 0.015 and 0.013 respectively. The concentrations (mg/kg) of Pb, Cd and Hg in sediments varied from 3.10 to 7.95, 0.45 to 1.06, less than detection limit to0.001 respectively. The concentrations (mg/kg) of Pb, Cd and Hg in fish tissues varied from

0.01, 0.48 and 0.28 respectively. Hence, the main reasons for the above results were the discharge of sewage and dumping of solid waste from households and other anthropogenic activities and sedimentation at the North region. The results of the present study will be helpful for developing future management plans for sustainable utilization of this brackish water ecosystem.




Project highlights

Progress (%) : Financial – 68.93 % Physical - 93%

PROJECT NO: 2.6

A COMPREHENSIVE STUDY ON COASTAL WATERS IN EASTERN PROVINCE OF SRI LANKA WITH SPECIAL REFERENCE TO FISHERIES HARBOURS POLLUTION, WATER QUALITY, AQUATIC BIODIVERSITY, AND DISEASE MANAGEMENT.

Coastal belt along northern and eastern parts of Sri Lanka is being highly affected by increasing urbanization and industrialization activities. Further, there are many coastal and inland water bodies which are least studied during the last three decades mainly due to north-east conflict. Several fish kills and other pollution incidents were recorded due to excessive nutrient loading from the anthropogenic activities. Fishing is the main source of income of the people living in the areas like Batticoloa. Therefore, assessing aquatic health is vital for ensuring sustainability of fishery industry while protecting the aquatic environment.

The main objective of this study was to assess aquatic health in economically important coastal waters, fishery harbours and disease management in existing aquaculture farms and potential locations in eastern coast of Sri Lanka. The study was carried out in selected 18 sampling points located in between Batticoloa and Akkaraipattu in the Eastern province from April 2015to December 2015. The selected sampling points comprised of fishery harbours, fish landing sites, recreational beaches and lagoons like Batticoloa and Valachchenai where fishing is allowed. Ten sampling points were in Batticoloa lagoon which is the third largest lagoon in Sri Lanka. It is surrounded by a densely populated area and one of the main livelihoods of people is fishing and shrimp farming. The lagoon has extensive mangrove some patch, which regulate pollutions coming from land-based activities.

Physical, chemical and biological parameters of water quality were measured. In-situ parameters such as water temperature, pH, salinity, electrical conductivity, dissolved oxygen, turbidity were measured. Ammonia, Ortho-phosphorus, Nitrate and Nitrite concentrations (ppm), Total suspended solids, BOD, COD, Chlorophyll α, oil and grease analysis and plankton diversity were the tests carried out in the laboratory. All the tests were performed according to the standard methods for Water and Waste Water Analysis given by American Public Health Association (APHA).

One undergraduate student from Uva Wellassa University completed his final year research under this project. The results of the study revealed that some of the physico-chemical properties of water in Batticaloa lagoon have strong positive correlation in determining phytoplankton diversity and abundance. A total of 41 species of phytoplankton belonging to 4 classes were recorded during this study. *Bacillariophyceae* (Diatoms) made largest contribution to the total phytoplankton abundance (71%) followed in order by *Dinophyceae* (15%), *Chlorophyceae* (12%) and *Cyanophyceae* (4%). Diatoms were represented by 29 species, *Chlorophyceae* were represented by 6 species *Dinophyceae* were represented by 5 species *Cyanophyceae* were represented by only 1 species. *Coscinodiscusgranii, Coscinodiscus radiatus,* and *Chaetoceros decipiens* were the most dominant diatoms. *Anabaena spp.* and *Nitzschia*were found to be good indicators of water pollution. *Coscinodiscus spp.* was observed in each location as a tolerant species. Furthermore, there was a risk of formation of algal blooms during dry period in some locations of Batticoloa lagoon.

According to the results from fisheries harbours, pollution from plastics and oils in Oluvil harbour is gradually increased. However, Valaichenai fishery harbour basin was relatively less polluted and highly dynamic water quality were observed due to its location.




Project Highlights

Progress (%) : Financial: 117.81% Physical: 93%

Remarks

Due to non-availability of funds project commencements was delayed.

TEST SERVICES

- During the period of 2015, 41 clients have been provided with test reports by environmental studies division and the total earning is 334,610.00.
- During this period, officers participated in several scoping meetings related to EIA and IEE projects conducted by the Central Environmental Authority, Coast Conservation and Coastal Resources Management Department, Ministry of Environment etc. to advice on management and conservation of aquatic resources.

MEETINGS ATTENDED

- Consultation meeting to finalize draft Master plan for Kelani river basin management and conservation by Central Environmental Authority on 30th November 2015 at Central Environmental Authority, Battaramulla.
- Wildlife sector research committee (RC) meetings by Department of Wildlife Conservation on 11th September 2015.(6 meetings)
- Technical Evaluation Committee meeting for the Initial Environmental Examination (IEE) on proposed 100 roomed 5 star hotel project, Dadalla, Galle organized by Coast Conservation and Coastal Resources Management Department on 26th June 2015 at Coast Conservation and Coastal Resources Management Department, Colombo 10.

- Meeting on "Proposal to develop YACHT tourism sector in Sri Lanka" by Sri Lanka Tourism Development Authority on 15th September 2015 at SLTDA.
- Technical Evaluation Committee meeting for the Environmental Impact Assessment (EIA) on proposed 212 roomed Ambassador Resort & SPA hotel project – No 151, Thalaramba, Kamburugamuwa, Marara by Coast Conservation and Coastal Resource Management Department on 26th November 2015 at CCD, Colombo 10.
- Scoping committee meeting for tourism investment (The Ark, Terrace View point, Hotel project at "Trivoli Site", Proposed Hotel for Melwa Hotels and Resort, Kalutota Hotels – Kamburugamuwa, Kalutota Hotels - Ambalantota) conducted by Sri Lanka Tourist Development Authority
- Meeting on National Water Quality Monitoring Programme conducted by Marine Environmental Protection Authority
- Technical Evaluation Committee meeting for the Initial Environmental Examination (IEE) on proposed 136 units of resident development Galle road, Ambalangoda, by CCD on 1st November 2015.
- Technical Evaluation Committee meeting for an IEE on proposed 30 room an IEE on proposed 30 roomed Yala Palathupana hotel development project by CCD on 1st November 2015 (2 meetings).
- Progress review meeting 2*250 MW Trincomalee coal power project by Ministry of Power & Energy on 2nd October 2015 (3 meetings).
- Technical Evaluation Committee meeting for an EIA on proposed 2*250 MW coal fired power plant in Trincomalee by CEA on 11th August 2015 at Mahaweli centre.
- Technical Evaluation Committee meeting for an IEE on proposed Silvawaththurai by CCD on 13th July 2015.
- Meeting on creation of drive reef in Hikkaduwa by Sri Lanka Tourism at SLTDA on 29th June 2015.
- Special meeting on advisory council to finalize the CZ & RM plan 2015 by CCD on 19th June 2015.
- Wildlife sector research committee meeting by Department of Wildlife conservation on 21st December 2015.
- Environmental clearance for industrial sitting meeting by Board of Investment at Environmental Management Department on 4th December 2015.
- Meeting on project proposal of marine environmental baseline study, Manar and Cauvery basin by Petroleum Resource Department secretariat at PRDS on 6th February 2015.
- Meeting on Eco five star villa resort project at Roggala by CEA on August 2015.
- Meeting on calling project ideas/concepts for Green Climate fund by Ministry of Mahaweli Development and Environment on 29th September 2015.
- Meeting of National water quality monitoring programme conducted by MEPA.
- National Steering Committee meeting by CEA at Ministry of Mahaweli Development and Environment on 8th December 2015.
- Field inspection of a breakwater in Madu Ganga sea mouth at Balapitiya
- Meeting on Finalization of Trincomalee- Post Biological Baseline Survey (PBBS) final report and submission of Galle & Hambanthota on 28th of August 2015 by Marine Environmental Protection Authority (MEPA).
- IMT meeting on Oil spill at Lunawa lagoon in Uswetakeiyawa on January 2016
- Incidental Management Team (IMT) meeting on implementation of National Oil Spill Contingency Plan on 4th August 2015 at Marine Environmental Protection Authority.
- Field visits to Oil spill at the Lunawa lagoon in Uswetakeiyawa on January 2016

- Meeting on Chilaw lagoon management committee meeting on July 2015
- Consultative workshop on Kelani River basin management and conservation on July 2015
- Meeting on EIA for biomass power plant at Trincomalee
- Inter-Agency Committee on Climate Change (IACCC) meeting by state ministry of Environment on 30th July 2015 (2 meetings).

PUBLIC AWARENESS PROGRAMMES

- Beach clean-up programme was conducted on International Beach Clean-up day (19th September 2015) with the participation of over 60 NARA staff at Muthuwella harbour and Kelani river mouth.
  Dr. W. D. N. Wickramaarachchi

LECTURES

- Conduct lecture on "Water Pollution" at Kalawana Gamini Madya Mahavidyalaya and Meepagama MahaVidyalaya (19th May 2015).
  Mrs. K. A. W. S. Weerasekara
- Lecture on "Water Pollution and its effects" for school students which organized by Vidatha Resource Centre, Thissamaharamaya, Sri Lanka (12th June 2015).
  Ms. N.D. Hettige
- Lecture on "Water Pollution and its effects" for general public which organized by Vidatha Resource Centre, Thissamaharamaya, Sri Lanka (12th June 2015)
  Ms. N. D. Hettige
- Conduct lectures on "Toxic material and harmful chemicals in aquatic environments" for Training programme at Foundation institute conducted by Marine Environment Protection Authority (MEPA).
  Dr. A. A. D. Amarathunga
- Conduct lecture on "Introduction to Standard Operating Procedure" to The Ocean Observation Centre under National Institute of Oceanography and Marine Science.
  Dr. W. D. N. Wikramaarachchi and Dr. A. A. D. Amarathunga

PRESENTATIONS

- Presentation on aquatic ecosystems and their uses and threats at D. S. Senanayeka National School, Beruwala as a invited speaker on 31 October 2015.
  Dr. W.D. N. Wickramaarachchi
- Presentation on project proposal Marine Environment Baseline Study within EEZ of Sri Lanka on 17th December 2015 at Petroleum Resources Development Secretariat.
  Mr. S. A. M. Azmy, Dr. W. D. N. Wickramaarachchi and Mrs. K.A.W.S. Weerasekara
- Presentation on "Environmental Emergencies" to staff of Ocean observation centre, NARA on 16th December 2015.
  Dr. W.D. N. Wickramaarachchi
- Presentation on insight into Marine biological research in Sri Lanka, organized by Scientists Association of NARA (SAN)
  Dr. W.D. N. Wickramaarachchi Presentation on Haritha Lanka mission 4
  Dr. W.D. N. Wickramaarachchi
- Model estimation of pesticide concentration in downstream waters of tropical river basins. "Aquatic Research for Blue Economic Development, NARA, Scientific

Sessions – 2015, Colombo, Sri Lanka, pp 25. Presentation to Hon. Mahinda Amaraweera, Minister/FARD Mr.S.A.M.Azmy

TV/RadioProgrammes

- Sri Lanka Broadcasting Corporation (SLBC) – 30 min interview on "Aquatic Pollution" in the inland waters of Sri Lanka
  Dr. W. D. N. Wikramaarachchi
- BIZ news- 30 min interview at Derana 24*7 on 9th September 2015 on water pollution status of Sri Lanka.
  Dr. W. D. N. Wikramaarachchi
- Derana TV programme "Aluth Parlimenthuwa" expert panel discussion in the field about CKDu issues on 9th September 2015.
  Dr. W. D. N. Wikramaarachchi

Posters

- Assessment of marine litter along selected beaches in the Western Province, Sri Lanka, conducted by Marine Environmental Protection Authority (November 2015)
  Ms.N.D.Hettige, Mrs.K.A.W.S.Weerasekara and Mr.S.A.MAzmy

Number of undergraduate Research projects has been supervised as an External Supervisor – Industrial Training

- Study of the Diversity of Benthic Macro-invertebrates in Panadura Estuary in Sri Lanka, Study of the Diversity of Benthic Macro-invertebrates in Panadura Estuary in Sri Lanka, Final year student B.Sc. (Special) in Aquatic Resources Technology Uwa wellassa University of Sri Lanka
  Supervised byDr.A.A.D.Amaratunga and N.D.Hettige
- Assessment of current water quality status of coastal waters in North Western province in Sri Lanka, Final year student B. Sc. (Special) in in Aquatic Resources Technology Uwa wellassa University of Sri Lanka
  Supervised by Mrs. K. A. W. S. Weerasekara and Mr. S. A. M. Azmy
- Present status of water quality on photo plankton diversity and abundance East part of Batticoloa Lagoon of Sri Lanka, Final year student B.Sc. (Special) in Aquatic Resources Technology Uwa wellassa University of Sri Lanka
  Supervised by Dr. W.D. N. Wickramaarachchi

Training of Research Students as an External Supervisor – Industrial Training

- Conducted practical lessons related to integrate coastal and Marine Resources Management on 20th and 24th July 2015 at Environmental Studies Division laboratory with a total of 15 students from Ocean University of Sri Lanka.
  Dr. W. D. N. Wikramaarachchi
- Training for the personals from Department of Department of Coast Guard about coast conservation on 13th March 2015.
  Dr. W. D. N. Wikramaarachchi

- Postgraduate student from Sir John Kothalawala Defence University, Ratmalana, from Environmental Management Field.
  Mrs. B. R. D. Mendis

EXTERNAL REPORTS

- Internal report on fish kill incident at Kandy Lake
  Dr. A. A. D. Amarathunga and Ms. N. D. Hettige
- Internal report on fish kills incidents at MaduruOya
  Dr. W. D. N. Wickramaarachchi, Mrs. K. A. W. S. Weerasekara, Mr. S. A. M. Azmy, *Mrs. S. R. C. N. K. Narangoda*
- Report on Effect of Saltern on Marine Resources in Kuburupiddy, Kuchchavell, Trincomalee on July 2015
  Mr.S.A.M..Azmy and Dr. W.D. N. Wickramaarachchi

TRAINING OBTAINED

Local

- Training of Trainers Program for National Stakeholders: Strengthening Capacity to Control the Introduction and Spread of Invasive Alien Species in Sri Lanka (19th and 20th March 2015) N.D.Hettige

WORKSHOPS CONDUCTED

- Three day workshop on Fisheries and Eco System Management for 25 stakeholders in coordination with MBRD, University of Waymba, Ministry of Fisheries, Department of Fisheries and National Aquaculture Development Authority (NAQDA) at Tamarind Tree hotel.
  Mrs. K. A. W. S. Weerasekara and Mrs.DeshiniHerath

WORKSHOPS PARTICIPATED

- National Strategic plan on eradication of CKDu stakeholders' meeting on testing, Inspection, Certification and Accreditation by Sri Lanka Accreditation Board for Conformity Assessment on 4th March 2015 at Industrial Technology Institute, Colombo.
- Inception workshop on Switch – Asia sustainable consumption and production National Policy support component for Sri Lanka, by Ministry of Mahaweli Development and Environment on 9th April 2015, at Taj Samudrahotel, Colombo.
- SLAFAR pre- symposium workshop on "Monitoring water quality for safe drinking water conducted by Sri Lanka Association for Fisheries and Aquatic Resources on 16th May 2015.
  Mrs. S. R. C. N. K. Narangoda and Mrs. S. H. U. Chathurani
- 2nd National Workshop on Scientific Data Handling, Analysis and Interpretation, conducted by Postgraduate of Science (PGIS), University of Peradeniya, Sri Lanka (27th June 2015).
  Ms.N.D.Hettige
- Workshop on "Writing high impact research article" conducted by National Science and Technology commission (NASTEC) on 9-10 July 2015.
  Mrs. S. R. C. N. K. Narangoda and Mrs. J. K. P. C. Jayewardena

- Consultative workshop on Analysis of integrated environmental solution plans for 14 local authorities in the Kelani river basins by State Ministry Environment on 13th August 2015 at Hotel Galadari, Colombo 01.
  Dr. A. A. D. Amarathunga and Dr. W.D.N. Wickramaarachchi
- Consultative workshop on preparation of Master plan for Kelani River basin management and conservation by Central Environmental Authority on 29th September 2015 at Waters Edge, Battaramulla.
  Dr. W.D.N. Wickramaarachchi
- NOSCOP awareness workshop for Incident Management Team (IMT) members at SL foundation on 15-16 October 2015.
  Mrs. J. K. P. C. Jayewardena
- Workshop on Validation of the final draft of the "National Action Plan for Haritha Lanka Programme" and update the "National Environmental Policy & strategies (2003) by Ministry of Mahaweli Development and Environment on 17th November 2015 at Sethsiripaya, Battaramulla.
  Dr. W. D. N. Wickramaarachchi
- Stakeholder workshop on feasibility study on constructing fuel transfer pipeline from Muthurajawela to Katunayaka and associated developments by Ceylon Petroleum Corporation on 24th November 2015.
  Mr. S. A. M. Azmy
- Coastal Engineering Symposium 2015, organized by Coast Conservation and Coastal Resource Management Department on 6th November 2015 at Waters Edge, Battaramulla.
  Dr. A.A. D. Amarathunga and Dr. W. D. N. Wickramaarachchi
- Symposium on "Emerging Trends on Agrochemicals and CKDu" by Toxicology Society of Sri Lanka (TSSL) on 21st November 2015 at BMICH.
  Mrs. K. A. W. S. Weerasekara
- Workshop on SPSS training conducted by University of Colombo - December 2015
  Mrs. K. A. W. S. Weerasekara and Dr. A. A. D. Amarathunga
- Workshop on Training on Incidental management team for oil spill response, conducted by Marine Environment Protection Authority, 2015.
  Dr. A. A. D. Amarathunga

RESEARCH PUBLICATIONS

Abstracts

- Amarathunga, A.A.D. and Kazama, F. (2015). Model estimation of pesticide concentration in downstream waters of tropical river basins. "Aquatic Research for Blue Economic Development, NARA, Scientific Sessions – 2015, Colombo, Sri Lanka, pp 25.
- Jayawardhane J.K.P.C., Azmy S.A.M., Weerasekara K.A.W.S., Hettige N.D., Amarathunga A.A.D., Maddumage M.D.S.R., Narangoda S.R.C.N.K and Wickramaarachchi W.D.N. (2015). *Status of water pollution at some selected coastal habitats in the Eastern coast of Sri Lanka,* Proceedings of 21st Annual Scientific Sessions of Sri Lanka Association for Fisheries and Aquatic Resources (SLAFAR), 22 May 2015 pp 38.Sri Lanka Association for Fisheries and Aquatic Resources (SLAFAR).
- Narangoda S.R.C.N.K., Maddumage M.D.S.R., Wickramaarachchi W.D.N., Weerasekara K.A.W.S., Hettige N.D., Jayawardhane J.K.P.C., Azmy S.A.M., Amarathunga A.A.D., and Mendis B.R.C. (2015) *Water quality status of selected aquatic environments in Sri Lanka during fish kill incidents,* Proceedings of 21st Annual Scientific

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5.2 FISHING TECHNOLOGY DIVISION

Head of the Division: N.B.P.Punyadewa

- Developing an efficient and environmental friendly fishing gear to harvest deep sea lobsters (*Panulirus*ornatus).
- Preparation of a catalogue for lagoon and estuarine fishing gear and crafts.
- Development of an effective fishing gear and bait for harvesting for Tank cleaner fish species in inland reservoirs of Sri Lanka

Activities

Deep Sea Lobster *(Panuliraornatus)* most widely distributed species in the tropics but it is observed that technical know-how of the fisherman used fishing gears are not suitable to exploit deep sea lobsters. Therefore, information and details were collected from fishing community and constructed the experimental fishing gear byFishing Technology division (FTD). Suitable areas for the experiments were identified with the help of fishing community.

In Sri Lanka, various kind of fishing gear and crafts are using to harvest lagoon fish recourses. But there is no any documented catalogue with details/specification about those fishing gear and craft for future uses. Therefore to build a catalogue, information and technical specifications were collected with the help of fishing community, diagrams were sketched for different fishing gears and crafts by scientist of Fishing Technology division (FTD).

Further, to develop new fishing gear to eradicate Tank Cleaner from the inland reservoir in Sri Lanka, information and details were collected from fishing community, experimental fishing gear was constructed by FTD and conducted several fishing experiment.

Further, in addition to the projects several fishing gear development was carried out for the requirement of the Ministry. The Fish aggregating devices (FAD) for the small scale fishing community was successfullydeployed at southern sea. Monitoring and evaluation process was carried out by the scientist of Fishing Technology division (FTD).

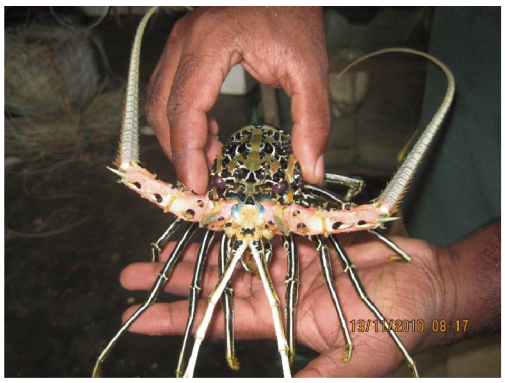
PERFORMANCE

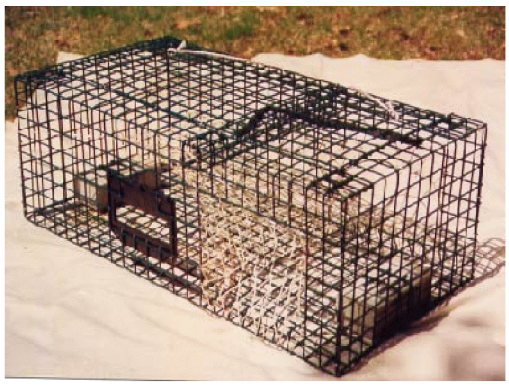
The project activities, data collection from the main fishery harbors were visited regularly and catch data were recorded. Few field visits were done for entire experiment period. Experiment at the sea was delayed due to roughness of the sea.

The development of traps for harvesting Tank Cleaner from the inland reservoir was carried out with community participation.

The preparation of catalogue, information and technical specifications were collected and diagrams were sketched.

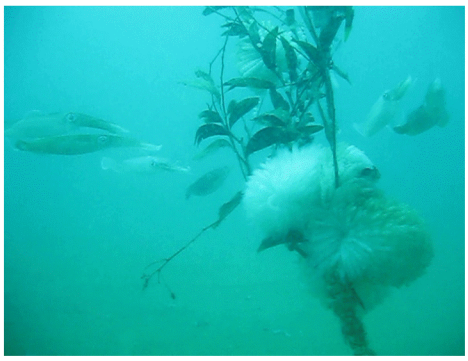
LOBSTER PROJECT





TANK CLEANER PROJECT

AMBAKADAWILA FISHING DISPUTE



FAD DEPLOYMENT

Programme	Project	Allocation Rs (Million)	Officers responsible	Period from	Physical Progress	Financial Progress
Development of New Fishing Techniques	Development of a fishing gear to exploit deep sea lobsters(*Panulirusornatus)*	LKR 800,000	NBP Punyadeva	2015 Jan-Dec	T-100% P- 95%	T- 100 % P- 123 %
	Preparation of a catalogue for lagoon and estuarine fishing gear and crafts	LKR 400,000	NBP Punyadeva	2015 Jan-Dec	T-100% P- 60%	T- 100 % P- 50 %
	Development of an effective fishing gear and bait for harvesting for Tank cleaner fish species in inland reservoirs of Sri Lanka	LKR 300,000	NBP Punyadeva	2015 Jan-Dec	T-100% P- 60%	T- 100 % P- 50

TRAINING / AWARENESS PROGRAMMES CONDUCTED

- Meetings were arranged with, Fisheries Inspectors and fishermen of in the fishing area.

Constrain

- Most field visits were cancelled due to lack of vehicles and due to bad sea conditions.

5.3 NATIONAL HYDROGRAPHIC OFFICE

Head of the Division: A.N.D Perera

Overview of the Year

The prime objective of National Hydrographic Office is to provide services to safe and efficient navigation in Sri Lankan water. The other principal services are the provision of up dated and accurate nautical information and bathymetric data for coastal zone management, environmental protection and maritime delimitation. The provision of accurate and up to date charts offers significant economic and commercial benefits through facilitating maritime trade and other marine activities.

For the year 2015 the following surveys and activities were conducted.

1. National Nautical Charting Programme
   - 1.1 1: 50,000 nautical chart of Trincomalee Approaches
   - 1.2 Nautical Chart of Approaches to Kankasanthurai
   - 1.3 Bathymetric data acquisition to fill the gap from Colombo to Weligama Nautical chart equivalent to BA chart 3700
2. Surveys conducted for special requests
3. Oceanographic Surveys, deployment of drifters and moorings to ocean observations by using RV Sammudrika.

Activities undertaken

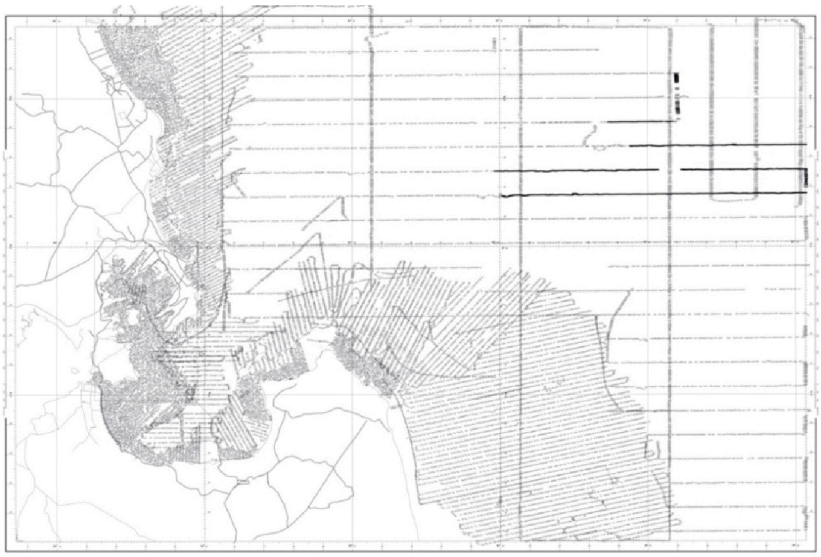
Programme	No.	Project	Officer Responsible	Period
1.National Nautical Charting	1.1	Data Acquisition for 1:50,000 Trincomalee Approaches	R.K.A Ariyarathne K.A. Ranasinghe D.L.P Hewage L.S.C Siriwardane R.M.D.I Rathnayake	Jan- Dec
	1.2	Data Acquisition of Kankasanthurai approaches chart		
	1.3	Data Acquisition for gap filling between Colombo to Weligama nautical chart equivalent to BA chart 3700	S.W.S Weerasinghe Y.M.R.N. Kumari W.A.A.P Wijesundara S.R.T.B. Singhabahu B.H.B Jayamale	
	1.4	Data processing and Cartography		
2. Surveys Conducted for special requests	2.1	Bathymetric surveys for Colombo Port City Development Project.	Y.M.R.N. Kumari R.K.A Ariyarathne K.A. Ranasinghe D.L.P Hewage L.S.C Siriwardane R.M.D.I. Rathnayake S.W.S Weerasinghe W.A.A.P Wijesundara S.R.T.P. Singahabahu B.H.B. Jayamalie	Jan- Dec
	2.2	Visual Survey for Vincent BEC		
	2.3	Bathymetric Survey at Mt.Lavinia for Vincent BEC		
	2.4	Bathymetric Survey at Delft Pier for Northern Provincial Council.		
	2.5	Bathymetric survey at Norochcholai for Ceylon Electricity Board.		
	2.6	First Season Survey for Zhen- He joint Project		

3.Surveys Conducted with RV Sammudrika	3.1	Bathymetric Survey	Research Officers and Hydrographic Surveys Co-ordinate by A.N.D Perera Head/ NHO	Jan-Dec

PROJECT NO: 1.1
DATA ACQUISITION OF 1:50,000 TRINCOMALEE APPROACHES

The bathymetric data compilation and processing are 70% completed and this chart has been planned to approach to the Trincomalee Harbour from the International Sea Route.

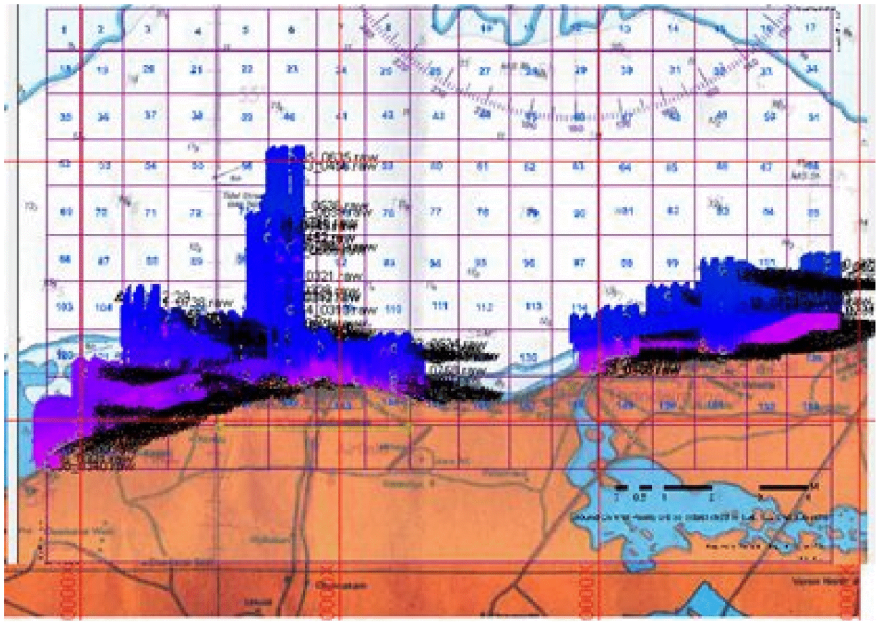
Trincomalee is an important commercial harbour in Sri Lanka which is situated under the significant geographical phenomenon. Trincomalee is a natural harbour and protect ships from wind and waves as they enter and dock. Further, it does eliminate the need for breakwaters as it will result in calmer waves inside the harbour and have long been of great strategic naval and economic importance. Therefore, production of Approaches to Trincomalee harbour chart is a mandatory requirement to full fill obligation of coastal nation enforce by SOLAS (Safety of Life at Sea) convention to provide safety information to mariners. All bathymetric data will be incorporated to the bathymetric data base of NHO. This data can be used for sea scientific and marine science, transportation, harbor development, seabed mining, and other research and development programs related to the sea.



1.50,000 Trincomalee Harbour Approaches Chart

PROJECT NO: 1.2
DATA ACQUISITION FOR APPROACHES TO KANKASANTHURAI NAUTICAL CHART

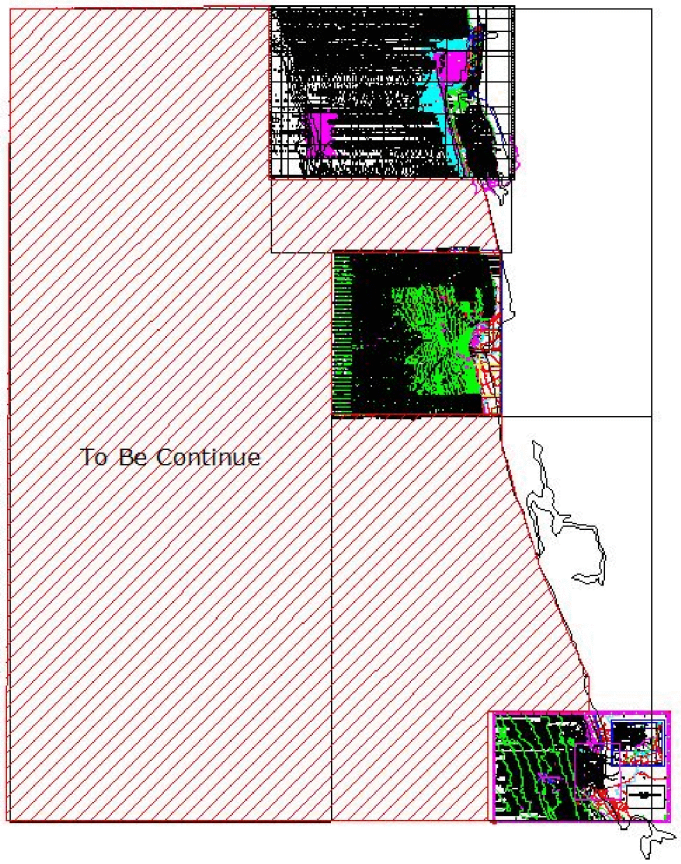
The Kankesanthurai harbor is to be developed as the third international harbor after Colombo and Ruhunu Magampura. Therefore, the nautical chart of this area is a prime requirement to fulfill the obligations of this harbor. The data acquisition for the approaches to KKS is 20% completed. This is a mandatory requirement to full fill the obligation of coastal nation enforce by SOLAS (Safety of Life At Sea) convention to provide safety of information to mariners.



Approaches To Kankasanthurai Nautical Chart

PROJECT NO: 1.3
BATHYMETRIC DATA ACQUISITION TO FILL THE GAP FROM COLOMBO TO WELIGAMA NAUTICAL CHART

The data acquisition for the gap filling between Colombo to Weligama was conducted under National Charting Programme using RV Sammudrika. This is a mandatory requirement to fulfill obligation of coastal nations enforced by SOLAS (Safety of Life at Sea) convention to provide safety information to mariners. Existing charts is based on unsystematic surveys conducted during the period of 1940 (lead line surveys). The updated information will give the opportunity for accessible to a new generation of cargo vessels and it will assist the growth of economy. Further, this will facilitate the Sri Lankan government capitalizing on the island's strategic location to promote it as an economic hub in South Asia.



Colombo to Weligama Nautical Chart

PROJECT NO: 1.4
DATA PROCESSING AND CARTOGRAPHY

- 1: 50,000 Trincomalee Approaches data compilation and processing is 70 % Completed
- Approaches to KKS chart data processing are ongoing.
- Data Processing for the acquired bathymetry for the gap filling between Colombo to Weligama is completed.

PROJECT NO: 2.0
SURVEYS CONDUCTED FOR SPECIAL REQUESTS FROM GOVERNMENT AND OTHER INSTITUTIONS

PROJECT NO: 2.1
BATHYMETRIC SURVEYING AND BEACH PROFILING FOR COLOMBO PORT CITY DEVELOPMENT PROJECT

The government of Sri Lanka has designed to implement a reclamation project covering approximately 500 acres of sufficient land area between the Colombo Port Expansion Project site and the Galle Face Green to create a city. The overall goal of this project is to provide a site for a modern urban development in keeping with the future image of Colombo as a leading hub city with regional and international business and infrastructure connections. Beach profiling surveys were carried out to monitor the identified parameters at the Environment Management Plan in detail and the bathymetric surveys were carried out to monitor the sea floor conditions.

PROJECT NO: 2.2
VISUAL SURVEY FOR VINCENT BEC (PVT) LTD

This visual survey was done according to the special request form the Vincent BEC Company to check out the availability of continuous reef running parallel to the shore and to find a gap to lay the pipe line.

PROJECT NO: 2.3
BATHYMETRIC SURVEY AT MT. LAVINIA FOR VINCENT BEC

This survey was done according to the request from Vincent BEC to identify the location to lay the pipe line.

PROJECT NO: 2.4
BATHYMETRIC SURVEY AT DELFT PIER FOR NORTHERN PROVINCIAL COUNCIL

This survey was done according to the special request from the Chief Secretary's Secretariat in Northern Provincial Council to provide an adequate draft to construct a vessel and to extend the pier to achieve reasonable draft to transport passengers between Kurikkadduwan and Delft.

PROJECT NO: 2.5
BATHYMETRIC SURVEY AT NOROCHCHOLAI FOR "LAKVIJAYA POWER STATION" FOR CEYLON ELECTRICITY BOARD.

The coal required for the power plant is procured by sea freight, which involves self-propelled barges to transport coal from vessel to the jetty. This survey was done to verify any silting on the sea bed.

PROJECT NO: 2.6
FIRST SEASON SURVEY OF ZHEN-HE JOINT PROJECT

This survey was done according to the request of Central Cultural Fund to search for wreckages of Zheng He's fleets off the coast of Sri Lanka by using the side scan sonar's and sub bottom profilers.

PROJECT NO: 3.0
SURVEYS CONDUCTED WITH RV SAMMUDRIKA

PROJECT NO: 3.1
BATHYMETRIC SURVEY

Bathymetric surveys for the gap filling from Colombo to Weligama, Trincomalee approaches and Kankasnathuria were done by using RV Sammudrika.

PUBLICATIONS / MAPS

Wijesundara WAAP, Ariyarathne RKA (2015), Development of Marine Spatial Data Infrastructure for Sri Lanka, Second International Social Sciences Conference, 11-13, August, Colombo, Sri Lanka.

TRAINING / AWARENESS PROGRAMME CONDUCTED:

- Routine awareness programmes in Hydrographic Surveying and Chart Production for Naval Officers and Seamen.
- Three undergraduates from Faculty of Geomatics, University of Sabaragamuwa were trained for 4 months period.
- Onboard Bathymetric Survey training was conducted to 60 undergraduates from Faculty of Geomatics, University of Sabaragamuwa at Beruwela.

FOREIGN / LOCAL TRAINING

- No. of officer 01: Cat A GEBCO Training Project, IHO-IOC Nippon Foundation, University of New Hampshire, USA
- No. of Officer 01: IOC/IODE/Ocean Teacher Global Academy: Marine GIS Training Course, Kuala Terengganu, Malaysia
- No. of Officers 03 : IHO/IMO Multi beam Training course for safety of navigation on port operation, Kualalampur, Malaysia
- No. of Management Assistant 03 : E Government course, SDFL, Sri Lanka.
- No. of Management Assistant 04 : Excel Course, SLIDA, Sri Lanka.
- No. of Officers and supporting staff 15 :GNSS Technology Field Observation and Data Processing, NARA
- No. of officers and Cartographers 10: Multibeam Echo sounder Data Processing Training Programme at NARA under the supporting of North Indian Ocean Hydrographic Commission (NIOHC)

NON SCHEDULED ACTIVITIES / CONSULTANCIES

Project	Contract Amount
Bathymetric survey and beach profiling survey for Colombo Port City Dev. Project	Rs.2,622,490.00
The first season survey for Zhen He Joint Project	Rs.5,052,639.35
Bathymetric survey for Delft Pier Area	Rs.884,130.00
On board bathymetric surveys training for undergraduates at Sabaragamuwa University	Rs.260,000.00
Bathymetric survey at Mount Lavinia for Vincent BEC	Rs.499, 999.50
Visual Survey at Mt. Lavinia for Vincent BEC	Rs.93,600.00
Bathymetric Survey at Norochcholai for CEB	Rs.807,820.00
Total	**Rs.9,720,679.35**

APPENDIX

Training Programme on GNSS Technology

Training Programme on Multibeam Echo sounder Data Processing

Onboard Bathymetric Survey training for undergraduates of Sabaragamuwa University

5.4 INLAND AQUATIC RESOURCES AND AQUACULTURE DIVISION

Head of the division: Dr. V. Pahalawattaarachchi

The Inland Aquatic Resources and Aquaculture Division (IARAD) contributes to the fisheries sector development mainly focusing on research related to inland and brackish water aquaculture through sustainable utilization of the natural resources. During year 2015 division has carried out 16 research projects on the following thrust areas of Aquaculture, Health Management, Ornamental fish breeding and culture as well as conservation of aquatic habitats.

In summary major outputs of the feed development for seabass were finding out local availability of ingredients, the optimum protein requirement of seabass culture in cages were app 40-45%. Cage culture of fresh water fish such as Tilapia, Indian Carps and fresh water prawn is recommended in abundant clay pits and it could be popularized in this area. Fish feed incorporated with locally available Jackfruit flesh could be successfully used as carbohydrate provider (wheat flour: jackfruit; 1:1) in Tilapia feed. The suitable ratio for wheat flour and jackfruit flesh is 1:1. Baseline data collection on site monitoring of oyster and seaweed culture will be useful in expanding the culture. Possibility explored for increasing rural aquaculture fish production through mono-sex Tilapia and utilization of abandoned ponds for rural aquaculture development at Hambantota district. Catch composition of invasive fish Knife Fish were identified as 20% to 22 % Value adding was identified as the best solution to Knife Fish problem according to the literature survey and basic technical knowhow of feed production was gained through the fish feed producing trials at Panapitiya station.

Woman participation in community based oyster culture could be highlighted to increase the family income, Depuration plant is being established at Kalpitiya while seed garden at Dondra is in continues operation Studies on *Holothuria scabra* breeding and culture were continued with the aspect of built up awareness among fishing communities on sea cucumber farming and developing and integration of different kind of breeding methods and studying processing techniques and nutritional analysis

Induced breeding of *Barbonyms schwanenfeldii* (Tin Foil barb) and Puntius *denisonii* (Denisonii Barb) were successful and technology transfer was carried out. Trials on endemic fish, *S. asoka (Asoka pethiya)* reveled that it cannot be easily bred in captivity through

environmental manipulation procedure. Its *in situ* conservation is very important for conservation and management. The development activities were carried out in the marine recirculatory hatchery system targeting to development of technology for breeding of seahorse,

Clown fish and fire shrimps. The 4mg/l BAP and 1mg/l IAA were the best concentration of hormone which gives the shoots from the rhizomes in *Cryptocoryne* tissue culture.

Health management in shrimp culture revealed that critical factors included in broodstock sourcing, post larvae sourcing, screening techniques and strategies, divers transmission pathways through no of carriers such as such as mud crabs and sand white ghost crabs (*Coyote quadrata)*. Even live feed such as Artimea also has higher risk to contaminate with WSSV positive water. Studies on use of probitics in shrimp culture reveled that ammonia levels at less than 0.05mg/l throughout the culture cycle although nitrate and phosphate levels were high during the latter part of the culture cycle. The disease survey of community based ornamental fish culture at Hambantota district exposed that high mortality in Gold fish tanks were due to parasitic diseases such as *Tricodina*, *Dactylogyrus*

The brush park fishery in Negombo lagoon is much interest to management planners, appears to be the most promising form of traditional community based management. The findings were useful for good management for successful brushpark fishery.

Project No.	Project Name	Allocation (Rs. Mn)	Officer Responsible
4.2.1	Development of formulated feed for seabass fingerling culture in lagoon floating net cages	0.5	D. A. Athukorale R. Weerasinghe
4.2.2	Seabass culture in pond environment	0.5	M.G.I.S. Parakrama
4.3	Community based food fish culture development in abundant clay pits using low- cost aqua-feed	1.00	M.H.S. Ariyaratne Ranga Jayawickrama
4.4	Development of community based oyster and seaweed farming through advances in cultivation, seed stock production and processing technologies.	1.6	Dr.H.M.P.Kithsiri S.Corea Medagedara Dr. V.Pahalawattaarachchi Upul Liyanage
4.5.1	Management of White Spot Syndrome Virus (WSSV) disease in the shrimp farming sector in Sri Lanka	2.	R.Thatrige S. Jayanatha
4.5.2	Effect of water quality management and use of probiotics in shrimp ponds in different culture zones with environmental parameters to enhance production.	0.97	A.S.L.E. Corea Ranga Jayawickrame

4.5.3	Distribution of Vibrio species in shrimp hatchery and pond culture system in Sri Lanka	0.71	P.P.M.Heenatigala
4.6.1	Development of suitable breeding techniques for selected high value high demand exotic ornamental fish species.	1.0	Amitha Adikari **E.** D.M. Epasinghe Dr.Palitha Kithsiri
4.6.2	Technology development for captive breeding and culture of endemic ornamental fishes in Sri Lanka.	0.60	R.R.A.R.Shirantha
4.6.3	Economically Important Marine Ornamental Species and micro Algae Culture for aquaculture.	0.65	M.J.C. Mallawaarachchi
4.6.4	Mariculture Development with the Emphasis on Community-based Sea cucumber Farming in North and Northwestern Provinces in Sri Lanka.	0.47	D.M.S.Sugeeshwari Ramani Shirantha; Dr.V. Pahalawattarachchi
4.7	Mariculture Development with the Emphasis on Community-based Sea cucumber Farming in North and Northwestern Provinces in Sri Lanka	1.24	P.A.D. Ajith Kumara
4.8	Community Based Ornamental fish culture and disease management in Hambantota District.	0.6	A.D.W.R. Rajapaksha
4.9	Improvement of rural livelihood through sustainable fish/prawn culture in Hambanthota and Matara District .	0.4	R. Amaraweera
4.10	Livelihood development of ornamental fish farmers in Kalutara District through Center for Living Aquatic Resource Research and Development(CLARRD)	1.15	G.S.C.Perera, E.D.M. Epasinghe
4.11	The effect of water quality and structural properties on feeding ecology, fish assemblages in brush parks of Negombo estuary.	0.50	G. Gamanpila
Total allocation		3.89	

PROJECT NO: 4.2.1

DEVELOPMENT OF FORMULATED FEED FOR SEABASS FINGERLING CULTURE IN LAGOON FLOATING NET CAGES

Responsible Officers: D. A. Athukorala
R. Weerasinghe

Objectives:

- Development of economically viable and nutritionally balance feed for Seabass fingerling culture in lagoon floating net cages
- Compare different formulated fish feeds on growth performance of Seabass fingerlings
- Compare formulated fish feeds with trash fish on growth performance of Seabass fingerlings

Asian Sea Bass (*Lates calcarifer*) is an ideal species to culture in Sri Lanka. Availability of seed is an important prerequisite for development of this industry. However, low cost but nutritionally balance feeds are needed to produce healthy, good quality Seabass fingerlings at an affordable price. Therefore, development of low-cost, nutritionally balance feeds are very important for the sustainability of Seabass fingerling production. This project is aim at the use of locally available ingredients to produce low cost nutritionally balance feeds for Sea Bass fingerling cage culture in lagoon.

Activities carried out:

- Literature survey
- Site Selection for experimental fish feeding trials
- Analysis of feed ingredients for moisture and ash
- Program writing on Excel for fish feed formulation
- Purchasing items for floating net cage construction
- Construction of wooden structure of floating net cages in the lagoon
- Start the construction of PVC structure for floating net cages

Results:

According to the literature survey it was revealed that the Seabass fingerling needed high protein diet for their better growth. The optimal dietary protein requirement of seabass is 40–45 %. Moisture content and ash content of the fish feed ingredients; fish meal, rice polish, soya powder and poonac powder were analyzed and given in Table 1. 25% of the experimental fish feed trial floating net cage system was constructed in the Negombo lagoon.

	Moisture % **SD ±**	**Ash %** **SD ±**
Fish Meal	4.90 ± 0.18	25.66 ± 0.44
Rice Polish	10.44 ± 0.11	6.54 ± 0.09
Soya Powder	10.88 ± 0.11	7.93 ± 0.12
Poonac Powder	9.33 ± 0.19	5.38 ± 0.38

Table 1: Moisture and Ash content of fish feed ingredients

Progress: Physical – 68 % Financial

Expected output:

Increased Seabass fingerling production

Constraints:

1. Unable to start experimental fish feed trials in July 2015 as planned, due to the delays in purchasing of requested items to construct experimental floating net cages in the lagoon.
2. Delay in providing the requested hiring vehicle to transport floating net cage construction material from NARA to study area of Negombo lagoon.
3. Unable to conduct field work of October 2015 as requested vehicle for field visit was not received.
4. Limited facilities at NARA to analyze fish feed ingredients.

PROJECT NO: 4.2.2
SEABASS (LATES CALCERIFER) CULTURE IN POND ENVIRONMENT - LOW COST PREPARED FEED FOR SEA BASS (LATES CALCERIFER) POND CULTURE

Responsible Officer: Dr. M.G.I.S. Parakrama

Asian Sea bass (*Lates calcerifer*) has recently emerged as an important and high tasty and nutritious fin fish species for aquaculture in Sri Lanka. Breeding technology has been disclosed to people and now it is available for everyone. The culture period being identified as 6 to 8 months vary with the culture environment and the feed availability. Trash fish is the traditional method of feeding fingerlings up to harvesting. A major portion of total production cost is to be spent for feeding them is a very high issue for the farmer and hence, they tend to avoid culturing sea bass as the availability of trash fish being a limiting factor as it has seasonal changes. Continuous supply of such feed is a hazard to many fish culturists. On the other hand, the formulated manufactured imported feed cost is the highest operating cost in semi-intensive aquaculture practices. There is a vast possibility to carry out sea bass food fish culture as an alternative in abundant shrimp ponds in North and North Western province. Accordingly introduction of economically feasible, good quality nutritious feed for sea bass fish culture is an urgent option to enhance the sea bass production in Sri Lanka.

Objectives:

- To develop an economical feasible highly nutritious feed for sea bass pond culture practice

- To enhance the annual income of small scale fish farmers with sea bass culture
- To Reduce poverty in poor fishing families due to introduction of a good quality fish feed
- To improve the health status in the society by making them utilize sea bass fish as a high protein source

Activities carried out in 2015

- Selection of suitable site/ pond system to grow out culture
- Preparation of ponds for culturing sea bass fingerlings (including weeding, cleaning, net cage renovation to partitioning the pond etc..)



- Construction of 2 piers in the pond to facilitate better observation
- Purchasing of feed ingredients
- Preparing of fish feed
- Weaning of sea bass fish from trash fish, then to farm fed imported feed and finally to NARA prepared feed
- Conducting experimental trials with the help of outside fish farmer
- Monitoring, sampling and Data collection for growth and survival success
- Report preparation


Results

- Sea bass grow out trial was conducted in the "Senura Aqua farm" at Thoduwaawa using a new feed formula with 55 % crude protein level.
- Total 480 fingerlings were stocked with average single wt 8.5g and initial length 5.5±0.50 – 8.5±2.50 cm in six 10 x10x 6 feet net cages installed in the pond. (80 number individuals in each cage)
- They were given trash fish only for two weeks and then started to wean with imported feed mixed with formulated feed. After another two weeks they were totally given the formulated feed. Trial was conducted for 100 days period until juvenile stage.
- Average weight (single) 30g. Maximum single weight 105g and minimum was 35g.
- Survival was very low (30%) due to heavy rain during the trial period and unexpected drastic salinity variances and DO levels and deterioration of water quality in the pond influenced the experimental results.
- Though the survival was lower, no diseases were recorded during the trial period.

Progress % : Physical 95% Financial

Constraints

Insufficient transport facilities for field visits, lack of petty cash and/or special advances and sometimes insufficient supporting staff

PROJECT NO: 4.3
COMMUNITY BASED FOOD FISH CULTURE DEVELOPMENT IN ABUNDANT CLAY PITS USING LOW COST AQUA-FEED

Responsible Officer: M.H.S. Ariyaratne

The abundant clay pits are filled water and not in use after excavating the mud in maximum quantity. As these are not use in any other task, its getting environmental problems and danger for the community living nearby. However, these clay pits could be used in aquaculture practices, introducing cultivable fish species such as Carps and Tilapia to obtain cheap animal protein for the poor people living nearby. As such the introduction of Freshwater prawn larvae (PL20) in these clay pits is a income generating activity. This

project introduced to the community as pilot project those who had hands on experience about cage culture in abundant clay pits through NARA Projects since 2010. The community in the area who are the victims of this water bodies could be involve in these aquaculture practices and could be obtain cheap animal protein as well as income through this self employment. However to success this aquaculture practices, it is necessary to provide a low cost aqua-feed. In this regard, use jackfruit flesh (Kos madulu) as an ingredient in fish feed and tested with Tilapia in cage culture.

Work carried out:

1. Organized the community who involve in clay mining, transportation, owners and workers
2. Trained some of them in cage making using S-lon tubes, Plastic net and Bamboo trees
3. Trained some farmers on feed preparation using low cost ingredients
4. Introducing "Lift nets" for harvesting fish in clay pits where bottoms are unequal due to clay mining
5. Fresh water prawn larvae (PL20) were stocked in 3 clay pits to get the idea on growth
6. Eleven experimental cages ($1m^3$ in each) were made with community and installed in abundant clay pit in Muruthana, Kochchikade to test the suitability of jackfruit as an ingredient.

Three kinds of aqua-feed that prepared using jackfruit flesh and wheat flour in various ratios (1:0, 1:1 &1:2) as carbohydrate provider. The used other ingredients were (i) local fish meal, (ii) coconut oil, (iii) vitamin pre mix. These feed were comparing with commercial feed to determine suitability. Jackfruit was selected as it is vastly available in January- July months of the year and exceeds the human consumption.

Results:

After 1 year period, Fresh water prawn has grown up to 9-10" with body weight ranged 200 - 250g. Some were mature female with eggs. The Average Daily Growth (ADG) of the Tilapia fed on these 3 feed types and commercial as follows.

Table 1. Average daily Growth (ADG) of Tilapia that fed on jackfruit flesh included feed

	Feed-A(1:0)	Feed-B(1:1)	Feed-C(1:2)	Commercial .Feed
ADG(g/day)	0.4313	0.7703	0.5226	1.0033

Among the tested feed types, Jack fruit flesh: Wheat flour (1:1) included feed is better as the fish fed on this feed has shown high Average Daily Growth (ADG) as 0.7703 g/day.

People prefer to use "Lift net" for harvesting partially as it is the proper way to catch the fish for their utilization when they need.

Conclusion

- Cage culture is recommended in abundant clay pits and it could be popularized in this area.
- Jackfruit flesh could be used as carbohydrate provider in Tilapia feed. The suitable ratio for wheat flour and jackfruit flesh is 1:1.
- Fresh water prawn could be cultured extensively in clay pits.

Output:

- Clay mining doing without environmental problems
- New resource for the development of aquaculture
- Low cost aqua-feed that prepared using jack fruit flesh *(kos madulu*) as carbohydrate source and local Fish meal as protein source.

Out comes:

- Self employments
- Cheap animal protein for the community

Progress (%) : **Physical : 95%** **Financial**

Constrains: Lack of vehicle in sometimes and late arrival of treasury funds

PROJECT NO: 4.4

DEVELOPMENT OF COMMUNITY BASED OYSTER AND SEAWEED FARMING THROUGH ADVANCES IN CULTIVATION, SEED STOCK PRODUCTION AND PROCESSING TECHNOLOGIES.

Responsible Officers: Oyster - H.M.P. Kithsiri, A.S.L.E. Corea

Seaweed- V.Pahalawattaarachchi, G.Dahanayake, Upul Liyanage

Objectives and justification

The main objectives of the project are to Introduce oyster culture as an aquaculture practice, as oysters have a demand in the tourism industry. Therefore oyster culture was carried out with the participation of the community in selected locations in Puttalam lagoon and they were supported with scientific advice and monitoring. A separate growth study in the same locations was carried out to collect information on the growth of oyster and water quality changes in the selected locations.

The seaweed *Kappaphycus alvarezii (Rhodophyta, Solieriaceae)* culture as a raw material for the carraegenan was introduced to the world by the Philippine during 1970,s and at recent it is popular among many parts of the world for industrial purposes. Large scale commercial seaweed culture in Northern and Northwestern part Sri Lanka was started recently with the support of NARA. Cultivation of seaweeds on a commercial scale requires a large number of propagules with desirable phenotypic traits which include high growth rates and resistance to diseases.

Optimization of culture conditions for the direct regeneration of *Kappaphycus alvarezii*. Cultivation of seaweeds on a commercial scale requires a large number of propagules with desirable phenotypic traits which include high growth rates and resistance to diseases. Culture trial and the seed garden were continued at Kaisawella point, Dondra in the South part of the country considering conservation of the seeds during the Northeast monsoonal period.

Activities carried out

- Oyster culture

Oyster growth was monitored together with water quality in 4 selected sites of the lagoon. Provided advice on managing the oyster culture activities carried out by the community.

- Seaweed culture

Sporling cultivation experiments were conducted using concrete rings laid at coastal area. Existing commercial culture systems at Walepadu and Pallikuda was monitored. Water quality and the growth rates were measured in raft cultivation. Extraction of carageenan at different was conducted in collaboration with IPHT, NARA

Results and Discussion

- Oyster culture

More participants were introduced to the culture programme at Kandakuliya and were trained in oyster culture. Seed were obtained from oysterbeds at gangewadiya for culture, and culture trials were carried out at Gangewadiya, Kandakuliya, Anawasala and a control study site at Kalpitiya.

Due to heavy rains and water flow from the Kalaoya, salinity levels were low during most parts of the year (less than 10ppt). It varied between 0-24ppt at Gangewadiya, 5- 34ppt at Kandakuliya and 5 – 30 at Kalpitiya. Growth was also affected due to low salinity.

- Seaweed culture

Conduct sporling cultivation of *Kappaphycus alvarezii* experiments using concrete rings laid at coastal area. The seedlings matured but the sporling was not observed during the study

period. Monitoring of culture system– culture monitoring conducted in two community based cultivation areas such as Walepadu, Pallikuda and Iranamatha.

Growth rate of *Kappaphycua alverezii* at Walepadu was 7%/day while stunted growth was observed at Palkuda site which has higher nitrate(2ppm) and sulphide (3.2ppm). The eutrophication condition and the Nutrient content, phosphates nitrates and sulphides were measured in the two sites. The condition of oxygen deficiency, known as hypoxia, is caused by an interaction between biological, chemical and physical factors. It is apparent that seagrasses died because of hypoxia which is a natural phenomenon that occurs periodically in coastal waters around the world. This showed the need of the culture sites continuously. Community based seed stock maintenance were conducted at Kaisawella point using selected good quality seed stock. Seeds were supplied for commercial culture. Growth rate was 7-8%/day.

Seed stock maintain at Dondra to get better quality seeds

Culture site at Walepadu where 7-8% daily growth rate was observed

Site at Wlepadu slow growth of seaweeds due to changes of the environment

Output:

Baseline data on site monitoring of oyster and seaweed culture; Woman participation in community based oyster culture; Depuration plant is being established at Kalpitiya while seed garden at Dondra is in continues operation

Progress % Physical 95 % financial %

Constraints:

Sampling was affected by the financial constraints at the beginning of the year and unavailability of vehicles during some periods of the year.

PROGARMME : HEALTH MANAGEMENT IN AQUACULTURE

PROJECT NO: 4.5.1
MANAGEMENT OF WHITE SPOT SYNDROME VIRUS (WSSV) DISEASE IN THE SHRIMP FARMING SECTOR IN SRI LANKA

Responsible Officers: M..L. RasikaThanthrige
J. Sarath Jayanatha
Dr. V. Pahalawattaarachchi

Objectives

- To identify WSSV occurrence in shrimp brood stock and most suitable areas for the shrimp brood stock collection with respect to specific pathogen free conditions in different regions of Sri Lanka and management of holding facility
- To identify the possible carriers of WSSV disease in the shrimp farming environment of North Western region and study about their occurrence and severity to the sector
- To Introduce low cost sensitive test kit for WSSV detection
- To prevent vertical transmission of specific pathogens to shrimp farms with special reference to screening the brood stocks and post larvae
- To test live feeds for WSSV occurrence of the broodstock feed used in the hatcheries

Activities carried out

- Shrimp broodstock were tested for the WSSV disease in some broodstock collecting areas of North Western Region.
- Completed the survey on broodstock collecting and holding facility in Handala, Negambo and Beruwala area and has to be given recommendations for the better holding facility.
- Mud crabs- Scylla serrata, Kadol kakuluwa- Scylla olivacea , Wild Shrimps- Penaeus indicus, Penaeus semisulcatus, Penaeus merguensis and Farm Crabs were tested for the WSSV disease and suspected as possible carriers of the WSSV disease

- Dr. Sahul Hameed WSSV PCR test kit were imported and tested for the wssv disease against to currently using IQ 2000 WSSV detection and prevention kit and 154 samples were tested up to now.
- Live feeds of Sand Flea - Emerita talpoida, Artimea- Artemia salina, Cuttle fish-Sepia officinalis, clam/bivalve were tested for the WSSV disease occurrence and its severity.

Results

- To identify outbreak season of WSSV spreading routes in particular area, more than 200 samples were checked (pooled and none polled).
- Fifty eight post larvaes, 6 artimea, 5 broodesr, 8 clam/bivalva, 32 mole crabs, 19 shrimp juveniles, 02 *Penaus indicus, 01 Penaus semisulcatus, Penaus megetisis*, 04 cuttle fish, 05 mud crab and 02 Kadola kakuluwa samples were tested for the WSSV disease by both IQ 2000 WSSV detection and Prevention kit and Sahul Hameed WSSV PCR test kit(Indian) .
- The monthly variation of WSSV positive in *P.mondon* PL is higher in April compared with other months. Rest of the study period, there were not any positive recorded from Chilaw area,
- The high risk for WSSV in vectors were recorded in November, however % prevalence was trend to increase. The highest risk was recorded from mud crabs in Chilaw and Kalpitiya costal states from August to November
- The artemia also WSSV positive in several hatcheries; it supposed to be contamination with WSSV from water particles. However, Sand white Ghost crabs from all coastal area were recorded highly positive for WSSV.

Conclusion and Recommendations:

- The *P.monodon* PL WSSV positive samples were recorded in Chilaw (hatchery) area; also can be contaminated with WSSV positive water particles. Therefore, hygienic conditions may provide protective environment. Even live feed such as Artimea also has higher risk to contaminate with WSSV positive water.
- This study reveals that, number of vectors have strong positive for WSSV, such as mud crabs and sand white ghost crabs (*Ocypode quadrata).*

- *P.monodon* brood stock collection should be carried out less risk area for WSSV and Chilaw area has higher contamination possibility from crab species.
- Research revealed that critical factors included; such as broodstock sourcing, post larvae sourcing, screening techniques and strategies, divers transmission pathways, critical infection levels, disease susceptibility and stressors.

Progress (%); **Physical:** **Financial:**

Constrains:

- Delay of purchasing of chemicals and equipments and laboratory furniture
- Unable to collect broodstock samples continuously to check WSSV disease occurrence and its severity.
- Repairing and painting of the laboratory took long time and during this period the laboratory routine works had to do other laboratories under so many circumstances.

PROJECT NO: 4.5.2

EFFECT OF WATER QUALITY MANAGEMENT AND USE OF PROBIOTICS IN SHRIMP PONDS IN DIFFERENT CULTURE ZONES WITH ENVIRONMENTAL PARAMETERS TO ENHANCE PRODUCTION

Responsible Officer : A.S.L.E. Corea,
P.P.M. Heenatigala
R. Jayawickrama

Objectives and justification

The main objectives of the project is to find the impact of probiotic types used in shrimp culture on water quality management, growth and health of shrimp and to study the water quality condition in the water source used for shrimp culture.

Since water quality in the water source change with the environment conditions, the effect of probiotics on water quality maintenance may be affected by this effect. Several different types of probiotics are used to maintain health and improve growth in culture ponds, the actual effect of these in maintaining water quality and health was not clear. Therefore this study aims to find the effects of these products and how they affect the water quality in ponds.

Activities carried out

Selected shrimp ponds from selected zones were sampled for water quality and bacterial quality in water. Selected sites of the lagoon were also sampled for water quality parameters.

Results and Discussion

Samples were collected from selected farms in the subzones of Mangalaeliya and Kottantivu in the zone 3 of shrimp culture zones.Two different types of probiotics were used in these farms. Both types controlled ammonia levels at less than 0.05mg/l throughout the culture cycle. In farms using one type of probiotic, it was observed that Nitrate and phosphate levels were high during the latter part of the culture cycle.(range 0.07- 1.3 and 0.02 – 2.1 mg/l respectively) In other farms the levels were 0.05 – 0.8 and 0.03 – 1.1mg/l respectively. In all farms salinity was between 17 – 25 ppt and rainy weather was observed regularly during the culture cycle. Shrimps were harvested at the end of a 4 month cycle at > 25g average weight and no other disease symptoms were recorded in any of the sampling sites. Selected sites in Arachchikattuwa subzone of Zone 2 was commenced and is continued.

Progress % Physical 65% Financial

Constraints

Sampling was commenced from June 2015. The work was commenced late due to financial constraints during the early part of the year and lack of vehicles for sampling work. Unavailability of vehicles affected the work throughout as sampling could not be carried as planned.Requested chemicals were not received and some parameters of water quality could not be carried out at the latter part of the year due to lack of chemicals.

PROJECT NO: 4.5.3
DISTRIBUTION OF VIBRIO SPECIES IN SHRIMP HATCHERY AND POND CULTURE SYSTEM IN SRI LANKA

Responsible Officer : P.P.M. Heenatigala

Objectives

- Identify the most common vibrio species found in the different culture stages of the life cycle of shrimp.
- Identify the effectiveness of the probiotics in shrimp aquaculture in Sri Lanka.

- Find out the most effective management practices and chemotherapeutant to kill those pathogenic bacteria.

Activities carried out:

- Sampling and data collection was carried out from the shrimp farms in Chilaw and Puttalam area.
- Total vibrio counts were carried out for the samples collected
- Water quality of the pond water was analyzed when required.

Progress (%): Physical: 92% Financial:

Constraints: Delay of purchasing chemicals.

PROJECT NO: 4.6.1
DEVELOPMENT OF SUITABLE BREEDING TECHNIQUES FOR SELECTED HIGH VALUE HIGH DEMAND EXOTIC ORNAMENTAL FISH SPECIES.

Responsible Officers : Amitha Adikari
E.D.M. Apasinghe

Objectives

- Development of suitable breeding techniques for *Puntius denisonii, Balantiocheilos melanopterus* and *Barbonymus schwanenfeldi*
- Development of suitable hatchery technologies for above fish species
- To develop better infrastructure facilities for ornamental fish section

Justification

The ornamental fish largely depends on more colorful and fancy exotic fish species. Sri Lanka has succeeded to breed most of attractive exotic fish species in captivity through the environmental manipulation procedure and to re-export them over 25 countries. But no authentic records to prove successful breeding of highly demanded valuable exotic species such as *Puntius denisonii, Balantiocheilos melanopterus* and *Barbonymus schwanenfeldii* under natural conditions. Due this scenario, their price is high even in the local market. Sri Lanka has a high potential to earn money with these fish species if we breed them in captivity. The hormonal induced breeding technology has been applied to breed such fish species that are difficult to breed under natural conditions. With concern to their high demand

and values it is important to develop proper breeding technology with hatchery and rearing techniques finally targeting the export market. According to IUCN Redlist *Puntius denisonii* is an endangered fish in India. Such this will support for their conservation and management.

Activities carried out

- Procumment of fish juveniles, chemicals, consumables and equipment.
- Collection of background data and import data (Countries, importation value, importers and growers etc.)
- Growing fish juveniles up to sexual maturity.
- Conducted continuous BIOPSIES in order to identify their maturation.
- Analyzing egg quality, egg diameters and position of GERMINAL VESICLE (GV)
- Used Ovaprim (GnRHa) and LHRHa with different concentrations and followed single and double dose
- Creating natural habitat in artificially with continuous water current for *Puntius denisonii* breeding
- Hand stripping method was followed for both species
- Conducting training programmes, awareness programs and consultancies

Results

Barbonyms schwanenfeldii (Tin Foil barb-TFB) and *Puntius denisonii* (Denisonii barb-DB) were successfully bred.

***Barbonyms schwanenfeldii* (Tin Foil barb-TFB) breeding-**

During the study period six samples of biopsies were carried out in order to identify Germinal Vesicle Migration Stage (GVMS) prior to induced breeding and to identify its first maturation during one year period.

- TFB showed GVMS from late October and its showed first maturity at this period.
- Egg diameter at GVMS was 1216.29±30.05µm.
- Breeding was successful for Ovaprim and reaction was negative for LHRHa
- Spawning performance was about 8 000 semi buoyant eggs.
- Fertilization was external and survival rate was about 50%.
- About 4 000 (2.5cm) size fish were sold for outside farmers at 8.00 rupees per unit

***Puntius denisonii* (Denisonii Barb-DB) breeding**

During the study period fifteen samples of biopsies were carried out in order to identify Germinal Vesicle Migration Stage (GVMS) prior to induced breeding.

- Egg diameter at GVMS was 1397.93±20.07µm.
- Natural breeding trail was not successful.
- Breeding was successful for Ovaprim and reaction was negative for LHRHa
- Breeding performance was about 200 eggs.
- The fertilized eggs were spherical, orange brown colored and adhesive with size of 1.5± 0.2mm diameter

Balantiocheilos melanopterus (Silver Shark-SS) breeding

During the study period seven samples of biopsies were carried out in order to identify Germinal Vesicle Migration Stage (GVMS) prior to induced breeding.

- SS showed GVMS from late September. This is showed its first maturity
- Egg diameter of SS at GVMS was 1175.13±0.6µm

Progress (%): Physical: 90% Financial:

Constraints:

- *Barbonyms schwanenfeldii* (Tin Foil barb-TFB) eggs are semi buoyant. During study normal glass tanks were used to hatching eggs due to unavailability of hatching jar facility in the present ornamental fish hatchery. Therefore, could not get higher survival rate.
- *Balantiocheilos melanopterus* (Silver Shark-SS) juveniles cannot find out at the correct stage. Therefore, studying of its induced breeding techniques was aborted.

PROJECT NO: 4.6.2
TECHNOLOGY DEVELOPMENT FOR CAPTIVE BREEDING AND CULTURE OF ENDEMICORNAMENTAL FISHES IN SRI LANKA.

Responsible Officer: R.R.A.R. Shirantha

Development of breeding technology for selected endemic ornamental fishes

Justification

Most of the endemic fishes in Sri Lanka are playing a major role in tropical ornamental fish industry; it has become a threat for them. There is a great need to protect them through sustainable utilization. Their captive breeding technology is very significant for better future in the aquarium industry. At the same time it is very essential to assess wild populations sizes of native fishes to provide technical support for the ministry and other institutions.

Objectives:

Develop better breeding technologies for selected endemic fish species,

Distribution studies on selected endemic/indigenous fishes,

Activities carried out

- Continuous captivity breeding of the selected economically important endemic fishes were carried out through environmental manipulated procedures.
- The critically endangered two endemic fish species namely *Systomus asoka* was subjected to captive breed experiments through environmental manipulation procedure.
- Acquired knowledge on successful breeding, culturing and rearing of the ornamental fishes was transferred to the public through courses/workshops conducted from time to time.

Result:

- More than 10000 captive bred offspring of 12 endemic fish species viz. *Belontia signata, Labuaca insularis, Puntius kelumi, P. singhala, Pethia nigrofasciatus, P. reval, P. cuminigii, P. titteya, P. srilankensis, Systomus martenstyni, Rasboroides vaterifloris,* and *Devario pathirana* are rearing at NARA.
- Indoor aquarium was restructured to new display tank system.

- Ecological survey conducted to study the critically endangered fish species *Systomus asoka* indicated that it inhabits only two locations in the Kelani river catchments. These populations are threatened due to river damming and habitat destruction. The captive breeding trials succeeded to bring few females to gravid stages but failed to get juveniles. Sudden white spot disease outbreak hit the experiment.
- Describing of three new fish species possibly endemic to Sri Lanka is in progress.

Conclusion:

S. asoka cannot be easily bred in captivity through environmental manipulation procedure. It's *in situ* conservation is very important for conservation and management.

Output:

Better technology for breeding of endemic fish

Progress (%): Physical: 80% Financial

Constrains

Due to frequent disease outbreak, which co-insides with temperature drop is a critical issue.

PROJECT NO: 4.6.3
ECONOMICALLY IMPORTANT MARINE ORNAMENTAL SPECIES AND MICRO ALGAE CULTURE FOR AQUACULTURE

Responsible Officers: M.A.J.C.Mallawa Arachchi
D.M.S. Sugeeshwari

Objectives:

- To develop marine ornamental species breeding technologies.
- To study nutritional value of different algal species
- To study and keep a collection of locally available algae for aquaculture specially for shrimp culture

Activities carried out

- The development activities were carried out in the marine recirculatory hatchery system. Seahorse brooders were collected from the wild. Brooder fish conditioning

and maturation were taken place in the hatchery. Fry obtained from brooders were taken for experiments and for seahorse brood stock development.

- Seahorse fry growth and survival improvement experiment was carried out by feeding with enriched *Artemia*. *Artemia* were enriched with sesame and sunflower oil.
- Clown fish were collected for breeding and culture. Fish conditioning and maturation was taking place in the hatchery.
- Marine water samples were collected from different places in Kalpitiya area for marine algae species extraction. Maintenance of important algae cultures was conducted in the laboratory.Identification of existing Mollusc species in Kalpitiya Marine Protected Area was carried out under the BOBLME project.

Recirculation system developed for seahorse breeding

Fry feeding experiment in the hatchery

Clown fish brooder maturation in the hatchery

Results

- In seahorse fry feeding experiment there was not any significant difference in fry survival between treatments and control. Further analysis is in progress.
- Clown fish broostock maturation continuing in the hatchery.

Progress (%): **Physical: 95%** **Financial:** %

PROJECT NO: 4.6.4

DEVELOPMENT OF SUITABLE TECHNIQUES FOR PROPAGATION OF SELECTED ORNAMENTAL AQUATIC PLANTS AND COMMERCIALLY IMPORTANT SEAWEEDS AND POSTHARVEST TECHNIQUE FOR LIVE PLANT EXPORT.

Responsible Officer: D.M.S. Sugeeshwari

Objectives

- Tissue culture technology development for three Crypocoryne spp. i.e. *C. wendtii, C. walkari ,C. pava,* Java fern (*Microsorium pteropus*) and commercially important seaweed species *Sargassum cervicom.*
- Post-harvest technology and hydroponic culture development for high demand endemic aquatic ornamental plants.

Justification

Export of aquatic ornamental plants is a rapid growing industry in Sri Lanka. It largely depends on the wild stocks particularly on some of highly demanded endemic Cryptocorynes. At, present, all *Cryptocoryne* species are threatened (national Redlist, 2012), some are not allow to export. However, the industry still has high potential to earn foreign exchange with export permitted *Cryptocoryne* spp. If proper propagation techniques developed, this sector can be expanded. It will ensure their regular supply. The tissue culture technique and hydroponic culture are techniques to support their *in vitro* propagation, which techniques not much developed in Sri Lanka. Therefore, it is reasonable to develop such technique for export permitted Crypts for betterment of ornamental fish industry. The export oriented aquatic plant industry also needs to have a developed technique for micro-propagation of Java fern *Microsorium petrous*, as it plant has a big demand with high value. Since, there is no proper postharvest technology development for this industry it also needs to carry out.

Sargassum cervicon, is an economically important seaweed in sri lanka. Its commercial use is mainly for production of algernic acid for textile industry. For commercial level propagation, a large number of propagule with desirable phenotypic traits is required. But seed availability is highly seasonal and it is a big. issue faced by the industry .Since seaweed tissue culture can ensure the ever supply of seeds for commercial level farming development such micro-propagation technique is important.

Activities carried out

- Procumbent of Java fern, consumables and equipment.
- Collection of background data and import data (Countries, importation value, importers and growers etc.)
- Developed hydroponic system to maintain mother plants.
- Developed the suitable sterilization method for explants.
- Finding of best hormone concentration for *Cryptocoryne* species to produce shoots from rhizomes.

- Conducting experiment to finding of best hormone concentration for the rooting of *Cryptocoryne* species.
- Renovation/of plant house.

Results:

- Using percentage of contaminated samples as a parameter seven types of sterilization methods were developed to find the most suitable method for ex plant sterilization. Out of them two were managed to get 100% survivals.
- They were;
  - Explant dipped in 1% fungicides for overnight, and washed with 0.1% mercuric chloride for 7 min, and washed with 40% Clorox for 10 min. Finally thoroughly wash with sterilize distilled water for 3 mins three times.
  - Dip the explant in teepole for 1 hour, Washed thoroughly under tap water, Dip in 70% ethanol for 1 min, washed with 0.1% mercuric chloride for 7 min, washed with 40% Clorox solution with 1 drop of tween twenty for 10 min and then with 20% Clorox solution with 1 drop of tween twenty for 7 min. Finally washed with sterile distilled water for three minutes for three times.

- Four different hormone concentrations (HC) used to obtain the best HC, which gives the shoots from the rhizomes of tested *Cryptocoryne* species. The 4mg/l BAP and 1mg/l IAA were the best HC.
- Critically endangered *C. bogneri* sample was collected from the wild.
- Mother plants culture with hydroponic techniques was carried out.
- Renovation of plant house was completed with an extra stocking capacity.

Progress (%): Physical : 80% Financial:

Constraints:

- Expected work could not be completed due to delay in procurement of plant hormones, which reviewed at end of May.
- In sufficient space/indoor tanks facilities limits the research capacity.

PROJECT NO: 4.7
MARI-CULTURE DEVELOPMENT WITH THE EMPHASIS ON SEA CUCUMBER FARMING IN NORTH AND NORTHWESTERN PROVINCES IN SRI LANKA

Responsible Officers: P. A. D. Ajith Kumara
C. B. Medagedara (RRC Kalpitiya)
M. S. M. Fahim (RRC Kalpitiya)

Objectives:

- Development of breeding, culture and grow-out techniques of economically important sea cucumber species
- Address and cater to the issues in sea cucumber farming
- Initiate alternative livelihood programmes through transferring artificial breeding technology and culture techniques of sea cucumber species to public and private sectors
- Post harvest studies and nutritional analysis of *beche-de-mer*
- Remedial measures to conserve natural stocks

Activities carried out:

- Establishment of hatchery facilities for Holothuria scabra and collection and conditioning of broodstock and also determination of the factors affecting breeding, larval survival and culture of sea cucumber species

- Community-based sea cucumber farming
- Development of processing techniques
- Nutritional analysis of Beche-de-mer

Results:

- Establishment of hatchery facilities for H. scabra, collection and conditioning of broodstock and investigate the seasonal breeding performance in order to develop year round seed production
- Two breeding programme succeeded and initial egg count was about 150,000. Three hundred juveniles had been reared by the end of year.

Pilot Project on Community- based Sea Cucumber Farming

Twenty two beneficiary families were selected from the Fisheries Society in Vinnasaoddei in Punekari Divisional Secretariat, Killinochchi and awareness programme was conducted to them covering all the aspects of sea cucumber farming.

Three month culture cycle carried out in Palakudawa area with community people introducing 100 juveniles (size 66.26 ± 2 52g; stocking density 1 juvenile per m^2) in to 20 X 15 m size pen enclosure which was mended early year with the assistance of them. Average growth for the end of three month culture period was 176.71±7.49g (113.0-263.0g).

Development of processing techniques

Forty eight no of sea cucumbers were processed measuring length weight changes in respective to boiling conditions such as gesture, time and temperature. Relationship will be introduced to find out, cut off length to be exploited.

Nutritional analysis of Beche-de-mer

(a). Comparison of body composition between fresh and processed sand fish

Normal oven dry method was used for determine moisture and ash content while Kjeldhal method used for protein analysis. According to the result mean moisture content was 75-90% whereas mean protein, fat and ash contents were 8.5-12, 0.50-0.70 and 5-7.5 respectively.

(b). Fatty acid composition

Fatty acid composition was determined by capillary gas chromatography fame method. Oil was extracted by Bligh & Dryer method. The results of this study showed the high content of

fatty acids, specially (ω-3) series in *H. scabra* and also all specimens were rich in palmitic acid (C16:0) and stearic acid (C18:1n9c) of saturated (SFA) and polyunsaturated fatty acids (PUFA), respectively. However major drawback of this study was total percentage of other unidentified peaks were observed around 25%.

Output:

- Built up awareness among fishing communities on sea cucumber farming
- Identified a chemical induce method to obtain seeds
- Development and integration of different kind of breeding methods
- Studied processing techniques and nutritional analysis
- Dissemination of the technical *know-how* preparing three scientific abstracts

Outcome:

The present study revealed that the development of alternative livelihoods such as sea cucumber culture has a good potential to become a popular policy to uplift the socio-economic status of small-scale fishers and to reduce fishing pressure on over-exploited fisheries.

Progress: **Financial** 100% **Physical** 95 %

Constraints:

Heavy precipitation to the area for several months resulted changing lagoon salinity adversely effect to the culture practices.

PROJECT NO: 4.8
COMMUNITY BASED ORNAMENTAL FISH CULTURE AND DISEASE MANAGEMENT IN HAMANTOTA DISTRICT

Responsible Officer: Dr. A.D. W. Rajapaksha

Objective **:** Upgrading Ornamental fish culture potential in Hambantota District

Activities carried out:

- Three ponds which belong to community people were selected from Hungama kanuketiya area**.**

- Each tank was divided in to three equal parts as replicates.
- Cleaned, dried and bleached all ponds for eradicating the wild fish.
- Surrounded by black polythene and covered roof by net materials for preventing predation from frogs and fish eating birds respectively.
- Each tanks were stocked with three fish species (Molly-Tank A.Malavi-Tank-B and Gold fish-Tank C).
- Tanks were visited fortnightly and monitored water quality parameters and collected growth parameters.

Tank-A

Results

The water quality parameters tested were dissolve Oxygen, pH, Conductivity , Temperature , Secchi depth measurement.

Parameter	TankA	Tank B	Tank C
DO2 (mg/l)	5-7	7-9.2	5-6.3
PH	7-8.2	7-8	7.3-7.8
Temperature(C)	28-30.6	28.6-32.9	28.1-29.5
Secchi Depth (cm)	15-35	30	25
EC(µs cm-1)	42.9-60.3	60-107	79-86.8

Value range of physic –chemical parameters of three Tanks

Number of fish stocked in each tank systems.

Tank No	Variety of fish stocked	No. of fish stocked/replicate
A	Molly	1500
B	Malavi	500
C	Gold fish	500

Tank No	Total Length at Harvested (cm)	TotalNo.of fish Harvested
A	**3.72**	**1310**
B	**-**	**-**
C	**4.53**	**168**

In Tank A, although covered by net and polythene, one Herron (Diyakawa) has entered to the pond area and eaten many fish. Loss of fish due to predation.

In B tanks after five month due to fish are not visible we decided to reduce the water level and watch the fish. But we are unable to see even the single Malavi fish. We could see the dead fish by eaten by predators such as large frog.

In Tank C, We had to stock in cages due to continuous increasement of frogs in pond. Due to that stagnant water are there. Because of that fish were infected by parasite such as *Tricodina*, *Dactylogyrus* etc. There for high mortality could be seen in Gold fish tanks.

Outcome: Further studies needed.

Out Put: Educated the community for rearing fish and feeding them.

Recommendations

According to the results and constrains Polythene is not suitable for covering around ponds as it is damaged due to heavy wind and recommended suitable nets for preventing from predators.

Progress (%): Physical: 70% Financial:80%

Constraints Lack of vehicle facility and laboratory facilities for testing samples.

PROJECT NO: 4.9
IMPROVEMENT OF RURAL LIVELIHOOD THROUGH SUSTAINABLE FISH / PRAWN CULTURE IN HAMBANTHOTA & MATARA DISTRICTS.

Responsible Officer: K.W.R.R.Amaraweera

Objectives

- To investigate growth performance of Tilapia mono-sex in mud pond culture.
- To introduce low-cost Nutritional feed for Tilapia mono-sex.
- To investigate profit of small scale Tilapia aquaculture system.

Activities carried out and results

- Monitoring growth performance of Tilapia mono-sex.
- Monitoring water quality parameters of aquaculture ponds.
- Preparing & Fertilizing ponds for fish culture.
- Preparing fish feed for Tilapia using feed ingredients and feeding.

Results

This research study was carried out 6 months for the Tilapia mono-sex (*Oreocromis niloticus*) & the initial weight of fish was 1.3 g – 2.0 g. Fish feeding rates according to body weight

1st month	5%
2nd – 3rd months	3%
4th – 6th months	1% - 2%

Grade	Mean weight (g)	Price (Rs / Kg)
1- Large	>300	240 - 250
2 –Moderate	>200	200 – 220
3-Small	<200	180 - 200

Thilapia fish prices in loccal areas (whole sale prices)

At end of the culture period Survival rate of fish was 70% - 75% and individual mean weigt of freshwater prawn was around 200g- 230g.

Out comes

- Introduction of optional income for rural community
- Introduction of low-cost nutritional feed for tilapia.

Out put

- Increasing rural aquaculture fish production through Tilapia mono-sex.
- Utilization of abandoned ponds for rural aquaculture development.

Progress (%): Physical: 80 % Financial: 100 %

Constraints

Lack of vehicle for field works; Lack of sufficient water for ponds in dry period, Hambanthota district; Laboratory equipments were out of order

PROJECT NO: 4.10
LIVELIHOOD DEVELOPMENT OF ORNAMENTAL FISH FARMERS IN KALUTARA DISTRICT THROUGH CENTER FOR LIVING AQUATIC RESOURCE RESEARCH AND DEVELOPMENT (CLARRD)

Responsible Officer: E.D.M. Apasinghe

Development of Improving Hardly Consuming Invasive Knife fish as a Commercial Fishmeal

Objectives:

- As a tool of minimizing the invasive Knife fish from internal water bodies - Inducing fishers to catch invasive Knife fish which is being threatened to local aquatic biodiversity.
- Developing an economical fish powder in order to minimize the fish feed cost of the small scale farmers.
- Extending the technology to community to produce a quality local fish meal instead of an alternative to the imported fish meals.

Justification

Knife Fish has been identified as a threatened invasive fish to the local aquatic bio diversity. Currently population of Knife Fish has been extended throughout both Kalutara and Colombo Districts in 6 and 9 Divisional Secretariats respectively. Fishers do not try to catch Knife Fish willingly because it is not a demanded fish as a food fish owing to numerous spines presented in its body. When Knife Fish is caught to the gill nets it is hardly used as food fish and thrown out. This fish would be a threat to the local bio diversity observing its propagation and fish catch composition. So it is necessary to take suitable action to minimize Knife Fish population. One of generally identified solutions is biological controlling. Another solution is creating a demand for the applicable fish. This could be done testing what kind of food could be prepared by Knife Fish. Another alternative is to make the fish meal using Knife Fish.

Number of people who engaged in both ornamental and food fish farming has been increased recently. Those farmers use homemade fish feed and fish meal as a main protein source is the most expensive component of a fish feed. Though some farmers use dried fish powder and sprats' powder, those items are not available in sufficient quantity and quality.In spite of some locally made fish meals available in the market, low quality and higher salt

concentration is a problem. On the other hand the imported fish meals are so expensive. So there is a vacuum for a quality fish meal for a economically tolerable level. Knife fish could be used for that purpose.

Activities carried out:

- Data collection of Knife Fish catches composition based on Uyanwatta reservoir during 8 months.
- Collection of literature both local and international regarding Knife Fish.
- Sample fish were dissected and dried.
- Purchasing of basic fish feed producing equipment and carrying out feed trials using other fish meals.

Results:

- Catch composition of Knife Fish were identified as 20% to 22 % for both 3.5" and 4.5" gill nets.
- Value adding was identified as the best solution to Knife Fish problem according to the literature survey.
- Basic technical knowhow of feed production was gained through the fish feed producing trials.

Progress (%): Physical: 51.51% Financial:

Constraints:

- Late purchasing of sample testing solutions.
- No way to storing of fish until drying and no proper drier received until January 2016.

PROJECT NO: 4.11

THE EFFECT OF WATER QUALITY AND STRUCTURAL PROPERTIES ON FEEDING ECOLOGY, FISH ASSEMBLAGES IN BRUSH PARKS OF NEGOMBO ESTUARY.

Responsible Officer **:** M.Gammanpila

Justification

Negombo lagoon is an estuarine ecosystem with an extent of 3164 ha located on the west coast of Sri Lanka (7^0 10' N and 79^0 50' E). The Negombo lagoon and its coastal environment have had a long association with the fishery industry and its an important livelihood for numerous people living in the area. Fishing takes place all year round using a different methods, of some of them are entirely traditional.

Brush pile fishing has a long history, with the first reference to it dating back to 1910 (Jayakody, 1996). Dense masses of tree branches on mangrove are placed in shallow areas in the estuary and the fish are attracted by provision of shelter from predators and suitable breeding place in natural food are abundant. The periphyton productivity is the main food source in brush parks which accounted for more than 75% of the catch in this lagoon. Brush-park fishing one of the traditional fishing gear used in Negombo estuary are covered 2200 brush parks of a mean area of 51.8m^2 of 11.3 ha of the surface of Negombo estuary in 2002 (Welcomme 2002). The mean fish yield in brush park fishery was 12.46 t ha^{-1} yr^{-1}.

Many factors could potentially influence an assemblages of fish in brush parks, including food availability, climate, habitat suitability, water quality, competition and flow rates. Fish yield per unit area and species composition from brush park fishery also depend on several factors such as twig density, duration between installation and harvesting, mangrove species used for construction of brush park and environmental factors. Although the estuary is a common property resource and there is no proper management of brush park fishery. The fishing has traditionally been carried out by a particular group of people while following certain territorial rules followed by the people in respective area. Scientific literature of environmental, social and economic information of brush park fishery have been little studied.

Objectives

- Study relation between feeding ecology and tropic level of fish assemblages in the brush parks in the estuary and their significance and management of fishery resources in ecosystem.
- Study of the factors effect on sustainability and economics return of periphyton-based brush-file fish production

Scope of the project

Proper management of water quality and natural habitats in the Negombo estuary to establish a sustainable brush park fishery practices, utilization and maintain quality of coastal habitat and uplift the living standard of the people who depend on the coastal resources for their livelihood in the area.

Activities carried out

- Regular monitoring of physical, chemical and biological parameters along with other oceanographic data associated with brush- parks in Negombo estuary.
- Collected information of structural properties of brush parks (mangrove species, twig density, number of days since their installation) and respective fisheries production and its economic return.

Results

Water quality parameters

Variation of salinity is a major factor that significant effect on assemblages of fish species in brush parks. The mean highest water salinity (18.75±10.52ppt) was recorded in Munnakkaraya followed by Dungalpitiya (16.7±9.38ppt) and Katunayake (10.1±6.37ppt). Mean dissolved oxygen ranged from 6.47±1.3mg/l to 7.28±1.68mg/l in Munnakkaraya and Dungalpitiya respectively. Higher amount of water turbidity and its variation (15.09±15.24NTU) was recorded in Katunayake, where main fresh water incursion was occurred. Mean minimum and maximum chlorophyll a of the sampling stations were ranged from 1.42±1.19 to 3.0±5.66 mg/m^3 in Munnakkaraya and Dungalpitiya respectively.

A majority of fishermen were involved that brush park fishing as their alternative livelihood activity since production of brush parks has been decreased during last decades due to several

reasons including limiting of mangrove twigs, climate changes, disturbance of other fishing gears and pollution of water

There were thirty nine finfish species, including *Etroplus suratensis, Siganus javus, Liza sp. Valamugil sp. Arius sp. Lutjanus sp., Lates calcarifer, Monodactylus argenteus, Scaptohagus argus and Epinephelus malabaricus* are major species occurring in brush parks. Additionally two crustaceans, including mud crab, *Scylla serrata* and fresh water prawn, *Macrobrachium rosenbergii* were also recorded.

It is severally believed by the fisherman that the yield of brush-parks is directly related to the mangrove species, density of branches, period of time of installation and harvesting. As a example, ornamental fish, *Scatophagus argus* and *Monodactylus argenteus* are perfered more branches of *Lumnitzera*, while branches of intact leaves are used mainly targeting of shrimp.Though, highest mean yield per unit area (0.25±0.98 kg m^2 $month^{-1}$) was recorded from Katunayake, highest mean income 2741±1598 Rs./single operation was recorded from Dungalpitiya where majority of fishermen were depend on brush parks as there major livelihood.

Conclusion

Since the estuary is a common property resource and there is no restriction on traditional fishing practices unlike several regulations has been implemented for management of other fishing activities in the estuary. These traditional fishing activities being operated by single or joint owners following certain territorial rules, where are socially accepted as their right. However those traditional regulations are valuable in that they exert some control. The brush park fishery is much interest to management planners, appears to be the most promising form of traditional community based management. Successful brush park fishing requires good management: a sufficient density of branches and not too frequent fishing.

Progress: Physical: 100% Financial: 100%

Constraints:

Lack of some instruments, proper laboratory facility for water quality analysis Unavailability of transport facility

EXTENSION WORK/ SERVICES PROVIDED:

Ornamental sector extension /services

- Conducted two 10 days consecutive training workshops on Ornamental Fish Breeding and rearing in August and November.
- Organized the two training program on Ornamental Fish Breeding, Culture and Management 2015 (OFBC&M 2015) and delivered lectures, conducted practical classes on "Ornamental Fish Breeding Rearing and Management" and Induced Breeding of Pangasius sutchi and Barbonymus schwanenfeldii
- Conducted Lectures and practical sessions as a resource person for the three days training programme on ornamental fish culture, breeding and management in NARA Rekawa for the small scale ornamental fish farmers in Tangalla and Beliatta organized by the southern province Council.
- Conducted one day training program on "ornamental fish breeding and disease management" for farmers in Karandeniya, "Angel fisheries Ornamental Society"- Divisional Secretariat, Karandeniya, 06.02.2015
- Conducted one day training program on "ornamental fish disease management tank construction" for farmers and in Kalutara district -Divisional Secretariat, Kalutara, 02.12.2015

Aquaculture

- Provided information and instructions to the ornamental fish farmers on fish feed formulation, Fresh water prawn culture, food fish culture, tank preparation etc on their request.
- An awareness programme on "Sea Cucumber Farming" was conducted in May 2015 for twenty two participants from Fisheries Society in Vinnaseoddei in Punekari Divisional Secretariat division.
- Conducted one day awareness program on "Pond Fish Culture" for farmers in Kalutara district Bandaragama Ornamental Societies- SANASA building, Hadhapangoda, 10.03.2015
- Study on monitoring the Present status of small scale Inland tanks in Hambantota District in order to development of aquaculture
- Provided information on shrimp culture for school a/l project students and to farmers who came to seek information.
- Poster presentation carried out in the poster session in recirculation systems and their application in aquaculture training program held in Spain.

HEALTH MANAGEMENT

- Work on investigations on sudden fish kills at Kandy Lake was carried out and reports were submitted.
- Organized 02 workshops on "sea bass health management" for resource personals and sea bass fish culturists under FAO project
- Analyzed disease fish samples and recommended treatments for the disease fish submitted by fish culturists (18 samples).

FISHERIES AND ENVIRONMENTAL MANAGEMENT AND CONSERVATION

- Helping lobster fishery management Activities – Releasing illegal lobsters to the suitable areas with help of Police station Tangalla according to the Tangalla court.
- A member of monitoring committee of salinity barrier at Walawe Ganga under the supervision of central environmental authority southern province.

OTHER TECHNICAL SERVICES

- Technical advisory given to revise the existing rules and regulation in Fisheries and Aquatic Resources Act. No. 2 of 1996, Department of Wildlife Conversation and Management.
- Aquatic biodiversity expertise given to upgrade the Chundikulam sanctuary as a Ramsar Wetland & National Park, under the Department of Wildlife Conservation (DWC), Sri Lanka.
- Participated as a resource person for "Scientific Information for National Red Listing 2016", State Ministry of Environment, Colombo 14th May 2015.
- Technical support provided to identify suspected "Sea horse species" export from Sri Lanka, Sri Lanka Customs Department, Bio Diversity Secretariat.
- School seminar programme conducted on "Endemic fish identification, their importance and conservation" at Kalawaana Gamini Madya Maha Vidyalaya and Meepagama Maha Vidyalaya on 19th May 2015
- School seminar programme conducted on "Water pollution and conservation of Aquatic Environment"at Kalawaana Gamini Madya Maha Vidyalaya and Meepagama Maha Vidyalaya on 19th May 2015
- Participated as a resource person for the "Curriculum Development Workshop of Aquaculture Technician". University of Vocational Technology, June 2015- October 2015, Rathmalana.

- Participated as a resource person for the workshops on "Validation of Curriculum Developed for the Advance level Technological Stream" at Tertiary Vocational training centre, Narahenpita.
- Participated in the panel of judges at undergraduate research symposium at Wayamba University, Sri Lanka,
- Participated at Technical Evaluation committee of seabass Aquaculture project conducted by NEDA.
- Participated at Technical Evaluation committee of offering seabass feed mill to privates sector by FAO /TCP project.
- Conducted evaluation of PhD thesis on Carbon sink function, of Sri Lanka mangrove ecosystems with special reference to Negombo estuary , University of Kelaniya as the examiner.
- Participated as a resource personal for drafting NVQ level 5 curriculums on integrated coastal and marine resource management, conducted at Ocean University.
- Evaluated following research abstracts for the 2nd National Symposium on Marine Environment
    - The evaluation of researches done to describe the Ecologically or Biologically Significant Marine Areas [EBSA] in Sri Lanka
    - Importance of marginal vegetation associated with estuarine waters in relation with the distribution of mysids (Crustacea) Mysidacea) in Sri Lanka
    - Isolation of Bioactive Natural Products from Some Selected Sri Lankan Seaweeds

- Evaluation of manuscript (Ref. 3355) titled "Heavy metal phytoremediation potential of mangrove plant species of Pattani bay, Thailand" submitted to Applied Ecology and Environmental Research.
- Invitation got for the editorial board of journal of Applied Ecology and Environmental Research.

MASS MEDIA

- ITN, Rupawahini and Derana media conference on "Endemic fishes and their conservation issues" in August, 2015.
- Participation of Derana media (24 hours channel) conference on seaweed culture prospects in Sri Lanka

- Participation of Derana media (24 hours channel) conference on oyster culture prospects in Sri Lanka

LECTURES DELIVERED TO UNDERGRADUATES

- Delivered lectures in "Post Graduate Diploma in Defense Management – Junior Naval staff Course" held in Trincolmalee Naval base.
- Conducted Lectures and practical sessions as a resource person for the training programme on Industrial ornamental fish culture in NARA Rekawa for diploma students of Ocean University on 20th – 21st july 2015.
- Conducted visiting lectures in the aquaculture and animal science department of Wayamba University.
- Conducted visiting lectures in the Coastal resources management course conducted by Ocean University.
- A lecture was delivered on "Aquaculture in Sri Lanka" for the undergrads from University of Jaffna.
- Conducted one day training program on "Ornamental fish management and fish culture" for student of Open university-Ornamental fish section NARA,29.01.2015
- Resource person for the workshop on Mangrove resources for the 120 student of Sumangala college, Weligama on13th February 2015.
- Public community participatory awareness program conducted in Knuckles mountain area to protect critically endangered fish species Labeo lankae in August.
- Resource person for the workshop on Mangrove resources for the 120 student of Sumangala college, Weligama on13th February 2015.
- Conducted awareness programmes and workshop on "Water Quality Management and usage of Test Kits" for the members of Bandaragama Ornamental Society-Vidatha Resource Center, Bandaragama, 29.12.2015.

PUBLICATIONS:

ABSTRACTS/POSTERS PRESENTED

- Abstract published in the proceedings of NARA symposium (2015) on "Effect of Sargassum wightii incorporated feed on growth and immunity development of Asian Sea bass (Lates calcarifer)".
- Abstract published in the proceedings of SLAFAR Annual Scientific Sessions (2015) on "Preliminary survey on the status of fishery at Bar Reef Marine Sanctuary (BRMS) at Kalpitiya".

- Corea S, 2015 Preliminary survey of nesting birds in the islands of Kalpitiya lagoon – 71st annual sessions of Sri Lanka Association for Advancement of Science (SLAAS)
- Mallawaarachchi M.A.J.C, Pahalawattaarachchi V., Kithsiri H.M.P. 2015. Growth and survival of seahorse fry (Hippocampus kuda) using two different live feed. In: 2nd International Conference on Fisheries and Aquaculture (ICFA) 2015, Colombo, Sri Lanka (Abstract)
- Ramani Shirantha (2015), "Unconcerned silent invader in Gongitota wetland; Peuvian Water primrose, Wanadivi Thethbim", vol.1 (V), Department of Wildlife Conservation, Sri Lanka.
- M. Epasinghe, H.M.P. Kithsiri, F.T. Wawwage 2015.Recent study on spawning success of Pangasius sutchi (Thailand Catfish) in Sri Lanka using Ovaprim™, Annual Scientific Session of NARA-
- Ajith Kumara P.A.D., J. Pushpakumara, A.J. Jayatissa, C.B. Medagedara, and M.S.M. Fahim. 2015. Community-based Sea Cucumber Farming as a livelihood alternative for fisher folks in Kalpitiya, Sri Lanka. pp 137-141. Proceedings of the National Aquatic Resources Research & Development Agency (NARA), Scientific Sessions 2015.
- Weerasingha, R., P.A.D. Ajith Kumara, V. Pahalawattaarachchi 2015. Present status of coral community in the Bar reef marine sanctuary, Sri Lanka. Annual Session of Marine Environmental Pollution Prevention Authority (MEPPA), Colombo
- S.P. Wanniarachchi, N.P.P. Liyanage ,E.D.M. Epasinghe , Development of Fishmeal using Knifefish Chitala ornata , proceedings of research symposium 2015, Uwa Wellassa University.
- Ariyaratne, M.H.S. (2015). Duck weed powder as a protein replacement in the fish feed used in Tilapia (GIFT) (Oreochromis niloticus) fry rearing. Proceedings of the 20th Annual Session of the Sri Lanka Association for Fisheries and Aquatic Resources (SLAFAR), 22nd May2015, NARA ,Mattakkuliya, Colombo-15 Sri Lanka.
- Ariyaratne, M.H.S. (2015). Aqua-feed based on Shrimp waste meal for the growth performance and colour enhancement of Gold fish (Carassius auratus). International Conference in Fisheries and Aquaculture, Colombo, Sri Lanka, 25-27 August, 2015
- Ariyaratne, M.H.S. (2015). Duck weed powder as a replacement for fish meal in the feed used in Tilapia (GIFT) (Oreochromis niloticus) fry rearing.International Conference on Duckweed Research and Application, 3rd-6th July 2015, Kyoto university, Kyoto,Japan.

- Ariyaratne, M.H.S., P.P.M. Heenatigala and V. Pahalawattharachchi (2015). Diversity of benthic fauna at upper reaches of the Puttalam Lagoon 71st Annual sessions of Sri Lanka Association for the Advancement of Science, December 2015, Colombo, Sri Lank.
- Pahalawattaarachchi, V. and Rifky, A.L.M.2015 Assessment of mangrove forest structure in Puttalam and Dutch Bay. Proc. Of 21st Scientific sessions of the Sri Lanka Association for fisheries and aquatic resources at National Aquatic Resources Research and Development Agency.
- R Weerasingha, Ajith Kumara, P.A.D. and Pahalawattaarachchi, V.2015 Present status of coral community in the Bar Reef marine sanctuary, Sri Lanka, Proc. Of Second National Symposium on Marine Environment, at Sri Lanka Foundation Institute, 18-19 November 2015.
- Ariyarathna,M.H.S.; Heenatigala, P.P.M. and Pahalawattaarachchi, V. 2015. Diversity of benthic fauna at upper reaches of the Puttalam lagoon (poster presentation) Proceedings of Sri Lanka Association for the Advancement Science,

FULL PAPERS:

- Heenatigala, P. P. M., (2014). Species diversity and antibiotic sensitivity of pathogenic bacteria isolated from hatchery bread shrimp larvae in Sri Lanka. Journal of National Aquatic Resources Research and Development Agency, Volume 43.
- M.G.I.S.Parakrama and P.P.M.Heenatigala (2015) "Growth, survival and immune responses of juvenile common carp Cyprinus carpio fed with diets enriched with α-tocopheryl acetate". Sri Lanka J. Aquat. Sci. 20 (2) (2015): 00-00.
- Ariyaratne, M.H.S and Ruchira Amaraweere (2015). Fish offal based aqua-feed for rearing post-larvae of freshwater prawn, Macrobrachium rosenbergii. Sri Lanka Journal of Aquatic Science, 20(2):39-45.
- Ariyaratne, M.H.S. (2015). Cage culture of the GIFT strain of Nile Tilapia (Oreochromis niloticus) fed with low cost aqua feed. Turkish Journal of Fisheries and Aquatic Sciences Vol: 15:1-2.
- D.D.G.L. Dahanayaka, H. Tonooka, M.J.S. Wijeyaratne, A. Minato and S. Ozawa, Comparison of Three Chlorophyll-A Estimation Approaches Using Aster Data Acquired Over Sri Lankan Coastal Water Bodies, Malaysian Journal of Remote Sensing & GIS, vol. 4, No. 1 (2015).

NEWS PAPER ARTICLES

- Paper article on "Wisithuru mathsya wagawa" published in DIVAINA news paper on 28th July 2015
- Paper article on "Fish feed preparation as a self employment" published in THARUNAYA news paper on 01st August 2015.
- Paper article submitted to NARA extension unit on "Fish feed preparation" and the publication in progress.

WORKSHOPS /SEMINARS ATTENDED:

- Two day Workshop on "Writing a high impact research article" Conducted by National Science and Technology Commission
- Attended to the "Basic Data Analysis using SPSS" on 21-23 December 2015 at University of Colombo, Colombo.
- Forum on "Scientific Information for National Red Listing 2016", State Ministry of Environment, Colombo 14th May 2015.
- Participated as a resource person for the "Curriculum Development Workshop of Aquaculture Technician". University of Vocational Technology, June 2015- October 2015, Rathmalana.
- Workshop on Scientific Data analyzing using spss conducted by IT division - University of Colombo Sri Lanka on 12th - 13th December 2016..
- Two day Workshop on "International Ornamental Fish Trade Conference" Conducted by Export development Board SL.
- Two Day workshop on "Invasive species in Sri Lanka" conducted by Ministry of Environment.
- Three day inception workshop on Enhancing the Conservation Effectiveness of Seagrass Ecosystems Supporting Globally Significant Populations of Dugongs across the Indian and Pacific Ocean Basins from 20-21 October 2015 in Colombo.

COMMITTEES SERVED IN

- Aquaculture technical committee - National Aquaculture Development Authority (NAQDA)
- Science education committee – Sri Lanka Association for Advancement of Science (SLAAS)

- Environment committee - Sri Lanka Association for Advancement of Science (SLAAS)
- Science popularization committee – Sri Lanka Association for Advancement of Science (SLAAS)
- Sectional committee – (section B - Agriculture and forestry) - Sri Lanka Association for Advancement of Science (SLAAS)
- Management Council 2015 - Sri Lanka Association for Advancement of Science (SLAAS)
- Hambanthota district development committee at Hambanthota divisional secretarial.
- Tangalla development committee at Tangalla divisional secretarial.
- A member of monitoring committee of salinity barrier at Walawe Ganga under the supervision of central environmental authority southern province.
- Committee member for Development of Center for Living Aquatic Resources Research and Development (CLARRD)
- National Expert Committee on Mangrove conservation and Sustainable use organized by Bio Diversity Secretariat of Ministry of Mahaweli Development and Environment.

UNIVERSITY STUDENTS SUPERVISION

- Following student were guided for their final year project works
- Mr.Jagath Keerthi, under the topic of "Impact of organic fertilizer on the growth of Koi Carp fry" Faculty of Agriculture,University of Ruhuna(.2014/2015).
- Mr.R. SriKrishna, under the topic of "Evaluation of Growth Performances of Fighter fish (Betta Splendens) under three different live feed"Faculty of Agriculture, University of Jafna.
- Conducted industrial trainings to the students of university of Kelaniya, Uva Wellassa, Wayamba

REPORTS

- Inspection of fish kill in "Kandy lake" (2015).
- Report on different Hippocampus (seahorse) species recorded in the sample collected from the customs department Sri Lanka.
- Report on present states of lagoons in Hambanthota District to Director General-NARA

TRAINING/ CONFERENCE /MEETINGS /SYMPOSIUM (FOREIGN / LOCAL)

Foreign:

- "Reducing and managing the risk of Acute Hepatopancreatic Necrosis Disease (AHPND)" – Panam 21st June – 26th June 2015.
- Participated to the training program on "recirculation systems and their application in aquaculture" was conducted by Mediterranean Agronomic Institute of Zaragoza, Zaragoza, Spain.
- 3rd International Conference on Duckweed Research and Application (3rd ICDRA), July 3-6, 2015, JAPAN
- Won a scholarship to study for PhD in Utah State University in USA.

Local:

- Participated to the workshop on "Elementary Data Analysis by using SPSS" conducted by Department of statistics, University of Colombo.
- 'Sri Lanka Association for the Advancement of Science' 2015
- International Conference on Fisheries and Aquaculture 2015 (TIIKM conference), August 25-27, 2015, Colombo, Sri Lanka.
- Attended expert meeting to prepare the National Redlist 2018, Bio Diversity Secretariat.
- Attended workshops on IAS fauna & flora, UNDP/GEF funded project, Ministry of Environment and Renewable Energy, Sri Lanka.
- National committee for livestock fisheries and aquaculture at Council of Agriculture Research Policy (CARP).
- Expert review workshop to prepare the 2018 IUCN red listing, Ministry of Environment and Natural Resources, Battharamulla, Sri Lanka.
- Steering committee for Invasive Alien Species, Ministry of Environment and Natural Resources, Sri Lanka.
- Annual Sessions of the Sri Lanka Association for Fisheries and Aquatic Resources, NARA Auditorium, Colombo, Sri Lanka.
- International Forum for Mathematical modeling-2015,November 9-13, 2015,Department of Mathematics, University of Colombo, Sri Lanka

5.5 MARINE BIOLOGICAL RESOURCES DIVISION

Head of the Division: Dr. R. Maldeniya

Overview of the year

The Marine Biological Resources Division (MBRD) is responsible for carrying out research towards management, development and conservation of salt water living resources. Nine treasury funded research projects were carried out by MBRD in 2015. Major research areas include;

- Assessment and monitoring of large and small pelagic fishery resources in Sri Lanka
  - By-catch study of large pelagic fisheries (special project)
  - Introduction of Octopus fishery pilot study
  - Experiential fishing to study the performance of pulse trawling in by-catch reduction and explore the magnitude of habitat destruction
- Assessment of Fisheries dependency on Biodiversity and reef study – Gulf of Mannar, and diving School
- Establishment of turtle hatchery and refugees in Kalpitiya and identification of spatial distribution of sea turtles
- A comprehensive study on major shark species in Sri Lanka
- Molecular species Identification
  - Molecular identification of commercially important Cephalopods
  - Molecular identification of Chondrichthyes and establishment of a protocol for sex determination of marine mammals
- Distribution and abundance of the blue whales (*Balaenoptera musculus*) in coastal waters of Sri Lanka, in relation to the seasonal changes of oceanographic factors and management of the whale watching industry
- Spiny lobster fishery management in south and east coasts (data collection for the management of the resource)
- Testing of fishing gear and suitable bait for harvesting of shrimps as an alternative for bottom trawling in the coastal areas (Kalpitiya and Negombo) of Sri Lanka"
- Study on seasonality, diversity and spatial distribution of small pelagic fish species and associated water quality parameters in the Weligama bay.

Apart from the treasury funded projects, MBRD carried out two external funded research projects:

- Study on population biology and fishery of the blue swimming crab (*Portunus pelagicus*) in Jaffna district. This project commenced in July, 2014 with the financial assist from Seafood Exporters' Association in Sri Lanka.
- Study the stock structure, some biological aspects, distribution and the abundance of Indian mackerel in the coastal waters around Sri Lanka. Bay of Bengal Large marine Ecosystem (BOBLME) project funded project.

MBRD attended to a number of activities in advisory and consultative capacities. More importantly, MBRD responded to a number of requests made by the Ministry of Fisheries and Aquatic Resources Development (MFARD) and the Department of Fisheries and Aquatic Resources (DFAR) by providing recommendations to resolve problems on the exploitation of marine fishery resources unsustainably. MBRD provided technical assistance to DFAR in the preparation of several management plans especially for sharks.

On court orders, several fish samples were analysed by MBRD to decide the cause of death. The samples were analyzed to determine whether the fish samples provided by the police were caught by explosives or other type of gear. Accordingly a total of 38 reports were submitted to the relevant authorities. In addition, the staff in the division was quite interactive with the fishing community throughout the island and also supported the private sector by attending to requests made by them. The division provided facilities and guidance to university students in undertaking industrial training and final year research projects and to school pupils to carry out their research projects. In addition, the division conducted a number of lectures and awareness programmes especially for The Sri Lanka Coast Guards, Sri Lanka Navy and Sir John Kotelawala Defence University.

The research staff of the MBRD was actively engaged in updating the large pelagic and small pelagic fishery databases, analysing the statistics and preparing research papers on trends and prospects of large and small pelagic fisheries in Sri Lanka. The report for the "Laila del ''was prepared and sent to the Department of Fisheries and Aquatic Resources for settling fishing disputes.

RESEARCH PROJECTS UNDERTAKEN BY MBRD FOR 2015

Project No	Project title	Officer /s responsible	Allocation/millions
1	Assessment and monitoring of large and small pelagic fishery resources in Sri Lanka – By-catch study of large pelagic fisheries (special project) – Octopus pilot study Experiential fishing to study the performance of pulse trawling in by-catch reduction and explore the magnitude of habitat destruction – Assessment of small pelagic fisheries	Dr. R. Maldeniya Dr. S.S.K. Haputhantri Dr. H.A.C.C. Perera Ms. D.N.A. Ranmadugala Ms. K.H.K. Bandaranayake Mr.R.A.M. Jayathilake Mr. Madhura Weerasekera	4.0
2	Assessment of fisheries dependency on biodiversity and reef study – Gulf of Mannar and diving School	Dr. R. Maldeniya Mr. Punyadewa Mr. Madhura Weerasekera	1.2
3	Distribution and abundance of blue whales (*Balaenoptera musculus*) in Coastal waters of Sri Lanka, in relation to the seasonal changes of oceanographic factors and management of the whale watching industry	Mr. Upul Liyanage Dr. K. Arulananthan Mr. Akila Harischandra	0.2
4	Testing of fishing gear and suitable bait for harvesting of shrimps as a alternative for bottom trawling in the coastal areas (Kalpitiya and Negombo) of Sri Lanka	Ms. A.A.S.H. Atukorala Mr. R.A.M. Jayathilaka Mr. Madhura Weerasekera	0.3
5	Molecular species identification – Molecular identification of commercially important Cephalopods – Molecular identification of chondrichthyes and establishment of a protocol for sex determination of marine mammals	Ms. D.R. Herath Ms. D.N.A. Ranmadugala	1.2
6	A comprehensive study on major shark species in Sri Lanka	Dr. S.S.K. Haputhantri Dr. H.A.C.C. Perera Ms. K.H.K. Bandaranayake Mr. R.A.M. Jayathilaka Mr. K.G.S.Nirbada MS. A.A.S.H. Atukorala	0.2
7	Spiny lobster fishery management in south and east coasts (data collection for the management of the resource)	Mr. Upul Liyanage	0.2
8	Establishment of Turtle hatchery and refugees in Kalpitiya and identification of spatial distribution of sea turtle	Dr. R. Maldeniya Mr. Punyadewa Mr. R.A.M. Jayathilake	0.6
9	Study on seasonality, diversity and spatial distribution of small pelagic fish species and associated water quality parameters in the Weligama bay	Mr. U.S.P.K. Liyanage Mr. J.S. Jayanatha	0.1
Total Allocated Budget for MBRD			8.0

PROJECT NO: 1
ASSESSMENT AND MONITORING OF LARGE AND SMALL PELAGIC FISHERY RESOURCES IN SRI LANKA

Assessment and monitoring of large pelagic fisheries

Large pelagic fish landings were monitored at fishery harbours and major fish landing sites in the Western, Southern and the Eastern coasts of Sri Lanka. This includes collecting information/data such as details on fishing operations, recording the quantity of the landings by species and by different fishing vessel-gear combinations, measuring the lengths of key species and reporting the active fishing boats operated. The Sri Lankan fishing vessels engaged in multiday fishing mainly target tuna and tuna-like species. The bulk of offshore and deep sea fish production mainly comprises of tuna and tuna-like fish. MBRD is actively engaged in activities related to the requirements of Indian Ocean Tuna Commission (IOTC). The PELAGOS database handled by MBRD is being used to fulfill the IOTC (Resolution 10/02) requirements continuously as it consists of catch and effort data according to craft – gear combination, craft type, more wider range of species and size categories, for all major large pelagic varieties. Furthermore, comprehensive studies on possible by-catch such as seabirds and turtles were carried out. Large pelagic fishery database was upgraded and it provides precise reporting system.

Indo-Pacific Sailfish

Indo-Pacific Sailfish (*Istiophorus platypterus*) is one of the important billfish species found in the large pelagic fishery in Sri Lanka. Though tuna is the key target group in the gillnet fishery and longline fishery in Sri Lanka, billfish including sailfish is also frequently caught as a non-target species. In many cases, the whole billfish is not landed by the vessels. The billfish caught at the sea is cut into two or three pieces and brought onboard to the fishing port. Therefore, it is not possible to obtain accurate length and weight measurements during the port sampling. In addition, since there is no proper onboard observer programme existing for Sri Lankan fishing vessels, collecting biological data for billfish is a challenging task. In order to minimize this issue, an initial attempt was made to obtain some morphometric relationships for sailfish. For this purpose, morphometric measurements of occasionally landed whole sailfish in the gillnet fishery and longline fishery were obtained at the fishing ports in the west coast of Sri Lanka in 2014. Accordingly, different length measurements

(upper jaw-total length (UJTL), upper jaw-fork length (UJFL), lower jaw-total length (LJTL), lower jaw -fork length (LJFL), pectoral-dorsal length (PDL) and pectoral-anal length (PAL)), total body weight (w) and girth measurements (girth via beginning of pectoral fin (PG) and girth via beginning of 1st anal fin (1AG)) were obtained. The estimated length-weight relationship between the length (L) (lower jaw-total length -LJTL) and the body weight (W) was $W = 0.01L^{2.7}$, thus showing a negative allometric pattern of growth. All length-weight, length-length and length-girth relationships were significant. Some of these relationships could be incorporated as conversion factors in particular, for the new large pelagic database of Sri Lanka (new PELAGOS database) which is in the process of being developed.

Assessment and monitoring of small pelagic fishery resources

Small pelagic fish landings were monitored at the major fish landing sites in the West, South and the East coasts of Sri Lanka. This includes collecting information such as details on fishing operations, recording the quantity of the landings by species and by different fishing vessel-gear combinations, measuring the length of key species and reporting the active fishing boats operated. The major target fish group in small pelagic fishery is clupeids. This group includes *Amblygaster sirm* (Spotted sardinella) and *Sardinella* spp. (Sardines) etc. *A. sirm* is the dominant species in the catch and it contributes presently around 20% of the total small pelagic fish catch. Relationships between length-length parameters (Standard Length – SL, Fork Length –FL and Total Length –TL) were obtained for *A. sirm*: TL = 0.938SL, TL = 0.981FL and SL = 0.940FL. The relationship between length and weight was also obtained ($W = 0.0119L^{2.9}$). All length-length (L-L) and length-weight (L-W) relationships were statistically significant at 0.05 level.

Three types of fishing crafts are operated in coastal waters targeting small pelagic fish: out-board engine fibre reinforced plastic boats (OFRP), out-board engine motorized traditional boats (MTRB) and non-motorized traditional boats (NTRB). Small pelagic fishery in the West coast is mainly carried out using small meshed gillnets of mesh sizes ranging from 6.5 to 50.8 mm. The depth of fishing varies on the range of 9 to 80m. Traditional crafts are usually operated in the shallow coastal waters where the depth is ranging from 5 to 25m whereas FRP boats are frequently operating within 15 to 80 m depth range. The engine size of a OFRP boat varies between 10 and 30hp, but frequently used engine size range is 15 and 25 hp. A clear increasing trend in the gillnet usage (i.e. number of gillnet pieces used per single fishing operation) could be observed in the West coast small mesh gillnet fishery. A

considerable decline trend in the relative contribution of key species (Herrings and Sardines) to the total small pelagic catch was also observed for recent years. The study emphasizes the importance of introducing necessary management measures in order to ensure the sustainability of key species.

Progress (%): Physical: 95 Financial:

PROJECT NO: 2
ASSESSMENT OF FISHERIES DEPENDENCY ON REEF BIODIVERSITY AND REEF STUDY – GULF OF MANNAR AND DIVING SCHOOL

Fisheries dependency on reef biodiversity in Gulf of Mannar

The study was initially planned to be conducted in the area of Modaragama Paar of the Pearl Bank in Gulf of Mannar but this could not be started due to delays in obtaining funds until April. Since the monsoon had already started at the time of April, the study was conducted in the area from Passikudha to Kayankani in Batticaloa District. Almost the entire length of this coastal stretch contains reef habitats. The survey sites were located at three major reefs; Passikudha, Elephant Point and Kayankani reefs. The study revealed that this area is a most preferred fishing ground for aquarium fish collectors. Most of the species taken are associated with reefs. Aquarium species are collected by snorkeling in shallow inshore reefs and by scuba diving in offshore reefs to a depth of about 35 m.

Fishery dependent data such as number of collectors, crafts and types of fishing gear was recorded by visiting fish collecting centers. In addition, the impact of fisheries on biodiversity in the said locality was studied using underwater visual assessment. The overall quality of the coral reef habitats was low except in small patches in Kayankani. During this survey, many sites had relatively low abundance of butterfly fish as indicated by the total number sighted for most of the transects, especially in Passikudha, indicating the low hard coral cover in many sites. Ornamental fish collectors continue to use the 'moxy net' which is illegal under the Fisheries and Aquatic Resources Act. However, this is difficult to implement as the moxy net is small and can be taken by a diver without being detected. In addition, the use of spear guns resulted in over harvesting, particularly the slow moving adults of selected species such as parrot fish and groupers etc. The habitat quality is seriously compromised by other human activities, particularly the use of nets on reef habitats and tourism, especially in Passikudha reef. These bottom-set nets are used to catch spiny lobsters and reef fishes. Entanglement

causes loss of reef building organisms such as hard corals, soft corals and sponges. Nets laid even close to reefs can get entangled on reefs as the nets move during strong currents and they eventually get hooked onto reef structures. Furthermore, a large number of invertebrates: various species of Echinoderms and mollusks, are also brought up as a result of netting. Therefore, it is necessary to implement the existing regulations under the Fisheries Act, Coast Conservation Act, Environmental Act and the Fauna and Flora Protection Ordinance to stop all forms of illegal resource extraction and the use of fishing gear and the conduct of activities that cause habitat degradation, over-exploitation and destruction of species that are part of the by-catch in other commercial fisheries. Issue licenses to all ornamental fish collectors and determine the types of gear that can be used by the collectors. These should be identified in the permits issued for ornamental fish collection.

Activities on SCUBA training

Six staff members attached to the Department of Animal Husbandry of the University of Peradeniya has applied for SCUBA training. Out of them four have completed the training successfully and obtained their certificates.

PROJECT NO: 3

DISTRIBUTION AND ABUNDANCE OF THE BLUE WHALES (*BALAENOPTERA MUSCULUS*) IN COASTAL WATERS OF SRI LANKA, IN RELATION TO THE SEASONAL CHANGES OF OCEANOGRAPHIC FACTORS AND MANAGEMENT OF THE WHALE WATCHING INDUSTRY

The coastal waters around Sri Lanka have been identified as a well-known home for the Blue whale colony in the Indian Ocean. However the knowledge on cetacean population dynamics, distribution, habitat reference and abundance is still poor due to the lack of research conducted, scarcity of funds and poor guidance from different management bodies; both government and private sector. Various natural and anthropogenic threats such as acoustic pollution, shipping, commercial whale watching and fisheries provide platform for research on management of cetacean stock and their habitats. Such initiatives require properly extracted scientific information regarding the distribution, migration and the seasonality, ecosystem and the population dynamics of cetacean populations.

It is believed that there is a strong relationship between whales and the availability, distribution and abundance of their prey items. The availability of the prey items is directly influenced by the primary productivity of the area based on oceanographic factors such as

Sea Surface Temperature (SST), density, salinity, fluorescence, and other major nutrients, plankton etc. During 2015 April and September samples were collected from 8 samplings from South west and 8 from North east.

Visual observation survey for the marine mammals (Blue whales) was conducted during April 2015 to cover the South Western coastal areas. The length of the transect was 230 km and the area covered was 2000 km^2. Visual observation survey for the North Eastern area was done during the Late September 2015 similar to the first survey.

Opportunistic sampling was done since August 2014 to up to date with the aid of commercial whale watching operators based in Mirissa. For the individual identification of the whales, identification of the resident whale and their small scale migration around the coastal belt of Sri Lanka will be studied using photo identification techniques. Individual identification of the animals was conducted manually with the identification sheets. Further expansion of the identification is still continuing.

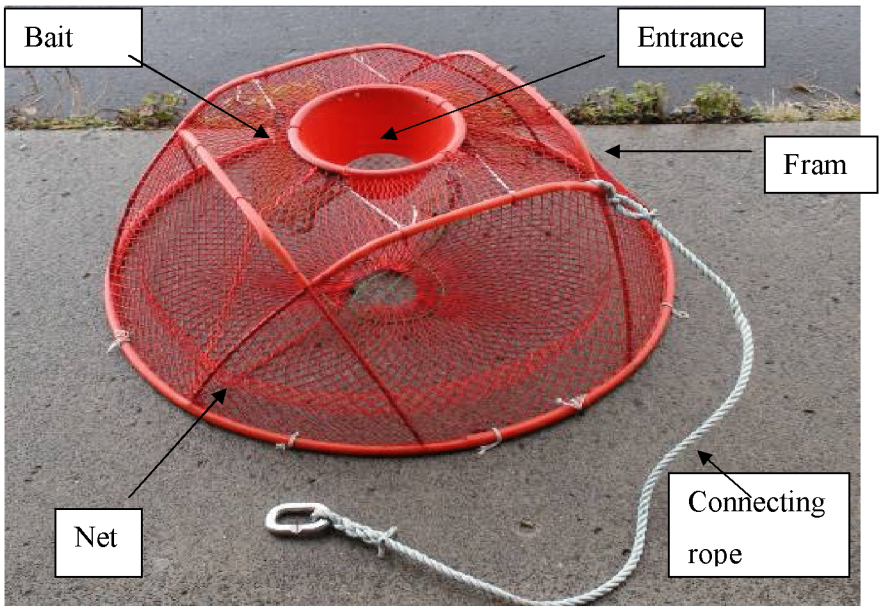
Data collection for the project is continuing until end of the year 2016 and detailed report will be compiled after completing the project with recommendations for the management of the whale watching industry and conservation of the Marine mammals in the area.

Whale visual survey in Trincomalee

PROJECT NO: 4

PREPARATION OF FISHING GEAR AND SUITABLE BAIT FOR HARVESTING OF SHRIMPS AS AN ALTERNATIVE METHOD FOR INSTANCE OF BOTTOM TRAWLING IN THE COASTAL AREA OF SRI LANKA

The main objective of this project was to introduce alternative fishing method for the shrimp bottom trawling in the coastal areas to minimize the trawling disturbances on the sea beds habitats including sea grasses beds, coral reef beds etc. The other objective was the biological study of the catches of bottom trawling in the Negombo coastal area. The project activities began in the month of February 2015 and continued until 2016. Seven major species of shrimps have been identified in the area. They were *Penaeus indicus, P. monodon, P. merguiensis, P. semisulcatus, Metapenaeus dobsoni, M. affinis* and *Parapenaeopsis coromandelica.* These species contributed about 55% to the total catch. The other 44% was the by-catch species. The experimentally designed shrimp pots, made of fishing net with 20 mm mesh size and steel frame with a narrow mouth top of the trap and traps will be setting on the sea floor within the selected locations in the Negombo trawling ground. Shrimps get attracted to the bait and enter through the mouth and get trapped inside. The bait will be changed according to availability at the market and favourable baits were tested for the shrimps.



Completed Shrimp trap

The other trap was designed to catch *Macrobrachium* spp. in the seasonal tanks. It is also the same structure but is larger in mesh size and frame.

Prawn traps were tested at shrimp trawl ground in Poruthota, Negombo.

Shrimp trawling ground at Poruthota, Negombo

Sailing Oru operated at trawling ground

Arranging the traps with baits by the research team

Traps being positioned at the location

Picking the traps from the location

Trapped fish and crabs

PROJECT NO: 5
MOLECULAR STUDIES ON SELECTED MARINE SPECIES - CEPHALOPODS AND RAYS.

Molecular identification of commercially important Cephalopods

Cephalopods include a diverse collection of more than 650 species of octopi, cuttlefish, squid and nautilus. Several of these species are commercially important in Sri Lanka. Morphological identification is sometimes difficult in cephalopods as morphological characters employed for cephalopod identification are influenced by sex, age, growth, sexual maturity and the environment, while some important features appear only in the mature male. Therefore, the availability of methods using molecular techniques would be very useful for the identification of these cephalopod species. In addition, it would help in the accurate identification of these species in sea food products.

Sepia aculeata

Sepia pharaonis

Sepiella inermis

Sample collection was carried out in Chilaw, Negombo, Beruwela, Kalpitiya, and Dehiwela landing sites. Samples were stored in alcohol and transported to the laboratory. The samples were subject to a standard DNA extraction protocol and the extracted DNA was quantified and the quality determined by agarose gel electrophoresis. Mitochondrial COI PCR reactions were carried out for the extracted DNA and the PCR products were out sourced for sequencing. The sequences were then analyzed using Bioedit and identified using the Barcode of Life database and the NCBI blast facility.

Sepioteuthis lessoniana

Loligo (Uroteuthis) duvauceli

Cistopus taiwanicus

The following species were identified: *Sepia aculeata*, *Sepiella inermis*, *Sepia pharaonis*, *Sepioteuthis lessoniana*, *Loligo singhalensis*, *Sepia pharaonis*, *Loligo* (*Uroteuthis) duvacelli, Cistopus taiwanicus* and *Octopus vulgaris*.

The species *Cistopus taiwanicus* is not listed as a species found in Sri Lanka but has been recorded in the Indian Ocean in regional studies. This species was found from Negombo as well as from the Kalpitiya area.

Molecular identification of chondrichthyes

The high demand for rays in Asia continues to drive the fishery for rays. Therefore, urgent research is needed of these vulnerable species. The objective of the study was to promote ray conservation via the application of various genetic and molecular techniques and increase public knowledge and understanding of different species of rays.

Manta and mobula rays belong to the Suborder Myliobatoidei, which contains all of the Eagle Rays (Myliobatidae), Cownose Rays (Rhinopteridae) and the Mobulid Rays. In total this suborder contains about 40 species which are characterized by diamond shaped bodies and wing-like pectoral fins. Manta and mobula rays (Mobulidae) are a pelagic family of 11 extant species present in tropical and temperate waters worldwide. The two species within the genus *Manta* are; *Manta birostris* (commonly known as the Giant or Oceanic Manta Ray) and *Manta alfredi* (Reef Manta Ray). The Mobula, or Devil Rays (*Mobula*) consist of nine different species, 5 of which occur in the Indian Ocean. Oceanic Manta ray, together with three species of Hammerhead sharks (Great, Smooth and Scallopped) and Porbegale shark are now listed in the Appendix II of CITES and therefore need permission before export.

Biological data together with DNA sequence data for all of these species are very limited (White *et al.*, 2006).

Muscle tissue samples were obtained from Ray species from Negombo, Beruwala and Chilaw landing sites and were stored in 70% ethanol. DNA was extracted and the mitochondrial COI PCR analyses were conducted using universal fish primers (FISH F1 and FISH R1). Approximately 650 bp region of the mtDNA CO1 gene was amplified and sequenced. These PCR products were sequenced and DNA bar codes of species including Short fin Pygmy Devil Ray, Banded Eagle Ray, Japanese Devil Ray, Sharp nose Sting Ray, sickle fin devil ray, Javanese cow nose Ray, Jenkins whip ray, white spotted guitar fish, Oceanic manta ray, cow tail sting ray, spine tail devil ray, butterfly ray and blue spotted sting ray were generated. The identity of each species was determined using NCBI BL AST sequence analysis programme.

Progress (%): Physical: 100% Financial: %

PROJECT NO: 6
A COMPREHENSIVE STUDY ON MAJOR SHARK SPECIES IN SRI LANKA (CONTINUED PROJECT SINCE 2014)

Heavy metal analysis of silky shark

Sri Lanka is one of the major shark fishing countries in the Indian Ocean. Under the present study, shark landings were monitored by a research staff of MBRD at major shark landing sites in the west, southern and eastern coasts of Sri Lanka. Essential trace elements in the muscle tissue of eighty-one (36 male and 45 female) individual specimens of *Carcharhinus*.

falciformis were analyzed using an atomic absorption spectrometer namely; essential trace elements iron (Fe), copper (Cu), and zinc (Zn) and Non-essential trace metals, namely lead (Pb), cadmium (Cd), mercury (Hg), and arsenic (As). The values for the female fish were determined as Hg: 0.805; Cd: 0.052; As: 8.570; Pb: <0.52; Fe: 3.602; Cu: 0.360; and Zn: 5.160 (mg/kg w/w). The mean trace elements of the male fish were determined as Hg: 0.879; Cd: 0.064; As: 6.330; Pb: <0.52; Fe: 3.536; Cu: 0.382; and Zn, 4.219 (mg/kg w/w). The mean trace elements in the muscle tissue of female and male did not significantly vary ($p < 0.05$). According to the European legislation, the maximum allowable trace metal limits for this species is Hg: 1.00, Pb: 0.03 and Cd: 0.05 (mg/kg w/w). The results show that mean Hg and Cd concentrations were not significantly ($P < 0.05$) greater than EU legislation.

Study on the spiny dog fish shark fishery in the West and North-West coast of Sri Lanka

Spiny dog fish sharks (Order: Squaliformes, Family; Centrophoridae) are mainly used for extraction of liver oil and as fish meals. In Sri Lanka, the fishery for spiny dog fish sharks exists as a seasonal fishery which is conducted from November to April in the coastal waters off Thalawila and Chilaw in the Northwest coast, Negombo and Beruwala in the West coast, Mirissa in South coast, from May to October in Mutur and Vallachchinai in the East coast. The preliminary studies were conducted on the spiny dog fish shark fishery in Beruwala, Negombo, Chilaw and Thalawila during the months of April, May, October, November and December 2015. Main Objective of the study was to strengthen the scientific understanding of the status and trends of the spiny dog fish shark fishery in the West and North-West coasts of Sri Lanka. In these areas Spiny dog fish sharks are mainly harvested by using long line with baited hooks. The fishing crafts used are fiberglass reinforced plastic boats with outboard motors (OFRP-18feets) and Multiday boats (IMUL- 28-34feets). The average number of hooks per OFRP boat is about 700 and 1000 per IMUL boat. The average fishing duration is about 12 hours and the fishing operation is carried out across the depth range 200m-2000m. The main species caught are *Centrophorus granulosus* (Gulper shark), *Centrophorus moluccensis* (Small fin gulper shark) and *Centrophorus uyato* (Little gulper shark). During the period of study, the estimated highest catch was recorded in Beruwala (12705 kg), while the next highest catch was in Negombo (12495 kg).

Progress (%): Physical: Financial:

PROJECT NO: 7
CONSERVATION AND MANAGEMENT OF THE SPINY LOBSTER RESOURCES IN THE SOUTH AND EAST COSTAL FISHERIES MANAGEMENT AREAS

Spiny lobster fishery in some parts of Sri Lanka plays a vital role in the small scale fishers' economy while contributing to foreign exchange earnings by exporting 95% to the foreign market. After implementation of the Spiny lobster Co-Management mechanism to the South and East coastal regions of the country, some development of the fishery can be observed. During the 2007 -08 period 32 percent of the catch represented both male and female undersized lobsters but at present it has reduced to zero.

Still, *Panulirus homarus* (Sand lobster) is playing a major role in the South and East coast spiny lobster fishery contributing 85 % to total catch. While *P. longipes* and *P. versicolor* species are representing 6.5 % and 6.12 % respectively, there is an increasing trend in their catch rates compared to the past years. However, *P. homarus* annual length frequencies chart revealed that this species is under severe threat because of the increasing fishing pressure heavily removed the matured lobsters from the stock. Further, it revealed that small lobsters are representing the catch in greater extent as (6-7.5 cm in Carapace length) 67 percent and the elder lobsters are found in smaller quantities. Action should be taken to control the small size lobsters in the catch till they grow to a reasonable length. Contribution of the *P. versicolor* on the catch is very small and its fishing pressure is comparatively small because of the lower demand and the living depth making it difficult to catch them.

Monthly length frequency analysis charts revealed that the period from November to January the catch consisted of bigger size lobsters, while small length classes are dominant during the rest of the months of the year representing recruitment period.

According to the year 2000 Spiny Lobster Regulation, February, September and October months are declared as closed season due to the peak breeding seasons but current research revealed that peak breeding seasons can be shifted slightly. Further, it revealed that the first peak breeding cycle starts in January and ends in March and the second cycle extends from September to November.

Recommendations

- Reduce the fishing efforts during the recruitment period.
- Technology development for the spiny lobster fattening. Small size lobsters are represented in the catch in larger quantities during the recruitment period. These small size lobsters are growing faster than the older ones and their survival rate is high. Considering these facts fishermen have the potential to culture the small lobsters till they reach a reasonable size and get a bigger income rather than selling the small sizes.
- Conservation of berried lobsters until they release eggs.
- Extension of the closed season
- Extension of the research and increase the sampling frequency

- Progress (%): Physical: Financial:

PROJECT NO: 8
ESTABLISHMENT OF TURTLE HATCHERY AND REFUGEES IN KALPITIYA AND IDENTIFICATION OF SPATIAL DISTRIBUTION OF SEA TURTLES

Establishment of turtle hatchery and refugees in Kalpitiya

Exploitation of sea turtles and their eggs continues all along the coastline, year-round, despite the fact that all sea turtles and their eggs are protected by law. The Northwest coast is not a principal sea turtle nesting beach but the coastal sea is a popular feeding ground. Thereby accidental catch in commercial fisheries or entanglement in marine debris are serious threats to sea turtles, as well as destruction of beach habitat, harvesting or poaching for meat and eggs by people or by animals, and even boat strikes. In the absence of a turtle reserve in the area, it is impossible to police so many hundreds of miles of unprotected beach. Thus, a model turtle hatchery has been set up using proper scientific techniques to meet the required biological needs of the turtles at the premises of the RRC Kalpitiya. Around 1000 eggs collected from unprotected nests in the area were incubated at the hatchery in two occasions and over 90% hatching rate was realized.

The turtle refugee center serves as a rehabilitation center for sick and injured turtles. During 2015 a total of four injured turtles rescued by the Sri Lanka Navy and the Department of Wild Life Conservation were directed to the center for treatment. All four had critical

injuries. One seemed to be struck by a boat and the head and the shell were badly damaged. The others had lost one or two flippers. The one who had been struck by a boat died after two weeks and the others recovered. Two were released after rehabilitation as they could manage feeding and could swim naturally with their remaining three flippers. The one who lost two flippers is residing at the center.

A study on temporal and spatial distribution of sea turtle nesting in the West and South-West coasts of Sri Lanka

Of the seven living sea turtle species in the world, five are reported to nest along the coastal belt of Sri Lanka: the green turtle (*Chelonia mydas*), olive ridley (*Lepidochelys olivacea*), hawksbill (*Eretmochelys imbricata*), loggerhead (*Caretta caretta*) and leatherback (*Dermochelys coriacea*). **Sea turtles and their habitats in Sri Lanka have been identified as a critical threatened wild group of animals and set of habitats.** They are fully protected under the Fauna and Flora Protection of 1938(amended 1972) and the fisheries act No. 49 of 1993 and Act No 2 of 1996.

There were two main components of this research, study on the sea turtle nesting beaches and survey on the sea turtle hatcheries of Sri Lanka. The study area extended 31.3 km over three administrative districts, Colombo, Galle and Matara, including fifteen major nesting beaches (Mount Lavinia, Benthota, Warahena, Induruwa, Mahapalana, Duwemodara, Kosgoda, Ahungalla, Balapitiya, Ambalangoda, Kahawa, Mahamodara, Habaraduwa Koggala and Mirissa). The information was collected by volunteer data collectors and through direct supervision of NARA research staff. The estimated total annual number of nesting in the study area was 1602. Out of which 69.65%, 28.97%, 0.56%, 0.37% and 0.44% were made by Green turtle, Olive ridley turtle, Hawksbill turtle, Loggerhead turtle and Leatherback turtle respectively. It was revealed that Green turtle was the most predominant species. The highest nesting density 267 nest km^{-1} $year^{-1}$ was reported in Kosgoda beach. The highest number of nesting frequencies of Green turtle was observed during the period of February to June. The highest number of nesting frequencies of Olive ridley turtle was observed during the period January to March and December.

There were 15 operational sea turtle hatcheries situated along the coastal belt from Mount Lavinia to Koggala. Hatcheries, normally received eggs from the surrounding beaches, for *ex-situ* conservation activities, the turtle hatchery buried eggs inside the hatchery premises.

During the survey period 96947 green turtle eggs, 32418 Olive ridley turtle eggs 791 Hawksbill turtle eggs, 720 Loggerhead turtle eggs and 653 Leatherback turtle eggs were buried inside the hatcheries.

PROJECT NO: 9

STUDY ON SEASONALITY, DIVERSITY AND SPATIAL DISTRIBUTION OF SMALL PELAGIC FISH SPECIES AND ASSOCIATED WATER QUALITY PARAMETERS IN THE WELIGAMA BAY

The Weligama Bay is a one of productive coastal ecosystems of Sri Lanka and the bay has a width of about 2.5 km and length of about 2.9km. During the mid-1970s the fiberglass oru (crafts coupled with an outrigger) were introduced to the bay fishery with nylon nets. The outrigger oru fishermen set their nets within the bay area and the artisanal fishermen were severely affected.

The Minister of Fisheries appointed a Commissioner in the latter part of the 1970's to investigate the dispute and to safeguard the rights of the small scale fishermen. The Weligama Bay Fishing Regulations were framed on the recommendations of the Commissioner.

At the moment implementation of these regulations is inactive and out of date. Illegal fishing operations are widely practiced in the entire bay. Small pelagic species such as *Sardinella* spp., Anchovy, Shads, *Thryssa* spp., Pony fish and Ribbon fish are very common during the Northeast monsoon period. All these fish species caught whilel they small in size and are sold at very cheaper prices. Sometimes big amounts of small fish catches are buried due to a lack demand for the small sizes.

Most fishermen complain about their low catch per unit effort. Fishing activities are carried out by violating regulations and most fishing method and gear are illegal. Unregulated fisheries will lead to resource overexploitation. According to fishermen's information, several years ago, bay fishery has supported large size valuable fish species such as seer fish and carangid species, but those species do not appear in current fish catches.

There are three types of fishing crafts, small non-motorized fiber glass canoe (10ft), medium size motorized canoe (20ft) and large motorized fiberglass canoe. Small size crafts are mainly used for lobster fishery and gill net fishery, medium crafts are used for gill net fishery and large craft are used for surrounding net fishery. Total crafts in the bay are about 40 and about half of them are daily operated. Surrounding net and gill net are major gear types used in the bay. Length of surrounding net is 280m and height is 34m in average. At present total

surrounding nets in the bay is 13 and about 6 nets are operated daily. In the gill net, wide range of mesh size nets are used varying from 6" to ¾". Large meshed gill nets are used for lobster fishery and ray fishery and small meshed gill nets are for small pelagic fishery.

The small pelagic fish species such as *Sardinella* spp., *Thryssa* spp., Pony fish and Anchovies are widely contributed in the catch exhibiting seasonal abundance due to oceanographic factors. *Stolephorus* spp. are major contributors in the bay fishery and this fishery dominates from June to September. Among three anchovy fish species belonging to Genus *Stolephorus*, and *Encrasichdina* in the bay fishery, *Encrasicholina heteroloba* (Rahu halmassa) and *Stolephorus insularis* (potta halmassa) are common in fish catches while *Stolephorus waitei* is rarely reported. Three species of *Thryssa* were recorded: *Thryssa baelama, Thryssa hamiltonii* and *Thryssa setirostris*.

Surrounding fish nets should be prohibited or limited in the bay and other net species must be controlled for operations, because within the breeding season all the small fish are caught by the surrounding net and small mesh gill net operators, before they grow to the marketable size. Fishing effort should be limited by controlling fishing time or number of nets or number of craft.

Small meshed gillnet (Left) and small meshed surrounding net (Right)

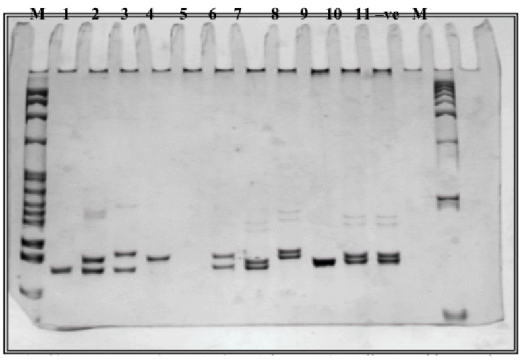
Progress (%): Physical: Financial:

EXTERNALLY FUNDED PROJECTS

1. **Study the stock structure, some biological aspects, distribution and the abundance of Indian mackerel (*Rastrelliger kanagurta*) in the coastal waters around Sri Lanka**

Stock structure of Indian mackerel in the coastal waters around Sri Lanka

Indian mackerel is a popular fish in Sri Lanka but it is not a major target species and is mainly caught as by-catch from fisheries targeting other small pelagic species. They are primarily caught in gillnets which mainly operate over the wider shallow continental shelf, sometimes out to 25 km offshore. Of the 100 species of small pelagic around Sri Lanka, only 25 contribute significantly to the commercial production. Indian mackerel is the dominant mackerel species but it has been shown that Indian mackerel only represent about 2-3% of the catch. Annual catches for this species from 2006 to 2008 are reported to range from 15,570-17,620 MT. To confirm that the species collected for microsatellite analysis were *R. kanagurta*, mitochondrial COI analysis was conducted on a few random samples from different locations for PCR amplification and sequencing. The 14 microsatellite loci identified were used for the genetic analysis. A total of 200 samples were collected from 10 sample locations of 20 individuals each location. Length and weight data was collected for all the fish sampled. A total of 2,800 PCR reactions were sent to Scigenom Labs in India for genotyping. The genotyping analysis indicated that the Indian mackerel resources around Sri Lanka consist of one stock.



Some biological aspects, distribution and the abundance of Indian mackerel

Indian Mackerel, *Rastrelliger kanagurta* is one of the most valuable food fish in Sri Lanka. It is the 4th dominant species in the small pelagic fishery and is mostly landed as a bycatch with

other small pelagic fish. Small pelagic fish landings are monitored by MBRD but, the sampling coverage of the monitoring programme is inadequate. Also, since little scientific information is available on the fishery, biology and other aspects of Indian Mackerel, the present study was initiated by MBRD in 2013 under the financial support of Bay of Bengal Large Marine Ecosystem (BOBLME) Project in view of strengthening the small pelagic fishery data collection and to study Indian Mackerel fisheries, stock structure and biology. The project was completed in 2015.

The small pelagic fishery sampling included collecting information on fishing operations (fishing time, fishing depth, gear used etc), recording the quantity of the landings by species and by different fishing vessel-gear combinations, measuring the lengths of key species etc. A total of 388 individuals of *Rastrelliger kanagurta* obtained from Western and Southern waters of Sri Lanka were also analyzed to study their reproductive biology, to estimate Somatic Index (GSI), Length at first maturity (L_m) and fecundity and to determine the Spawning season(s). Morphological characteristics such as length-length and length-weight relationships were also obtained. Stomach contents of the mackerel samples were analyzed to study the variations in food intake. The fishing season of Indian Mackerel varies from area to area and is mostly confined to a few months. None of significant difference was observed in the average true fishing time of the operated boats targeting Indian Mackerel. The estimated length – weight relationship of *Rastrelliger kanagurta;* $W= 0.006L^{3.2}$ for male and $W = 0.007L^{3.2}$ for female shows the positive allometric growth of the two sexes of species. All the relationships between length-length parameters were significant. The estimated male to female sex ratio of Indian Mackerel was significantly different from 1:1 at 0.01 level of significant. The spawning season of Indian Mackerel in the Western and Southern waters of Sri Lanka was found to be in the months of May and June. Size at first maturity (L_{50}) ranged between 255 and 265 mm (TL) for females whereas the respective value for males was in the range of 245 mm and 255 mm. Total fecundity estimated in the study varied from 75420 to 101609 eggs and the relative fecundity was at 323 ± 93 eggs per gram body weight of a female mackerel. Studies on food and feeding of mackerel concluded the planktonic diet dominated by zooplankton varieties with higher abundance of copepods and their nauplii stages.

2. A study of the population biology and fishery of the Blue Swimming Crab (*Portunus pelagicus*) fishery in Jaffna District

The Blue Swimming Crab (BSC) *Portunus pelagicus* has a wide geographical distribution and is an important commercial species throughout the subtropical waters. The geographical extent of the BSC resource in Sri Lanka extends from Chilaw on the Northwest coast to Trincomalee on the nNortheast coast. The resource is more abundant in the shallow coastal waters of the Palk Bay which is bounded by three administrative districts: Mannar, Kilinochchi and Jaffna. MBRD agreed to undertake a study on behalf of the Seafood Exporters' Association to fulfill the research needs for the management of BSC. The aim of the study is to carry out a comprehensive research including the reproductive biology, food & feeding, population biology and fishery of BSC. Accordingly, data collection at the landing sites in Mandativu (two landing sites), Vellanai (one landing site) and Chatty (one landing site) in Jaffna district was started in November 2014. Eight enumerators (two per site) were recruited for sampling. A field coordinator was also appointed for coordinating the data collection activities. The whole data collection process was closely supervised by a MBRD research team. They visited Jaffna monthly during the data collection time. Also, they engaged in biological data collection at Nawanthurai lagoon where juvenile crabs caught from the lagoon are landed in considerably large quantities. One year field data collection was completed in October, 2015. In each month, freshly caught blue swimming crab samples obtained from the landing sites were also brought to the MBRD laboratory with ice and preserved them at the laboratory in a deep freezer for biological analysis. Each individual crab was measured and examined for the following: total length (mm), carapace width (mm), chelar propodus length, chelar propodus height, abdomen width, abdomen length, body weight, mouth gape, sex determination, maturity stages and fecundity. More than 600 individuals of blue swimming crabs have so far been analyzed for biological study. Field data entry has been completed and data analysis is now in progress. The length based BSC stock assessment is also in progress. The study is due to be completed in March, 2016 with important recommendations for the sustainable management of the BSC resource in Jaffna.

Progress (%): Physical: 75% Financial:

OTHER ACTIVITIES UNDERTAKEN

- Identified and provided reports for two fish samples and one canned fish sample using molecular techniques, for Shaw Wallace Ltd.
- Attended the Magistrate's Court of Trincomalee on 3rd June 2015 to give evidence on reports provided by NARA for the analysis of a suspected dynamite fish sample (sample no BR 539/S/12).
- Examined and provided a report on identification of fish gill samples sent by A.K.J. Trading.
- A Scientist of MBRD has been serving as a member of the National Committee on Agricultural Biotechnology under the CARP since May 2013.
- Examined and provided reports on fish samples sent by various high courts for blast fishing.
- Examined and provided a report on identification of shark samples sent by the Exporters.
- External Supervision for a BSc student was made on a request of the academic Head, Fisheries and Marine Science Division, Ocean University of Sri Lanka.
- Lectures were conducted on the importance of biodiversity and coral reefs for Sri Lankan Coast Guard.
- Scientists of MBRD Supervised students of Uva Wellassa University for carrying out their final year research projects (2014).

POSTGRADUATE DEGREES COMPLETED

Following Scientists of MBRD completed their postgraduates:

- R.P.P.K. Jayasinghe, Ph.D. in Water and Coastal Management. University Cadiz, Spain. Title of the Ph.D. thesis: Links between the qualitative descriptors of European Marine Strategy Framework Directive (MSFD).
- M.I.G. Rathnasuriya. M.Sc. in Fisheries Science. Pukyong National University, Busan, South Korea.

PUBLICATIONS

- Warsha Singh, Gudmundur Thordarson, Sisira Haputhantriand Gunnar Stefansson, 2015. Optimized sampling strategies for identifying models in length-frequency distributions. Communications in Statistics- simulation and computation. DOI:10/1080/03610918.2014.930903.

- Athukoorala, A.A.S.H., K.H.K. Bandaranayaka and S.S.K. Haputhantri, 2015. A study on some aspects of reproductive biology and population characteristics of Amblygaster sirm in the west coast of Sri Lanka. International journal of fisheries and aquatic studies. 2(4): 41-45.
- Jayasinghe, R.P.P.K., U.S. Amarasinghe and A. Newton. 2015. Evaluation of marine subareas of Europe using life history parameters and trophic levels of selected fish populations. Marine Environmental Research 112, 81-90. DOI: doi:10.1016/j.marenvres.2015.08.002.

REPORTS

- Haputhantri, S.S.K. and Bandaranayake, K.H.K. 2015. Study on some biological aspects, fishery, distribution and the abundance of Indian mackerel in the coastal waters around Sri Lanka. The final report of the BOBLME Indian Mackerel study submitted by NARA to BOBLME.
- A study of the population biology and fishery of blue swimming crab (Portunus pelagicus) fishery in Jaffna District:Inception Report submitted by MBRD to the Seafood Exporters' Associations of Sri Lanka's Blue Swimming Crab Fishery Improvement

TRAININGS/WORKSHOPS/MEETINGS ATTENDED

- BOBLME Indian mackerel genetics data analysis workshop. 17th – 18th February 2015. Phuket, Thailand.
- Essential Ecosystem Approach to Fisheries Management (EAFM) Workshop. 9-14 March 2015, Katunayake.
- North-East Indian Ocean regional workshop to facilitate the description of ecologically or biologically significant marine areas (EBSAs) held from 23 to 27 March 2015, Colombo, Sri Lanka.
- International Seminar and Technical Training Programme on length based spawning potential: A new approach to assessing and managing data poor fisheries held on 11th and 12th August 2015, Colombo, Sri Lanka.
- Thirteenth Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Billfish (WPB), 1st to 5th September 2015,Olhão, Portugal.
- Final BOBLME Project Steering Committee (PSC) meeting. 17th and 18th November, 2015, Phuket, Thailand.
- Implementing shark and CITES listings in Sri Lanka – Developing Non-Detrimental Findings (NDF) and Species ID. 3rd December 2015. DWLC, Battaramulla.

- 9th Technical Advisory Committee (TAC-9) meeting of Bay of Bengal Programme Inter-Governmental Organization (BOBP-IGO) 21st and 22nd December, 2015, Chennai, India.

PROCEEDINGS

- Bandaranayake, K.H.K., Maldeniya, R, and Perera, H.A.C.C. Auxis thazard; major contributor in Sri Lankan Neritic tuna fishery. IOTC–2015–WPNT05–18 Rev_1
- Haputhantri, S.S.K. and H.A.C.C. Perera, 2015. Estimate length-weight relationship and some morphometric relationships of Indo-Pacific Sailfish (Istiophorus platypterus) using biological data of gillnet fishery and longline fishery in Sri Lanka IOTC–2015–WPB 13–22
- Jayathilaka R.A.M. and Maldeniya R. Impact of policies on the conservation of sharks in the large pelagic fishery IOTC–2015–WPB 13–22
- Perera, H.A.C.C., Maldeniya, R., Weerasekara, S.A., and Senadheera, S.P.S.D. Opportunistic dietary nature of Yellowfin tuna (Thunnus albacares): Occurrence of polythene and plastic debris in the stomach. IOTC–2015–WPTT17–19

OTHER COMMUNICATIONS

MBRD/ SLAFAR/ Seafood Exporters' Associations of Sri Lanka's Blue Swimming Crab Fishery Improvement Project jointly organized the International Seminar and Technical Training Programme on length based spawning potential: A new approach to assessing and managing data poor fisheries held on 11th and 12th August 2015 at NARA Colombo 15, Sri Lanka.

5.6 NATIONAL INSTITUTE OF OCEANOGRAPHY AND MARINE SCIENCES (NIOMS)

Head of the Division (Actg.) S. U. P. Jinadasa

The National Institute of Oceanography and Marine Sciences (NIOMS) have responsible for planning and conducting coastal and offshore oceanographic studies around Sri Lanka. In this regard oceanographic and marine geological researches are being conduct in physical, chemical, biological oceanography. NIOMS has been conduct research on coastal and deep ocean research having long term archival of oceanographic datasets such as tides, currents and waves.

NIOMS equipped with modern instruments for data collection and some of the systems are connected to global ocean observation networks. The data consist of tides, currents and waves while other physical parameters such as salinity, temperature and chlorophyll are available in coastal water bodies and near shore areas. However, deep water physical parameters have been obtained from buoys and earth observing satellites.

The institute provides its scientific and technological services to a wider range of applications such as coastal constructions, living and non-living resource exploitation, energy harnessing including environmental impact assessments (EIA). Ocean observation center (OOC) of the institute is alert on 24 hours to provide early warnings on ocean based disasters such as tsunamis. The institute consists of an information service to provide predictions on potential fishing grounds using satellite technology to the offshore/high seas fishery sector.

Progress of research projects

NIOMS has conducted five major projects and several consultancy services during the year 2015. In addition, many publications were done by the NIOMS and two publications were received National Research Council (NRC) merit awards.

Following are the major projects and consultancy services carried out by NIOMS during 2015.

No.	Project title	Allocation (Rs.)	Officer/s responsible	Year
5.1	Hydrodynamics and bio-chemical characteristics of Kalpitiya Lagoon	700,000	KasunDalpatadu Dileka Samaranayake S. S. Gunasekara	2015
5.2	Monsoonal impact on upwelling and productivity around Sri Lanka	673,000	S.U.P. Jinadasa, H.B. Jayasiri	2015
5.3	Investigation of mineral sand resources in potential coastal and offshore regions	1,000,000	Dileka Samaranayake N. B. Suriyaarachchi	2015
5.4	Tuna fishing ground forecasting and improvement of its methodology	800,000	J.K. Rajapaksha S. S. Gunasekara	2015
5.5	Operation ocean observation center	2,500,000	K. Arulananthan S.U.P. Jinadasa N.B. Suriyaarachchi	2015

Table 1: Projects carried out by NIOMS

PROJECT NO: 5.1

HYDRODYNAMICS AND BIO-CHEMICAL CHARACTERISTICS OF KALPITIYA LAGOON

Coastal water bodies in Sri Lanka are one of the most productive eco systems, having characteristics of high diversity of environmental factors, habitats, a high connectivity in the food chain and a high diversity of species. Among them, Puttalam Lagoon is the second largest in the country and it plays an important role in flood control and acts as a source of water for the shrimp farms as well as the 'sink' for their waste effluents. It is also important in driving the nutrient cycle and food chain in nearby coastal waters including the Bar Reef Marine Sanctuary.

Despite the significant importance of the Puttalam Lagoon as remarkable ecosystem, it is well obvious that the lagoon is threatened due to mainly anthropogenic forces such as shrimp farming. The effluents form the shrimp farms as well as waste water from houses around the lagoon are discharged to the lagoon without treatment, which contain considerable amount of chemical residuals. This may account for the destruction of biotic community as well as resulting in eutrophication of the water body and pollution of ground water. As a cumulative effects of these anthropogenic activities, several alterations in the physiochemical and biological conditions in the lagoon has been observed such as increased the pH of the water and gradual increase of ammonia concentration. In addition a significant decline in salinity

over the last 50 years has been reported mostly due to the regulation of freshwater input via Kala Oya and MeeOya. Therefore, it is imperative to conduct routine assessments of the biological and physiochemical components of the lagoon in order to identify the prevailing trends of those components which could drive towards implementation of sustainably development activities in the lagoon eco system.

Due to these impacts, current studies were carried out to resolve the problems arise due to such activities. The main objectives of the study were to assess the spatial and temporal variation of some important physiochemical, plankton dynamics, and sediment distribution and identify the feasibility areas for aquaculture practices (ex: bivalve culture, sea cucumber culture).

During the year 2015, monthly sampling program was conducted in the study area to investigate seasonal variability of dynamics in the lagoon. The sampling points are given in the figure 1. Samples were taken to the NARA oceanographic laboratory and chemical analysis were done for chemical parameter studies.

Fig. 1: Sampling points in the Kalpitiya Lagoon.

RESULTS

Salinity

Considering the salinity distribution in the lagoon, seasonal variation in the horizontal distribution could be identified. Figure 2 shows the horizontal distribution of the salinity in each sampling month.

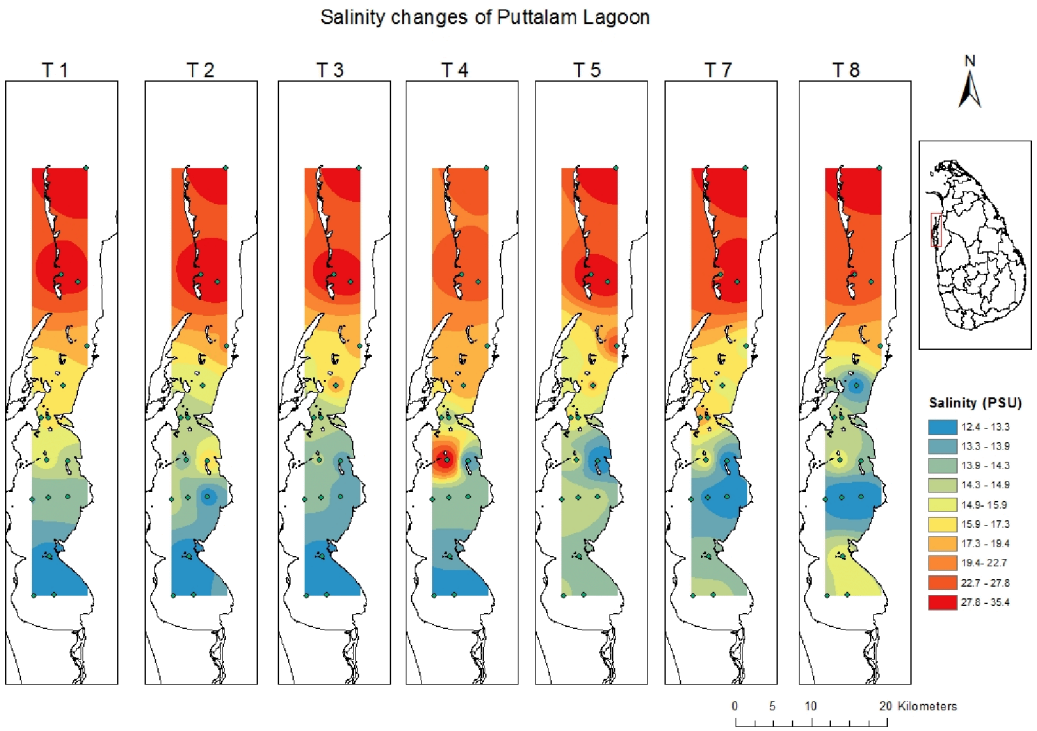


Fig. 2: the horizontal distribution of the salinity in each sampling month. (T1-May, T2-June, T3-July, T4-August, T5-September, T7-November, T8-December)

Dissolved Oxygen (DO)

DO shows seasonal variation as other parameters. Figure 1.3 shows the seasonal distribution of the DO in each sampling month.

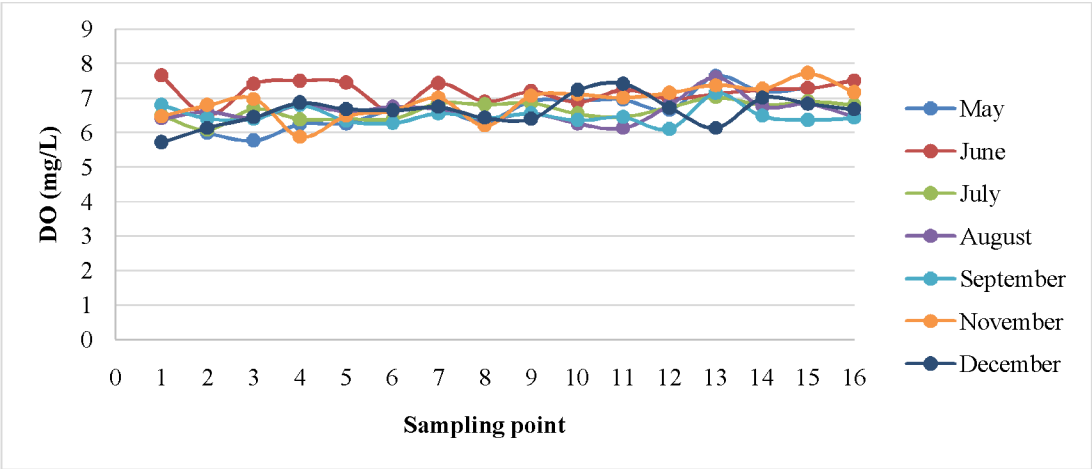


Fig.3: The seasonal distribution of the DO in each sampling month.

Temperature

Temperature shows seasonal variation as other parameters. Figure 4 shows the seasonal distribution of the Temperature in each sampling month.

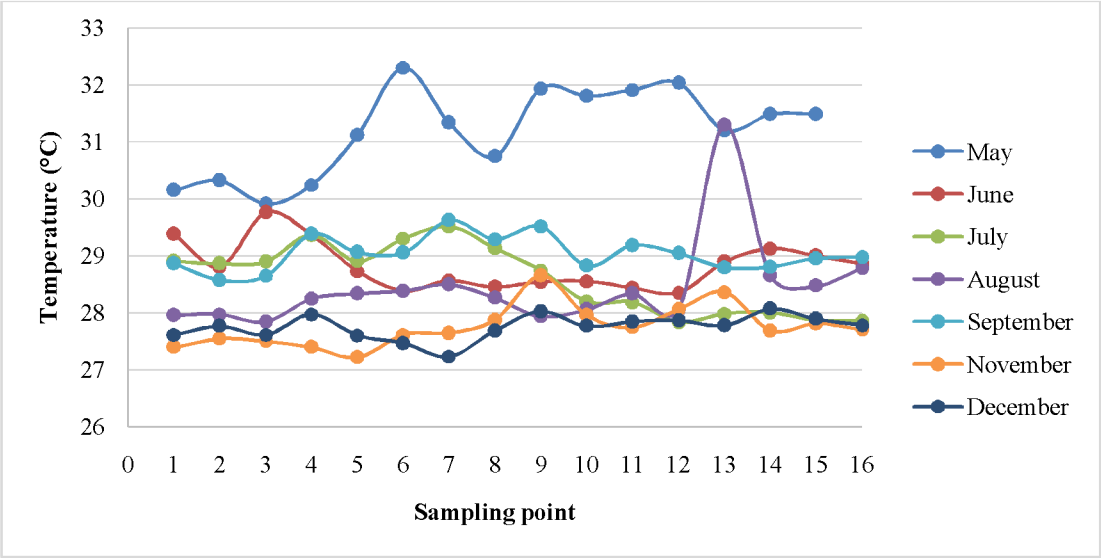


Fig.4: The seasonal distribution of the Temperature in each sampling month.

Total Suspended Solids (TSS)

Total Suspended Solids shows seasonal variation as other parameters. Figure 5 shows the seasonal distribution of the TSS in each sampling month.

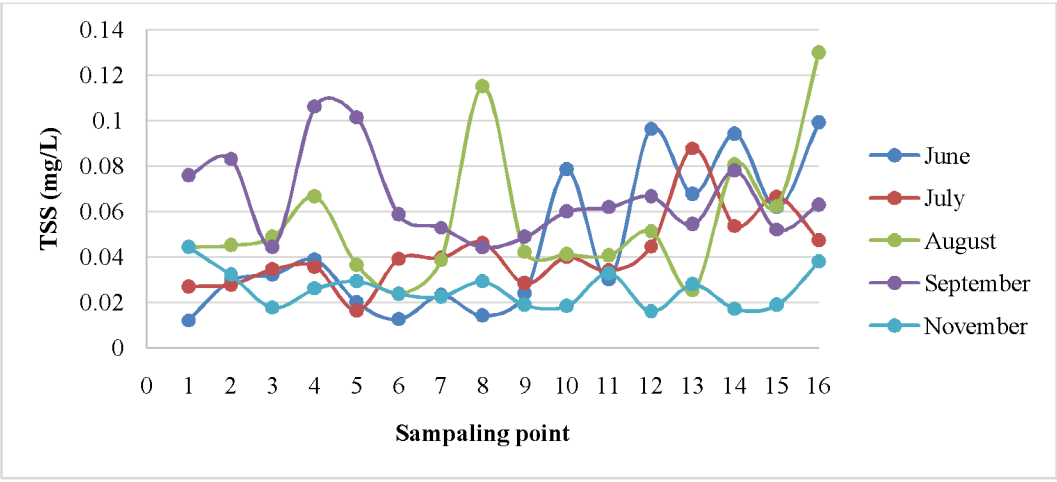


Fig.5 the seasonal distribution of the TSS in each sampling month.

Total orthophosphate

Total orthophosphate shows seasonal variation as other parameters. Figure 6 shows the seasonal distribution of the Total orthophosphate in each sampling month.

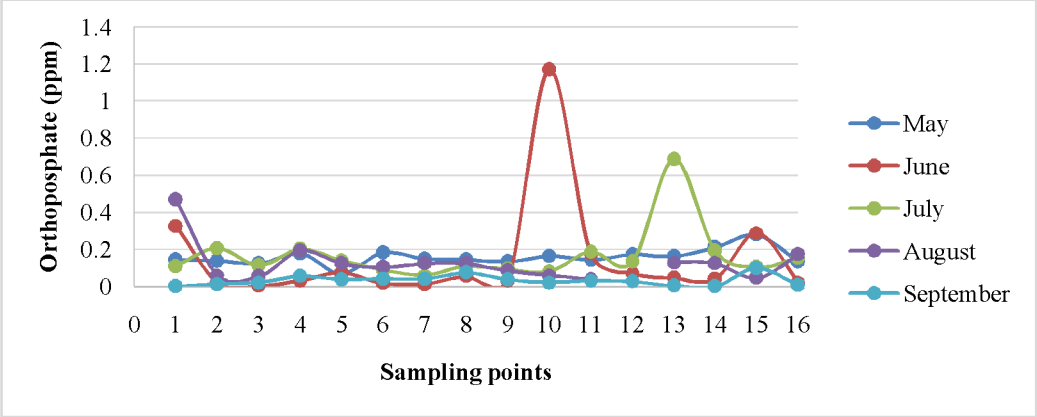


Fig.6 the seasonal distribution of the Total orthophosphate in each sampling month.

Considering the sampling program during the year 2015, available data is not enough to come to the final conclusion on annual variation of each parameters. Further for demarcating the suitable sites for aquaculture practices, it is imperative to conduct at least one year data collection as the nutrients as well as other important factors which are important for aquaculture practices may vary according to the seasonal variation in the climatic factors.

Therefore, it is recommended to conduct the research in 2016 in order to fulfill the objectives of the research. It has been planned to increase the number of sampling locations in order to increase the coverage of the lagoon as well as to increase the accuracy of the results that will be prepared for selected parameters. Heavy metal concentration in water, sediments and shrimp samples will be assessed in order to understand the levels of heavy metal contamination in the lagoon eco system.Water circulation in the lagoon will be studied in order to understand the physical parameters in the lagoon eco system.

progress : Physical 100% Financial: 113%

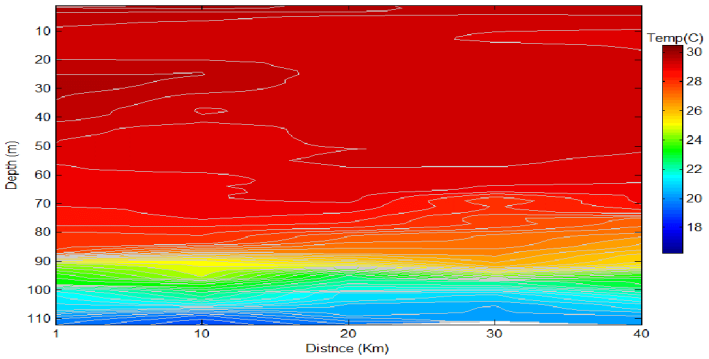
PROJECT NO: 5.2

MONSOONAL IMPACT ON UPWELLING AND PRODUCTIVITY AROUND SRI LANKA

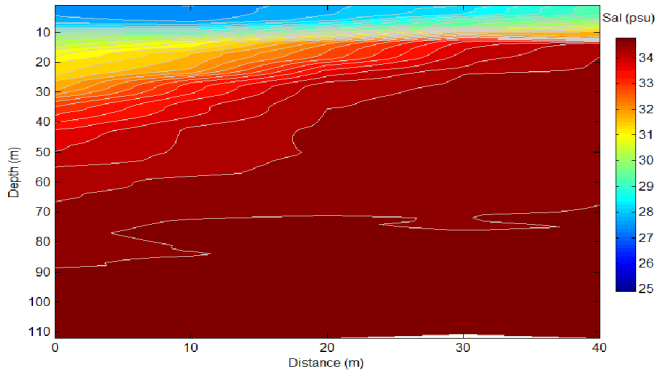
Upwelling process around Sri Lanka is much important to increase ocean productivity and which directly influence on fish production. Though, there is some evidences on upwelling around Sri Lanka scientific knowing of the seasonal cycle of upwelling would be vital for fishery industry to reduce searching time. The proposed study was designed to understand impact of monsoonal dynamics on upwelling around Sri Lanka. Several research cruises were planned during 2015 but it was hindered by unavailability of funding and Samuddrika vessel for the proposed work as scheduled. However, few cruises were conducted during late 2015. The details of the cruises were in the table and some results obtained are discussed below (Table: 1).

No	Date	Cruise	Number of days	Remarks
01	2015 April 29-May 01	Southern transect from Weligama to offshore area: CTD profiling and Drifter deployments were included to the cruise. However, plankton collection and drifter deployment were conducted after breakdown of winch	03	CTD winch was broken during the cruise and stopped the CTD data collection
02	2015 May 04-06	ADCP moorings were done in the south of Sri Lanka Weligama. The purpose of this was to collect time series data in southern Sri Lanka	03	After the ADCP deployment Samuddrika sail to the Trincomalee
03	2015 Oct 07-09	ADCP mooring and fix station CTD profiling were done.	03	Study the possible generation of internal waves in the area
04	2015-Nov.03-05	Recovery of 2 sea glider and deployment of new glider to collect salinity temperature and current data. In the same time data collection from East coast PIEs (Pressure Inverted Echo Sounders) were done	03	Completed successfully
05	2015 Nov. 09-11	Bioluminescence survey was done. The survey included CTD, bathy-photometer data collection and plankton sampling	03	Completed successfully
06	2015 Nov. 18-21	The vessel Samuddrika sail from Trincomalee to Beruwala	03	During the survey ADCP, CTD, bathy-photometer data were collected. Additionally, water sampling were done for plankton analysis
07	2015 Dec. 09-10	Bathy-Photometer and plankton sampling from offshore Beruwala to Weligama and back to Beruwala	02	Day and night sampling were done
08	2015 Dec.17-19	Southern PIE's deployment were done	03	Successfully completed

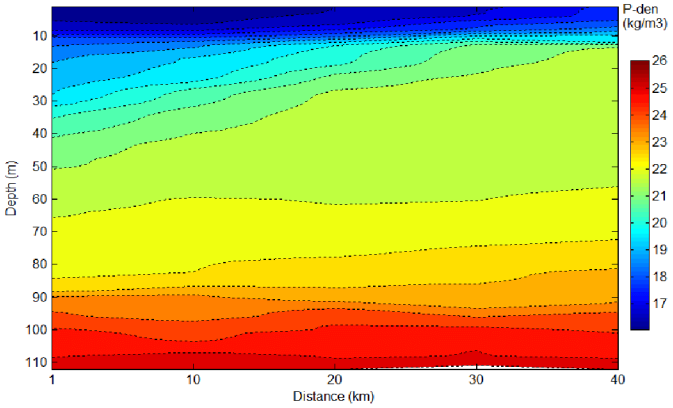
Table: 1. Samuddrika cruises conducted during 2015



(a)



(b)



(c)

Fig.7: The temperature (a) salinity (b) and density (c) profiles along the east transect

The figures 7 (a), (b), and (c) show the temperature salinity and potential density profiles obtained from the CTD measurements. The survey was carried out along the pre-established transect. The results obtained from this survey show that thermocline (a) was found at about 80 m depth. It was difficult to identify the well-defined halocline (b) but pycnocline (c) was clearly noticed at 70m depth.

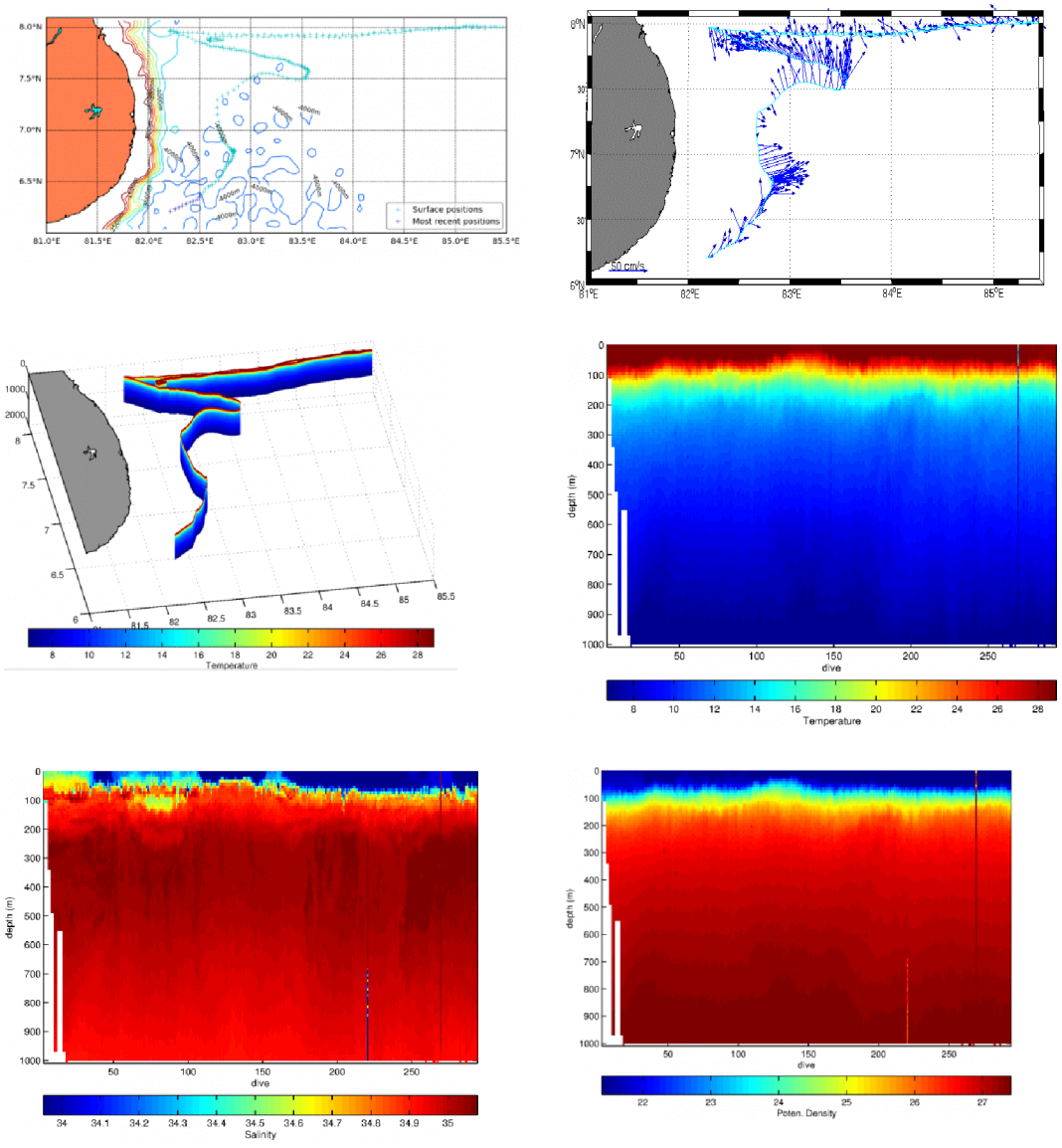


Fig.8: The glider trajectory, current patterns and salinity temperature profiles

The figure 8 shows the results obtained from the data collected by sea gliders. Two sea gliders were deployed on 8N and data collected during 3 months period. The results indicated that the glider trajectory, current patterns, salinity, temperature and density profiles. Current patterns are clearly indicated the boundary currents on the trajectory. In addition, salinity temperature and density profiles show that most of the oceanic processes are concentrated in upper 300 meters depth. Vertical distribution of temperature and chlorophyll profiles needs to be collected during next year for better understanding of upwelling season and area.

progress: Physical 100% Financial: 47%

PROJECT NO: 5.3

INVESTIGATION OF MINERAL SAND RESOURCES IN POTENTIAL COASTAL AND OFFSHORE REGIONS

Sri Lanka, being an island nation possesses comparatively large continental shelf and huge ocean territory, and therefore endowed for many marine based resources yet considerable evaluation has not done on marine based mineral resources. Despite of the Pulmuddai mineral sand deposit and other few sand deposits around Sri Lanka no considerable research done on mineral sand deposits. The project aimed to identify and quantify such mineral sand deposits in Kokilaiarea.

Sixty two (62) sediment samples were collected for analysis as proposed from stretch Mulativu to Trincomalee area. The collected samples were prepared for analysis in NIOMS laboratory. First the samples were cleaned by removal soluble salts. The samples were treated with fresh hydrogen peroxide (30% H_2O_2) for remove organic matter. For some samples which carry excessively secondary carbonates were treated with diluted HCl .Then they again washed with distilled water, dried and removed shell fragments and other unwanted materials.

After, preparation the samples, sieve analysis were done to get 125 µm mesh size fraction heavy mineral analysis. Only few samples were analyse for heavy minerals and need to be completed during 2016. Apart from the Quantitative analysis mineral sand will be done after microscopic analysis.

progress: Physical 100% Financial: 40%

PROJECT NO: 5.4

IMPROVEMENTS OF AN EXISTING TUNA FORECASTING SYSTEM OF NARA INCORPORATING DATA FROM SATELLITES AND IN-SITU OCEAN OBSERVATIONS

Fish forecasts were generated using satellite derived oceanographic status incorporating fishery data collected. The forecast information was disseminated to major fishery harbours by FAX. The information also distributed via email for registered users. Fisheries forecast interval was increased to twice a week (Monday and Thursday) according to fishermen requests. Fish forecast was not issued for six weeks during April and May due to failure of NASA's Tropical Rainfall Measuring Mission (TRMM) satellite and homogenous surface temperature of Indian Ocean. Forecasting model was updated to new satellite data source (Global Precipitation Measurement (GPM) satellite of NASA) and forecasting was continued again.

Questioner survey was started to identify information and services requirement of fishermen and their knowledge about tuna fish forecast of NARA. This survey will be continued to year 2016. Fishery data was not collected in first four months due to unavailability of funds for projects.

Fisheries forecast was disseminated via SSB radio from 23rd of November 2015. This service provides two broadcasts (11.00 AM and 15.00 PM on weekdays) on 6213.5 KHz (channel 37). Fishermen feedbacks received via same radio channel on weekdays. Weather forecast for multiday boats issued by Department of Meteorology of Sri Lanka was also provide to fishermen along with the fisheries forecasts as an additional service by NARA.

A web portal for fisheries information was started and fisheries forecasts were converted to shapefiles which supports web GIS. This web portal will be continued to year 2016.

OUTPUTS OF THE PROJECT

- Improved fishing ground forecasting system by updating data sources and programme
- Updated databases for offshore fishery and oceanographic data
- Web portal for fisheries information browsing

PERFORMANCE INDICATORS

- 49 fish forecasts were issued during year 2015
- Fish forecasting interval was increased to twice a week
- A web portal for fisheries information was initiated
- Radio fish forecasting system was initiated

OUTCOMES OF THE PROJECT

- Increased economic efficiency of offshore fishery sector and reduce the fishing pressure on coastal fishery resources.
- Improved capacity of fisheries related information generation and dissemination

Progress: Physical 100% Financial: 117%

PROJECT NO: 5.5.
OPERATION OCEAN OBSERVATION CENTER

The ocean observation center is functioning after the Indian Ocean Tsunami which was occurred in 2004. The center is running on 24x7 basis and monitoring and gathering real time ocean information data in the Indian Ocean specially around Sri Lanka.

The objectives of the establishment of such center are to develop and implement an observing system for monitoring the real time and near real time ocean status around Sri Lankan waters and the observations are vital during ocean based disasters to minimize impact and provide assistance for mitigating the events. Further, to implement an end-to-end system with the capability to detect, model and ultimately forecast changes in the ocean conditions around Sri Lanka waters.

The center produces updated version ocean information and provides it to coastal communities, maritime professionals and scientific communities to meet their needs. The data and information collected by the center is available in free access data base for intended users to be used. The freely available products can be utilized for scientists, researchers and university students only for scientific studies. However, in the case of commercial use can be done with written permission of Director General of NARA. The currently available products are sea level, sea surface topography, ocean wind, sea surface temperature, salinity and vertical temperature profiles, chlorophyll, wave climate, and deep ocean pressure data. The data are available as ASCII data as well as the map format.

The center collaborates with the Ministry of Fisheries and Aquatic Resources Development (MF&ARD), Disaster Management Centre (DMC), Geological Survey and Mines Bureau (GSMB) and the Department of Meteorology during the ocean based disasters to provide necessary technical support. Further provide guidance for early warning and mitigation of impacts of ocean based disasters. Additionally, center conducts awareness programsto aware the OOC activities specially ocean based disasters for three security forces, red cross, DMC and university students and school children etc. Also, facilitate the opportunities for study visits to security forces, school and University students.

Further, Ocean Observation Center of NARA responsible for maintaining of sea level station and acquisition of data from the stations at Colombo, Trincomalee and Hambatota. The objective is to gather and analyze sea level data around Sri Lanka for research and development applications such as navigational safety, climate and environmental studies and

coastal development planning. The real time sea level data from sea level stations will be transferred to the sea level data base in Ocean observation center of NARA. Weekly tidal status forecasting is disseminated to relevant authorities.

Progress: Physical 100% Financial: 44%

RESEARCH PUBLICATIONSDURING 2015

Full papers

No	Title	Authors	Publisher
01	Bimonthly variability of persistent organochlorines in plastic pellets from four beaches in Mumbai coast, India	***H. B. Jayasiri***, C. S. Purushothaman A. Vennila	Journal of Geophysical Research Ocean
02	Turbulence in the East China Sea: The summertime stratification	IossifLozovatsky Jae-Hak Lee H. J. S. Fernando SokKuh Kang *S. U. P. Jinadasa*	Ocean Dynamics
03	Internal waves in a summer pycnocline of the East China Sea	IossifLozovatsky *PriyanthaJinadasa* Jae-Hak Lee Harindra Joseph Fernando	

Abstracts

01	Diversity, abundance and composition of phytoplankton with special reference to toxic dinoflagellates in Colombo harbor.	H.B Jayasiri W.N.C. Priyadarshanie A.J.M. Gunasekara R.R.M.P.K. Ranathunga
02	Diversity and abundance of macro-benthic organisms at Jaffna Lagoon in relation to sediment quality parameters,	A.M.C.P. Kumara H.B. Jayasiri W.A.A.U. Kumara
03	Variability of zooplankton abundance and biomass in coastal and offshore waters, off southwest coast of Sri Lanka.	W.M.H.P Weerasekara H.B. Jayasiri S.C. Jayamanne.

POST-GRADUATES STUDIES

- Ruchira Jayatilake back to NARA after completion of the M.Sc. studies in the Netherland
- W.N.C. Priyadharshani left (2014-2017) the country to attend Ph.D studies in China

TECHNICAL SERVICES AND CONSULTANCIES

- Port City development project-Water quality and current measurements, 2014-2016
- Air-Sea Interaction in the Northern Indian Ocean (ASIRI) project- Oceanographic parameter studies.

SUPERVISED STUDENTS

- Mr. GayanPathirana, University of Ruhuna; MPhil Research work titled Observed spatial and temporal variability of coastal currents around Sri Lanka
- UdeshikaWimalasiri, University of Sri Jayewardenapura, MPhil research work titled, Preliminary study on planktonic bioluminescence in the marine waters of Sri Lanka
- W.N.D.S Jayarathna, University of Ruhuna, B.Sc final year project titled, Seasonal Variation of Sea Surface Salinity in Northern Indian Ocean.

5.7 INSTITUTE OF POST HARVEST TECHNOLOGY (IPHT)

Head (IPHT): Dr. G. J. Ganegama Arachchi (Principal Scientist)

A team of eight Scientists comprising two Principal Scientists, three Senior Scientists and three Scientist represent IPHT. IPHT has conducted four research projects under Trust area of reduction of post harvest losses and value addition. Other additional projects were conducted using funds separately provided by MFAR, and local industry. In addition, IPHT has provided Testing Services; consultancies; and tailor made training programs and awareness programs for stake holders including fishers, fish processors, fish sellers, school children in Sri Lanka.

PROJECTS FUNDED BY MINISTRY OF FINANCE

PROJECT NO: 3.1
ASSESSMENT OF QUALITY LOSSES OF FISH PRODUCTS AND UPGRADING THE SUPPLY CHAIN OF FISHERY PRODUCTS IN SRI LANKA

Project team: G. J. Ganegama Arachchi, Sujeewa Ariyawansa, B.K.K.K. Jinadasa, K. P, Ginigaddarage, T. Jayasinghe

Quality of fish landed at Mulathive, Jaffna and Mannar areas have been investigated from July to December 2015. Fish unloaded from boats, water used to clean water? (Seawater or water supply from municipal) and ice using in fish handling, fish contact surfaces (swabs) were sampled at selected locations. Microbiological (*Escherichia coli*, *Salmonella*, *Listeria monocytogenes*, Feacal Streptococci) and chemical (Total volatile base contact and histamine content) quality of particular samples were determined.

Mulathive area: Fifteen fish samples (Skip jack, *Sardinella* sps, and mullet) were found not contaminated with pathogenic bacteria. However, ice contained about 11 MPN/100ml of coliforms. Jaffna (Gurunagar) area: Ten Mackeral and five *Sardinella* samples were not contaminated with *Salmonella*. However six samples were contained *E. coli* in the range of 4-15 MPN/g. Ware and ice samples were not acceptable for use as contaminated with *E. coli* and fecal streptococci in the rage of 35-1600 MPN/100ml and 40-90MPN/100 ml, respectively.

Mannar and Thalai-Mannar: In three field visits it was found that fish, ice, water and ice obtained from fish collecting- stalls near one-day boat Anchoring places were contaminated with unacceptable levels of *E. coli* counts and *Salmonella.* These findings suggest urgent need of improving infrastructure at boat anchoring places, collecting centers, supply of potable quality water and ice and dissemination of knowledge of proper fish handling and sanitation.

Assessment of quality of Central fish market in Peliyagoda: Fish samples were collected from 45 stalls officially by Public Health Inspector at Peliyagoda and these samples were analysed for microbiological (Escherichia coli and Salmonella) and chemical (Total volatile base contact and histamine content). Thirteen fish samples out of 45 samples were unacceptable quality based on microbiological and chemical parameters, Legal actions are taken against sellers for selling of spoiled- fish at CFM in order to discourage distribution of low quality fish along fish supply chain.

Survey on handling temperatures of fish at retailing places: Wet fresh fish need to be handled at <4oC in order to reduce rapid deterioration of fish quality.

In Gamapha district and Colombo district, temperature of fish displaying/selling at selected retail outlets were measured using Infrared Thermometer after 4 pm. The fish displayed in chill cabinets in supermarket were found 0-1 ^{o}C. The fish kept without ice under electrical lighting bulbs were recorded fish temperature above 4 -17 ^{o}C while fish kept with ice under electrical lighting bulbs recorded 0-6 ^{o}C.

- Other activities: Preparation of Posters to distinguish the acceptable quality from unacceptable quality of different fish types using images of fish types in market based on sensory characteristics unique for different fish types (finfish, mollusks and crustaceans).

Conclusion

Fish landing sites in Mannar area need upgrading of infrastructure and supply of utilities such as water and ice to reduce fish contamination pathogens bacteria. Sellers of Central Fish Market and other retail places need to be trained on proper fish handling practices.

PROJECT NO: 3.2

EXPLORING AQUATIC RESOURCES FOR NATURAL COMPOUNDS: FROM DISCOVERY TO SUSTAINABLE PRODUCTION AND INDUSTRIAL APPLICATION

Project team: Suseema Ariyaratne P. S. Jayasinghe, G. D.T.M. Jayasinghe, B.K.K.K. Jinadasa, G. J. Ganegama Arachchi

Study I.

Development of a fish base biscuit using Tank cleaner fish (Orinoco Sale Fin Catfish / *Pterygoplichthys multiradiatus)*

The inland fishery industry plays a major role of human nutrition and livelihoods in rural community. Orinoco Sailfin Catfish (OSC) is an invasive alien species (IAS) migrated to inland water bodies and they have been a problematic fish due to their higher growth rate, invasion the native fishes, economic losses to the fishermen and destroying the biodiversity. In this study OSC flour was incorporated to the biscuits recipe and compared with the biscuits made without OSC flour for Proximate, sensory evaluation, nutritional value and shelf life.

According to the sensory evaluation study, there was no significant difference between two types of biscuits under 0.05 level of significance. The moisture, ash, crude protein and total fat contents in fish based biscuit was 02.28±0.06%, 03.69±0.13%, 29.04±0.36% and 13.61±0.26% respectively. Those in non-fish based biscuit were 02.38±0.02%, 03.81±0.01%, 10.71±0.06% and 12.71±0.01% respectively. The protein content of fish based biscuit was considerably higher. The saturated fat (SF), mono unsaturated fat (MUFA) and poly unsaturated fat (PUFA) contents of OSC flour based biscuit were 26.35%, 36.28% and 37.18%. The OSC flour based biscuit contains Eicosapentaenoic acid (EPA) in 0.16% out of total fat.

At shelf life analysis step, moisture content, water activity, free fatty acid value were within safety limits and their variations for a eight week period were not significant. As well as peroxide value was not detected within this period. The aerobic plate count, yeast and mold for a three week period didn't exceed the maximum permissible limit and Presumptive Coliforms were not detected. The cost of 100g of product was 40.48 LKR as more affordable price. The development of a biscuit using OSC flour will be able to solve the problems given by this fish and improve the nutrition and health of consumers.

Study II

Mineral composition of seaweed based products

Seaweed based soups: Seaweed based soups (Carrageenan and agar incorporated vegetable soups) samples developed in NARA were compared with a commercial vegetable soup sample for dietary mineral contents including Ca, Na, Mg and K. Both carrageenan and agar mixed soups contained significantly ($P<0.05$) higher amount of Ca, Na, Mg, and K than market soup sample. The amounts of Ca, Na, Mg, and K contained in Carrageenan based soup were 79018 mg/l, 9786 mg/l,1458 mg/l and 49947 mg/l respectively. Agar containing soup contained 18222 mg/l ,3121mg/l , 5901mg/l and 15397 mg/l of Ca, Na, Mg and K respectively.And also the amounts of Ca, Na, Mg, and K contained in market soup were 3.8 mg/l, 3.8 mg/l, 4.9 mg/l and 5.6 mg/l respectively.

The toxic elements such as Co, Ni, and Cr were not detected at unacceptable levels in the both soup types developed in this experiment. From the above nutritional data, it could be demonstrated that the dried vegetarian soup mixture had reasonable amount of required nutrients particularly macro and micro elements.

Seaweed based Jam:

Dietary mineral contents of different jam types prepared using seaweed agar was assessed. The commercial orange jam had the lowest Na content. The jam developed in this study for compared with commercial jam for mineral nutrients. Jam prepared using Agar and carageenan contained significantly high amount of Ca, Na, K, Mg, I_2 and Mn levels compared to market-jam sample. K content of orange jam incorporated with carrageenan showed to have highest levels 526 mg/L. The agar and carrageenan incorporated orange , mango , wood apple and *Ulva* jam are abundant with K due to availability of considerable amount of K in fruits and seaweeds. *Ulva* jam and agar-agar incorporated mango jam observed closer Na contents (241±24.9,245±26.7mg/l). Market orange jam was reported lower Ca content 6.7± 1.4 mg/l while *Ulva* jam was reported highest Ca level (101.3± 21.9mg/l). The agar incorporated orange jam has highest Mg content and commercial products were in the range of 68±0.67 – 72.21±6.0 mg/L. Iodine was detected significantly higher amount in *Ulva* jam followed by wood apple jamincorporated with carrageenan respectively 240.0±20.5,150± 13.2mg/l. The closer values were reported in agar incorporated wood apple ,orange jam and mango jam such as (135.02±21.8,134±51.6 and125±32mg/l respectively. The carrageenan incorporated jams were found range from 56± 5.9-150

±13.2mg/l. In the study *Ulva* and carrageenan jam were rich source of iodine compared to the others. The commercial market jams indicated very lowest levels of iodine content comparable to other jams. The reason for differences in iodine content was absorption and concentration capacity of iodine in different seaweed varieties. These jams can be extensively used as health food.

Seaweed based bio-fertilizers

The present study, low levels of micro-elements were found in crude extract of seaweed based biofertilizer compared to that of in commercial fertilizer. Seaweed extracts prepared by incorporating *Ulva lactuca, Kappaphycus alvarezii* and *Gracilaria verrucosa* could be used to enhance NPK levels of chemical fertilizers.

Furthur, investigations are needed to find methods to increase the extraction of nutrient element from seaweed solids in to liquid phase.

Study III.

Alginic acid extraction from brown seaweed species (*Sargassum wightii*) and test their acceptability for textile industry

Alginic acid is a polysaccharide which is extracted from brown seaweed species such as *Sargassum* species. Alginic acid is used in many industries including food, pharmaceutical and textile industries. In textile industry, alginic acid is used as a media for dissolved the dyes due to dyeing and printing. Moisture content and the viscosity of the alginic acid is most important parameters consider in the textile industry. Currently total amount of alginic acid that are required by local textile industry is imported to Sri Lanka. This study planned to optimize alginic extraction process utilizing naturally grown *Sargassum wightii* in southern and western cost of Sri Lanka. Sundried Seaweeds were used to precipitate the alginic acid and yield of 12.6% ±1.2, 11.4% ±4.3 was extracted, respectively. Although a significant difference at $P<0.05$ was not observed alginic acid precipitation method was selected because of economic feasibility. Alginic acid precipitating method was further optimized to develop the yield and purity. For that purpose 20 g of seaweed was extracted with 200 ml of Na_2CO_3. Concentration of Na_2CO_3 was changed as 1.5, 2.0, 2.5, 3.0, 5.0 and 7.5% (w/v). As results suggest 2.5% concentration which gave a yield of 15.8% ±0.7 was taken as the optimum concentration. Formaldehyde pretreatment was optimized to develop the colour of the extract. Blank, 0.25% and 1.0% (v/v) were used as treatments and the most desirable colour was observed in 1% formaldehyde treatment.

PROJECT NO: 3.3
SCREENING OF TOXIC CHEMICAL RESIDUES IN SELECTED FISH AND FISHERY PRODUCTS

Project team: B.K.K.K. Jinadasa, G.D.T.M. Jayasinghe

Fisheries and aquatic resources are exceptionally valuable natural assets enjoyed by millions of Sri Lankans. Appreciation of fisheries and aquatic systems has been accompanied by increasing concern about the effects of growing human populations and human activity on aquatic life and food quality. Pesticides are one group of toxic compounds linked to human use that have a profound effect on aquatic life and water quality. The objective of this project is to optimize the laboratory method to NARA to determine the Organo-chlorine pesticides residues (OCPR) and understanding the present residues accumulation situation in aquatic food. According to the project plan, during the year 2015 following task completed. Within 2016, plan to collection sample and prepare the basic data base regarding the OCPR in aquatic food.

- Establishment to ECD detector in GC
- Optimize the method for determination of OCPR
- Validation of the OCPR analysis

Conclusion: Facilities required for analysis of Organo-chlorine pesticides residues (OCPR) in samples, have been developed and field samples will be analysed in 2016.

PROJECT NO: 3.4
ASSESSMENT THE SAFETY OF OYSTERS AND CLAMS AVAILABLE IN KALPITIYA AREA

Project team: Sujeewa Ariyawansa, Pavithra Ginigaddarage, G.N Achini Subashi, C.B Madagedara

Oysters were collected from harvesting areas (Gangewadiya and Kandakuliya), cleaned in situ to remove mud on shell surface was collected in to cleaned gunny bags. Water was collected into sterile polypropylene bottles transported in ice and analysed in NARA laboratories. Oysters were depurated in sterile sea water (UV treated) with circulation for 18-24 hours before the analysis.

Oysters and water samples were analyzed for microbiological parameters including pathogenic bacteria namely total coliforms, faecal colifoms, *E.coli*, *Faecal streptococci*, *Vibrio cholerae*, *Vibrio parahaemolyticus* and *Salmonella* spp.

Water from Gangewadiya and Kandakuliya were often contaminated with high densities of Coliforms, Faecal coliforms, *E.coli* and *Faecal streptococci.* In 1 occasion water samples and oysters collected from Gangewadiya were contaminated with Salmonella spp. In 3 occasions oysters collected from Kandakuliya were found to be positive for Salmonella spp. All water samples and oyster samples tested from Gangewadiya and Kandakuliya were free from *Vibrio parahaemolyticus* and *Vibrio cholerae.* Care should be taken to depurate oysters harvest from these areas efficiently before consumption. .

Conclusion: Oyster samples and water collected from Gangewadiya and Kandakuliya sites were contaminated with high counts of E.coli and Faecal streptococci. Oysters from both sites were not contaminated with pathogenic bacteria.

PROJECTS FUNDED BY MFAR AND INDUSTRY

EXTRACTION AND CHARACTERIZATION OF COLLAGEN FROM SRI LANKAN FISH WASTE

- **Source of funding-** John Keels Holdings PLC , Sri Lanka
- **Project team:** Sujeewa Ariyawansa, Suseema Ariyaratne,

Methodology and results

Fish wastes such as skin, scales, bones and fins are major by-products in the fishery and aquaculture industries which have high collagen content. The collagen of skin, bones and fins of yellowfin tuna (Thunnus albacarces), tank cleaner fish (Pterygoplichthys multiradiatus) and Pothubari (Sufflamemn fraenatus) were seperated (Nagai & Suzuki, 2000) and characterized. Acid soluble collagen (ASC) and pepsin soluble collagen (PSC) (Hwang et al., 2007) was extracted from yellowfin tuna fish skin, bones and fins. The yields of skin, bones and fin collagens are 21%, 0.89% and 1.22%, respectively. SDS-PAGE pattern (Weber & Osborn, 1969) showed that ASC and PSC of fish skin, bones and fins are all type I collagen, which are composed α1, α2 and β chains. The molecular weight of fish skin/fin α1, α2 and β chains are 132kDa, 120kDa, and 220kDa, whereas the molecular weight of fish bones α1, α2 and β chains are 139kDa, 124kDa and 229kDa respectively. Fourier transform infrared (FTIR) spectroscopy proved that ASC and PSC are integrated and native. The results suggest

that collagen of fish waste such as skin, bones and fins have the potential to be used as an alternative source of collagen for various applications.

TESTING SERVICES OF IPHT

Quality Control Laboratory (Microbiological and Chemical units) of IPHT which has obtained accreditation status for several analysis parameters as per ISO/IEC 17025: 2005 Standards. Testing Services of this laboratory have been obtained by industry, especially, for fish exporting companies; Ministries, academic institutes and other stake holders. Total of 936 samples were analyzed for microbiological (753), chemical (73) quality. Relevant to these samples, 270 of test reports were issued by IPHT and total testing fees were LKR 2,596,075.00. Total of 2220 canned fish tins were also analysed sensory/physical characteristics while earning Rs. 1,166,000 as testing fees. Forty percent (40%) of total revenue will be remitted as royalty for NARA.

EXTENSION PROGRAMS OF IPHT

Creation awareness about quality, proper handling and nutrition of fish and fishery

Source of funds: Ministry of Fisheries and Aquatic Resources

Thirteen workshops/awareness programs were conducted for multiday fishers, fish sellers in Central Fish Market Peliyagoda, Public Health Inspectors, General food catering operators and school children in Food selling in Colombo, Gampaha and Hambantota Districts from November to December in 2015.

MAIN SERVICES TO OTHER LEARNED INSTITUTES

IPHT has provided facilities to undergo industrial-trainings and conduct research projects of 28 University students for 3- 6 months periods

PARTICIPATION AT WORKSHOPS/TRAININGS (OVERSEAS):

- Seminar on Value -added Fishery Development and Market System Construction for Developing Countries from 15th July to 4th August 2015(21 days), Freshwater Fisheries Resarch Center Chinses Academy of Fishery Sciences, Wuxi, China – Two personnel (Sussema Ariyarathna, Senior Scientist and Ruchitha Perera, Research Assistant) participated at this workshop from IPHT

- Bivalve safety management, International centre for advanced Mediterranean agronomic studies (CIHEAM) & Mediterranean Agronomic Institute of Zaragoza (IAMZ), University of Santiago de Compostela, Spain (2015) -- Kolitha Jinadasa, Senior Scientist

- Total diet studies- French Agency for Food, Environmental and Occupational Health & Safety (ANSES), Paris, France (2015) -- Kolitha Jinadasa, Senior Scientist
- National symposium: NARA Scientific Sessions in Post Harvest Technology

PUBLICATIONS

- A.S. Mahaliyana, B.K.K.K. Jinadasa, N.P.P. Liyanage, G.D.T.M. Jayasinghe, S.C. Jayamanne (2015). Nutritional Composition of Skipjack Tuna (*Katsuwonus pelamis*) Caught from the Oceanic Waters around Sri Lanka. *American Journal of Food and Nutrition.* 3 (4): 106-111. doi: 10.12691/ajfn-3-4-3. http://pubs.sciepub.com/ajfn/3/4/3/index.html

- B.K.K.K. Jinadasa, A.S. Mahalaiayana, N.P.P. Liyanage and G.D.T.M. Jayasinghe (2015). Trace metals in the muscle tissues of skipjack tuna (*Katsuwonus pelamis*) in Sri Lanka. Cogent Food and Agriculture (Taylor & Francis). http://dx.doi.org/10.1080/23311932.2015.1038975

- Abeywickrama D. E. S., Ginigaddarage P., Cyril H. W., Hettiarachchi K. S., and G. J. G. Arachchi (2015). Effect of lactic acid on total aerobic bacteria and total feacal coliform bacteria of chilled whole reef fish *(Epinephelus malabaricus).* Proceedings of Scientific Sessions "Aquatic Research for Blue Economic Development", National Aquatic Resources Research and Development Agency (NARA): 09th June, 2015, NARA Auditorium, Colombo, Sri Lanka.

- B.K.K.K. Jinadasa, C.K. Galhena and N.P.P. Liyanage (2015). Histamine formation and the freshness of yellowfin tuna (*Thunnus albacares*) stored at different temperatures. Cogent Food and Agriculture (Taylor & Francis). 1 (1): 1-10. DOI: 10.1080/23311932.2015.1028735

- B.K.K.K. Jinadasa, G.D.T.M. Jayasinghe, E.M.R.K.B. Edirisinghe and I. Wickramasinghe (2015). Mercury concentration of muscle tissue and relationship with size of yellowfin tuna, *Thunnus albacares*, of the Indian Ocean.*European Journal of Academic Essays* : 2(4): 35-40.http://euroessays.org/wp-content/uploads/2015/06/EJAE-376.pdf

- B.K.K.K. Jinadasa, H.K.S. De Zoysa, G.D.T.M. Jayasinghe & E.M.R.K.B. Edirisinghe (2016). Determination of the biometrical parameters, biochemical composition and essential trace metals of edible sea urchin (*Stomopneustes variolaris*) in Sri Lanka. Cogent Food and Agriculture (Taylor & Francis) http://www.cogentoa.tandfonline.com/doi/abs/10.1080/23311932.2016.1143343

- N.D. Hettige, K. A. W. S. Weerasekara,S. A. M. Azmy and B. K. K. K. Jinadasa (2015). Bioaccumulation of trace metals in *Cyprinus carpio* (Common Carp) from Bomuruella reservoir, Nuwara-Eliya. *Journal of* environmental professionals Sri Lanka: 4:1, 64-71

- P.S. Jayasinghe1, V. Pahalawattaarachchi1, K.K.D. S. Ranaweera(2015). Formulation of Seaweed Based Jam as a Sources of Nutrition. Proceedings of Annual Scientific session in National Aquatic Resource Research and Development Agency, pp-130-136

5.8 SOCIO-ECONOMIC AND MARKETING RESEARCH DIVISION (SED)

Head of the Division: Mr.K.H.M.L.Amaralal

The main functions of the division include social economic and marketing studies in the fishing industry, including the welfare of the fishermen and their dependents, analysis of fish marketing system and its impact on consumers.

RESEARCH PROJECTS CONDUCTED IN THE YEAR 2015

- Socio-economic and marketing aspects of lagoon fisheries in Sri Lanka- Puttalam Lagoon
- Women participation in Fisheries and alinged industries in Sri Lanka –Clombo, Kaluthara and Gampaha
- The Fisheries Information Centre (FIC) of NARA

Activities

- Under the above mentioned i and ii projects following activities were carried out by the research team of the division.
  - Data collection
  - Data analysis
  - Report writing/annual publications
- Under the fisheries information center or project iii, provided all the information which were inquired by the fisheries stakeholders and general public via the telephone.

Programme	Project	Allocation(Rs)	Responsible Officer	Duration
Socio economic & Marketing	1. Socio-economic and Marketing aspects of lagoon fisheries in Sri Lanka (1.10)	1,000,000.00	KHML Amaralal MMAS Maheepala D.W.L.U de Silva K.P.G.L.Sadaruwan	One year
	2. Women participation in fisheries and aligned industries in Sri Lanka (4.1)	1,000,000.00	KHML Amaralal H.D. Wimalasena	One year
	3. The Fisheries Information Centre (FIC) of NARA (6.4)	1,000,000.00	K.H.M.L. Amaralal	Continuing

Table 1, Detail of the projects

PROJECT NO: 1.10

SOCIO-ECONOMIC AND MARKETING ASPECTS OF LAGOON FISHERIES IN SRI LANKA

The study was conducted in puttlum lagoon as a result of lack of reliable information on social and economic importance and the marketing system of the lagoon fishery. Puttlum lagoon is economically and ecologically rich lagoon in the country and significant amount of fishers are engaging in fishing activities in the lagoon using different craft and fishing gears.

The study mainly based on primary data which was collected using the structured questioners. The data was collected from six fishery inspector divisions such as Palakudawa, Kalpitiya-Land, Kalpitiya-Island, Kandakuliya,Puttalam and Wanathawilluwa. 160 fishers and 35 fish traders were subjected to interview during the period.

It was revealed that OFRP,MTRB and NTRB are the main type of fishing craft use in the lagoon and there are different type of gears used by the fishers. The main types of gears are Shrimp net (use in different sizes according to the depth), Crabs net, Small meshed gill nets, Medium meshed gill nets, Shark net (specially used for "Moda"/ Sea bass), bottom set net, trawl net. In addition to the fishing nets bottom line is dominant as line fishery in the lagoon.

Around four family members are living in the fishing family and the monthly fishing income of the family is around Rs:30,000.00. Considering the education of the fishers, more than 95% of fishers are below the level of ordinary level of schooling.

High price of the fishing gears, Practice of the illegal nets, Low support from the government, Inaccessibility of credit are the major issues of the lagoon fishers. Trap nets (Kudu nets) Push nets, Sangili nets were mentioned as more harmful fishing techniques for the lagoon. It is stated that transparent government intervention for the lagoon is really important for the sustainable utilization of the lagoon resources.

Since fishers borrow money from the fish collectors (Wadiya/merchant) to purchase fishing gears, and day to day consumption, many fishers in the lagoon bond with the fish collectors. Therefore the fish collectors have permanent fish suppliers (fishers). Some fish collectors specially based on the Palakudawa FI division have rented fishing crafts to the fishers. As a result fishers have to sell their harvest for the collectors under low prices. Profit margins of the fish collectors differs according to the verity of the fish. According to the collectors average profit margin for 1kg of fish is Rs 20. However, the large profits (50-100) gain from the exportable verities and high valued species such as mud crabs, shrimp, sea bass.

PROJECT NO : 4.1
WOMEN PARTICIPATION IN SRI LANKAN WITH SPECIAL REFERENCE TO KALUTHARA, GAMPAHA AND COLOMBO DISTRICTS.

There are lots of research have been carried out related to the fishermen. But we have very little knowledge regarding fisherwomen and their role in the fisheries sector. Ignorance of the role of women in the fisheries is to discount their potential to strengthen the sector. Hence carrying the research related to the fisher women is very important. The resulting knowledge would be helped formulate effective interventions to promote the participation of women in fishing industry of Sri Lanka.

These studies try to compressively explore the role of fisher women by understanding demographic characters of fisherwomen and their role in day to day household affairs, decision making, and fisheries related activities and women empowerment. As well this report is revealed the issues related to women life and recommend the policy to remove or mitigate the obstacle of life of women for development of whole fishing community.

The study was carried on the women participation in Sri Lankan Fisheries in the Kaluthara, Gampaha and Colombo districts from January to October 2015, with the aim of identifying the role of women in the fisheries family and their contribution to fishing industry. The data of Kaluthara, Gampaha and Colombo districts were analyzed by using SPSS software. The result of these two districts is given here.

Average income for Gampaha, Kaluthara and Colombo are Rs. 43,687.50, Rs 47,222.872/= and Rs. 49,014/= per month in fishing season but the fishermen unable to practice fishing in at least one month of every year. Monthly average expenditure per house hold is Rs. 36,808.38, in Gampaha, Rs 34995.27 in Kaluthara and Rs. 43252.82 in Colombo over 65% 0f the sample belongs to Rs. 15,000-Rs 45,000 expenditure range. There are huge income fluctuation can be seen among fishermen. If fishermen have excess income after settling debts and loans they try to save money for next zero income periods. Fishermen do not maintain a huge balance in their account in long term because they withdraw money to survive in non-fishing season. Cheettu is an informal community level short term finance collection. Group of neighboring fisherwomen participate for a Cheettu collection. The money taken from Cheettu utilize to purchase fishing gears, craft and consumer durable products such as furniture, electric equipment. The gold jewelries are not just an ornament for ladies in fishing community it is an asset for them to hold wealth.

Although, the nature and degree to which women practice financial management of the household varies across household and type of relationship. It is in her interest to maintain good relationships with family and friends, shopkeepers, money lenders and banks and community organizations not only for social but also for financial reasons. For those women who have income of their own, through informal income earning activities or a formal job, there is more independency in decision making.

Even though women do not participate directly for fish catching 39% of fisherwomen provide side support to their husband for net cleaning, net repairing, net lording and fish sorting activities. 28% of women in overall sample engage with homemade dry fish processing. Fish selling is famous among the women of Gampaha district (Negambo area) 28% of them sell fish but it is not popular among the women of Kaluthara and Colombo and it recorded less than 1%

68% of women in the samples have no occupation but 92% perceived that these days' women should do a job to support for family income and 98% women of the sample are willing to engage with self-employing activities but them unable to start due to resource scarcity.

All the hours of a day can be sorted in to two categories as effectively working hours and nonworking hours. Time taken for house hold activities, supporting for husband, caring children and participating for social activities are accounted to working hours. The time spend for taking meals, sleeping, leisure time and time taken for religious activities are calculated for non-working hours. Typical fisherwomen dedicate 12 hours and 30 minutes for effective house hold works and they spent 11 hours and 30 as non-working hours.

PROJECT NO : 6.4
THE FISHERIES INFORMATION CENTRE (FIC) OF NARA

Socio-economic division maintains the fisheries information center to provide necessary information for any stakeholder of Sri Lankan fisheries industry and general public. Since the inception until end of the year 2015, a total number of 304 queries were received through the hot line 07 10 10 10 10 of fisheries information Centre from different respondents. All the queries are categorized in to five groups. Numbers of queries and the percentages under each information criteria are given bellow table.

Information criterion	Number of calls received	Percentage
Academic and Research Related Services	105	35%
Consumer and Industry related Services	94	31%
General Complains and Comments	56	18%
Fisherman Welfare and Disasters Related Services	29	10%
Trade and Investment Related Services	20	7%
Total	304	100%

All queries received were successfully solved out with the assistant of NARA scientists, officials of Ministry of fisheries and department of fisheries, Officials of NAQDA and other relevant officers from private and government sectors.

One Helper and one Research Assistant was recruited to the Fisheries Information Centre on Contract basis.

To promote the information center among stakeholder of fisheries sector more than 10 banners were displayed in the fisheries harbors and 1000 of leaflets were distributed in harbors, landing site, fisheries inspectors' offices, and other government and non-government office premises which are located all-around the costal line of Sri Lanka.

PUBLICATIONS

Reports

- Women participation in Fisheries in Western province of Sri lanka
- Socio-economic impacts assessment of proposed sand extraction for Colombo port city development project on fishing communities (Phase II)
- Fisheries outlook 2014 published on the website of NARA

Abstract Publications

- H.D.wimalasena, Maheepala M.M.A.S. and Amaralal K.H.M.L. (2015). **An Analysis of Profitability of Freshwater Ornamental fish Growing in Cement Tanks and Mud Ponds**. In proceedings of the NARA Scientific Sessions, 09th June, 2015, Colombo, Sri Lanka.

- M.M.A.S. Maheepala, Amaralal K.H.M.L. and Wimalasena, H.D. (2015). **Gracilaria Collection, Processing, Marketing and Consumption in Sri Lanka**. In proceedings of the NARA Scientific Sessions, 09th June, 2015, Colombo, Sri Lanka.

- De Silva D.W.L.U, Sandaruwan K.P.G.L. and Amaralal K.H.M.L. (2015) **A Study of Fish Protein Consumption of Up Country Estate Sector of Sri Lanka.** . 21st Annual Scientific Sessions of the Sri Lanka Association for Fisheries and Aquatic Resources (SLAFAR), 2015 May 22, Colombo, Sri Lanka; 26 pp.

Journal Publications

- H.D.Wimalasena, Maheepala M.M.A.S, Amaralal K.H.M.L. (2015). **The impacts of fuel price increase on marine fishing operations in Sri Lanka**. In: Journal of the National Aquatic Resources Research & Development Agency, Vol. 44, NARA, Colombo, Sri Lanka.

TRAININGS

Local

- H.D.Wimalasena participated in a workshop on "Training on effective proposal writing", on 6th November, 2015, conducted by the National Science Foundation, Colombo, Sri Lanka
- Amaralal K.H.M.L. participated in a workshop on "Ecosystem approach for fisheries management" in October, 2015 at Katunayaka Sri Lanka, conducted by IMFS and BOBLEM
- M.M.A.S. Maheepala participated in a short term training course on " GIS and its application" in 6th -11th of June 2015 conducted by University of Peradeniya, Sri Lanka
- D.W.L.U. De Silva participated in a short term training course on "Application of "R" software for data analysis" on 10th November, conducted by postgraduate institute of Peradeniya university, Sri Lanka.
- K,P.G.L. Sandaruwan participated in a short course on " Computer base data analysis in December of 2015 conducted by Jayawardhanapura University of Sri Lanka.

OTHER DEVELOPMENTS

One Development Officer and one Office Assistant were recruited to the Division

5.9 MONITORING AND EVALUATION DIVISION

Head of the Division: Mr. A.B.A.K. Gunaratne (Director M & E)

The Monitoring and Evaluation division is responsible for project planning, monitoring and evaluation. It performs the duties of ensuring effective monitoring, evaluation and coordination of the research programmes. Preparation of the action plan, monthly progress monitoring of the each activity, compilation of annual report are the main responsibilities of the division. Information Technology unit, Library and Information unit and Extension unit are placed under the Monitoring and Evaluation division.

INFORMATION TECHNOLOGY UNIT

The mission of the Information Technology Division is to provide the highest quality technology-based services, and support to the organization for its strategic goals and objectives as it applies to research activities and provide effective technology support for audio/visual, multimedia, desktop and web based applications and services.

Information Technology Division conducts research using Geography Information system (GIS) and Remote Sensing (RS) for resources planning and identify suitable areas for aquaculture development and forecasting. GIS technologies applies in the diverse fields and committed to delivering high-quality spatial and attribute data to the internal researches as to allow better decisions to be made based on the best available information. Information Technology Division acts as a store room of spatial data of marine and terrestrial areas. Division is intended to facilitate as a platform to pool all data/information available in respect to aquatic resources, environment and users and develop products for environmental friendly economic development and scientifically based management of aquatic resources/environment.

The Division is responsible to provide all aspects of IT and systems implementation for information gathering, processing, sharing and dissemination among all stakeholders for management, conservation and development of aquatic resources. It provides expertise in computing hardware and software support as well as LAN (Local Area Network) and WAN (Wide Area Network) connectivity to the staff and administrative support of computer networks. And also ITD maintains IT contracts and software licenses, and coordinates the procurement of IT related hardware and software.

ACTIVITIES UNDERTAKEN

Programme	Project	Allocation (Rs)	Officer Responsible	Period	
				From	To
Open access to knowledge and dissemination of information	6.1 Internet services and online information system	2,600,000.00	A.B.A.K. Gunaratne	2015	
	6.2 A quantitative assessment of sensitive coastal habitat in Puttalam Lagoon -GIS and Remote Sensing approach	300,000.00	A.B.A.K. Gunaratne D.D.D.Weragodatenna	2015	
	6.3 Development of a coastal spatial database	100,000.00	A.B.A.K. Gunaratne D.D.D.Weragodatenna	2015	

Performance

PROJECT NO: 6.1

INTERNET SERVICES AND ONLINE INFORMATION SYSTEM

Main objective of the project is to disseminate the information via World Wide Web and to provide other Internet services for scientific staff of NARA and its stakeholder with a view of facilitating information sharing.

Web site and Mail servers were upgraded during the period. Staff engaged with PC assembling, repairing and upgrading, 65 computers were repaired, 5 computers assembled and 2 were upgraded. Software, network and configuration issues resolved day to day. Web page updating was carried out and new web pages were created, total number of web pages updated count was 50 pages and 65 pages were created for the new design. Inform Database that used to evaluate research cost of the institutions engaged in CARP network, was submitted to CARP.

Expected target was achieved during the period.

Progress (%) : Physical : 100 Financial: 100

PROJECT NO: 6.2

A QUANTITATIVE ASSESSMENT OF SENSITIVE COASTAL HABITAT IN PUTTALAM LAGOON - GIS AND REMOTE SENSING APPROACH

The main objective of this study was to assess the sensitive coastal habitat including mangrove and seagrass quantitatively in and around the Puttalam Lagoon. The remote sensing technology was utilized to achieve the goal.

Mangroves as a unique ecosystem provide wide range of benefits and services to the environment and people. Interconnectivity between mangroves, sea grass and coral reef is key habitats to highly diverse coastal ecosystem. Extensive mangrove coverage around Puttalam Lagoon located in North Western coast of Sri Lanka is significant to the fish production in the lagoon. Expansion of shrimp aquaculture in 80'sdecade caused to decline the vast extent of mangrove coverage in the area.

Spatial and temporal changes of mangrove coverage during a 38 years period from 1977 to 2015 were investigated by the study. Landsat data acquired at different years of 1977, 1988, 2000, 2005, 2010 and 2015were employed for the analysis. Remotely sensed data were processed through main four steps as image pre-processing, image classification, change detection and projection of changes.

The analysis of the mangrove extent shows that the mangrove coverage had been declined by 62% during past 38 years in the area. Aquaculture development particularly shrimp culture was the major cause for the reduction of mangrove cover. Totally, 1371 hectares of mangrove area had been deforested to establish shrimp ponds during the period of 1988-2000. It is significant that there were 417 hectares of abandoned shrimp ponds in year 2000 due to a virulent spread of white spot and yellow head viral diseases began in 1996. The results signify that expansion of salt industry has been escalated by 280% during the period of 2000-2015. Totally 65 % of the abandoned shrimp ponds were converted into saltpan in this period. The map of Spatial distribution of mangrove Active / Abandoned Shrimp Farm and saltpan during the period of 1977-2015 is given below.

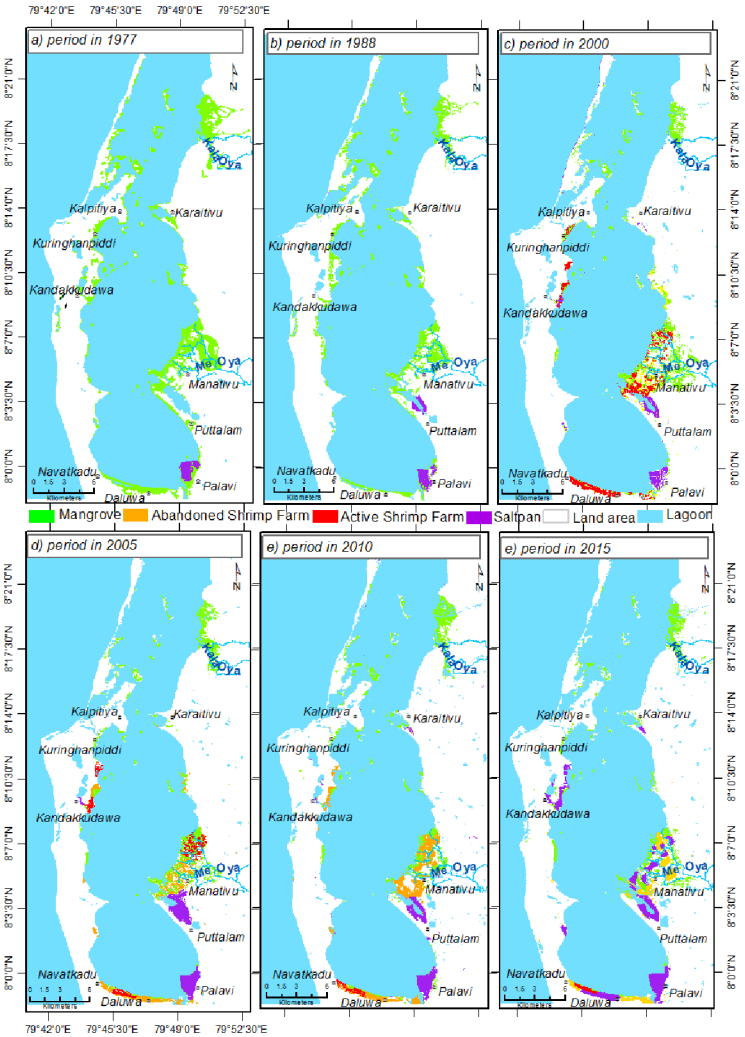


Figure 4: Spatial distribution of mangrove Active / Abandoned Shrimp Farm and saltpan during the period of 1977-2015.Projected result of mangrove changes by MARKOVE analysis shows that mangrove coverage is further to be declined by approximately 314 hectares (7%) by 2020. Deforestation of mangrove would continue due to the expansion of salt industry and population growth. Therefore, more effective land use planning is rather important at this milieu to conserve mangrove ecosystem while expanding the local industries in a sustainable manner.

Progress (%) : Physical : 100 Financial: 100

PROJECT NO : 6.2
DEVELOPMENT OF A COASTAL SPATIAL DATABASE

Main objective of this project is to gather spatial data of the research studies carried out by NARA and store data in one location. Many advantages can be gained if there is a spatial data base through easy access, avoid repetition of data creating and security of the data.

Progress (%) : Physical : 80% Financial: 100%

CONSULTANCY PROJECT

Project Name: Assessment of the physical, biological and socio-economic environment in the Sand exploration site, Supplementary Environmental Impact assessment, Colombo port city development project.

Total value of the consultancy : Rs 3,563,950.00

Duration : Sep – Dec 2015

Study team;

Dr. K. Arulanathen, Principle Scientist, NIOMS

Dr. Rekha Maldeniya, Principle Scientist, MBRD

Mr. S.U.P Jinadasa, Principle Scientist, NIOMS

Dr. H.B.Jayasiri, Principle Scientist, NIOMS

Mr. A.B.A.K Gunaratne, Director, M&E

Mr. K.H.M.L. Amaralal, Principle Scientist, SED

Mr. H.D. Wimalasena, Senior Scientist, SED

Ms. D.D.D Weragodatenna, Scientist, M&E

Mr. M.M.A.S. Maheepala, Scientist, SED

Mr. A. Harishchandra, Scientist, NIOMS

Mr. N. Suriyaarchchi, Scientist, NIOMS

PUBLICATIONS

Extended Abstract

- M.Naveenan, A.B.A.K. Gunaratne, D.D.D. Weragodatenna, R.M.C.W.M. Rathnayake and S.C. Jayamanne, Remote Sensing and GIS approach in assessment and conservation

of seagrass beds in the coastal stretch, Gulf of Mannar, 2015, proceeding of Journal of National Aquatic Resources Research and Development Agency, Scientific Sessions

- R.M.H.N.K Nisansala, A.B.A.K. Gunaratne, D.D.D. Weragodatenna, R.M.C.W.M. Rathnayake and S.C. Jayamanne, Assessment of the impact of aquaculture practices in the Puttalam lagoon on the mangrove ecosystem by using remote sensing and GIS technology, 2015, proceeding of Journal of National Aquatic Resources Research and Development Agency, Scientific Sessions

FULL PAPERS

Following papers are accepted to publish;

- D.D.D. Weragodatenna* and A.B.A.K.Gunaratne, Change detection of mangrove coverage in Puttalam Lagoon of Sri Lanka using satellite remote sensing techniques, Journal of National Aquatic Resources Research and Development Agency, Vol 44.
- D.D.D. Weragodatenna* and A.B.A.K. Gunaratne, Detection of aquatic habitats by Geo-Eye satellite images at the Palk Strait, Sri Lanka, *Asian Journal of Geoinformatics* The Official Journal of the Asian Association on Remote Sensing (AARS)

REPORTS

- Assessment of the physical, biological and socio-economic environment in the sand exploration site, Supplementary Environmental Impact assessment, Colombo port city development project. Report Submitted to Urban Development Authority, Ministry of Megapolis and Western province Development on October 2015

TRAININGS/ WORKSHOPS ATTENDED

- D.D.D. Weragodatenna, Workshop on "Ensuring Accountability in Disaster Risk Management and Reconstruction", JAIC Hilton, Union Place, Sri Lanka - 8th Dec.2015
- D.D.D. Weragodatenna, Workshop on "Writing High Impact Research Article" , National Science Foundation, Colombo 7, Sri Lanka - 9th and 10th July 2015
- D.D.D. Weragodatenna, Certificate course on Digital Image processing, IIRS, Deheradun, India - 5 Jan – 28 Feb. 2015

Library and Information

Overview

NARA Library is a Special Library acting as an information & reference centre holding a special collection of Fisheries and Aquatic Resources related information in physical and electronic media. The division ensures the information needs of the scientists and scholars strengthening the resource and also sharing relevant and current knowledge to achieve the mission and goals of the NARA and also to the sector. The Online Public Access Catalogues (OPAC) was updated. The collection were strengthened by purchase of resources, donations, exchanges and downloads from the web and freely available e-resources using subject gateways. NARA Library is serving effectively and competently in the world of rapid evolution of information.

Activities undertaken

Project	Activities	Allocation	Officer Responsible	Period (from-to)
1. Collection Development of Library Resources	1.1 Procurement of books and Journals 1.2 Collecting Research Reports and Papers 1.3 Obtaining of library resource donation 1.4 E-downloads	2.00	BGS Kariyawasam RS Liyanarachchi BGS Kariyawasam -do- BGS Kariyawasam RS Liyanarachchi	Jan- Dec Jan-Dec
2. Collection Management of the library	2.1 Editing and updating library catalogues 2.2 Subject Classification & filing of library resources 2.3 Compilation of e-repository collection		BGS Kariyawasam Menaka Karunaratne BGS Kariyawasam Menaka Karunaratne	Jan– Dec
3. Information Retrieval	3.1 Current Awareness Services (CAS) 3.2 Selective Dissemination of Information Service (SDI) 3.3 Indexing Services 3.4 Exchange Service 3.5 Literature Survey 3.6 Compilation of digital collection		BGS Kariyawasam RS Liyanarachchi BGS Kariyawasam BGS Kariyawasam RS Liyanarachchi	Monthly Jan- Dec

4. Publishing Journal & Publicity Service	4.1Assisting for Publishing NARA journal vol. 4.2 Distribution of NARA publication 4.3 Distribution of NARA Scientific Abstract 4.4 Sale & free distribution of NARA Publications		BGS Kariyawasam BGS Kariyawasam RS Liyanarachchi Menaka Karunaratne	Jan- Dec

PERFORMANCE

PROJECT NO: 6.7

ACQUISITION OF LIBRARY RESOURCES

Strengthened the Library resources by purchasing, donations, exchanges and electronic downloads according to the requests of the scientists of NARA. Also, collected information relevant to NARA.

Purchases:

5 Journals were requested for the year 2015, out of them only 02 were subscribed & 02 were renewed.

Subscribed Journal Titles:

1. AOAC International journal: Food additives toxicology Part A & B
2. Journal of Molluscan Studies .

Renewed Journal Titles:

1. National Geography
2. Asian Fisheries Science (Online)

Book Titles – 205 Nos. Purchased, 187 Nos. Donations, 24 Nos.Online Databases - 01 No. (AGORA)

DONATIONS & EXCHANGE :

Received 150 nos. (24 Books, 65 Reports, 26 Newsletters, 27 Travel Reports, 08 CD-ROM).

Progress (100%) Physical (100%) Financial (0.60%)

PROJECT NO: 1.2

RESOURCE MANAGEMENT

The resource acquired, were catalogued and classified manually and also entered to the electronic catalogue and accessible not only to the NARA but also to the public. Other indexes (electronic) were also updated regularly.

Library resource referral service was accessible to the scholars using Open Public Access Catalogue (OPAC). Journal Article Index (JAI) database was updated.

INFORMATION RETRIEVAL

In order to retrieve from Journal articles, Postgraduate theses, Research reports, Research articles and Newspaper clippings databases were updated electronically and were compiled indexes using WINISIS & Alice software. Summary of data entered for the year as given below.

Name of the Database	Quantity of Data
Journal Article Index (JAI)	**49** (Total 5092)
Thesis Database	Total 74
Research Reports Index	Total 194
Research Article Index	17 (Total 881)
Newspaper Article Index	168 (Total 1346)

1.3.1 Collected information for literature surveys for the following titles – Aquatic Resources, Coral Reefs, Fish feeds, Sea cucumber and Indigenous knowledge. Replied for the information requests made by users over the phone and also via email.

1.3.2 Electronic Article database was started using DSPACE software.

1.3.3 Library has provided services for the Scientists, Researchers, Postgraduates and Undergraduates who arrived from different institutions and universities. The Number of users visited was 167nos.

1.3.4 Document Delivery Service - Library has joined for the British Council Membership programme and Cooperate membership Service with ITI library and served to the NARA staff.

1.3.5 Library has provided photocopy services - the total amount received through photo-copying during the year was Rs. 2441/= and 1049 Pages for free of charge.

Progress (100%) Physical (100%) Financial (0.25-%)

COLLECTION MANAGEMENT

1.4.1 As a preservation method, the Ministry of Fisheries Administration Reports and The Bulletin of Fisheries Research Stations were scanned and added to the e-repository collection, 3119 pages were edited.

Progress: Physical (75%) Financial (-%)

PUBLICATION AND PUBLICITY SERVICE

1.5.1 NARA journal Vol. 42 & 43 were published & distributed among Universities and other research institutes on exchange basis.

1.5.2 Sale of NARA publication were done by the library & the total amount received was Rs. 48,934.00/= and distributed 390 items free of charge.

TRAINING PROGRAMMES, WORKSHOPS & COMMITTEE MEETINGS ATTENDED :

LOCAL

- International Conference on Library and Information Sciences (ICLIS) 2015 organized by the National Library of Sri Lanka.

International

- 18th International Conference on Electronic Theses and Dissertations, New Delhi, India

Progress (75%) Physical (75%) Financial (.50-%)

EXTENSION UNIT

OBJECTIVES OF THE EXTENSION SERVICE ARE,

- Transfer the useful technology experiences and knowledge obtained by the researchers to fishermen and other stakeholder.
- Awareness – Building program
- as in a broader context are designed to educate stakeholders and to create an interest and awareness among the general public.
- To provide fishermen with the latest research result and fishery technique for their Socio-economic betterment.
- To conduct public awareness programme to enhance efficient fishing, suitable fishing method and sustainable management of ocean and aquatic resources.

PROJECT NO: 6.2
EXTENSION SERVICES

The unit carried out public awareness programs, providing auditorium facilitates, printing services for printing Posters, Leaflet report, forms etc.14 Requests had been received from various institutions to take part their exhibitions. However, only 06 exhibitions could be attended due to financial constraints.13 Educational visits (schools, navy & government institution) consisting more than 1300 students & officers were noted during the year.

EDUCATION VISIT

No	Institution	No of participhents	Date
01	Naval & Maritime Academy - Trincomalee	19	26th January 2015
02	Hatares kotuwa primary school – Galoya Junction	45	26th March 2015
03	Kirawanagama Navodya Maha Vidyalaya - Haldummulla	79	27th March 2015
04	Ocean university – tangalle Branch	10	27th March 2015
05	New Lyceum Collage - Nawalapitiya	31	05th June 2015
06	Lakdasa De mel Vidyalaya - Kurunegala	315	18th June 2015
07	Darmapala Maha vidyalaya - Bandarawela	186	03rd July 2015
08	Bandara KoswatteMaha Vidyalaya – Bandara Koswatte	59	06th July 2015
09	Sri Lanka NAVY - Talatuoya	31	20th July 2015
10	Sri Lanka NAVY Headquarters - Colombo	20	23rd – 24th July 2015
11	Nikawewa Dewanampiyatissa Central Collage Moragollagama	140	29th July 2015
12	Wellassa Central Collage	60	29th July 2015

	- Bibila		
13	Naval & Maritime Academy Trincomale – Intake officer cadets	30	08th September 2015
14	University of Jafna – Faculty of Agriculture	69	11th September 2015
15	Naval & Maritime Academy Trincomale	29	19th October 2015

EXHIBITIONS

	Exhibition / School	Place	Period
1	Marians Dreams Fiesta	Jaela	May 07th to 11th , 2015
2	Aqualife 2015	Polpitigama	September 13th to 17 , 2015
3	Elizabeth Moir School	Colombo 05	Octorber 24th ,2015
4	Darmapala vidyalaya pannipitiya	Pannipitiya	October 01st to 05th ,2015
5	AKVA 2015 - Univercity of Kelaniya	Kelaniya	November 10th to 13th , 2015
6	Galu samaya 2015	Galle	December 24th – 31st , 2015

MEDIA WORK

1. T Derana – 'BIZ NEWS' – 06 Programme.
2. Derana TV 24 Hours – 'THE ATHER SIDE – 01 Programme , about samuddrka.
3. S.L.B.C ,Swadeshiya sevaya – 'VIDULOWA' -06 Programme.
4. SAYURA FM – 02 Programme.
5. S.L.B.C 'Deewara nawodaya' , Sent to Scientific Information in every month.
6. NARA Scientific Session Media work and organize the session .
7. NARA Scientific News article were published in 'Divaina, Dinamina, Lankadeepa, Ade, Dally News,Tinakkural National Papers and Electronic Media .

OTHER ACTIVITIES

1. Supported to Auditorium Facilities & Printing leaflets for the NARA Scientific session 2015.
2. Auditorium facilities for Conducting NARA Workshops ,Other institute and Education Tours.

Progress (%) Financial : 100 Physical : 90

6. ANCILLARY SERVICES

6.1 PURCHASING & SUPPLY UNIT

Head of Division: Mr.M.D.Senarathna / Director Finance (Actg)

Introduction

The premier function of the division is to provide all necessary services and supplies in a formal and systematic manner in accordance with procurement guide lines in order to carry out research & development activities of divisions of National Aquatic Resources Research & Development Agency and Regional Research Centers.

Overview of the Division

Purchasing & Supply Division was established with effect from 23/05/2007.The functions and responsibilities of the unit are as follows.

- Supply goods and services relevant to the all divisions
- Handle all tender works
- Procurement works relevant to all divisions
- All insurance matters
- Prepared by payment voucher
- Air freight and clearance of goods
- Auction work relevant to disposal items
- Provide details to all divisions on their requirement

Performance

A. According proper tender procedures Mainly purchase of ongoing projects,

- Purchase of Lab Equipment & Chemical Items
- Vehicle Occupation
- Purchase of Security services & Cleaning services
- Purchase of all Shipping Spare parts
- Purchase of all vehicle Parts
- Purchase of all technical equipment & Accessories
- Purchase of Stationery ,Furniture & other goods

The selection of supplies is use of supplier registration 2015 & rainbow –pages. Calling of tenders, quotations from local and foreign supplies for goods /equipments /Chemicals following tender procedures as per the given specifications .Purchase of goods for day to day use by utilizing a petty cash imp rest and maintain records.

FOR THE YEAR 2015, THE DIVISION HAS MAINTAINED ABOUT 111 TENDERS FOLLOWING THE TENDER PROCEDURES.

- Clearance of goods received as donations, purchase of goods from foreign sources or airfreight of goods for repairs. Take actions where necessary to obtain tax relief when clearance of goods received from foreign sources are done & sending equipments for repair etc: abroad subject to normal mail & airfreight charges.

- Insure all vehicles /motor- cycles/equipment of NARA through proper tender procdures.obtain insurance coverage for the personal who perform duty at sea and land.

- Arrange for Tender Elevation Committee & Tender Board Meeting

- Distribution of goods ordered by this Division to respective divisions after updating in the Main stores .Computerizing for all purchasing details & submit report to respective divisions when requested are also performed by this Division.

- To provide a smooth service to the NARA, the staff of the unit has been responsibility.

6.2 SERVICE AND OPERATION DIVISION

Head of the Division: Mr. A J G S Dahanayake

Overview of the Year

Service & Operation Division (S & O) is a supportive division of the institution. S & O division provides and maintains all the services and develops the infra-structure facilities in line with work programs of the institution.

Activities

Service & Operation Division have several activities. They are categorized as follows.

- Rehabilitation of NARA main building & other regional centres.
- Installation and maintenance of air conditioners & electric/electronic appliances
- Installation and maintenance of electrical distribution system.
- Repair & maintenance of vehicles.

For the year 2015, in addition to the day to day maintenance, below mentioned work has been completed.

01. Rehabilitation of NARA main building & other regional centres.

1. Renovation of PCR lab
2. Repairing roof of IPHT
3. IPHT lab extension construction
4. IPHT lab extension 2
5. IARAD Tissue culture lab partitioning
6. IARAD Research Assistant room portioning
7. IARAD Wet lab partitioning and tiling
8. Completion of observation building construction
9. Renovation of generator room
10. Renovation of JSU office
11. Tiling and partitioning work at Administration building
12. Partitioning at Socio economic division
13. Renovation work at NHO division
14. Floor tiling at Monitoring and evaluation division
15. Floor tiling at Purchasing and supply division
16. Repairing of fence at NARA entrance
17. Renovation work at DG's office

In Addition to the above completed jobs following construction works partially completed.

1. Renovation of MBRD lab.
2. Floor tiling and partitioning at Service and operation division
3. Pond renovation work at Panapitiya

02: Installation and maintenance of air conditioners & electric/electronic appliances

1. Completion of installation of equipment, electrical works nad plumbing works of sepuration plant at Kalpitiya.
2. Repair and installation of main pump at main building
3. Installation of the pump at main supply and installation of auto electricity control system.
4. Supply of telephone facilities to quarantine building
5. Wiring for internet facilities for Administration division and Environmental Studies Division(ESD).
6. Wiring for internet facilities for DDG's office.
7. Repairing and reinstallation of the water pump at Kalpitiya Centre.
8. Supply of telephone facilities to Dr. Sujeewa/ IPHT
9. Repairing of Fish cutting machine and Ice making machine at IPHT.
10. Repairing of water pumps at Panapitiya Centre.
11. Maintaining service agreements for all necessary office equipment/ Air conditioners/ lab equipment/ refrigerators/ PABX system of NARA.

03**. Installation and maintenance of electrical distribution system.**

1. Wiring and fixing all accessories and street lighting at Panapitiya Centre.
2. Lighting work at Tsunami Warning Centre, Beruwala.
3. Three phase supply for NARA canteen.
4. Wiring and installation of electrical accessories at hatchery sea horse breeding building and hatchery aquatic plants building.
5. Three phase electricity supply for the blower at IARAD
6. Wiring at PCR lab.
7. Wiring and doing all other related works at DDG's office.
8. Rewiring of three phase supply at IARAD.
9. Rewiring and installation of safety accessories at IARAD Fish Feed production Room.
10. Rewiring of irregular wiring system of main building.
11. Three phase supply for water distiller at QC lab.

04: **Rehabilitation of Vehicles (08 nos.)**

There are 31 vehicles & 17 Motor cycles in NARA fleet and 08 of them fleet taken for rehabilitation during the year. The vehicles under rehabilitation were.

Reg.No. - 32-7028
32-7196
32-3417
61-6251
PA-5935
GY-0027
PB-8107
PB-7365

Addition to above Rs.8,184,454.00 spent for services, running repairs, license and insurance of the fleet during the year. Out of 31 vehicles 04 vehicles disposed due aged and uneconomical for further use. 27 vehicles & 17 Motor cycles effectively utilized for the running of 504,740.00 km during the year.

Cost for the Year Rs

For NARA Fleet

1) Rehabilitation of vehicles (From Capital Budget)	Rs. 3,760,806.73
2) Running repairs, Services cost Insurance & License fee (From recurrent Budget)	Rs. 8,184,454.00
3) Vehicle Hiring charges	-
4) Fuel Cost	Rs. 4,462,263.00
5) Total operated (km)	504740

* Exclude Drivers salary, Overtime and Bata and maintenance staff cost

NATIONAL AQUATIC RESOURCES RESEARCH AND DEVELOPMENT AGENCY

STATEMENT OF FINANCIAL POSITION AS AT 31 ST DECEMBER 2015

		31.12.2015	31.12.2014
ASSETS	**Notes**	**Rs.**	**Rs.**
CURRENT ASSETS			Restated
CASH AND CASH EQUIVALENTS	1	29,775,785	5,814,897
TRADE AND OTHER RECEIVABLES	2	12,847,028	12,652,243
INVENTORIES	3	2,001,440	2,750,186
PREPAYMENTS	4	3,238,153	2,455,241
		47,862,405	**23,672,567**
NON-CURRENT ASSETS			
RECEIVABLES- DISTRESS LOAN	5	9,096,725	4,188,996
INFRUSTRUCTURE, PLANT AND EQUIPMENT	6	433,023,190	448,005,544
LAND AND BUILDINGS	6	3,538,898,497	3,541,163,611
CAPITAL WORK IN PROGRESS	7	2,902,938	21,508,558
		3,983,921,350	**4,014,866,709**
TOTAL ASSETS		**4,031,783,755**	**4,038,539,277**
LIABILITIES			
CURRENT LIABILITIES			
ACCOUNTS PAYABLES	8	25,543,213	13,516,282
ACCRUED EXPENSES	9	42,417,535	61,237,046
		67,960,749	**74,753,328**
NON-CURRENT LIABILITIES			
PROVISION FOR GRATUITY	10	110,425,709	90,768,450
		110,425,709	**90,768,450**
TOTAL LIABILITIES		**178,386,458**	**165,521,778**
NET ASSET		**3,853,397,298**	**3,873,017,499**
ACCUMULATED FUNDS	11	455,656,063	455,079,644
RESERVES	12	3,397,741,235	3,417,937,855
TOTAL EQUITY AND LIABILITIES		**3,853,397,298**	**3,873,017,499**

THE SIGNIFICANT ACCOUNTING POLICIES AND NOTES ANNEXED FORM AN INTEGRAL PART OF THESE FINANCIAL STATEMENTS.

M.D.Premarathne
HEAD/FINANCE

APPROVED AND SIGNED ON BEHALF OF THE BOARD.

Dr.Anil Premarathne	**B.C.W.Iddamalgoda**
CHAIRMAN	**DIRECTOR GENERAL**
COLOMBO, 30th April, 2016	

NATIONAL AQUATIC RESOURCES RESEARCH AND DEVELOPMENT AGENCY			
PERFORMANCE STATEMENT FOR THE YEAR ENDED 31 ST DECEMBER 2015			
		2015	2014
REVENUE	**NOTE**	**Rs.**	**Rs.**
			Restated
GOVERNMENT GRANT	**13**	336,904,529	266,607,003
OTHER INCOME	**14**	11,198,538	16,060,763
AMORTIZATION OF LOCL & FOREIGN GRNT	**15**	98,330,247	89,212,183
TOTAL REVENUE		**446,433,313**	**371,879,949**
EXPENSES			
PERSONNEL EMOLUMENTS	**16**	258,391,005	185,815,229
TRAVELLING & SUBSISTENCE	**17**	286,282	1,532,513
SUPPLIES & CONSUMABLES USED	**18**	1,526,352	2,317,669
MAINTENANCE EXPENDITURE	**19**	13,475,171	13,425,107
CONTRACTUAL SERVICES	**20**	27,664,831	29,071,219
RESEARCH & DEVELOPMENT EXPENDITURE	**21**	63,321,729	70,635,702
DEPRECIATION & AMORTIZATION EXPENSES	**22**	98,330,247	89,212,183
OTHER OPERATING EXPENSES	**23**	3,918,153	8,710,809
REVALUATION DIFICIT		-	46,097,693
TOTAL EXPENSES		**466,913,768**	**446,818,124**
SURPLUS (DEFICIT) FOR THE YEAR		**(20,480,455)**	**(74,938,175)**
THE SIGNIFICANT ACCOUNTING POLICIES AND NOTES ANNEXED FORM AN INTEGRAL PART OF THESE FINANCIAL STATEMENTS.			

NATIONAL AQUATIC RESOURCES RESEARCH AND DEVELOPMENT AGENCY		
CONSOLIDATED CASH FLOW STATEMENT FOR THE YEAR ENDED 31 ST DECEMBER 2015		
	31.12.2015	31.12.2014
	Rs.	Rs.
		Restated
CASH FLOWS FROM OPERATING ACTIVITIES		
SURPLUS (DEFICIT) FROM ORDINARY ACTIVITIES	(20,480,455)	(74,938,175)
ADJUSTMENT FOR:		
DEPRECIATION ON PROPERTY, PLANT AND EQUIPMENT	98,330,247	89,212,183
AMORTIZATION OF DEFERRED EXPENDITURE	(98,330,247)	(89,212,183)
PROVISION FOR RETIRING GRATUITY	23,446,337	16,445,908
PROFIT ON DISPOSAL OF VEHICLES	(1,226,780)	38,500
REVALUATION DIFICIT	-	46,097,693
OPERATING PROFIT/ (LOSS) BEFORE WORKING CAPITAL CHANGES	**1,739,101**	**(12,356,074)**
WORKING CAPITAL CHANGES		
(INCREASE)/DECREASE IN INVENTORIES	748,746	(970,044)
(INCREASE)/DECREASE IN TRADE & OTHER RECEIVABLE	(194,785)	9,290,965
(INCREASE)/DECREASE IN PREPAYMENTS	(782,913)	(43,596)
INCREASE/(DECREASE) IN ACCOUNTS PAYABLES	12,026,931	(3,336,337)
INCREASE/(DECREASE) IN ACCRUED EXPENSES	(18,819,511)	13,797,385
CASH GENERATED FROM/(USED IN) OPERATIONS	**(5,282,429)**	**6,382,300**
RETIRING GRATUITY PAID	**(3,789,078)**	(3,176,494)
NET CASH GENERATED FROM / (USED IN) OPERATING ACTIVITIES	**(9,071,507)**	**3,205,806**
CASH FLOWS FROM INVESTING ACTIVITIES		
PURCHASE OF PROPERTY PLANT AND EQUIPMENT	(42,467,828)	(36,810,010)
INVESTMENT IN DISTRESS LOAN	(4,907,729)	
CAPITAL WORK IN PROGRESS	-	(5,199,182)
PROCEED FROM SALE OF VEHICLES	3,729,680	38,500
		-
NET CASH GENERATED FROM/ (USED IN) INVESTING ACTIVITIES	**(43,645,877)**	**(41,970,692)**
CASH FLOWS FROM FINANCING ACTIVITIES		
CAPITAL GRANTS RECEIVED	76,678,271	29,364,298
NET CASH GENERATED FROM/ (USED IN) FINANCING ACTIVITIES	**76,678,271**	**29,364,298**
NET INCREASE / (DECREASE) IN CASH AND CASH EQUIVALENTS		
DURING THE YEAR	23,960,888	(9,400,588)
CASH AND CASH EQUIVALENTS AT THE BEGINNING OF THE YEAR	5,814,897	15,215,485
CASH AND CASH EQUIVALENTS AT THE END OF THE YEAR	**29,775,785**	**5,814,897**
ANALYSIS OF CASH & CASH EQUIVALENTS AT THE END OF THE YEAR		
CASH AT BANK	29,775,785	5,814,897
	29,775,785	**5,814,897**
THE SIGNIFICANT ACCOUNTING POLICIES AND NOTES ANNEXED FORM AN INTEGRAL PART OF THESE FINANCIAL STATEMENTS.		

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கணக்காய்வாளர் தலைமை அதிபதி திணைக்களம்
AUDITOR GENERAL'S DEPARTMENT

මගේ අංකය / எனது இல. / My No. } එෆ්එල්එස්/ඒ/නාරා/1/15/15 ඔබේ අංකය / உமது இல. / Your No: } දිනය / திகதி / Date } 2017 ජනවාරි 23 දින

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ජාතික ජලජ සම්පත් පර්යේෂණ හා සංවර්ධන නියෝජිතායතනය

ජාතික ජලජ සම්පත් පර්යේෂණ හා සංවර්ධන නියෝජිතායතනයේ 2015 දෙසැම්බර් 31 දිනෙන් අවසන් වර්ෂය සඳහා වූ මූල්‍ය ප්‍රකාශන පිළිබඳව 1971 අංක 38 දරන මුදල් පනතේ 14(2)(සී) වගන්තිය ප්‍රකාර විගණකාධිපති වාර්තාව

මාගේ සමාංක හා 2016 නොවැම්බර් 30 දිනැති ලිපියට යොමුවේ.

02. ඉහත සඳහන් ලිපිය සමඟ එවන ලද මාගේ වාර්තාවේ ඉංග්‍රීසි අනුවාදය මේ සමඟ එවා ඇත.

ඒ.එම්.ඩී.නයනකාන්ත

අතිරේක විගණකාධිපති

විගණකාධිපති වෙනුවට.

පිටපත් : 1. ලේකම් - ධීවර හා ජලජ සම්පත් සංවර්ධන අමාත්‍යාංශය

2. ලේකම් - මුදල් අමාත්‍යාංශය

අංක 306/72, පොල්දූව පාර, බත්තරමුල්ල, ශ්‍රී ලංකාව. - இல. 306/72, பொல்துவ வீதி, பத்தரமுல்லை, இலங்கை. - No. 306/72, Polduwa Road, Battaramulla, Sri Lanka
+94-11-2887028-34 +94-11-2887223 oaggov@sltnet.lk www.auditorgeneral.gov.lk

විගණකාධිපති දෙපාර්තමේන්තුව
கணக்காய்வாளர் தலைமை அதிபதி திணைக்களம்
AUDITOR GENERAL'S DEPARTMENT

මගේ අංකය / எனது இல. / My No. FLS/A/NARA/1/15/15 | ඔබේ අංකය / உமது இல. / Your No. | දිනය / திகதி / Date 30 November 2016

The Chairman

National Aquatic Resources Research and Development Agency

Report of the Auditor General on the Financial Statements of the National Aquatic Resources Research and Development Agency for the year ended 31 December 2015 in terms of Section 14(2) (c) of the Finance Act, No.38 of 1971

The audit of financial statements of the National Aquatic Resources Research and Development Agency for the year ended 31 December 2015 comprising the statement of financial position as at 31 December 2015 and the statement of financial performance, statement of changes in equity and cash flow statement for the year then ended and a summary of significant accounting policies and other explanatory information, was carried out under my direction in pursuance of provisions in Article 154(1) of the Constitution of the Democratic Socialist Republic of Sri Lanka read in conjunction with Section 13(1) of the Finance Act, No.38 of 1971 and Section 32(3) of the National Aquatic Resources Research Development Authority of Sri Lanka Act, No. 54 of 1981 amended by the Act, No. 32 of 1996. My comments and observations which I consider should be published with the Annual Report of the Agency in terms of Section 14(2) (c) of the Finance Act appear in this report. A detailed report in terms of Section 13(7)(a) of the Finance Act will be issued to the Chairman of the Agency in due course.

1.2 Management's Responsibility for the Financial Statements

The Management is responsible for the preparation and fair presentation of these financial statements in accordance with Sri Lanka Public Sector Accounting Standards and for such internal control as the management determines is necessary to enable the preparation of financial statements that are free from material misstatements, whether due to fraud or error.

අංක 306/72, පොල්දූව පාර, බත්තරමුල්ල, ශ්‍රී ලංකාව. - இல. 306/72, பொல்துவ வீதி, பத்தரமுல்லை, இலங்கை. - No. 306/72, Polduwa Road, Battaramulla, Sri Lanka
+94-11-2887028-34 +94-11-2887223 oaggov@sltnet.lk www.auditorgeneral.gov.lk

1.3 Auditor's Responsibility

My responsibility is to express an opinion on these financial statements based on my audit. I conducted my audit in accordance with Sri Lanka Auditing Standards consistent with International Auditing Standards of Supreme Audit Institutions (ISSAI 1000-1810). Those Standards require that I comply with ethical requirements and plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatements.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgement, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the Agency's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Agency's internal control. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of accounting estimates made by management, as well as evaluating the overall presentation of financial statements. Sub-sections (3) and (4) of Section 13 of the Finance Act, No.38 of 1971, give discretionary powers to the Auditor General to determine the scope and extent of the audit.

I believe that the audit evidence I have obtained is sufficient and appropriate to provide a basis for my audit opinion.

1.4 Basis for Qualified Opinion

My opinion is qualified based on the matters described in paragraph 2.2 of this report.

2. Financial Statements

2.1 Qualified Opinion

In my opinion, except for the effects of the matters described in paragraph 2.2 of this report, the financial statements give a true and fair view of the financial position of the National Aquatic Resources Research and Development Agency as at 31 December 2015 and its financial performance and cash flows for the year then ended in accordance with Sri Lanka Public Sector Accounting Standards.

2.2 Comments on Financial Statements

2.2.1 Sri Lanka Public Sector Accounting Standard - 07

The following observations are made.

(a) Even though the useful life of assets should be reviewed in the revaluation of assets, their useful life had not been valued in the revaluation of assets in the year 2014.

(b) Even though the depreciation of fixed assets should begin when it is available for use in terms of the Standard, the Agency had followed the policy of making provisions for depreciation for the entire year in which the asset is disposed of, without making provisions for the year in which it had been purchased.

2.2.2 Accounting Deficiencies

The following observations are made.

(a) In the adjustment of amortization relating to assets purchased using Capital grants received in the preceding years, amortization of Rs.111,606,435 relevant to domestic and foreign grants adjusted already in the financial statements had been adjusted again.

(b) Even though the Fisheries Trade Complex and the Tsunami Centre at Beruwala had become suitable for use since March 2014, provisions for depreciation had not been made since that date. As such, depreciation for the years 2014 and 2015 had been understated by Rs.1,193,373 and Rs.1,591,165 respectively.

(c) Even though the Kadolkale Research Centre revalued at Rs.14,220,234 transferred to the Agency under a 99 year lease agreement had been revalued again for a sum of Rs.198,000,000 in the preceding year, relevant adjustments thereon had not been made in the financial statements.

(d) Overprovisions for depreciation amounting to Rs.225,778 had been made in the year under review due to computation of provisions for depreciation without specifically identifying the class of the asset.

2.3 Accounts Receivable and Payable

The following observations are made.

(a) Even though the advance of Rs.272,160 paid for an external institution for a computer software system not in compliance with the requirements of the Agency, had elapsed for 05 years, action had not been taken to recover same.

(b) Steps had not been taken to recover a sum of Rs.1,612,898 receivable from an external institution for preparing a feasible study report on the development of 06 fishery harbours.

2.4 Non-compliance with Laws, Rules, Regulations and Management Decisions

Non-compliances with the following laws, rules, regulations etc. were observed.

Reference to Laws, Rules, Regulations and Management Decisions	Non-compliance
(a) Treasury Circular No.842 of 19 December 1978 and Treasury Circular No. IAI/2002/02 of 28 November 2002.	The Register of Fixed Assets and the Register relating to Computer and Software had not been maintained in an updated manner.
(b) Public Enterprises Circular No. PED/95 of 14 June 1994	A sum of Rs.456,533 had been paid as allowances for the Divisional Heads for 19 officers of the top management of the Agency in the year under review without obtaining the approval of the Treasury.
(c) Public Finance Circular No.434 of 31 December 2008	The assessment services required for state corporations depending on financial aid of the General Treasury should be obtained from the Government Valuer without making a payment. Nevertheless, a sum of Rs.775,000 had been paid by the Agency in the year under review to a private party for obtaining assessment services.

2.5 Transactions not supported by Adequate Authority

Despite having informed by the Transport Officer that the repairs of the motor vehicle had not been carried out satisfactorily, a sum of Rs.501,619 had been paid in the year under review to a private institution for repairs of the motor vehicle.

3. Financial Review

3.1 Financial Results

According to the financial statements presented, the financial result of the Agency for the year under review had been a deficit of Rs.20,480,455 as compared with the corresponding deficit of Rs.74,938,175 for the preceding year, thus indicating a decrease in the deficit by Rs.54,457,720 in the year under review as compared with the preceding year. Even though the staff remuneration had increased by Rs.72,575,776 in the year under review, the increase in Government grants by Rs.70,297,526 and the decrease in revaluation loss by Rs.46,097,693 had mainly attributed to this decrease.

In the analysis of financial results for the year under review and 04 preceding years, the deficit had increased continuously from the year 2011 to the year 2013. However, a decrease in the deficit was observed in the years 2014 and 2015. In considering the depreciation for non-current assets and employees' remuneration, the contribution of the Agency which had been Rs.152,754,450 in the year 2011 had decreased to Rs.123,494,212 in the year 2012. Nevertheless, the contribution had improved gradually during the period from the year 2013 up to the year 2015 and it had been Rs.336,240,797 in 2015.

4. Operating Review

4.1 Performance

The objectives and functions of the Agency in terms of the National Aquatic Resources Research Development Agency Act, No.54 of 1981 are ;

- Ensure the application and utilization of scientific and technological expertise for the implementation of the national development programme on the subject of aquatic resources.

- Promote and conduct research activities directed towards the identification, assessment, management, conservation and development of aquatic resources; Provide advisory and consultancy services on technological and legal matters relating to aquatic resources; Co-ordinate the affairs of institutions engaged in those activities; Collection, dissemination, publication and taking over of data useful; Provide the training required and exercise, discharge and perform all the powers, functions and duties conferred or imposed on the Agency.

According to the Performance Report for the year under review, the following observations are made in respect of fulfilment of activities of the Agency.

(a) (i) Out of the provisions of Rs.1,000,000 made for the Project of Identification of Biological Matters and valuation in respect of persistence of fish in the areas of Mannar and Nilaweli, a sum of Rs.884,292 had been spent thereon. However, designing a map in respect of the ecosystem and presentation of proposals on the biodiversity which are the main activities of that project had not been fulfilled.

(ii) Even though a sum of Rs.600,000 had been allocated for the Project of Identification of Breeding Centres for Sea Turtles and their dispersal in the Kalpitiya Area, only the collection of data had been done by spending a sum of Rs.250,131. No activities whatsoever such as the management of the dispersal of turtles scientifically, establishment of breeding centres for turtles and giving publicity so as to attract tourists in an environmental friendly manner, had been fulfilled and the implementation of the project had been discontinued halfway. However, it had been notified that 96 per cent of the physical progress of the Progress Review Reports had been completed.

(b) In the examination of the Action Plan and the Progress Reports relating to the year under review, the physical progress of the implementation of main programmes and 05 projects ranged from 70 per cent to 85 per cent and as such, it was observed that the targets had not been achieved up to the maximum level.

(c) The percentage of the self-generated income of the Agency which had been 09 per cent in the year 2011 had decreased up to 02 per cent by the year under review. The Management had not taken adequate action to increase the self-generated income.

4.2 Management Activities

Action had not been taken even by July 2016 to transfer the ownership of the lands to the Agency, valued at Rs.53,400,900 shown under the non-current assets.

4.3 Operating Activities

The "Tharanee" vessel constructed by spending Rs.15,685,632 in the year 2012 for the research activities of the coastal zone had not been used for the relevant purpose up to now. Even though directives had been given at the Committee on Public Enterprises held on 12 November 2014 that action should be taken to sell the relevant ship, it had not been sold even by 04 August 2016. Further, a cost of Rs.7,663,375 had to be incurred from the date on which this vessel had been constructed up to the end of the year under review for salaries, overtime and security purposes of the officers who were engaged in the activities of the vessel.

4.4 Transactions of Contentious Nature

The following observations are made.

(a) The fish stall constructed by spending Rs.15,245,000 contrary to the objectives of the Agency, had remained idle without using for any purpose since 21 March 2014. Further, action had not been taken to properly vest the land relevant to these constructions in the Agency.

(b) Even though a sum of Rs.4,493,052 had been spent in the year 2011 for the purchase of two engines for production of 02 boats, a sum of Rs.2,902,938 by the

end of the year under review for production activities, those production activities had been ceased halfway.

4.5 Idle and Underutilized Assets

The following observations are made.

(a) The Tandoori Burner valued at Rs.120,000, the Plate Washing Machine valued at Rs.352,800 and the Alluminium Ladder valued at Rs.100,000 purchased without identifying the requirement had remained idle without using from the year 2011 up to 31 August 2016, the date of audit.

(b) A computer software purchased for Rs.76,800 in April 2014 had not been made use of up to April 2015, the date of audit.

4.6 Identified Losses

A computer valued at Rs.52,000 in which a computer software purchased for Rs.411,000 in the year 2009 had been installed, had been misplaced in the year 2012 and the Management had not taken action to recover the relevant loss from the responsible parties.

4.7 Commencement of Projects on Lands not Properly Vested

Constructions had been carried out by spending Rs.552,906 in the year under review without vesting the ownership of a land located at Panapitiya area belonging to the National Aquatic Resources Research and Development Agency.

4.8 Resources of the Agency Given to other Public Institutions

The Agency had released four officers to the Line Ministry and other Government Institutions and paid a sum of Rs.1,142,846 as allowances in the year under review

4.9 Staff Administration

The following observations are made.

(a) Out of 132 vacancies of the Agency as at 31 December of the year under review, existence of 96 vacancies relating to research activities had affected the implementation of research activities considerably which was the main function of the Agency. Nevertheless, action had not been taken to fill those vacancies.

(b) Duties of the post of Director (Human Resources) had been covered by an acting officer since November 2014 and action had not been taken to appoint a permanent officer for that post.

(c) Two officers had been placed on a high salary scale contrary to the approved salary scale and as such, a sum of Rs.1,741,540 had been over paid from the year 2009 to the year 2015.

5. Accountability and Good Governance

5.1 Presentation of Financial Statements

Even though the financial statements should be presented to audit within 60 days after closure of the financial year in terms of Section 6.5.1 of the Public Enterprises Circular, No. PED/12 dated 02 June 2003, the Agency had presented financial statements for the year under review to audit after a delay of 119 days that is, on 28 June 2016. Further, the Draft Annual Report which should be presented along with the financial statements had not been presented to the Auditor General.

5.2 Internal Audit

The Management of the Agency had not taken proper action on recommendations submitted by the Internal Audit Unit in respect of the minimization of the cost of the vessel per hour, constructed for research and survey activities and the loss of Rs.2,204,727 due to accident occurred on 08 December 2013.

5.3 Budgetary Control

Variances ranging from 26 per cent to 76 per cent were observed between the budgeted and the actual income and expenditure, thus indicating that the budget had not been made use of as an effective instrument of management control.

6. Systems and Controls

Deficiencies in systems and controls observed during the course of audit were brought to the notice of the Chairman of the Agency from time to time. Special attention is needed in respect of the existence of main functions in the process of preparation of salaries under the control of the same officer and non-comparison of information of the Accounts Division timely with the information of the Human Resources Division.

H. M. Gamini Wijesinghe
Auditor General

NARA/Audit Query/2015 17/04/2017

The Auditor General
Auditor General's Department
No 306/72
Polduwa Road
Battaramulla

Steps taken by the Management of National Aquatic Resources Research and Development Agency on the Audit Report as per Section 14(2)(C) of the Monetary Act No: 38 of 1971 regarding accounts for the year ended 31 December 2015

2.2 Expression of Opinion on Finances

2.2.1 Sri Lanka State Sector Accounting Standards

(a) Agree with Audit Observation
(b) Agree with Audit Observation

Wish to inform that depreciation could not be provided as per the standards due to the inability to obtainsufficient information on dates of purchase. However, steps have been taken to provide depreciation according to the standards for the year 2016.

2.2.2 **Shortcomings in Accounting**

(a) Steps have been taken to rectify this error when preparing final accounts for the year 2016
(b) Steps have been taken to rectify this error when preparing final accounts for the year 2016
(c) Steps have been taken to rectify this error when preparing final accounts for the year 2016.
(d) Steps have been taken to rectify this error when preparing final accounts for the year 2016.

2.3 Receivable and Payable Accounts

(a) Agree with the Audit Observation
Preliminary legal procedure required to recover the amount paid to the external Institution have already been commenced and actions are due to start on the recommendation made by Audit and Management Committee to commence preliminary investigations to identify parties responsible.

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(b) Ministry of Fisheries and Aquatic Resources has called for details and information on the Institutions stated in the agreement from the Company Registrar as per the recommendation made by the Audit and Management Committee and further steps are due to be taken based on that information.

2.4 Non Compliance with Laws, Practices, Regulations and Management Decisions

(a) Based on the Assets as at 01/01/2014, an Assets Register has been prepared and by including Assets purchased and disposed in year 2014 and 2015 it has been updated and that register can be submitted for auditing. This register is being updated for the year 2016.

(b) This allowance has been paid to Heads of Divisions of this Institution since prior to 1977. The main reason for that is the holding of positions as Heads of Divisions by Research Officers since this Institution is a Research Institute. This allowance has been paid for the administrative duties they perform in addition to their official duties and it has been applied for Heads of Divisions of supportive Divisions.

Wish to further statethat the value of this allowance has been revised from time to time on the approval of the Governing Board.

(c) Although it was advised that assessment activities would be carried out free of assessment fees as per the Finance Circular No: 434 dated 31/12/2006, as per the Circular dated 2002/18 attached to letter dated 16/07/2013 sent to Director General under the signature of Deputy Head of Assessments, it was informed that fees would be levied as per the circular. Further since information such as date purchased, value , model number, country of manufacture, cost of installation, the present condition of the assets were needed, this transaction was carried out transparently by calling sealed tenders in accordance with the tender procedure.

2.5 Transactions not authorized by the Appropriate authority

(a) Transport Officer has confirmed on 15/10/2015 that the repairs (after trial runs) carried out asper the invoice dated 14/10/2015 submitted by the subject Institution (Transmech Engineering) have been completed satisfactorily. Accordingly, payment for relevant invoice has been made.

03 Financial Review

3.1 Financial results

(a) Agree with the note regarding financial results.

04 Operations Review

4.1 Performance

The objectives and duties of the National Aquatic Resources and Research Institute are clearly stated in a, b, c, d, e, f, g of No: 4 in National Aquatic Resources and Research and Development Agency Act No: 54 of 1981 and amended Act No: 32 of 1996 and accept that a summary of those are stated therein.

(a) i. Out of the Rs. 1,000,000/- allocated for identifying and assessing biodiverse information regarding existence of fish in Mannar and Nilaweli areas, Rs 884,292/- had been spent and the main activities of that project, the map on environment systems in Mannar area has been prepared and proposals regarding biodiversity information have been submitted.

Fisheries industry using fisheries equipment not friendly with the environment and explosives greatly affect the environmental systems and those human actions exert a lot of pressure on biodiversity. Quick action needs to be taken regarding loss of interconnection between environmental system of coral reefs, sea grass, mangroves etc and loss of environmental habitats for creatures. Based on the recommendations made regarding this, regulations have been enacted regarding Surukku and Laila fishing after informing to the Ministry of Fisheries and Aquatic Resources.

ii. The topic of Centre for Sea Turtle Breeding and project for identifying special instances of distribution should be corrected as Centre for Sea Turtle Breeding in Kalpitiya area and project for identifying spatial distribution.

A place has been setup at Kalpitiya Regional Centre for providing required treatments for the release of sea turtles from the Breeding Centre and disabled turtles. During the year, out of 830 sea turtleeggs, 610 sea turtle hatchlings have been released. 06 disabled sea turtles have been rehabilitated during the year. Replies have been provided for Audit Query regarding this.

(b) Releasing of provisions by the Treasury for the year 2015 commenced on 20 March 2015. Due to delayed receipt of provisions, the expected results in physical progress could not be achieved.

(c) Due to the fierce competition for consultancy services, it is very difficult to raise the self generated income. However, due to an increase in consultancy services and external projects in 2016 an income close to Rs 13 million could be earned which is an increase of Rs 2.7 million over the income generated in 2015 which is a 24% increase as a percentage

4.2 **Management Activities**

(A) Wish to inform that arrangements are being made to obtain the ownership of lands for Rs 53,400,900 stated under non-current assets.

In accordance with a written order made by the Chairman prior to the submission of the final report after completion of all necessary facts regarding the agreement, payments have been made to proceed with the project. Accordingly, the sum of Rs 1,625,898 borne in excess of the sum received is shown in Final Accounts of 2015 as a receivable balance which has not been received upto end of February 2017.

4.3 Operational Activities

Agree with your audit observation. However, an Inter Ministerial Committee comprising of four persons has been appointed by the Secretary of the Ministry of Fisheries and Aquatic Resources to make a technical evaluation on defective conditions during the building of the vessel and, arrangements have been made to obtain the report of that committee and,further, a discussion was held to assign it to Ceynor institution and Fisheries harbour Corporation coming under the Ministry of Fisheries and Aquatic Resources Development since it could not be started. A decision has been made to sell or assign that vessel to another institution and wish to advise that action would be taken according to that decision.

4.4 Transactions resulting in controversies

(a) The building referred to in Audit Observation consists of a ground floor and an upstair and the upstair is used for Ocean Observation and Fisheries Information Centre and although steps had been taken to construct a model fish market in the ground floor and the opening of that has been delayed due to the delay in taking the relevant decision by the Beruwala Municipality which has been dissolved. Forwarded to state that the present situation has been created by the absence of an agreement regarding that.

(b) Agree with the Audit Observation. The Boat engines purchased for the two boats were bought in year 2011. Those were not used upto February 2017 and although prices had been fixed for disposal of those, no sufficient price quotations were received and that process was stopped. However, steps have been taken to dispose these assets during the next few months. The boats being constructed are in a similar condition and wish to inform that those Two would be disposed during the next few months.

4.5 Malfunctioning and under Utilized Assets

(a) Agree with the Audit Observation. The disposal of these assets would be carried out during the next few months.

(b) This software has been purchased to computerize stores operation on the advice of the Director General without properly identifying the requirements and due to the problems arisen during the use of that software, a new software that included Accounting, Stores and Purchase Operations was purchased in 2016 which resulted

on the giving up of the previous one. Although the cost of this software was accounted as Rs 76,800/- , the amount actually paid was Rs 13,516.80. Action will be taken to write-off this sum from the books of accounts after obtaining approval from the Governing Board.

4.6 Identified Losses

Steps have been taken to take legal action and to take action as stated in the Finance Code regarding computer software and relevant computers.

4.7 Assets not properly acquired

Action is being taken to acquire the land belonging to National Aquaculture Development Authority.since this land has been vested with NARA for a 10 year period to establish an Ornamental Fish Breeding Centre, only constructions necessary for that have been carried out.

4.8 Resources of the Agency assigned to other State Institutions

Agree with the Audit Observation. The number of staff members assigned is 04 and out of them two have been released on the requests made by Deputy Ministers of Fisheries and Aquatic Resources appointed from time to time and later the period was extended regularly and it was advised in writing to permanently take them to the Ministry. Wish to advise that only the salaries are being paid by NARA for these two gentlemen.

Another two have been released to State Pharmaceutical Manufacturing CorporationSri Lanka on a request made by the Secretary to the Ministry on whom NARA makes no payment and it was advised to get them permanently released to that institution.

4.9 Staff Administration

(a) Out of the vacancies existed in the year 2015 following recruitments have been made based on the provisions available.

1	Assistant Project Monitoring Officer	01
2	Helper	24
3	Drivers	03
4	Field Research Assistant	01 (Contract basis)
5	Research Assistant	07
6	Development Officer	12
7	Assistant Bungalow Keeper	01
8	Skipper	01 (Contract basis)

5

On 27/05/2015 requested approval for 130 recruitments to 33 posts from the Management Services Department, but approval was granted for 75 vacancies in 9 posts.

Also, it was advised to manage the approved posts out of the provisions available in NARA in the year 2015. Accordingly, recruitments were made only for the posts mentioned above . Approval has been sought again to recruit the remainder in the year 2016.

(c) Although approval has been granted to recruit a Director (Administration and Human Resources) with the condition to manage within the available provisions, that recruitment was not made due to non-availability of provisions. Request for provisions was made in year 2016 and although it was advertised and interviews were held for the postbut, since, there had not been qualified applicants, this vacancy could not be filled in 2016 too. Upto now in 2017 an advertisement has been published for this post on 07/03/2017.

© For the post of Board Secretary/Legal Officer, after advertising according to the procedure for recruitment at that time and calling for applications, recruitment was made based on recommendations of the interview panel and the approval of the Board.

Two persons have appeared for the interview and Ms Amila Jayarathe being the person requesting lowest salary out of the two was placed in Grade HM 1-2 on the recommendation of the interview panel and approval of the Governing Board and placed in Grade HM 1-2 at the salary point of Rs 41,455/-

This officer has now resigned from the service.

Prior to the preparation and approval of Management Services Circular No 30, the post of Personal Assistant to the Director General and the Chairman were able to get promotions up to Grade I as per the Recruitment and Promotion procedure existed then. Accordingly, based on the evaluation test held on 09/11/2009 and decisions of the Governing Board No 348.03, the promotions had been approved. Since the new Recruitment and Promotion procedure was not prepared and approved by then, on the instructions of the then Director General, they were placed in HM 1-2 Grade.

Since appointment to HM 1-2 Grade had been made on a proper evaluation test and after obtaining the approval of the Governing Board, the recovery of salaries paid to her is a problem.

5.0 Accounting and Good Governance

5.1 Submitting Financial Statements

Agree with the Audit Observation

5.2 Internal Audit

During the year 2015, the opportunity to use the vessel was lost in spite of dates being allocated for the National Charting Programme (N C P) of the National Hydrographic Office due to estimated cost being reduced to 50%.

It is not practically possible to use the vessel during the full 30 days of a month and Projected targets can be achieved by deploying the vessel for around 15-20 days. Since 2015, about 152-200 days are for the National Charting Programme and other projects and the balance period is allowed for the maintenance of the vessel such as fuel, water, electricity and other engineering repairs.

The following actions were taken since the year 2015 in order to increase the number of days the vessel is being used for research and surveying.

i. Heads of Divisions were informed in writing to pay special attention to the possibilities of using the vessel in the projects when preparing projects for the year.

ii. A leaflet with all the information on the vessel has been designed and it is available in the NARA website which is presented as an advertisement along with other survey activities. It would be helpful to gain advertising internationally. Further, providing information regarding the vessel to delegations coming to meet officials of NARA on various projects is usually done. Towards that a programme has already been taken action to use the vessel for Norway Stock Assessment project during the next two years.

iii. Requirement to provide the services of the vessel to other institutions on a daily basis

- Earning a sum of Rs 5,052,639.35 by providing the vessel (March/April 2015) for the first phase surveying of the Zhen He Project,the project already launched by the Central Cultural Fund.
- Deploying the vessel for the surveying in the second phase of the same project (April 2016) to earn A total income of Rs 5,817,600.00 . An opportunity may arise for this project to be continued in the coming years on Chinese funding.
- Project proposals have been submitted for surveying planned for project PRDS in future.
- Oceanography research carried out in 2015 by Oceanography division in association with a Research Institution in United Kingdom.

- Annual training programme for undergraduates of the Faculty of Geomatics of the Sabaragamuwa University.
- In addition to the above training , a Memorandum of Understating has been prepared with that university for Category B Course for hydrographers which is internationally recognized (FIG/IHO Cat B) and implementation of that could pave way for using the vessel for that training and to continue it annually. Based on the success of the Cat B course by making it a Cat A Course, the use of the vessel can be further improved.
-

Further, using the vessel for collecting data useful for management of the fisheries sector through a census of fish in Sri Lankan waters in association with Centre for Development Corporation Fisheries(CDCF) of the state of Norway is expected to be carried out in the years 2017/2018.

Further, due to an error that occurred in obtaining evidence for the initial inquiry on the loss incurred by this vessel causing a delay in the inquiry and the removal of the Skipper of the vessel from his post later, the proceedings of the inquiry have been stopped.

When proceeding as above by making plans to reach the expected targets, the vessel had to be removed from running from May 2016 upto February 2017due to a mechanical defect and has been anchored at the Beruwela harbor and no sooner maintenance work is over it is scheduled to be used for research work.

5.3 **Budgetary Control**

Accept that there were considerable variances between budgetary figures and actuals .

Wish to advise that the main reason for the variances between budgetary figures and actuals was the non-approval of an adequate sum annually by the Treasury to meet the expected recurrent expenditure. Necessary steps were taken to minimize these variances in 2016 and actions are being taken to improve on that in the future.

6.0 **Systems and Networks**

As mentioned by you, action has been taken to pay a special attention to matters from (b) to (e) .

Dr Anil Premaratne
Chairman/NARA