ANNUAL REPORT & ACCOUNTS




2014 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 2014 and eight Board Meetings were held during the year.

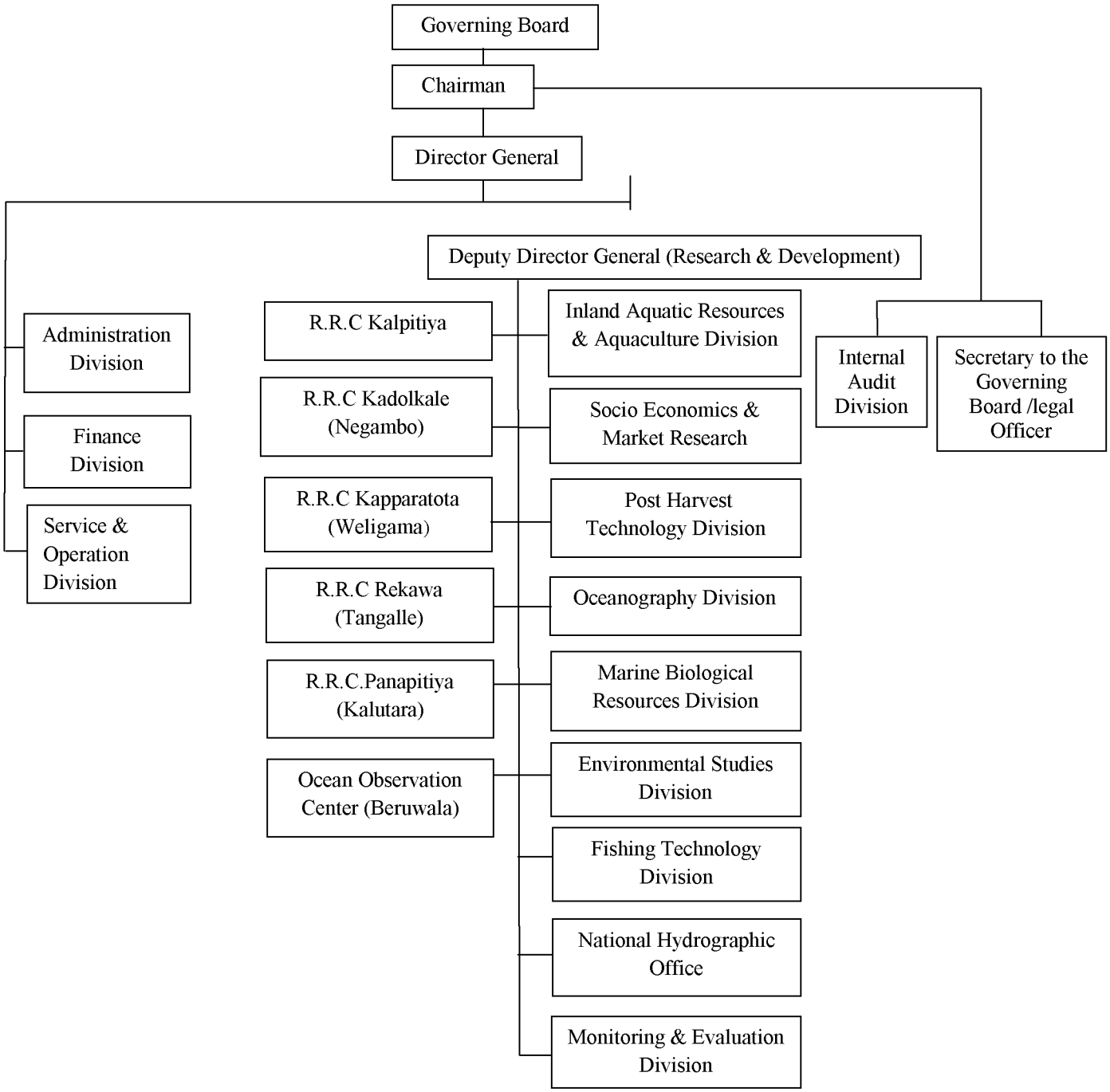
Appointed Members

Dr S G Samarasundera	Chairman
Professor W M T B Wanninayake	Member
Professor T S G Fonseka	Member
Mr. Dunstan Fernando	Member
Mr. K. N. Rienzie Perera (up to February 2014)	Member
Mr. M. J. Irshad Rumy Jauffer	Member
Mr P N N Fernando	Member
Mr.Roshan Fernando	Member
Mr.S.A.Sriyananda(Since March 2014)	Member

Ex –officio Members

Mr.H.M.B.C.Herath	Director General(Technical),Ministry of Fisheries & Aquatic Resources Development
Mr.S.Suriyaarachchi	Director General, NARA
Mr.N.Hettiarachchi	Director General, Department of Fisheries & Aquatic Resources
Rear Admiral N.J.B Rosayro	Director General /Operations, Sri Lanka Navy
Ms.M.A.G.Thushari	Assistant Director, Department of National Planning
Dr.K Thavalingam (up to April 2014)	Survey General, Department of Survey.
Mr Nihal Gunawardena (Since May 2014)	Survey General, Department of Survey.
Mr.P.M.U.Udayakantha (Since September 2014)	Survey General, Department of Survey.

Organizational Structure



Organization

Dr S G Samarasundera functioned as the Chairman and Mr S Suriyaarachchi 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 2014.

Research Divisions

Mr. S. A. M. Azmy	Environmental Studies Division
Mr. N. B. P. Punyadeva	Fishing Technology Division
Mr.M.A.Ariyawansa (01.01.2014-27.03.2014) Mr. A.N.D.Perera (28.03.2014-31.12.2014)	Hydrographic Office Division
Dr. V. Pahalawattaarachchi	Inland Aquatic Resources & Aquaculture Division
Dr. R. R. P. Maldeniya	Marine Biological Resources Division
Dr T.K.D.Tennakoon (01.01.2014-30.10.2014) Mr.S.U.P.Jinadasa (03.11.2014 – 31.12.2014)	National Institute of Oceanography & Marine Sciences
Dr.G.J.Ganegamaarachchi	Institute of Post Harvest Technology
Mr. K. H. M. L.Amaralal	Socio Economics & Markt Research Division
Mr. A. B. A .K. Gunaratne (05.02.2014 – 31.12.2014)	Monitoring & Evaluation Division

Support Services Divisions

Mrs. P A M R Chandrasekara (01.01.2014-10.11.2014) Mrs.R.A.L.T. Rupasinghe (05.11.2014 – 31.12.2014)	Administration Division
Ms.G.W.N.Pavithra (01.01.2014-06.07.2014) Mr.N.M.K.S.Ranjith (07.07.2014-31.12.2014)	Finance Division
Mrs. P A M R Chandrasekara (01.01.2014-30.09.2014) Mr.A.J.G.S.Dahanayake (01.10.2014-31.12.2014)	Services & Operation Division
Mr. M. D. Senarathne	Internal Audit Division

2. Research Highlights

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

Marine Fish Resources: Aactively engaged in updating the large pelagic and small pelagic databases, analysing the statistics and preparing research papers on trends and prospects of large and small pelagic fisheries in Sri Lanka, with special reference to further development of the large pelagic fisheries. Furthermore, molecular studies on selected marine species (Cephalopods and rays) and establishment of a protocol for sex determination of marine mammals were also studied**.** Two projects were carried out under the financial assistance of Bay of Bengal Large Marine Ecosystem (BOBLME). Major objective of the study was to draft a National Plan of Action for the conservation of shark species in Sri Lanka. Furthermore, studies on population biology and fishery of the blue swimming crab (*Portunus pelagicus*) in Jaffna district were also started from October 2014 with the financial assistance from Seafood Exporters' Association in Sri Lanka. According to the requirements of Indian Ocean Tuna Commission the large pelagic database was upgraded to present precise reporting system.

Aquaculture and inland Fisheries: *Kapphaphycus alverezii*, seaweed nursery in Southern Coast is successfully developed and seeds were deployed for the commercial scale and community based projects. Pilot scale oyster culture research and development activities was completed successfully in Puttalam lagoon and findings were transferred to community and entrepreneurs interested in oyster farming. Research trials to find out breeding season and larval feeding of *Holothuria scabra* were conducted. Establishment of hatchery facilities and conditions of *Holothuria scabra* was further developed. Community based *sea cucumber* farming using hatchery bread larvae was started using reared larvae for the first time in Sri Lanka. Community based food fish culture in abandoned clay pits highlighted the feasibility of utilize these vast area of clay pits for fish culture using low cost fish feeds. Feed development is given priority as the high quality formulated feed is the most necessary factor for the development of aquaculture. High quality (42% protein) feed has been developed for seabass culture at cost of 165 SLR to 180 SLR. Invasive tank cleaner has become a nuisance to inland fisheries; it has been proved that incorporation of powder form of the fish spiked the protein level as well as growth of the fish. Research reveled critically endemic Asoka Pethiya has been successfully bread with environmental manipulation. Experiments are continued for breeding of endemic ornamental plant *Cryptocoryne*. White spot disease condition was the

most critical during the year and 175 samples were tested in the laboratory for WSSV and further research programme was developed for minimizing the viral disease out breaks.

Fishing gear Technology: Study was carried to compare catch composition of an offshore ring net fishery (Kandan course) associated with floating objects with that of drift gillnet/longline catches. 287 boats sampled, were categorized into three groups (R), (R/G), (R/L). Catch per boat per trip was estimated for each species from the above three categories. In ring nets, juvenile *Katsuwonus pelamis* and *Thunnus albacares* were also observed. Statistical analyses revealed that fish catch composition from GL boats was different to that from R and RGL boats. In the landings of multi-day boats of fisheries harbour, a total of 17 fish species were identified. *Decapterus russelli*, *Elagatis bipinnulata*, *Coryphaena hippurus* L. and Abalistes stellatus contributed significantly to catches in R and RG boats, which in contrast were insignificant in the catches of RL boats. In ring nets, juvenile *Katsuwonus pelamis* (16-45 cm total length) and *Thunnus albacares* (15-60 cm total length) were also caught. The total catch of the R/RG/RL boats have nearly 20 % of Tuna species. It consist most of the tuna juveniles in every Multiday fishing boats which operate Ring nets. The totals by catch (unwanted target species) are nearly 26 %-27 % from the total catch. It is found that the deep sea ring nets are not environmentally friendly fishing gears. It will be highly affected to reduce the coastal tuna fishery in future. Further, development of a fishing trap for harvesting fresh water shrimp was done and it was tested with the community participation in the reservoirs. Its performances are monitored and progress was obtained from the fishing community.

Oceanography: Oceanographic parameters study was carried out perpendicular to Eastern and Southern coast of Sri Lanka during 2014. Though the survey was carried out up to 1000 m water depth, the salinity, temperature, and density profiles were recorded only up to 150 m depth. The reason to illustrate the selected depth was due to most of the oceanic processes are concentrated only within upper 200 meters. The results would be vital for understanding of ocean status and validation of forecasting models (climate, fishery etc.) Based on collected data oceanographic and climate forecasting maps were prepared. Weekly forecasting maps and report on potential fishery grounds were disseminated to the selected fishery harbours and fishermen. The real time sea level data from sea level stations were transferred to the sea level data base in the Ocean observation center of NARA. Weekly tidal status forecasting is

disseminated to relevant authorities including Ministry of Fisheries and Aquatic Resources. Data were analyzed to study the long-term sea level variability around Sri Lanka. The directional variability of the ocean around Sri Lanka is not well established yet. The current effort was to establish current patterns including behavior of East Indian Coastal Currents (EICC) in the Bay of Bengal and Arabian Sea during summer and winter monsoons. The investigation was carried out using SVP drifter trajectories in the area by deploying 3 drifters in each month. In addition to directional variation, the instrument is responsible to provide temperature variability along the trajectories.

National Hydrographic Office (NHO) conducted the Hydro graphic Surveying in Trincomalee and production of nautical charts in that area. Both nautical charts for approaches to Trinco harbour and Trinco harbour chart which were published by UKHO (Admiralty Charts) are based on unsystematic surveys such as lead line surveys, more than 100 years old. Those surveys were conducted by using preliminary methods and those are not adequate for the current standards of IHO to ensure safe navigation. It is national obligation to provide updated nautical information to mariners according to the IMO SOLAS convention. Base on new surveys NHO has streamline the production of two nautical charts in 2015 as new publications for mariners. The digital data has been compiled to fulfil the requirements of production of ENC's (Electronic Navigational Charts), it's a relatively new technology that provides significant benefits in terms of navigation safety and improved operational efficiency. It is an automated decision aid capable of continuously determining a vessel's position in relation to land, charted objects, aids-to-navigation, and unseen hazards. The electronic chart represents an entirely new approach to maritime navigation.

Environmental research: Environmental Management and the aquatic health including a project to cater the emergency situations such as fish kills were conducted. Project findings show that water pollution of fishery harbours occurred due to high Chemical Oxygen Demands (COD) and Biochemical Oxygen Demand (BOD) concentrations, Oil and Grease and also due to fecal coliforms. Additionally, heavy metals such as cadmium, mercury and lead were identified in muscle of the common carp fish catches in the Bomuruella Reservoir. Water samples collected from the Eastern Coast beaches showed parameters such as BOD and COD in rainy days recorded higher concentration than the accepted coastal water quality guidelines of CEA. Five fish kill incidents in Athanagalu Oya, Nalandawa tank in

Bandaragama, Lunawa Lagoon, Fish pond in Central Environment Authority and Diyawannawa Oya were inspected. It was determined that majority of the fish kills occurred due to poor aquatic health conditions owing to water pollution. This is an alarming trend in the last few years.

Post Harvest Technology: An investigation on quality of locally produced and imported dried fish, found that all samples failed to comply with acceptable limits of parameters (aerobic plate count, total coliforms, *E. coli*, *Staphylococcus aureus*, yeast and mould halophilic count; salt and histamine contents; and water activity) as per Sri Lankan Standards. This study suggests an urgent need to take measures to upgrade the quality of dried fish. A study found that oil extracted from yellow fin tuna head parts contained 26% saturated, 28% mono unsaturated, 45% poly unsaturated and 39% omega-3 fatty acid. One Liter of good quality tuna fish oil can be extracted using 100 kg of Tuna fish waste. Another study revealed that Sea urchin (*Stomopneustes variolars*) samples was a good source of protein and trace metals like Fe, Cu, and Zn. Quality of fish and infrastructure facilities in main points of local fish supply chain: Out of 62 samples, 33 (53%) of fish samples from Central Fish Market (CFM) in Peliyagoda were found not acceptable according to chemical or microbiological criterion including *Salmonella* contaminations. Fish lots and ice in fish landing harbours (Tangalle, Galle, Valachcheni, Trincomalee, Jaffna, Mannar, Kalpitiya, Negombo, Chilaw, Mulathive) were found contaminated with fecal coliforms and fecal streptococci. *Salmonella* contaminations were also found in some of the fish, ice or water samples collected from Negombo, Mulathive, Mannar and Chilaw harbours. The harbor water of Trincomalee and Negombo harbours contained unacceptable levels of petroleum oils (44-52 ppm). An investigation reported that oysters harvested from Gangewadiya and Kandakuliya in Puttalam district need to be depurated effectively before consumption. Seaweed incorporated products: Two jam products containing 6% agar-agar or 3% carrageenan were found with acceptable sensory qualities and the shelf life of these products were more than six months. Locally adaptable low cost technology for extraction of agar-agar from *Glacilaria verrucosa* (Kanghi passi) has been developed in NARA. Highly acceptable seaweed agar incorporated set yoghurt product has been developed successfully.

Socio-economic and marketing research: survey on women participation in Sri Lankan fisheries sector covered five fisheries districts Puttalam, Chilaw, Galle, Matara and Tangalle. Average monthly household income for fishers household of Chillaw and Puttlam were Rs 45455/= and Rs. 41014/= per month in fishing season. Monthly average expenditure per house hold is Rs. 31237.00 in Puttalam and Rs.30866.00 in Chillaw. On an average 80% of the sample belongs to Rs. 15,000-Rs 45,000 expenditure range. About 73% of women in the samples had no occupation but 83% perceived that the women should do a job to support for the family income and 96% women of the sample are willing to engage in self-employing activities but them were unable to start due to resource scarcity. Typical fisherwomen dedicate 13 hours for effective house hold works and they spent 11 hour as non-working hours. Addiction of fishermen for drug, smoking and liquor is the main problem of fisher women. Generally, 81% of the fisherwomen in the sample suffered due to this problem. Nearly 45% of the sample accepted domestic violence prevailing in their community. Approximately 52% of fishing families, fisher women conduct household financial management. Hence it is essential to educate and aware fisherwomen for socio-economic well being of the fishing community.

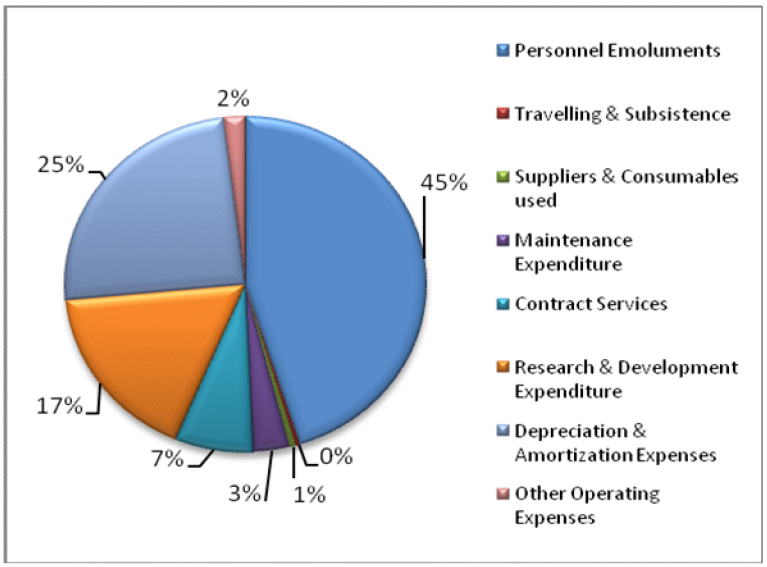
3. Financial Review

Following highlights are reported for the information of the Board.

Operating Expenses

GOSL Grants

Description	%	2014
Personnel Emoluments	45.11	185,815,229
Travelling & Subsistence	0.37	1,532,513
Suppliers & Consumables used	0.56	2,317,668
Maintenance Expenditure	3.26	13,425,107
Contract Services	7.06	29,071,219
Research & Development Expenditure	17.15	70,635,702
Depreciation & Amortization Expenses	24.56	101,182,576
Other Operating Expenses	1.93	7,935,809
Total		**411,915,823**



mainly constitute of Personnel Emoluments 45% and Depreciation and Amortization expenses 25% followed by Research & Development expenditure at 17% and contractual services at 7% amongst others.

This analysis offers us the opportunity to reevaluate the areas where recurrent expenses are high and restructure it so as to utilize these funds in more productive areas such as RCD and Research activities which would more productively fulfill the national objectives.

The income as a percentage of the expenses is only a little more than the 4%. The total income earned by NARA is sufficient to support only a very small portion of the expenditure budget.

Self Generated Income

Year	Amount Rs.cts.
2012	**5,637,562.46**
2013	**10,177,551.16**
2014	**10,630,245.54**

Operating Expenses

Vehicle Pool at a Glance

Vehicle - In Running Condition

Type	Nos. of Vehicles	Age
Cars	1	14
Double Cab	8	19,17,17,16,16,14,06,06
Jeeps	5	26,26,23,20,19
Vans	6	21,21,17,04,03,01
Trucks	1	25
Three Wheeler	1	12
Total	**22**	

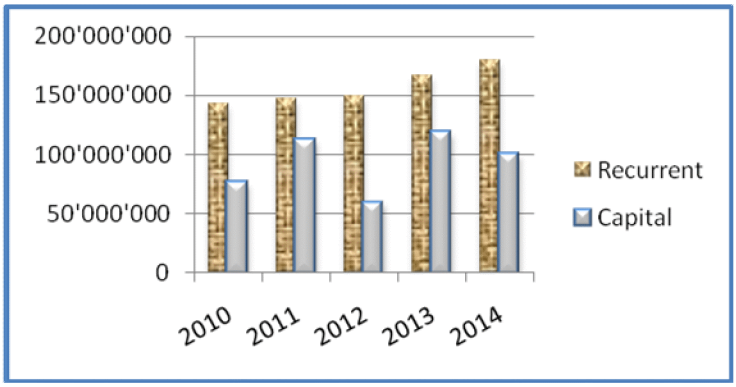
70% of vehicles from the fleet are, more than 10 years old.

Age Analysis – All Vehicles

Less than 10 years	**05**
Between 11-19 years	**10**
More than 20 years	**07**
Total	**22**

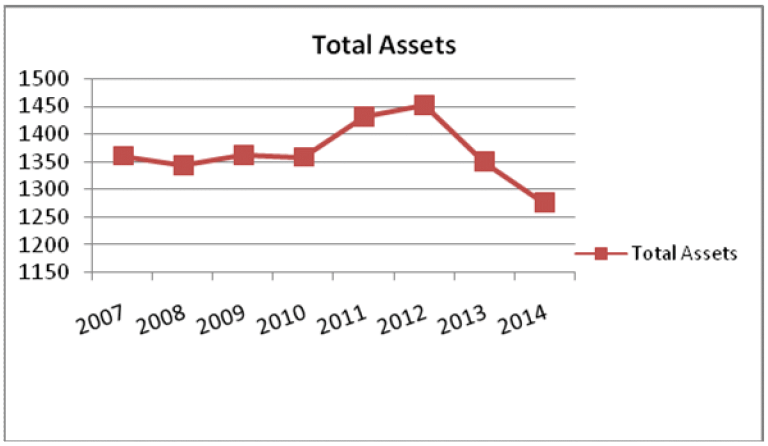
Allocations at a Glance – GOSL

	2010	2011	2012	2013	2014
Recurrent	142,243,000	146,667,000	149,331,453	166,894,000	180,000,000
Capital	75,950,000	112,440,000	59,301,583	118,272,205	100,000,000



Growth in total assets

Description	2007	2008	2009	2010	2011	2012	2013	2014
Total Assets	1361.09	1343.698	1362.354	1358.65	1431.65	1452.6	1350.1	1275.6



Growth in total assets more decreased at 6% due to settling the debts in 2014.

4. Human Resources Information

Recruitments

No.	Name	Designation	Date of Appoinment	
			Permanent	Contract
1	Mr.K.V.R.Chathuranga	Helper	01.01.2014	
2	Mr.W.A.I.E.Wanniarchchi	Helper	01.01.2014	
3	Ms.R.A.L.T.Rupasinghe	Assistant Director (HR)	07.01.2014	
4	Ms.N.Apsara	Development Officer(Project)	05.02.2014	
5	Ms.P.A.M.J.Wijepala	Research Assistant	10.02.2014	
6	Mr.T.D.W.Kasthuriarachchi	Research Assistant	10.02.2014	
7	Mr.N.B.Sooriyaarchchi	Scientist	02.05.2014	
8	Ms.T.B.D.T.Samaranayake	Scientist	02.05.2014	
9	Mr.K.R.Dalpathadu	Scientist	05.02.2014	
10	Ms.A.M.A.N.Adikari	Scientist	12.05.2014	
11	Mr.C.S.Peiris	Administrative Officer (HR)	21.05.2014	
12	Mr.K.G.S.Nirbada	Scientist	06.02.2014	
13	Ms.N.Andrahennadi	Scientist	06.02.2014	
14	Ms.G.D.T.M.Jayasinghe	Scientist	06.02.2014	
15	Ms.M.D.S.R.Maddumage	Scientist	06.02.2014	
16	Ms.J.K.P.C.Jayawardane	Scientist	06.02.2014	
17	Ms.D.M.S.Sugeshwari	Scientist	06.02.2014	
18	Mr.R.Jayawickrama	Scientist	06.02.2014	
19	Ms.D.W.L.U.De.Silva	Scientist	06.02.2014	
20	Ms.M.R.L.Thanthirige	Scientist	06.02.2014	
21	Ms.Enica De Gunarathne	Helper	09.16.2014	
22	Mr.G.S.C.Perera	Scientist	06.11.2014	
23	Mr.W.A.K.Prabath	Cartographer Data Analyst (GIS)	06.16.2014	
24	Mr.S.S.Gunasekara	Scientist	23.06.2014	
25	Mr.T.A.D.W.Karunarathne	Development Officer(Project)	01.07.2014	
26	Mr.M.G.C.R.Wijesinghe	Scientist	01.07.2014	
27	Mr.H.M.T.C.Madusanka	Scientist	01.07.2014	
28	Mr.N.M.K.S.Ranjith	Director (Finance)		07.07.2014
29	Mr.Dulap Rathnayake	Hydrographic Surveyor	01.08.2014	

30	Mr.S.Aravinth	Land Surveyor	01.08.2014	
31	Mr.A.P.C.T.Sanadaruwan	Helper	01.08.2014	
32	Mr.U.U.K.L Dilanka	Helper	01.08.2014	
33	Ms.A.K.D.R.Priyadarshani	Helper	12.08.2014	
34	Mr.C.B.Medagedara	Scientist	18.08.2014	
35	Ms.S.R.C.N.K.Narangoda	Scientist	18.08.2014	
36	Mr.S.M.D.C.P.Senarathne	Helper		01.09.2014
37	Mr.K.P.G.L.Sandaruwan	Scientist	09.01.2014	
38	Mr.D.C.D.Liyanaarachchi	Helper		04.09.2014
39	Ms.G.N.A.Subashi	Scientist	09.09.2014	
40	Mr.S.J.W.W.M.M.P. Weerasekara	Scientist	09.09.2014	
41	Ms.G.M.G.Ranjane	Management Assistant		10.09.2014
42	Mr.A.J.G.S.Dahanayake	Director (Service & Operation)	01.10.2014	
43	Mr.Nisan Croos (Daily Pay)	Boatswain	15.10.2014	
44	Ms.S.U Amarasinghe	Development Officer (Project)	20.10.2014	
45	Ms.H.D.C.Prasanna	Management Assistant	24.10.2014	01.10.2013
46	Mr.U.V.R.Jayasanka	Helper	24.10.2014	02.06.2014
47	Mr.M.R.S.P.Senevirathne	Helper	24.10.2014	25.06.2013
48	Mr.W.A.R Madhuranga	Helper	24.10.2014	16.12.2011
49	Mr.J.R.Samaraweera	Management Assistant	24.10.2014	11.08.2011
50	Ms.E.S.R.De Zoysa	Management Assistant	24.10.2014	15.01.2013
51	Mr.G.G.Nishantha	Helper	24.10.2014	01.06.2013
52	Ms.W.A.T.Pradeepika	Accounts Officer	02.06.2014	02.06.2014
53	Mr. B.A.S.Harshana	Shroff	17.11.2014	
54	Mr.K.A.D.S Nilanga	Helper	17.11.2014	

Departures of the Service

No.	Name	Designation	Effective date	Remarks
1	Mr.R.W Fernando	Research Assistant	1/19/2014	Retired
2	Mr.M.G.N.S Udawaththa	Management Assistant	2/7/2014	Resigned
3	Mrs. I.Hasanthi	Assistant Director (Admin)	2/4/2014	Resigned
4	Mr.R.M.V.C.B Rathnayake	Research Assistant	4/24/2014	Dead

5	Mr.D.P Sunil	Survey Labour	5/22/2014	Retired
6	Mr.R.A.D Piyadasa	Driver	5/23/2014	Retired
7	Dr.R.S.Karawita	Scientist	5/6/2014	Resigned
8	Mrs.S.B.N Ahamed	Scientist	2/8/2014	Resigned
9	Mr.Lasun Dilanka	Helper	4/8/2014	Vacation of Post
10	Mr.A.L.M Rifky	Scientist	10/8/2014	Resigned
11	Ms.Suthamathi Nadarajah	Scientist	8/30/2014	Resigned
12	Mr.D.R.Kamilas	Helper	10/17/2014	Dead
13	Ms.N.Andrahennadi	Scientist	10/22/2014	Vacation of Post
14	Mrs.P.L.M.R Chandrasekara	Head Admin	10/11/2014	Resigned
15	Dr.T.K.D. Tennakoon	Principal Scientist	10/30/2014	Resigned
16	Mr.R.M Premarathna	Driver	11/29/2014	Retired
17	Mr.M.H.S Herath	Shroff	4/12/2014	Resigned

Unfilled Vacancies

Srl No.	Designation	Salary Code	Vacant
1	Director General	HM 2-3	1
2	Director (Admin/HR)	HM1-3	1
3	Principal Scientist(Fishing technology/ Environmental Studies/Oceanography)	HM1 -3	3
4	Senior Scientist	AR-2	1
5	Senior Hydrographic surveyor	AR-2	1
6	Deputy Hydrographer	AR-2	1
7	Scientist	AR-1	33
8	Sociologist	AR-1	1
9	Economist	AR-1	1
10	Hydrographic Surveyor	AR-1	1
11	Senior Land Surveyor	MM 1-2	0
12	Senior Cartographer	MM 1-2	1
13	Senior System Aanalyst/Programme	MM 1-2	1
14	Data Analyst	MM 1-2	1
15	Asst.Director (Service & Operation)	MM 1-2	1
16	Asst.Director (Admin)	MM 1-2	1
17	Asst.Director (Information Technology)	MM 1-2	1

18	Senior Extension Officer	MM 1-2	1
19	Assisitant Director (Vessel Operation & Maitainance)	MM 1-2	1
20	Assisitant Information Technology Officer	JM1-2	1
21	Technical Officer (Mechanical)	JM1-2	1
22	System Analyst /Programmer	JM1-2	1
23	Technical Officer (Civil)	JM1-2	124
24	Diving Officer	JM1-2	125
25	Translator	MA 4	3
26	Development Officer (Project)	MA 3	14
27	Assistant Network Administrator	MA 2-2	1
28	Field Research Assistant	MA 2-2	3
29	Research Assistant	MA 2-2	26
30	Catographic Draughtsman	MA 2-2	2
31	Coxwain	MA 2-2	1
32	Head Driver/Marine	MA 2-2	1
33	Multi Media Designer	MA 2-2	1
34	Management Assistant (Transport)	MA 2-2	1
35	Draughtsman	MA 2-2	1
36	Diver	MA 2-2	1
37	Technical Assistant (Electrical)	MA 2-2	1
38	Mgt.Asst. (Library)	MA 2-2	2
39	Ocean Observation Technician	MA 2-2	1
40	Assistant Skipper	MA 2-2	1
41	Geological information System Technician	MA 2-2	1
40	Radio Officer	MA 2-2	1
41	Book-Binder	PL-3	1
42	Plumber	PL-3	1
43	Carpenter	PL-3	1
44	Mason	PL-3	2
45	Motor Mechanic	PL-3	1
46	Driver	PL-3	3
47	Deck Hand	PL-3	1

48	Marine Mechanic	PL-3.	1
49	Vedio Editor	PL-3	1
50	Assistant Bungalow Keeper	PL-2	1
51	Caretaker/Cook	PL-2	2
52	Helper	PL-1	28
53	Survey Labourer	PL-1	1

Promotions

NO.	Name	Designation	Effective Date	Promotion	
				From	To
1	Mrs. W.N.C . Priyadarshani	Senior Scientist (AR-2)	2012.12.24	Scientist (AR-1 Grade I)	Senior Scientist (AR-2)
2	Mr. K.A.M.L. Amaralal	Principal Scientist (HM 1-3)	2013.01.10	Principal Scientist (HM 1-2)	Principal Scientist (HM 1-3)
3	Mr. D.S. Ariyarathne	Senior Scientist (AR-2)	2013.01.20	Scientist (AR-1 Grade I)	Senior Scientist (AR-2)
4	Mr. B.K.K. Jinadasa	Senior Scientist (AR-2)	2013.07.03	Scientist (AR-1 Grade I)	Senior Scientist (AR-2)
5	Mr. A.N.D.Perera	Chief Hydrographer (HM 1-3)	2014.03.28	Hydrographer (HM 1-2)	Chief Hydrographer (HM 1-3)
6	Mr. A.B.A.K. Gunarathne	Director Monitoring & Evolution (HM 1-3)	2014.05.02	Director Monitoring & Evolution (HM 1-2)	Director Monitoring & Evolution(HM 1-3)
7	Dr. H.M.P. Kithsiri	DDG (HM 2-1)	2014.07.10	Principal Scientist (HM 1-2)	DDG (HM 2-1)
8	Dr. W.D.N. Wicramaarchchi	Scientist (AR-1)	2009.10.23 2014.07.31	Scientist (AR - I Grade II)	Scientist (AR - I Grade I)
		Senior Scientist(AR-2)		Scientist (AR - I Grdae I)	Senior Scientist (AR-2)
9	Mrs. H.A.C.C. Perera	Senior Scientist(AR-2)	2014.07.31	Scientist (AR-1 Grade I)	Senior Scientist(AR-2)

10	Mr. S.A.S. Azmy	Senior Scientist (AR-2)	2014.07.31	Scientist (AR-1 Grade I)	Senior Scientist (AR-2)
11	Mrs. R.R.A.R. Shirantha	Senior Scientist (AR-2)	2014.07.31	Scientist (AR-1 Grade I)	Senior Scientist (AR-2)
12	Mr. P.R.P. Peera	Stores Officer (JM 1-2)	2014.09.11	Management Assistant (MA 1-2)	Stores Officer (JM 1-2)

Local Training

No	Name	Date	Course	Venue	Ammount (Rs.)
1	M.M. Alawathugoda	One Year	Disaster management	University of Kelaniya	46 750.00
2	M.S.M. Fahim	Two Years	MsC in Fisheries & Aquatic Resource Management	University of Jayawardanapura	155 000.00
3	B.R.C. Mendis	Three Years	M Phill/ PhD Programme	University of Colombo	264, 000.00
4	J.A.C. Prasad	Two Years	MsC in Fisheries & Aquatic Resource Management	University of Jayawardanapura	155 000.00
5	U.D.C. Udawatha	One Year	Construction Management	Center for Habitat Planing & Development	60 000.00
6	A.T.P.K. De Silva	One Year	Diploma in Public Procurement	SLIDA	100 000.00
7	Nihal Liyanpatirane	Two Years	Master of Art (MA)	University of Kelaniya	80 000.00
8	A.M.A.S.K. Adikaranayake	One Year	Diploma in English	SLIDA	60 000.00
9	Sunethra Liyanaarachchi	One Year	Diploma in Library & Information Science	University of Colombo	75 000.00
10	J.K. Rajapakse	Continue to 2014	PhD Programme	University of Peradeniya	61,200
11	M.D. Senarathna	22.01.2014	Internel Auditing	PRAG	8000.00
12	V.K.M. Chamari	22.01.2014	Internel Auditing	PRAG	8000.00
13	IPHT Division Staff	21/03/2014	Quotation for House Training Programme	National Institute of ocupational safety and health	25000.00

14	Sunethra Liyanaarachchi	29-30/ 01/2014	Workshop on information Management fFramework (IMF)	Institute of policy study of Sri Lanka	4000.00
15	Dr. Reka Maldeniya	24-26/ 02/2014	Short course on Multivariate Data Analysis	University of Peradeniya	10 000.00
16	D.R. Hearath	24-26/ 02/2014	Short course on Multivariate Data Analysis	University of Peradeniya	10 000.00
17	D.N.A. Ranmadugala	24-26/ 02/2014	Short course on Multivariate Data Analysis	University of Peradeniya	10 000.00
18	Dr. H.A.C.C. Perera	24-26/ 02/2014	Short course on Multivariate Data Analysis	University of Peradeniya	10 000.00
19	A.A.S.H. Athukorala	24-26/ 02/2014	Short course on Multivariate Data Analysis	University of Peradeniya	10 000.00
20	I. Rathnasooriya	24-26/ 02/2014	Short course on Multivariate Data Analysis	University of Peradeniya	10 000.00
21	R.A.M Jayathilaka	24-26/ 02/2014	Short course on Multivariate Data Analysis	University of Peradeniya	10 000.00
22	Akila Harichandra	24-26/ 02/2014	Short course on Multivariate Data Analysis	University of Peradeniya	11 000.00
23	W.N.C. Priyadarshani	24-26/ 02/2016	Short course on Multivariate Data Analysis	University of Peradeniya	12 000.00
24	K.W. Indika	17-22/ 02/2014	55th short course on 'GIS' and application	University of Peradeniya	25 000.00
25	B.L.S. Wimalasinghe	04-05/ 03/2014	Transport Managing	ICTACD	5500.00
26	W.T. Nuwanthika	04-05/ 03/2014	Transport Managing	ICTACD	5500.01
27	Management Assistants for NARA	14/3/2014	Official File Management system	NARA Auditorium	free of charge
28	Supporting staff of NARA	19/3/2014	Leadership Modern Motivation & Team Building Programme	NARA Auditorium	40 000.00
29	Executive Staff of NARA	31/03/2014	Leadership Modern Motivation & Team Building Programme	NARA Auditorium	41 000.00
30	T.D.W. Kasthuriarachchi	24-25/ 03/2014	Development or Quality Manual Procedures	SLAB	8000.00
31	M.D. Senarathna	26/03/2014	Salary Management	PRAG	8000.00
32	H.A.M. Priyankara	06-10/ 05/2014	Machanical Course	ICTACD	10 500.00
33	W.D. Thilakarathne	07-11/ 04/2014	Diesal Jenarater Maintaining	ICTACD	11 500.00
34	Malaka Weerasinghe	23/04/2014	Engine Technical Course	NIFNI -Negombo	free of charge

35	G.W.N. Pavithra	5/5/2014 & 29/05/2014	Workshop on Public Sector Accounting Standards	Association of Accounting Technicians of Sri Lanka	14 000.00
36	Achala Gunathilake	5/5/2014 & 29/05/2014	Workshop on Public Sector Accounting Standards	Association of Accounting Technicians of Sri Lanka	15 000.00
37	R.A.L.T. Rupasinghe	06-07/06/2014	Human Resources Development through proper Disiplinary Management	Grand Oriental Hotel	9500.00
38	A.M.A.S.K. Adikaranayake	06.03.2014	Secretarial Excellance Training	MC,Quire Rens & Jhones PVT Ltd	8120.00
39	Sunethra Liyanaarachchi	19.05.2014	National Confrerence on Library and information Science (NACLIS)	Sri Lanka Library Association	3500.00
40	W. Antheny Fernando	31/05/2014	Carpenter Course	NAITA	7500.00
41	A.N.D. Perera	25/06/2014	Finance for Non- Finance managers Proffessional programme	The Institute of charted Accountants of Sri Lanka	15 000.00
42	G.D.T.M Jayasinghe	24/06/2014	Seminar of Sustainable Ulization of Sri Lanka	University of Pearadeniya	3500.00
43	Nadeesha Andrahendhi	24/06/2014	Seminar of Sustainable Ulization of Sri Lanka	University of Pearadeniya	3500.00
44	A.K. Wickramarathne	05.05.2014	H.K. Kasun Schorlarship programme	Global Higher Education Centre	free of charge
45	Manel Chandrasekara	15-17/ 09/2014	Workshop on Bid Evaluation	SLIDA	5000.00
46	Nishamani Dharmarathne	31/07/2014 & 05th,12th, and 19th August	Secretarial Practices	SDFL	15 000.00
47	Pavithra Ginigaddarage	28-29/ 08/2014	ISO-IEC, 17043:2010 proficiency Testing	Sri Lanka Accreditation Board (SLAB)	8000.00
48	Thilini Jayasinghe	28-29/ 08/2014	ISO-IEC, 17043:2010 proficiency Testing	Sri Lanka Accreditation Board (SLAB)	8000.00
49	D.M.S. Sugeeswari	18-22/ 08/2014	Tissue Cultre Training Course	Department of national Botanic Garden	5000.00
50	N.M.S.K. Ranjith	20-22/ 08/2014	Workshop on Essence of Public Procument	SLIDA	5000.00

51	G.W.N. Pavithra	20-22/ 08/2014	Workshop on Essence of Public Procument	SLIDA	5000.00
52	K.G.L. Irangani	20-22/ 08/2014	Workshop on Essence of Public Procument	SLIDA	5000.00
53	G.W.N. Pavithra	10-11-12/ 11/2014	Workshop on Public Financial Management	SLIDA	5000.00
54	K.G.L. Irangani	10-11-12/ 11/2014	Workshop on Public Financial Management	SLIDA	5000.00
55	D.N.L.V. De Silva	21/08/2014	Workshop on Effective Research proposel writing	National Science Foundation	2000.00
56	D.N.A. Ranmadugala	15-16/ 09/2014	Workshop on Experimental Designs	National Science and Technology Commission	1000.00
57	D.R. Hearath	15-16/ 09/2014	Workshop on Experimental Designs	National Science and Technology Commission	1000.00
58	W.D.N. Wickramaarachchi	15-16/ 09/2014	Workshop on Experimental Designs	National Science and Technology Commission	1000.00
59	Dr.W. Rajapakse	15-16/ 09/2014	Workshop on Experimental Designs	National Science and Technology Commission	1000.00
60	B.R.C. Mendis	15-16/ 09/2014	Workshop on Experimental Designs	National Science and Technology Commission	1000.00
61	Dr. H.A.C.C. Perera	15-16/ 09/2014	Workshop on Experimental Designs	National Science and Technology Commission	1000.00
62	K.H.K. Bandaranayake	15-16/09/2014	Workshop on Experimental Designs	National Science and Technology Commission	1000.00
63	A.A.S.H. Athukorala	15-16/ 09/2014	Workshop on Experimental Designs	National Science and Technology Commission	1000.00
64	K.G.S. Nirbada	15-16/ 09/2014	Workshop on Experimental Designs	National Science and Technology Commission	1000.00
65	R. Thanthirighe	15-16/ 09/2014	Workshop on Experimental Designs	National Science and Technology Commission	1000.00
66	S.Sugeeswari	15-16/ 09/2014	Workshop on Experimental Designs	National Science and Technology Commission	1000.00

67	A.Adikari	15-16/ 09/2014	Workshop on Experimental Designs	National Science and Technology Commission	1000.00
68	Gayathri Upeksha	15-16/ 09/2014	Workshop on Experimental Designs	National Science and Technology Commission	1000.00
69	V.K. Ranasinghe	15-16/ 09/2014	Workshop on Experimental Designs	National Science and Technology Commission	1000.00
70	W.A.K. Prabath	6Months	IDM Diploma in ICT & Computing	IDM Campus	21 800.00
71	J.K. Rajapakse	26-27/ 09/2014	Short Course and Analysis Count Rank Data	University of Pearadeniya	15 000.00
72	N.B.P Punyadewa	26-27/ 09/2014	Short Course and Analysis Count Rank Data	University of Pearadeniya	16 000.00
73	H.M.T.C. Madushanka	26-27/ 09/2014	Short Course and Analysis Count Rank Data	University of Pearadeniya	17 000.00
74	C. Wijwysinghe	26-27/ 09/2014	Short Course and Analysis Count Rank Data	University of Pearadeniya	18 000.00
75	S.S. Gunasekara	26-27/ 09/2014	Short Course and Analysis Count Rank Data	University of Pearadeniya	19 000.00
76	M.A.J.C. Mallawaarachchi	26-27/ 09/2014	Short Course and Analysis Count Rank Data	University of Pearadeniya	20 000.00
77	T.D.W. Kasthuriarachchi	26-27/ 09/2014	Short Course and Analysis Count Rank Data	University of Pearadeniya	21 000.00
78	H.D. Lahiru Madushanka	26-27/ 09/2014	Stores Management Course	ICTACD	5500.00
79	M.R.S. Priyankara	26-27/ 09/2014	Stores Management Course	ICTACD	5500.00
80	Manel Chandrasekara	26/09/2014	Financial Regulation 104	SDFL	5000.00
81	V.K.G. Jayaseana	26/09/2014	Financial Regulation 105	SDFL	5000.00
82	P.Ginigaddarage	02-03/ 10/2014	Quality Manual and Operating	SLAB	8000.00
83	G.D.T.M Jayasinghe	02-03/ 10/2014	Quality Manual and Operating	SLAB	8000.00
84	G.N. Achini Subashi	02-03/ 10/2014	Quality Manual and Operating	SLAB	8000.00
85	M.H.S.K. Abeyrathne	02-03/ 10/2014	Quality Manual and Operating	SLAB	8000.00
86	K.H. Hettiaarachchi	02-03/ 10/2014	Quality Manual and Operating	SLAB	8000.00
87	G.P. Roshan	02-03/ 10/2014	Quality Manual and Operating	SLAB	8000.00

88	P.A.M.J. Wijeypala	02-03/ 10/2014	Quality Manual and Operating	SLAB	8000.00
89	M. Ruchitha Perera	02-03/ 10/2014	Quality Manual and Operating	SLAB	8000.00
90	Dr. Geevikaarachchi	02/10/2014	Seminar on product Development and innovation	Institute of Chemistry	2500.00
91	K.H.M.L. Amaralal	21-22/ 11/2014	National Fourm on Small Meadium Enterprise Empowerment	The Ceylon Chamber Commerce	12 500.00
92	Anuruddha	02/11/2014	Digital Photograph	Hegoda Seya Silpa	22 000.00
93	Samantha Peris	26/09/2014	Human Resources - Disciplinery Management	Grand Oriental Hotel	6000.00
94	D.D.D. Weerakodathenna	11-12/ 11/2014	Super Map GIS Training Programme	Katak- GIS	5000.00
95	K.H.M.L. Amaralal	17-18/ 11/2014	The 5th Session of Bangaladesh Sri Lanka. Joint Economic	Ministry of Fisheries & Aquetic Resource Development	free of charge
96	B.G.S. Kariyawasam	21-22/ 11/2014	NILIS Symposium and Workshop	NILIS	4000.00
97	R.S. Liyanaarachchi	21-22/ 11/2014	NILIS Symposium and Workshop	NILIS	4000.00

Foreign Travels

No	Name	Foreign Travel Attended		
		Country	Purpose	Period
1	Ms W A A P Wijesundara Hydrographic Surveyor	India	Short Course on Remote Sensing with Special Emphasis on Digital Image Processing	05.01.2014 - 01.03.2014
2	Dr. S.G.Samarasundara Chairman	India.	Inaugural Function of 07th India International Aqua Show	24.01.2014 - 26.01.2014
3	Dr.H.M.P.Kithsiri Deputy Director General (Research & Development)	India	International Seminar on Ornamental Fish Breeding, Farming and Trade	25.01.2014 - 29.01.2014
4	Dr S S K Haputhantri Principal Scientist Dr H B Jayasiri Principal Scientist	Thailand	BOBLME Ecosystem Characterisation Workshop	09.02.2014 - 13.02.2014
5	Dr.V.Pahalawattarachchi Principal Scientist	Malaysia	BOBLME Marine Protected Area (MPA) Working Group Meeting	10.02.2014- 13.02.2014
6	Ms B R C Mendis Scientist	Japan	GTC : Case Studies on Reconstruction Process from the Great East Japan Earthquake	10.02.2014 - 28.02.2014
7	Mr.B.K.K.K.Jinadasa Scientist Dr. Karawita Scientist Mrs.J.M.Chandrika Research Asst Mr.M.H.S.K.Abeyaratne Research Asst	Norway	Workshop on Seafood Quality and Sefety	15.02.2014 - 22.02.2014
8	Dr. S.G.Samarasundara Chairman Mr M A Ariyawansa Hydrographic Consultant	Thailand	Invitation to XIVth North Indian Ocean Hydrographic Commission (NIOHC) Conference	25.02.2014 - 01.03.2014
9	Mr.S.U.P.Jinadasa Principal Scientist	U.S.A.	PhD Training	01.03.2014 - 31.08.2014
10	Dr.T.K.D.Tennakoon Principal Scientist Dr H B Jayasiri Principal Scientist Mr.J.K.Rajapaksha Principal Scientist	China	Meeting on Clooaborative Research in First Institute of Oceanography (FIO)	17.03.2014 - 22.03.2014
11	Mr.K.W.Indika Lab Attendant	Thailand	Training Course for Operators of Sea Level Stations	16.03.2014 - 22.03.2014

12	Dr R R P Maldeniya (Marine Biology)	Mauritius	Regional Workshop to Support Compliance with IOTC Requirements for the Collection and Reporting of Fisheries Data to the IOTC	16.03.2014 - 22.03.2014
13	Mr.Epasinghe Scientist	China	Aquaculture Technology for Developing Countries	09.05.2014 - 04.06.2014
14	Dr. S.G.Samarasundara Chairman	Rusian	Invitation by the Vice – President of Russian Ecological Fund Techeco	20.05.2014 - 28.05.2014
15	Mr. K A D A T Harischandra Scientist	South Africa	5th Western Indian Ocean Data Buoy Cooperation Panel	11.05.2014 - 16.05.2014
16	Ms D N A Ranmadugala Senior Scientist	Mauritius	Regional Workshop on the "Identification of Deep-sea Cartilaginous fishes of the Indian Ocean"	08.06.2014 - 15.06.2014
17	Dr. S.G.Samarasundara Chairman	Australia	World Aquaculture Adelaide 2014	06.06.2014 - 12.06.2014
18	Dr. S.G.Samarasundara Chairman	U.S.A.	'Our Ocean" International Oceans Conference	16.06.2014 - 17.06.2014
19	Mr U S P K Liyanage Scientist	Iceland	Training Programme on Marine Mammal Field Course	07.06.2014 - 18.06.2014
		Sweden	PhD Training Programme	19.06.2014 - 30.06.2014
20	Dr.H.A.C.C.Perera Scientist	Thailand	1st Workshop on Connecting the IOTC Science & Management Process and 4th Working Party on Neritic Tunas 2014	24.06.2014 - 03.07.2014
21	Mr. M.I.G.Rathnasooriya Scientist	South Korea	Master's Degree programme in fisheries science	29.06.2014 - 05.09.2015
22	Mr.D.S. Ariyarathne Senior Scientist	Australia	International Institute of Fisheries Economics & Trade Conference	06.07.2014 - 13.07.2014
23	Mr J P Wickramaarachchi Research Asst	India	Indian Post Graduate Scholorship – 2014/15	31.07.2014 - 31.07.2016
24	Mrs.D.R.Herath Senior Scientist Ms.K A W S Weerasekara Senior Scientist	India	Training Programme on Essential EAFM: Developing Capacity in the Ecosystem Approach to Fisheries Management	10.08.2014 - 17.08.2014
25	Mrs Y M R N Kumari Hydrographic Surveyor	U.S.A.	Postgraduate Certificate in Ocean Bathymetry 2014/2015	22.08.2014 - 25.08.2015
26	Mr.D.A.Athukorala Principal Scientist	Thailand	Utilizing Indigenous Food Resources for Food Security	30.08.2014 - 28.09.2014
27	Ms W N C Priyadharshanie Senior Scientist	Thailand	BOBLME Ecopath – Ecosystem modeling Workshop	07.09.2014 - 13.09.2014

28	Ms W N C Priyadharshanie Senior Scientist	China	China – Marine Scholarship Programme	15.09.2014 - 15.07.2018
29	Ms D N A Ranmadugala Senior Scientist	India	6th Regional Training Course on the Code of Conduct for Responsible Fisheries	19.09.2014 - 02.10.2014
30	Mr M. Gammanpila Senior Scientist	Iceland	Fisheries Training	28.09.2014 - 28.03.2015
31	Mr.K.W.R.R.Amaraweera Scientist	Egypt	Scholorship on Fish Culture Development	29.09.2014 - 17.12.2014
32	Mr A N D Perera Dy. Director/Hydrographer	Monaco	5th Extraordinary International Hydrographic Conference	05.10.2014 - 11.10.2014
33	Ms.R.R.A.R.Shirantha Scientist	Thailand	Strengthening Capacity to Control the Introduction and Spread of Alien Invasive Species in Sri Lanka –Capacity Development Program on Invasive Alien Species Control	05.10.2014 - 11.10.2014
34	Dr R R P Maldeniya (Marine Biology)	Japan	12th Working Party on billfish (21st to 25th October 2014) and 10th Working party on Ecosystem & Bycatch (27th to 31st October 2014)	20.10.2014 - 01.11.2014
35	Dr S S K Haputhantri Principal Scientist Dr H B Jayasiri Principal Scientist	Thailand	BOBLME Ecosystem Characterisation Workshop & EBSA Identification Preparatory workshop	02.11.2014 - 07.11.2014
36	Mr.J.K.Rajapaksha Principal Scientist	China	IOC/WESTPAC Training Course on Climate Models UNESCO/IOC Regional Training and Research Center on Ocean Dynamics and Climate	01.11.2014 - 16.11.2014
37	Dr S S K Haputhantri Principal Scientist	Indonesia	Participation of 16th Working Party on Tropical Tuna from 15th to 19th November 2014 and Bali Tuna Conference from 19th to 21st November 2014	14.11.2014 - 22.11.2014
38	Dr. S.G.Samarasundara Chairman	Rome	Second International conference on Nutrition	17.11.2014 - 23.11.2014
39	Mr L S C Siriwardena Hydrographic Surveyor	Oman	North Indian Ocean Hydrographic Commission (NIOHC) Capacity Building work programme MSI Training Course	14.12.2014 - 19.12.2014

Court Cases

Labour Tribunal

a) Case No : 02/ Add/3183/06 – J. B. A. Magammana Vs NARA

The judgment of the above case delivered on 07/11/2014 in favor of the Applicant, Mr. J.B.A.Magammana. As per the Judgment, NARA had to pay Rs.2,537,294.76 to the applicant as compensation.

District Courts

a) Case No : 3894/10/DMR – District Courts, 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 Defendant is residing in Canada.

b) Case No: 3237/10/DMR- District Courts , Colombo

This case was filed against Mr. A. W. Gunasekara, Hydrographic Surveyor who resigned from service without serving the required bonded period. The case was settled at courts. As per the terms of settlement Mr Gunasekara should pay the due amount to NARA in installments within three years.

c) Case No:05151/08/DMR – District Courts, Colombo.

This case was filed against Ms.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 abroad. Steps has been taken to issue summon through the Ministry of Justice since the 1st Defendant resides in New Zealand.

Welfare Activities

Annual New Year festival celebrated. In addition to that transport 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 main function of the division is to conduct research related to environmental aspects of aquatic resources with special reference to water quality and aquatic ecology. The information resulting from the comprehensive research undertaken by the division is used to provide technical advice to government and other organizations, in order to inform decision making processes and implement sustainable environmental management strategies. Head of the Division, three Senior Scientists, five Scientists, two Research Assistants, a Word Processing Operator and two Laboratory Assistants contributed to implement the work programme of the Division. During this period the division carried out five research projects related to the Environmental Management and the aquatic health including a project to cater the emergency situations such as fish kills and a project to improve the quality of the laboratory.

Programme		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.	600,000	S.A.M. Azmy W.D.N.Wickramaarachchi K.A.W. S. Weerasekara N.D.Hettige J.K.P.C.Jayawardane	Jan 2014	Dec 2014
2	Conservation and Management	2.2	Investigation of causes for emergency incidents such as oil spills, algal blooms and fish kills(emergency studies).	100,000	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.Chandima N.K. Narangoda	Jan 2014	Dec 2014

3	Conservation and Management	2.3	Determination of water pollution status of selected fishery harbors in Sri Lanka and its impacts to the fisheries industry in Western and Southern provinces	450,000	K.A.W. S. Weerasekara S.A.M. Azmy N.D.Hettige M.D.S.R.Maddumage J.K.P.C.Jayawardane S.R.C. N.K. Narangoda	Jan 2014	Dec 2014
4	Conservation and Management	2.4	Determination of current water pollution status in Bomuru-Ella reservoir in Nuwara-Eliya district and its impacts on inland fishery resources.	450,000	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.C. N.K. Narangoda	Jan 2014	Dec 2014
4	Conservation and Management	2.5	Assessment of heavy metals in water and bioaccumulation patterns of heavy metals in selected edible fish species in Negombo estuary	400,000	B.R.C. Mendis S.A.M. Azmy	Jan 2014	Dec 2014

Progress

Project 1

The sea around the Eastern Province of Sri Lanka is composed of a large coastal community and is highly affected by the increasing urbanization and industrialization activities. These anthropogenic activities will increase the amounts of organic and inorganic waste input into the system and would have an impact on the overall coastal ecosystem. Water quality is an important tool in monitoring and assessment of pollution of aquatic environment. This helps in management and conservation of ecological aspects including biological and fisheries aspects. The objective of this project is to identify oceans and lagoons that are of poor health and to identify pollution sources in order to determine the impacts of above pollution sources on the health of the oceanic and lagoons water quality and biodiversity.

According to the results of the monthly monitoring programme in 14 sampling locations of the eastern province, some important findings were observed. This study was highly

significant due to non availability of the water quality data in the eastern province after 35 years in the past. According to the sites, all important parameters were collected in the recreational beaches such as Arugambay and Passikuda and fisheries habours & fish landing sites. Furthermore, some untouched beaches were also monitored in the coastline. Interestingly most of the sites were good in terms of water quality with respect to the coastal water quality guidelines of CEA. However, seasonal fluctuation was observed in all locations. Parameters such as Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demands (COD) in rainy days were recorded as several times higher than the accepted coastal water quality guidelines of CEA.

Some selected sampling locations- Valachchenai and Arugambay

Progress (%) :- Physical: 85% Financial: 100%

Project 2

A high number of aquatic pollution incidents in recent years identified by fish kill incidents were recorded specially in the reservoirs and lagoons of Sri Lanka. In the year 2014, five fish kill incidents were recorded in several administrative districts of Sri Lanka. Those are Athanagalu Oya, Nalandawa tank in Bandaragama, Lunawa Lagoon, Fish pond in Central Environment Authority and Diyawannawa Oya. No any other emergencies were recorded during this year.

Field visits were conducted to identify the causes for pollution. Reports with suitable recommendations were sent to the relevant authorities to prevent or minimize such fish kills in future. Public awareness on such fish kills incidents also given through media.

Some photographs from recorded kill fish incidents

Progress (%):- Physical: 100% Financial: 99%

Water Body	Causes	Remedies
Athanagalu Oya	Oxygen depletion and due to high turbidity levels	Water pollutant sources, which discharge pollutants into the inland waters directly or indirectly, should be identified through proper monitoring programs & action should be taken to prevent further damage to the water bodies.
Nalandawa tank in Bandaragama	All the important parameters were within the accepted range of the Proposed Ambient Water Quality Standards for fish and aquatic life as proposed by CEA, 2001. However the dead fishes appeared to be matured stage. Thus, over age fishes (*Catla catla*) had died without any specific reasons	The tank needs to be renovated to improve water quality.
Lunawa Lagoon	Salt water intrusion due to the opening of the lagoon mouth.	This is seasonal event. Therefore, no actions are recommended. The effect of fish kill is insignificant.
Fish pond in Central Environment Authority	Overcrowding of Thilapia. (Korali)	Reduce the stocking density.

Diyawannawa Oya.	1. Overcrowding of Tilapia (Korali) 2. Poor water quality in the bottom layer of the lake Due to above two reasons, bacterial gill rot disease and pop-eye disease were infected to the Tilapia species in the lake.	Improve water quality by mechanical aeration pumps- bottom layer should be aerated to improve aerobic decomposition of the bottom sediments (reduced sediment oxygen demand) Control overcrowding of Tilapia fish – Allow fishermen to catch fish or by relevant institute and release to other common water body where fishing is performed. There are some chemical treatments for these diseases. But it is practically impossible to do with in open water body like Diyawanna Oya Lake.

Project 3

The objectives of this project to determine the current status of water quality (including physical, chemical and biological) of the selected fishery harbours located in Colombo, Gampaha, Kalutara, Galle, Matara and Hambantota Districts. Furthermore, identify the contamination of harbour sea water and tap water through microbiological analysis. According to the data, microbial and biochemical oxygen demands were shown to be the higher than the accepted levels in some fisheries habours selected for the study. This information is important to set institutional monitoring guidelines to decreased post harvest losses in each habours. According to the results, Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demands (COD) were recorded as five times higher than the accepted coastal water quality guidelines of CEA. The microbial pollution was also recorded beyond the limits. Furthermore, oil and grease contents were ten times higher than normal. The final outcome of the project is to give recommendations to Ceylon fishery Harbour Cooperation (CFHC) for further actions.

Mainly two undergraduate students from Sabaragamuwa University of Sri Lanka and Uva wellassa were supervised for their final year project using this project.

Project Highlights

Progress (%):- Physical: 95% Financial: 88%

Project 4

Bomburuella Reservoir is situated in Nuwara Eliya District, Sri Lanka and is surrounded by Kandepola – Seetha Eliya forest reserve. This reservoir is covered more than 30 ha and it is an important water resource for this area and feeds Uma Oya. The reservoir is also important as a popular inland fishing location to people who are living in this area. There are more than forty fishermen doing their fishing activities in this reservoir with the support of fisheries society.

The objectives of the study was to identify pollution sources and determine current status of water quality in the reservoir to assess its suitability for inland fishery resources, determination of heavy metal concentration in the fish tissues and provide mitigatory measures to the identified issues of pollution. According to the results, heavy metals such as cadmium copper were identified in surface water in some of the locations. Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demands (COD) were beyond the limits of the ambient water quality guideline of CEA. Furthermore, cadmium, mercury and lead were identified in muscle of the common carp fish catches in the tank. The mean concentration of heavy metal namely Hg, Pb and Cd recorded as 0.61 ± 0.35 mg/Kg, < Limit of Detection(LOD) and 0.03 ± 0.02 mg/Kg whereas Hg and Cd concentration of the fish sample in the reservoir were ranging from 0.37 to 1.01mg/Kg and 0.01 to 0.06 mg/Kg respectively. However concentration of Pb was less than limits of detection. Heavy metal concentrations in Fish tissues were decreased in the sequence Pb < Cd < Hg.

Project Highlights

Progress (%):- Physical: 100 % Financial: 85%

Project 5

This project was initiated with the objectives to assess the spatial and seasonal variations of the water quality of the Negombo estuary with special reference to the heavy metal contaminations in order to identify the pollution sources and to evaluate the seasonal variations in the bioaccumulation patterns of heavy metals in selected edible fish species.

Eight sampling locations were selected for the study and effect of the effluent from most of the industries in Ja-Ela and Katunayake free trade zones, boats anchorages and wastewater from households .The study was mainly focused to identify Physico-chemical parameters of water including Biochemical Oxygen Demand, Chemical Oxygen Demand, Ammonia, Nitrate, Phosphate, and Total Suspended Solids, heavy metals .Heavy metal content of fish tissues were also studied.

Project Highlights

Negombo estuary north sites comparing to the other sites prove the presence of large quantities of organic and inorganic pollutants in the estuary waters. This was expected due to the fact that these areas receive high concentrations of organic and inorganic pollutants from industrial, domestic as well as diffuse agricultural wastewater. The heavy metal residues in the fish tissues of exhibited different patterns of accumulation and distribution among the

selected tissues and localities. Fish, are considered to be the dominant site for contaminant uptake because of their anatomical and physiological properties that maximize absorption efficiency from water. However, it was evident from our study that muscle tissues were the overall site of least metal accumulation. The metal levels in many aquatic ecosystems have been increased due to anthropogenic activities which raises the concerns of metal bioaccumulation and related human health hazards.

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

Consultancies and Test services done by the Division

Consultancies

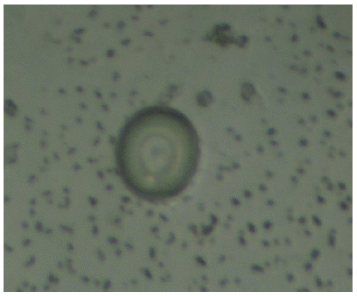
Initial Environmental Examination of Freshwater Fish Fry Rearing System at Puthumurrippu, Kilinochchi District, Sri Lanka – 2014

This study was conducted at the request of Sevalanka Foundation of Borelasgamuwa, specifically to determine water quality and fish disease of a freshwater fish fry rearing system at Puthumurrippu – Kilinochchi District The site consists of 3O ponds [area of each pond is approximately 5OOm^2] and 4 conditioning ponds. Total area of the entire facility is around 5 acres and located nearly 15O m away from the Pudumurrippu tank bund.

During the site seen, it has been observed that, Tillapia (*Oreochromis*) and Common carp (*Cyprinus carpio*) were the main fish species cultured in this fresh water fish rearing system.

At the time of sampling no disease conditions were observed among cultured fish except skin smears from Thilapia in two selected tanks and external parasite Trichodina was found in very low densities there. However, this parasite could be available in low densities in fish even in natural habitats and may not cause motilities or disease conditions under normal conditions.Among the water quality parameters considered, it is found that only Biochemical Oxygen Demand (BOD) is above the proposed standards for Fish and Aquatic Life (CEA, 2001). However, these values are lower than the results from the surrounding environment (Puthumurippu Tank and Irrigational Channel). For most of the important parameters, it is noted the levels in the ponds are within the standard Limits for fish and aquatic life.

Hatchery Sites



Sample Preparation for Microscopic Identification of fish disease

***Trichodina sp* observed**

The Feasibility Study for the development of fishery harbours in Northeast and Northwest Coasts of Sri Lanka

With the development of the fisheries industry in the northern territory of the country, requirement of infrastructural for fisheries development has become a key factor in developmental plan of the government. Presently, fishery harbours are inadequate in the northwest and northeast of Sri Lanka. Therefore, fishermen have to face many financial constrains in handing over their fish catch in to the market. Few functioning fishing harbours in Kalpitiya, Millady and Cod-Bay are inadequate them to land effectively. Therefore, as an immediate requirement the government has decided to construct new fishing harbours in the selected locations in the northern part of the country. Hence, six fisheries harbours project was initiated and presently, relevant stake holders are in identifying the most suitable locations for construction.

The proposed sites are Pasalai or Konthippidi in Mannar District, Chalai, Mulathivu/Nayaru, Puduwakattu, Ilangathurai/Lanka Patuna, and Palchchanai. The initial field investigation and relevant data collection have completed in each site. The water quality of the proposed sites was measured as baseline data and anticipated environmental impacts have been identified

during the field investigation by the study team. The following aspects were considered as environmental perspectives in this study. Those are current status of water quality of the selected sites, socio economic background of the vicinity of the proposed fishery harbor sites, identification of potential sites to be developed as a fishery harbor as an alternative sites, detail review of such identified sites with reference to environmental and other external parameters and Identification of coastal and other environmental impacts due to proposed development including the possible negative impacts.

Concurrently, discussions were made with relevant government officials and obtained statistics in related divisional secretariat area.

Rocky headland in Palachchenai

Livelihood activities of the fisheries community at Pesalai

NARA Conference

Aquatic ecosystems perform many important environmental functions such as buffering and recycling of various toxic compounds and nutrients, attenuate floods, recharge ground water, provide habitats for endemic species and other animals etc. They are also used for human recreation, and are very important to the tourism industry, especially in coastal regions. However, a rapid increase of population and sometimes unplanned development and anthropogenic activities threatens the ecosystem leading to increased pollution of inland water bodies, wetlands and coastal areas. Thus, widespread problems related to aquatic environment should be identified and immediate actions are required to overcome them and preserve the good health of aquatic environment. Therefore, it is important to explore new

knowledge through research in potential areas for development including Northern and Eastern provinces in Sri Lanka.

NARA (National Aquatic Resources Research and Development Agency), being the apex body responsible for research on aquatic resources development, management and conservation conducts research to provide innovative solutions necessary for national development issues in the sector. Environmental Studies Division (ESD) of NARA is engaged in research with respect to inland, coastal and marine aquatic environment.

ESD organized the above conference with a view to identify the priories for future aquatic environmental research. The organizers gathered a fair number of leading scientists, educators, practitioners, entrepreneurs and a limited number of school students.Following the inaugural session, . Prof. C.M. Maddumabandara, an emeritus professors of the University of Peredeniya delivered the keynote address on "the concept of water footprint". Acting Minister Fisheries and Aquatic Resources, Mr. Sarath Gunaratne invited all experts in the country to work together towards the development and sustainable management of inland, coastal and marine aquatic resources in the country.

Then, the audience was exposed to three key presentations on inland aquatic environment, marine pollution and critical global issues related to marine environment delivered by Prof. Ivan Silva (Chairman, Water Resources Science & Technology), Dr. Terni Predeep Kumara (General Manger, Marine Environment Protection Agency) and Dr. Chris O'Brien (Regional Coordinator, The Bay of Bengal Large Marine Ecosystem Project) respectively. The subsequent discussion chaired by Dr. Chris O'Brien was indeed a brainstorming session, which highlighted existing site specific problems, recent trends in aquatic environment resulting from global climate change and challenges due to lack of expertise and infrastructure.

Conference Highlights

Test Services

During the period, 33 clients have been provided with test reports by Environmental Studies Division and the total earning is **Rs.199, 815.00.**

During this period, Officers participated in several scoping meetings related to EIA and IEE projects conducted by the Central Environmental Authority and the Coast Conservation Department to advise on management and conservation of aquatic resources.

Meetings Attended during the period

- National Steering Committee meeting on National Biodiversity National Plan Project and National Workshop on Preparation of Fifth National Report to the Convention on Biological Diversity
- Meeting on Proposed House Boat Project in Dedduwa Lake and Bentota River
- Meeting on Technical Proposed Extension of Pipe Borne Sewarage Coverage for Dehiwala Mt. Lavinia Municipal Council Area.
- Meeting on Draft guidelines for clean boating conducted by CEA
- Meeting on 147th Coast Conservation and Coastal Resource Management Advisory Council Meeting conducted by CC&CRMD
- Meeting on Updating the Mission 4; Wise usage of coast and the adjoining sea, for the period of 2013 -2020 conducted by Ministry of Environment and Renewable Energy
- Meeting on Sub-regional workshop validate the scoping study of nutrient pollution on the coastal and marine systems of South Asia conducted by SACEP
- Workshop on 'Climate Change Negotiations' conducted by Ministry of Environment and Renewable Energy
- Meeting on Implementation of National Oil spill Contingency Plan (NOSCOP) – 3 day national workshop for capacity building in first respondents of oil spills conducted by MEPA
- Meeting on 2x250 MW Coal Fired Power Plant at Sampoor, Trincomalee – Evaluation of the EIA Report conducted by CEA
- Meeting on 148th Coast Conservation and Coastal Resource Management Advisory Council conducted by CC&CRMD

- Meeting on Finalize the draft guideline for boat riding in water bodies of Sri Lanka conducted by CEA
- Meeting on Proposed Wind Power Project at Mukkuthoduwawa conducted by CC&CRMD
- Meeting on IEE on proposed 22 Roomed Bird Lagoon Three-star hotel project, Kalamatiya, Ambalanthota, Suri (Pvt.) Ltd conducted by CC&CRMD
- Meeting on Proposed off-shore sand mining and beach nourishment project at Unawatuna Bay conducted by CEA
- Meeting on Proposed 3D and 2D Seismic Acquisition Project in South West off-shore (Mannar Basin), North-East (Covary Basin and East and West of Sri Lanka).conducted by MEPA
- Workshop on Workshop on drafting New National Coastal Zones and Coastal Resource Management Plan conducted by CC & CRMD
- Meeting on Proposed extension of pipe borne sewerage coverage for Dehiwala – Mt. Lavinia Municipal Council Area conducted by CEA
- Meeting on Green Lanka Programme; Updating the National Activity Plan of the Sustainable use of coast and the adjoining sea, for the period of 2015 -2022 conducted by Ministry of Environment and Renewable Energy
- Training of trainers in eco system – based management of estuaries and lagoons conducted by IUCN, CC & CRMD
- Meeting on Preparation of National Climate Change Adaptation (NAP) for Sri Lanka conducted by Ministry of Environment and Renewable Energy
- Scooping Committee Meeting on Proposed Mineral Sand Project along the coastal stretch to Kamari to Akkaraipattu conducted by CC & CRMD
- Scooping Committee Meeting for Construction of Fisheries Anchorage – Kaikawala, Induruwa conducted by CC & CRMD
- Meeting on implementation of National Oil Spill Contingency Plan conducted by MEPA.

- Meeting on 150th Coast Conservation and Coastal Resource Management Advisory Council Meeting conducted by CC & CRMD
- Meeting on 18th International Intensive Environmental Impact Assessment Training Programme conducted by CEA
- Meeting on identifying the proposals for World Bank Fund conducted by Ministry of Fisheries and Aquatic Resource Development
- Meeting on EIAR of Trincomalee Thermal Power Project conducted by BOI
- Meeting on Proposed Trincomalee Coal Power Project conducted by CEA
- Meeting on Development of 100MW Wind Park along Southern Coast of Mannar Island conducted by CC & CRMD
- Meeting on151st Coast Conservation and Coastal Resource Management Advisory Council Meeting conducted by CC & CRMD
- Meeting on launching the Revised and Aligned National Action Programme for Combating Land Degradation in SL conducted by Ministry of Environment and Renewable Energy
- Meeting on Project on Enhancing Regional Corporation Mechanisms on Marine Pollution Preparedness and Response in the SACEP Region, National Preparatory Meeting of Sri Lanka conducted by MEPA.
- Public Consultation Workshop for Finalizing the New Coastal Zone and Coastal Resource Management Plan conducted by CC & CRMD.
- Meeting on Negombo Lagoon Development Project conducted by Ministry of Fisheries and Aquatic Resources Development
- Meeting on 3T National R and D Investment Plan of Sri Lanka conducted by Ministry of Agriculture.
- Meeting on Oil Spill Contingency Management plan conducted by Marine Environment Protection Authority.

Management Plans - National Level

1. Preparation of National Coastal Zone and Coastal Resource Management Plan by Coast Conservation Department

- Sensitive Habitats - S.A.M.Azmy
- Water Management - K.A.W. S. Weerasekara

Negombo Lagoon Management Plan by Ministry of fisheries and Aquatic Resources. (Water management)
B.R.C.Mendis

2. Port Biological Baseline Survey Project by Marine Environmental Protection Authority

- Ballast water group - K.A.W. S. Weerasekara and N.D.Hettige
- Environmental group - B.R.C.Mendis

Public Awareness Programs conducted

- Lecture on the marine biodiversity threats to the conference on finalization of "Haritha Lanka" Mission IV. -Dr. W.D.N Wickramaarachchi
- Workshop on environmental survey techniques for university students jointly organized by SLAFAR and NARA (November 2014) – 02 days
- K.A.W.S.Weerasekara, R.R.A.R.Shirantha, Dr.I.Parakrama, T.D.W. Kasthuriarachchi & Udeshka Chathurani

Presentations

- Awareness presentation about Environmental Studies Division for Educational Directors organized by NARA (April 2014) K.A.W.S.Weerasekara
- Presentation on "Current Status of water quality levels on Negombo lagoon" conducted by University of Moratuwa, Faculty of Architect (May 2014) B.R.C.Mendis
- Presentation on "Deterioration of coastal water quality from land based activities: western province, Sri Lanka" conducted by the Sri Lanka Association for Fisheries and Aquatic Resources K.A.W.S.Weerasekara (May 2014)

- Presentation on “Ballast water: availability of non-indigenous species and degree of management practices compliance by the ships arrived at the Colombo port, Sri Lanka” conducted by the Sri Lanka Association for Fisheries and Aquatic Resources (May 2014) K.A.W.S.Weerasekara
- Photo degradation of chlorpyrifos an organophosphorus pesticide with suspended matter bounded humic acid. Proceedings of Water and Environment Technology Conference 2014, 28th-29th June 2014, Waseda University,Tokyo, Japan. A.A.D. Amarathunga
- Presentation on Water quality status of selected water wells located in Kebithigollawa and Medawachchiya, North Central Province “conducted by Post Graduate Institute of Science, University of Peradeniya, Sri Lanka (June 2014) K.A.W.S.Weerasekara
- Presentation on “Contamination of Surface Water at Selected Sea Mouths in the Western Province”, conducted by University of Peradeniya (December 2014) N.D.Hettige

Booklets

- Booklet on “Environmental Studies Division”. (November 2015)

Number of Undergraduate Research Projects has been Supervised As an External Supervisor

- Assessment of current status of water quality & pollution levels in Beruwala, Tangalle & Hikkaduwa Fishery Harbours, Sri Lanka. Final year student B.Sc. (Special) in Environmental Sciences and Natural Resource Management University of Sabaragamuwa, Sri Lanka.

  Supervised by K.A.W.S. Weerasekara and S.A.M.Azmy

- Assessment of the current status of water quality and pollution levels in Hikkaduwa, Galle and Hambanthota Fishery Harbours, Sri Lanka: A Comparative StudyFinal year student B.Sc. (Special) in Aquatic Science in Resources Technology, Uvawellasa University of Sri Lanka.

  Supervised by K.A.W.S. Weerasekara and S.A.M.Azmy

- Determination of the current status of water quality in Bomuruella Reservoir in Nuwara Eliya District Final year student B.Sc. (Special) in Environmental Sciences and Natural Resource Management, University of Sabaragamuwa, Sri Lanka

  Supervised by N.D.Hettige and S.A.M.Azmy

- An Assessment of Water Quality and Pollution Level in Bomuruella Reservoir, Nuwara Eliya Districts- Final year student B.Sc. (Special) in Aquatic Science in Resources Technology, Uvawellasa University of Sri Lanka.

  Supervised by N.D.Hettige and S.A.M.Azmy

Training of Research Students as an External Supervisor

Industrial Training

- Two third year students from University of Sri Jayawardenepura following Aquatic Resource Management special degree.
- One final year students from University of Sri Jayawardenepura following Forestry and Environmental Science special degree

Reports / PhD Thesis

- Report on Environmental Impact Assessment of Freshwater Fish Fry Rearing System at Puthumurrippu, Kilinochchi District, Sri Lanka. S.A.M. Azmy, K.A.W.S. Weerasekara , P.P.M Heenatigala
- Report on the feasibility study for the development of fishery harbours in Northeast and Northwest Coasts of Sri Lanka. S.A.M. Azmy, W.D.N. Wickramaarachchi, K.A.W.S. Weerasekara, N.D. Hettige
- Travel report on Training Course on Case Study on Reconstruction Process from the Great East Japan Earthquake from February 11, 2014 to February 27, 2014 – B.R.C.Mendis
- Travel report on Training Course on “Essential Ecosystem Approach to Fisheries Management (EAFM): Developing Capacity in the Ecosystem Approach to Fisheries Management” from 11-16 August 2014 in Chennai Tamil Nadu.K.A.W. S. Weerasekara
- A thesis submitted as a partial fulfillment of the Degree of Doctor of Philosophy in Marine Life Sciences

Title: Insights into Immunological Role of Teleost Complement System: Genomic Structural Identification and Molecular Characterization of Consecutive Nine Complement Components of Rock bream (*Oplegnathus fasciatus*) by W.D.N Wickramaarachchi (February 2014)

- A thesis submitted as a partial fulfillment of the Degree of Doctor of Philosophy in Engineering.

  Title: Behavior of pesticide in tropical rivers with high concentrated suspended sediment by A.A.Deeptha Amarathunga (September 2014), University of Yamanashi,Japan.

Training Obtained

Local

- Training of development of quality manual & procedures – Project on mitigation of chronic kidney disease of unidentified etiology (CKDu) in North Central Province conducted by SLAB (26th – 27th March 2014).T.D.W.Kasthuriarachchi
- Short Course on analysis of count and ranked data conducted by Post Graduate Institute of Agriculture (23- 26 September 2014).T.D.W.Kasthuriarachchi
- Hands on Training on Vulnerability Assessment for Coastal Sector conducted by Marine Environment Protection Authority, Sri Lanka (09th – 10th December 2014).M.D.S.R. Maddumage

Foreign

- Case Study on Reconstruction Process from the Great East Japan Earthquake, Tokyo Japan. (From February 11, 2014 to February 27, 2014) B.R.C.Mendis
- Training on "Essential Ecosystem Approach to Fisheries Management (EAFM): Developing Capacity in the Ecosystem Approach to Fisheries Management", from 11-16 August 2014 in Chennai Tamil Nadu. K.A.W. S. Weerasekara

Workshops Attended

- Workshop for Capacity Building in the First Respondents of Oil Spill – Implementation of National Oil Spill Contingency Plan (NOSCOP) (04th – 06th June 2014)B.R.C.Mendis and M.D.S.R. Maddumage
- One day workshop on target oriented research proposal preparation in Post Harvest Technology and human nutrition (10th July 2014)J.K.P.C. Jayawardhane
- One day workshop on the preparation of a National Strategy for the prevention of Marine Pollution from fisheries sector conducted by MEPA. (26th October 2014) M.D.S.R. Maddumage, J.K.P.C. Jayawardhane and S.R.C.N.K. Narangoda
- Second Workshop on Implement National Strategy for Marine Pollution Prevention from Fisheries Sector (13th November 2014) N.D. Hettige, M.D.S.R. Maddumage and S.R.C.N.K. Narangoda
- Workshop on Enhancing Regional Cooperation Mechanisms on Marine Pollution Preparedness and Response the SACEP Region (16th – 17th December 2014) W.D.N.Wickramarachchi and N.D.Hettige

Research Publications Local – 03 Abstracts

- Hettige N.D., Weerasekara K.A.W.S., Azmy S.A.M. and Jinadasa K.B.S.N., 2014.Deterioration of coastal water quality from land based activities: western province, Sri Lanka, Proceedings of the Twentieth Sessions of the Sri Lanka Association for Fisheries and Aquatic Resources,pp.34
- De Croos M.D.S.T., Weerasekara K.A.W.S., Hettige N.D., Thilakarathne,R.M.G.N., Priyadarshana R.N., De Silva L.L.R.B.and Gunasekara K.A.U.S,2014. Ballast water: availability of non-indigenous species and degree of management practices compliance by the ships arrived at the Colombo port, Sri Lanka, Proceedings of the Twentieth Sessions of the Sri Lanka Association for Fisheries and Aquatic Resources, pp.11
- Mendis, B.R.C, Azmy, S.A.M., and Gammanpila M. Physico Chemical Properties of water quality variations in the Negombo estuary of Sri Lanka. Faculty of Graduate Studies University of Colombo, Annual Research Symposium 2014, pp 26.

International – 01 Abstract

- Weerasekara, K.A.W.S, Azmy S.A.M, Wickramaarachchi W.D.N and Amaratunga A.A.D., (2014).Water quality status of selected water wells located in Kebithigollawa and Medawachchiya, North Central Province. Third international symposium on "Water Quality and Human Health: Challenges Ahead" conducted by Post Graduate Institute of Science, University of Peradeniya,Sri Lanka,p.10.

Full Paper (Proceedings) - 02

- Hettige, N.D., Weerasekara, K.A.W.S., Azmy, S.A.M. and Jinadasa, K.B.S.N. (2014), Contamination of Surface Water at Selected Sea Mouths in the Western Province, Sri Lanka, 5th International Conference on Sustainable Built Environment,pp.85-94

- Deeptha AMARATHUNGA and Futaba KAZAMA, (2014). Photo degradation of chlorpyrifos an organophosphorus pesticide with suspended matter bounded humic acid. Proceedings of Water and Environment Technology Conference 2014, 28th-29th June 2014, Waseda University,Tokyo, Japan. 29pp.

Journal Paper – 06

- Hettige , N. D., Weerasekara, K. A. W. S., Azmy, S. A. M. and Jinadasa, K. B. S. N. (2014), Water Pollution in Selected Coastal Areas in Western Province, Sri Lanka: A Baseline Survey, Journal of Environmental Professionals Sri Lanka, Vol. 3 – No. 2,pp. 12-24.

- Amarathunga, A.A.D. and Futaba, K., (2014). Photodegradation of chlorpyrifos an organophosphorus pesticide with humic acid bounded suspended matter, Journal of Hazardous Materials, 280, 671–677 (2013, 5-Year Impact Factor - 5.123) DOI: http://dx.doi.org/doi:10.1016/j.jhazmat.2014.08.063

- Amarathunga A.A.D. and Sureshkumar, N. (In press) Assessment of water quality of major streams in the Madu Ganga catchment and pollution loads draining into Madu Ganga from its own catchment, journal of the National Aquatic Resource Research & Development Agency, Sri Lanka, Vol. 42. Xx-xxpp

- G.I. Godahewa, W.D. Niroshana Wickramaarachchi, Ilson Whang S.D.N.K. Bathige,Bong-Soo Lim, Cheol Young Choi, Mahanama De Zoysa, Jae Koo Noh, Jehee Lee. Two carboxypeptidase counterparts from rock bream (*Oplegnathus fasciatus*): Molecular characterization, genomic arrangement and immune responses

upon pathogenic stresses Veterinary Immunology and Immunopathology, Volume 162, Issues 3–4, 15 December 2014, Pages 180-191

- Umasuthan, N., S. D. N. K. Bathige, Kasthuri Saranya Revathy, W.D.N. Wickramaarachchi , Qiang Wan, Ilson Whang, Eunmi Kim, Myoung-Ae Park, Hae-Chul Park , Jehee Lee (2014). "A C1 inhibitor ortholog from rock bream (*Oplegnathus fasciatus*): Molecular perspectives of a central regulator in terms of its genomic arrangement, transcriptional profiles and anti-protease activities of recombinant peptide." Developmental & Comparative Immunology 42(2): 197-210.
- W.D. Niroshana Wickramaarachchi, Qiang Wan, Bong-Soo Lim, Hyung-Bok Jung, Mahanama De Zoysa, Myoung-Ae Park, Jehee Lee, Ilson Whang (2014). "Genomic characterization of interferon regulatory factor 5 from rock bream (*Oplegnathus fasciatus*) and its role in antiviral defense." Fish Shellfish Immunol 37(2): 256-267.

Journal Papers (02) in progress

- Weerasekara, K.A.W.S., Amarathunga, A.A.D., Shirantha,R.R.A.R, Sureshkumar, N., Azmy S.A.M. and Wickramaarchchi,W. D. N.2013. Assessment of Current Water Pollution Status in Uma Oya Stream, Sri Lanka, Sri Lanka Journal of Aquatic Science (Under Review)
- Hettige, N.D., Weerasekara, K.A.W.S., Azmy, S.A.M., Wickramaratne, C. and Amarathunga, A.A.D.2013.Water Pollution Assessment near the Sea Mouth of Wellawatta Canal, Sri Lanka, Sri Lanka Journal of Aquatic Science (Under Review)

5.2 Fishing Technology Division

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

Development of an environmental friendly Ring net (Kandan course) for offshore fishery to sustainable harvest of underutilized Carangidae, Balistidae resources in deep sea.

Development of a fishing gear to exploit deep sea lobsters (Panulirus ornatus)

Development of a fishing gear to exploit Knife fish in inland reservoirs.

Deployment of FAD (Fish Aggregating Devises) for small scale fishers.

Development of suitable trap for harvesting freshwater shrimp species.

Activities

Data collection from the ring net catches and length, species composition, and cost were obtained from the boat owners. In addition to that, Long line catch data and Gill net catch data for the Yellow-fin tuna and Skipjack tuna were gathered. To construct the experimental ring net required net materials were purchased. Experimental ring net design was completed.

To harvest deep sea lobsters the experimental fishing trap was designed and completed. Suitable areas for the experiments were identified with the fishing community.

Further, in addition to the projects several fishing gear development was carried out for the requirement of the Ministry. The FAD deployment for the small scale fishing community was arranged and required materials were purchased. Due to bad sea conditions FAD deployment was postponed.

Performance

The project activities, data collection from the main fishery harbours were visited catch data from the Ring net from Multiday fishing boats were collected and while Tuna long line boat catches and Gill net catches were recorded. 10-15 field visits were done for a month. Required fishing nets were purchased and net design was made. The experimental fishing net was practice with help of community participation. The data gathered from the experimental net is in progress. Form the data analysis; it is found that the deep sea ring nets are not environmental friendly fishing method. Recommendations were given to the MFAR for future usage of deep sea ring nets.

The experimental Trap for harvesting the deep lobster was designed and completed. Experiment at the sea was delayed due to the roughness of the sea.

The development of a trap for harvesting freshwater shrimp species was carried out with community participation.

Programme	**Project**	**Allocation Rs (Million)**	**Officers responsible**	**Period from**	**Physical Progress**	**Financial Progress**
Development of New Fishing Techniques	Development of an environmental friendly Ring net (Kandan course) for offshore fishery to sustainable harvest of underutilized Carangidae, Balistidae resources in deep sea. Development of a fishing gear to exploit deep sea lobsters*(Panulirus ornatus)*	0.5	NBP Punyadeva NBP Punyadeva	2014 Jan-Dec 2014 Jan-Dec	T-100% P- 95% T-100% P- 60%	T- 100 % P- 123 % T- 100 % P- 50 %

Physical Achievement: Cumulative target Cumulative Achievement

Project 1	*Cumulative target	100 %
	* Achievement	95 %

Financial Achievement:

Project 1	* Financial target	100 %
	* Achievement	123 %

Publications

Research Report:

Development of an environmental friendly Ring net (Kandan course) for offshore fishery to sustainable harvest of underutilized Carangidae, Balistidae resources in deep sea.

Extended Abstract

Ring Nets (Kandan Cource) Fisheries associated with floating objects in the offshore waters of Sri Lanka and their possible impacts on the pelagic Tuna fish stocks. NARA scientific sessions 2015

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. Most field visits were cancelled 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.

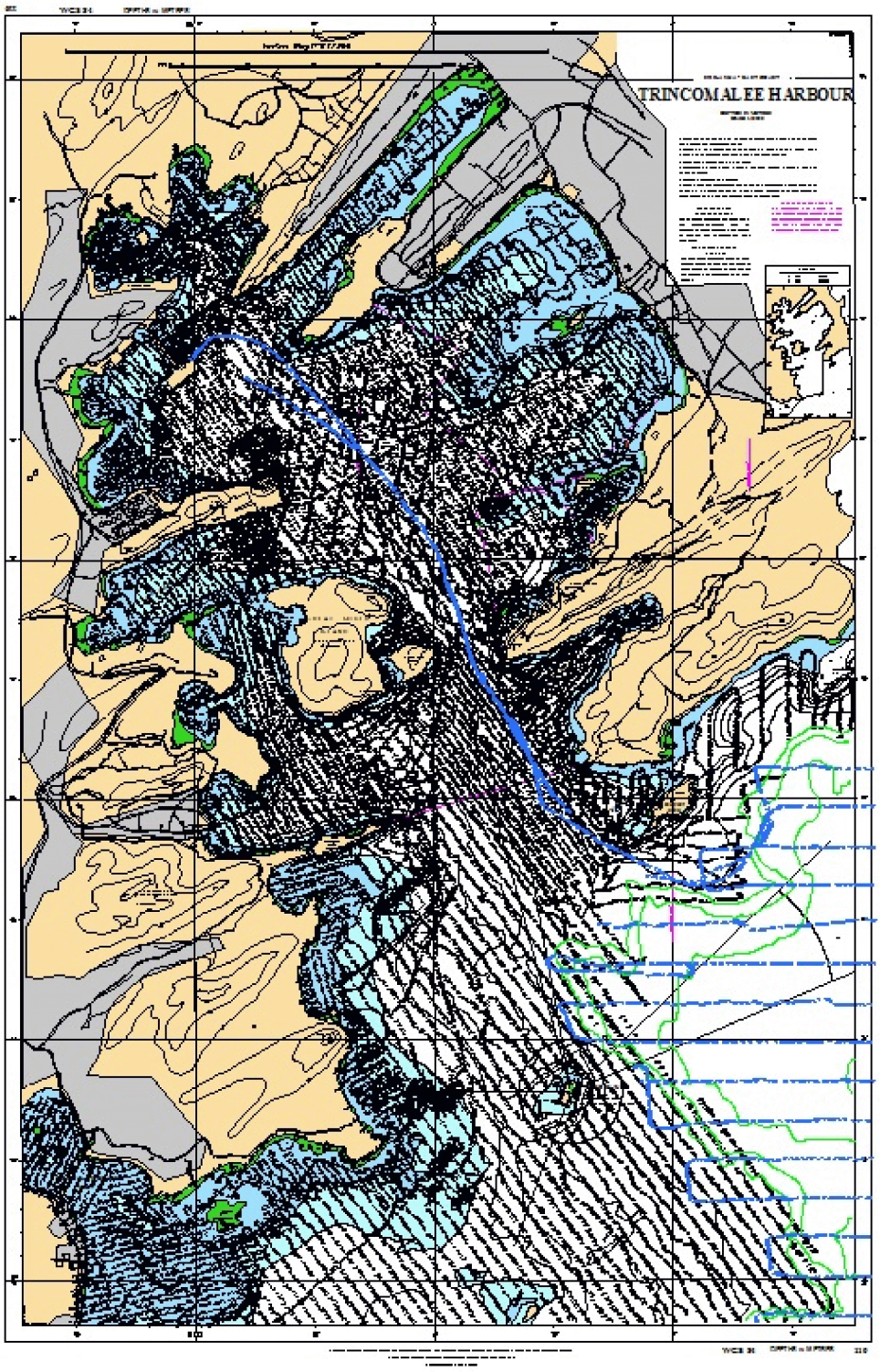
For the year 2014 the following surveys and activities were conducted.

1. Completed updating of 1:10000 Nautical chart of Trincomalee Harbor
2. 1:50,000 nautical chart of Trincomalee Approaches
3. Surveys conducted for special requests
4. Special Surveys undertaken for NARA Research & Development work
5. Bathymetric data acquisition to fill the gap from Colombo to Weligama Nautical chart equivalent to BA chart 3700
6. Oceanographic Surveys, deployment of drifters and moorings to ocean observations by using RV Sammudrika.

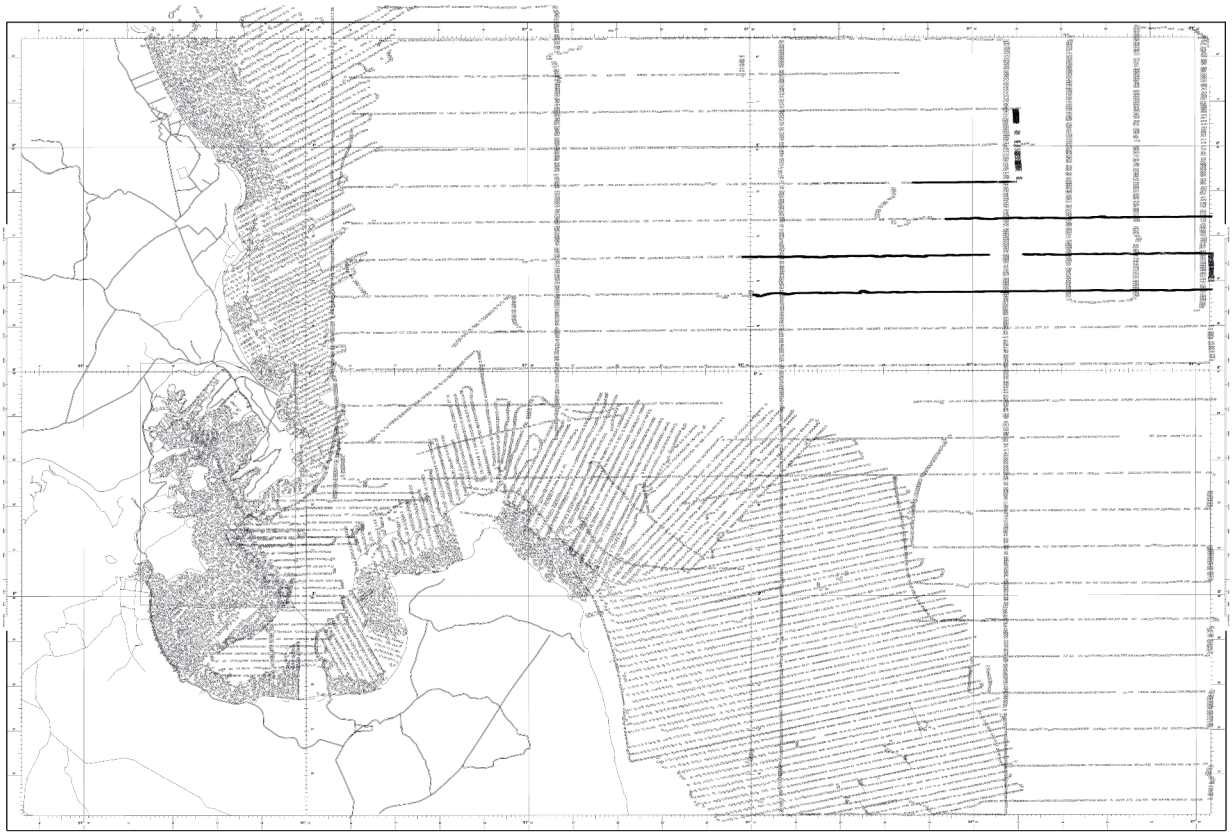
Activities undertaken

Programme	No.	Project	Officer Responsible	Period
1.National Nautical Charting	1.1 1.2	Data Acquisition for gap filling between Colombo to Weligama nautical chart equivalent to BA chart 3700 Data Acquisition for 1:50,000 Trincomalee Approaches	R.K.A Ariyarathne K.A. Ranasinghe D.L.P Hewage L.S.C Siriwardane S.Aravinath	Jan- Dec

	1.3 1.4	Data Acquisition of Trincomalee Harbour upgrading Data processing and Cartography	S.Aravinath S.W.S Weerasinghe W.A.A.P Wijesundara	Jan- Dec
2. Surveys Conducted for special requests	2.1 2.2 2.3 2.4	Bathymetric, Topographic surveys for the feasibility study of development of six fishery harbours at Pesalai, Puduwakkadu, Kallady, Palachchenai, Chalai, Nayaru. Bathymetric Survey near Ruhuna University for CC & CRMD Bathymetric Survey and shore profile at Unawatuna Bay for CC and CRMD Beach Profiling survey from Mt. Lavinia to Uswetakeiyawa for Colombo Prot City Development Project – China Harbour Engineering Company Ltd.	R.K.A Ariyarathne K.A. Ranasinghe D.L.P Hewage L.S.C Siriwardane S.Aravinath S.Aravinath S.W.S Weerasinghe W.A.A.P Wijesundara	Jan- Dec
3.Surveys Conducted with RV Sammudrika	3.1 3.2 3.3 3.4	Bathymetric Survey Oceanographic Surveys Deployment of drifters Moorings to ocean observations	Research Officers and Hydrographic Surveys Co-ordinated by A.N.D Perera Head/ NHO	Jan-Dec



1.10,000 Trincomalee Harbour Chart



1.50,000 Trincomalee Harbour Approaches Chart

Performance

Project 1.1: 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).

Project 1.2: Data Acquisition for 1:50,000 Trincomalee Approaches

The data acquisition for the 1:50,000 Trincomalee approaches is 95% completed. This 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.

Project 1.3: Data Acquisition of Trincomalee Harbour upgrading

The bathymetric data compilation and processing has completed and this chart has been planned to approach to the Trincomalee Harbour from the International Sea Route. All bathymetric data has been incorporated to the bathymetric data base of NHO. This chart is produce to fulfill one of the requirements of International Maritime Organization's SOLAS Convention. This data can be used for sea scientific and marine science, transportation, harbour development, seabed mining, and other research and development programs related to the sea.

Project 1.4: Data Processing and Cartography

1: 10,000 Trincomalee Harbour Chart is completed.

1: 50, 000 Trincomalee Approaches is 50 % Completed

Data Processing for the acquired bathymetry for the gap filling between Colombo to Weligama is completed.

Project 2.0: Surveys Conducted for special requests from government and other institutions

Project 2.1: Feasibility study for the development of six fishery harbors in North and East

The detailed bathymetric and topographic surveys and control surveys were done to support to conduct the feasibility study of development and construction of fishery harbours at six locations in Northern and Eastern provinces of Sri Lanka. These data was used for the purpose of modeling and designing.

The following locations in four coastal districts in the two provinces were considered for the studies;

1. Pesalai in Mannar District
2. Chalai and Mullativu in Mullativu District
3. Puduwakaddu and Illangathurai in Trincomalee District
4. Palachchenai in Batticaloa District

Project 2.2: Carrying out bathymetric surveys and shore profiles in coastline near to University of Ruhuna.

This survey was done according to the special request form the Coast Conservation and Coastal Resource Management Department (CC & CRMD) for the design of boat anchoring facility at the coast line for the purpose of detail design of proposed coastal structures.

Project 2.3: Bathymetric Survey and shore profile at Unawatuna Bay for CC and CRMD

This survey was done according to the special request form the Coast Conservation and Coastal Resource Management Department (CC & CRMD) for the investigation of the sea bottom profiles.

Project 2.4: Beach profiling survey from Mt. Lavinia to Uswetakeiyawa for Colombo Prot City Development Project for China Harbor Engineering Company Ltd.

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 beach profiling were done 10 km South and North of the proposed site to fulfill the main objective of monitoring the identified parameters at the Environment Management Plan in detail.

Project 3.0: Surveys Conducted with RV Sammudrika

Project 3.1: Bathymetric Survey

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

Project 3.2: Oceanographic Survey

The survey was conducted to recover sea glider 169 using RV Sammudirka by NIOMS. Further, they have done CTD, VMP and ADCP surveys conducted along with zooplankton sampling.

Project 3.3: Deployment of Drifters

Sea glider 167 deployment and 3 drifters were deployed by NIOMS using RV Sammudrika.

Project 3.4: Moorings to Ocean Observations

Training on calibration ADCP, VEMCO sensors for ADCP mooring at 100m water depth on the east transect using research vessel by NIOMS. The purpose of this survey was to trap the bottom boundary layer currents.

Publications / Maps

- Nautical Chart of Trincomalee Harbour

Training / Awareness programme conducted:

- Routine awareness programmes in Hydrographic Surveying and Chart Production for Naval Officers and Seamen.
- Two undergraduates from Faculty of Geomatics, University of Sabaragamuwa were trained for 3 months period.
- Onboard Bathymetric Survey training was conducted to 60 undergraduates from Faculty of Geometrics, 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: Short Course on Remote Sensing Special Emphasis on Digital Image Processing, Indian Institute of Remote Sensing, Dept. of Space, India
- No. Of Officer 01: Marine Safety Information Course, Oman.
- No. of Officers 03: Production of Electronic Navigational Charts (ENC) using Caris S57 Composer in Sri Lanka

Non Scheduled Activities / Consultancies

Project	Contract Amount (Rs.)
Bathymetric Survey for the feasibility study for the development of six fishery harbours in North and East	2,314,200.00
Bathymetric Survey and Shore profile for Coast Conservation and Coastal Resource Management Department at Unawatuna	1,978,470.00
Bathymetric survey near Ruhuna University for CC & CRMD	1,155,310.00
On board bathymetric surveys training for undergraduates at Sabaragamuwa University	257,715.41
Beach Profiling survey for Colombo Port City Dev. Project	815, 620.00
Total	**6,521,315.41**

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 2014 division has carried out 14 research projects on the thrust areas of Community Based Aquaculture, Increase culture diversity of aquaculture commodities through development of breeding, larval rearing and grow out technology and feed development, Health Management, Ornamental fish breeding and culture as well as conservation of aquatic habitats.

In summary of research and development, *Kapphaphycus alverezii*, seaweed nursery in Southern coast is successfully developed and seeds were deployed for the commercial scale community based projects. Pilot scale oyster culture research and development work was finished at Puttalam lagoon successfully and the research findings were disseminated for the initiation of community based oyster farming at Puttalam lagoon. Establishment of hatchery facilities and conditions of *Holothuria scabra* was further developed through research trials to find out breeding season as well as larval feeding. Community based farming using hatchery bread larvae was started reared larvae for the first time in Sri Lanka. The larval rearing practice is still improving with different feed trials.

Community based fish culture development in abandoned clay pits highlighted the feasibility of utilize these vast area of clay pits for fish culture using low cost fish feeds.

Feed development is given priority as the high quality formulated feed is the most necessary factor for the development of aquaculture. High quality (42% protein) feed has been developed for seabass culture at cost of 165SLR to 180 SLR. Tank cleaner has become a nuisance to inland fisheries and the study revealed that incorporation of powder form of the fish spiked the protein level as well as growth of the fish.

Minor cyprinids small underutilized fish species in the inland tanks could be used to prepare a fish feed for Koi Caprs as such this can be applied for utilization of these resources. Critically endemic Asoka Pethiya has been successfully bread with environmental manipulation. Necessary data base was developed in order to induce breeding of Tin foil barb and Silver shark. Endemic ornamental plant *Cryptocoryne* was propagated in sand culture and hydroponics media. Tissue culture of endemic *Cryptocorynes* has been started. Study

revealed that White gut disease of shrimp caused by vibrio species. Although app. 81% of the ornamental fish sampled in the mycobacterial study were infected with mycobacteria although they were free from main pathogenic mycobacterial species of *M. fortitum, M. Chelonae* and *M. Marinum*. Therefore causative agent for dead on arrival of the export ornamental fish market in Sri Lanka still to be further explored. White spot disease condition was the most critical during the year and 175samples were tested in the laboratory for WSSV. Controversial results given by the laboratories have reduced the faith of the farmers on the WSSV detection. Hence laboratory calibration was proposed. Introduction low cost high precise test kit is carrying out. The monthly yield of all species was recorded in the brush parks of Negombo lagoon varied from 0.09 kg $m^{-2}month^{-1}$ and 1.53kg $m^{-2}month^{-1}$ respectively. Those changes depend on the mangrove species used and the health of the lagoon.

	Project Name	**Allocation (Rs. Mn)**	**Officer Responsible**
4.1	**Health management and monitoring in shrimp culture, ornamental fish culture and lagoons**		
4 .1.1	Investigation on white feces & white gut disease in farmed shrimp and its causes, prevalence and prevention	3	A.S.L.E.Corea, P.P.M.Heenatigala
4.1.2	Monitoring of viral disease conditions in shrimp cultured in North western & Eastern provinces		Dr. A.D.W.R.Rajapakshe
4.1.3	Study on effects of water quality changes and periphyton gone on brush-pile fish production in Negombo Estuary		M.M. Gammanpila
4.3	**Community based fisheries development**		
4.3.1	Development of seed stocks and monitoring of community participatory seaweed and oyster	2	Dr. H.M.P.Kithsiri Dr.V. Pahalawattaarachchi, S.Corea, R.Weerasinghe Upul Liyanage
4.3.2	Study of Distribution of Mycobacteriosis (Fish Tuberculosis) in ornamental fish culture system		P.P.M. Heenatigala S. Epasinghe
4.4	**Increase culture diversity of aquaculture commodities through development of breeding, larval rearing and grow out technology**		
4.4.1	Mariculture development with emphasis on sea cucumber farming in North & Northwestern provinces.	1.7	P.A.D.Ajith Kumara

4.4.2	Development of low costal highly nutritious feed for culturing of Asian seabass (*Lates calcerifer*).		Dr.M.G.I.S. Parakrama,
4.5	**Development of captive breeding/culture techniques for high value endemic and exotic ornamental fish species, aquatic plant propagation and live feed culture.**		
4.5.1	Development of breading techniques for selected exotic/endemic ornamental fish species & propagation of aquatic plants.	3.1	Dr. H.M.P.Kithsiri, Dr.V. Pahalawattarachchi R.R.A.R.Shirantha, S. Epasinghe, D. Karunarathne, J. Mallawaarachchi
4.5.2	Micro algae culture & technologic development for important marine ornamental fish species.		J. C. Mallawarachchi, Dr. H.M.P. Kithsiri, Dr.V. Pahalawattarachchi
4.6	**Inland Fisheries**		
4.6.1	Utilization of *Pterygolipthys multiradiatus* (tank cleaner) fish silage and dried powder on high valued food fish feeds.	4	R.Weerasinghe D.A. Athukorala, P.A.D. Ajith, B.K.K.K. Jinadasa
4.6.2	Assessment of productivity and selection of most suitable fish species for stocking selected tank in Hambanthota district with NAQDA.		Dr.A.D.W.R. Rajapakshe
4.6.3	Development of low cost fish feed using fish in reservoirs for koi-carp grow out culture.		D.A. Athukorala, R. Weerasinghe M.Epasinghe, Susima Ariyarathna
4.6.4	Appropriate technology for the development of rural aquaculture in abundant clay pits with community participation in Katana area.		M.H.S.Ariyaratne
4.6.5	Development of rural livelihood through sustainable fish culture and fresh water prawn culture in Hambanthota, Matara & Kaluthara Districts.		K.W.R.R. Amaraweera Dr. M.G.I.S. Parakrama
Total		**13.8**	

Project No 4.1 : Health management and monitoring in shrimp culture, ornamental fish culture and lagoons

Component 4.1 : Investigation on white feces & white gut disease in farmed shrimp and its causes, prevalence and prevention.

Responsible Officer: A.S.L.E. Corea

The shrimp industry in the North western province was affected by white feces disease which lowered production and quality of cultured shrimp. No information was available on the spread of this disease. Therefore baseline information on the disease spread, management methods carried out by farmers and its success and the causative agent was needed to provide scientific methods for management of the disease and improve quality.

Shrimp culture in Baticaloa district commenced after the end of the civil war in the region. But there was no information regarding the practices observed in the area and water quality in the water source or the ponds, Therefore collection of information was necessary before any disease conditions affected the area.

Objective

The objective of the study was to find the distribution of the White feces disease, its impact on production cause of the disease and management of the disease in the Puttalam district and collect baseline data on shrimp culture activities, disease occurrence and water quality in the water source in Baticaloa district.

Activities carried out

The activities carried out included a survey on the disease occurrence and actions taken by farmers to manage the disease including the result of such action. Samples were collected from farms with disease and the pond water quality was also analyzed in these farms.

Results and Discussion

The disease was reported from 70% of the farms from all zones in the Puttalam district 4% farms did not treat the disease. The harvested shrimp were graded as low quality with soft shells and the growth was retarded. The others treated the disease with probiotics, garlic powder or powder provided by the farm consultant, which could not be identified. Farms in the southern Dutch canal, Mundel area responded to probiotics. The water quality indicated high suspended matter (> 260ppm) loads in farms having the disease and high plankton densities were observed in these farms.

The samples analyzed contained protozoans in the gut, but could not be identified to species level as they were deteriorated. The bacteria samples were isolated from the samples collected *Vibrio para heamolyticus* and *Vibrio alginolyticus* were present according to colony morphology and biochemical testing. Confirmation of the results need to carried out using further identification techniques.

Sampling in Batticcaloa distinct was carried out during the period March to October. The results revealed that the nitrite and ammonia levels in the water source were higher than the optimal level for shrimp culture (0.07 – 0. 13 mg/l and 0.10 – 0.537 mg/l) respectively. Some farms at Baticcaloa were affected by water quality problems in the September – October period and had to be harvested prematurely. However since most farms used bacterial treatment methods the ammonia and Nitrite levels in the ponds were not very high during sampling.

Output

Causative agent for white feces disease in Sri Lanka identified as bacteria either *Vibrio para heamolyticus* or *Vibrio alginolyticus.*

Progress (%): Physical: 65% Financial :

Constraints:

Unavailability of vehicles in January and February for field work resulted in commencing the project work only from March. Unavailability of funds and vehicles from November cancelling field work after November. Even during the mid year vehicle problems affected sampling.

The chemicals and equipment requested for 2014 was not received and some of the parameters could not be completed in chemical analysis during the latter part of the year.

(Alkalinity and Phosphate could not be tested.)

Component 4.1.2 : Monitoring of viral disease conditions in shrimp cultured in North Western & Eastern provinces

Responsible Officers: Dr.V.Pahalawattaarachchi, Rasika Thantrige

Disease has become a major constraint to shrimp aquaculture in the world. Especially since the outbreak of white spot disease (caused by the white spot syndrome virus, WSSV), shrimp production has decreased significantly in many countries and farmers are facing serious difficulties in continuing production When the patterns of spread of diseases and pathogens of shrimp are examined, especially those for viral pathogens, there is convincing evidence that most major disease outbreaks are associated with the movement of live shrimp (bloodstock, nauplii, postlarvae (PL and cultured shrimps). Our understanding of the avenues and options for controlling shrimp diseases, especially WSSV, has improved over the past few years, mainly through crop rotations. The ultimate solution for combating shrimp disease problems is to culture certified, domesticated stocks that are free of specific pathogens on nutritious, dry feeds in biosecure ponds under conditions that are not stressful to the shrimp. Hence the project is suggested for determination of WSSV infections with the movement of live shrimps.

Objectives

- Identify zones around the Puttlum district where wild *P. monodon* brooders could be obtain.
- The seasonal occurrence of *P. monodon* in the identified zones.
- Identify and monitoring of WSSV disease conditions in brooder PLs and cultured shrimp samples in shrimp cycle.
- Validation of NARA in house 2-step PCR assay for detection of WSSV.

Activities carried out

- Sampling and samples were tested for WSSV disease condition in brooder, PLs and juvenile stages in North western region.
- Repair the roof of PCR laboratory and reconstruction of internal facilities of the laboratory in IARAD.
- Initiate the organizing of Inter calibration workshop among Island wide WSSV disease testing laboratories in Sri Lanka.

Results

About 171 samples were tested for WSSV Disease in 2014. Among that 87 were recorded as WSSV positive and 84 samples were recorded as WSSN negative. Hence there was 50.8% of

WSSV disease prevalence in the North Western region. This sampling represented brooders, post larvae ad juvenile stages all together. This confirmation done by IQ 2000 WSSV detection and Prevention kit.

Progress (%): Physical: 65% Financial:

Constrains

- Delay of purchasing of chemicals and equipments.
- Unable to collect samples continuously to check WSSV disease distribution and severity.
- Repairing and painting of the laboratory took long time and during this period the laboratory had to be completely closed.

Component 4.1.3 : Study on effects of water quality changes and periphyton gone on brush-pile fish production in Negombo Estuary

Responsible Officer: M. Gammanpila

Objectives

- Study relation between nutrients and secondary tropic level in the estuary and their significance for the ecosystem.
- Seasonal variation in water quality in Negombo estuary in relation to fisheries production of brush-parks,
- Study of the factors effect on sustainability and economics of periphyton-based brush-file fish production.

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.

Results

Mangrove species which are mostly used to construct brush parks were R. *mucronata, L. racemosa, A. marina* and *Excoecaria agallocha*. Nearly 58.33% brush parks had 15-30 days duration between installation and harvesting. Most brush parks (63.64%) had 51-100 mangrove twigs and diameter of brush parks varied between 3 – 12 m in Negombo estuary. The twig density, expressed as twig dry weight per unit volume of Brush Park ranged from

0.31 to 7.55 kg /m3 and average twig density was 1.31±1.44 kg/m^3.The lowest and height monthly yield of all species was recorded 0.09 kg $m^{-2}month^{-1}$ and 1.53kg $m^{-2}month^{-1}$ respectively.

Progress: Physical: 100% Financial:

Constraints

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

Project 4.3 : Community based aquaculture development

Component 4.3.1 : Development of seed stocks and monitoring of community participatory seaweed and oyster culture

Responsible Officers: Dr. H.M.P.Kithsiri, Dr.V. Pahalawattaarachchi, A.S.L.E. Corea, R. Weerasinghe, Upul Liyanage

Study 1: Seaweed nursery maintenance and monitoring studies

The seaweed, *Kappaphycus alvarezii* 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. Just after the war in the North and Northwest region of the country, seaweed culture trials were started in the Mannar region and it was affected during the Northeast monsoonal period as a result of the heavy rains and fresh water flush. Culture trial and the seed garden were started in Dondra , Kaisawella point in the South part of the country considering conservation of the seeds during the Northeast monsoonal period. And it was successful and seeds were supplied to the commercial culture for Helyis Company, NAQDA and ANN associates. Anyhow aim of the study was to keep the seed stock as well as improve the quality continuously.

Activities carried out

Twelve 1X1x2 m^3cages were deployed in sheltered part of the bay attached to two parallel anchor ropes. Floating cages were prepared with 1 inch PVC pipes and fittings, Anton PVC nets with the support of 12 Styrofoam floaters for a cage. Heavy (50 kg) triangular concrete anchors with the hooks fixed to underneath side were used to fix line ropes. Each 200 g, 32 bunches (6.4 kg) of *Kappaphycus alvarezii* were set to a cage. Those bunches were loosely tie to the stretched ropes through the longitudinal direction of the cage. Initially topside of the

cages were kept open to facilitate enough light penetration, easy sampling and cleaning. But under the rough sea condition all the cages were affected and damaged seaweed particles were floated away from the cages.

The culture trials were continued throughout the year, and growth studies were carried out during one culture trail since early march to late April 2014. Growth measurements (weight) were taken 10 days interval. Ten bunches were measured from a cage at a time. Average temperature and the salinity during the culture period were 29.71^{0}C ± 1.79 ^{0}C and 32.71 ± 1.11 ppt respectively.

Results

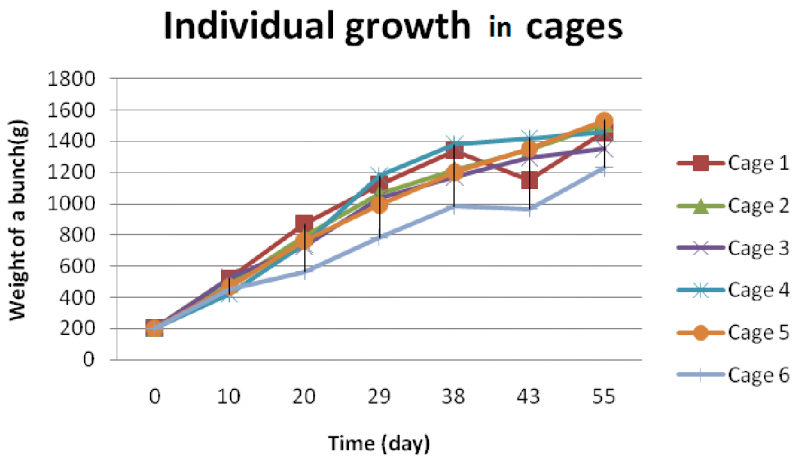


Fig 4.3.1.1: Growth of seaweeds in the individual cages

Individual growth of bunches in 6 different cages were monitored throughout the culture period. During the initial period of the culture cycle, growth differences (STDEV) are quite smaller than the later stages (Figure 4.3.1.1x & table 4.3.1.1). According to the Figure the growth of the cage 6 showed comparatively slow with compared to other cages. This can be due to the placement of the cages within the limited space of the bay in which different depth could be observed. While growing the bunches after attaining some weight, growth may have affected with the light availability and breaking of fragments due to high wave actions.

Results

Time (day)	0	10	20	29	38	43	55
Cage 1	200	522.5±66.09	869±124.73	1120±177.03	1340±227.76	1150±237.18	1460±336.28
Cage 2	200	482.5±66.71	790±100.27	1064±194.73	1219.5±176.85	1345±136.83	1512.5±282.90
Cage 3	200	525±122.47	721.5±140.35	1031.5±158.71	1167±225.54	1292.5±233.05	1350±288.68

Cage 4	200	422.5±156.1	737±131.78	1177±243.12	1377.5±312.13	1419±180.35	1460±447.09
Cage 5	200	467.5±102.09	763.5±174.75	991±204.60	1202±254.26	1352.5±231.38	1532.5±421.15
Cage 6	200	452.5±94.41	564±73.24	783.5±115.64	984±121.88	968.5±175.61	1232.5±399.66

Table 4.3.1.1: Growth rate of seaweeds in individual cage

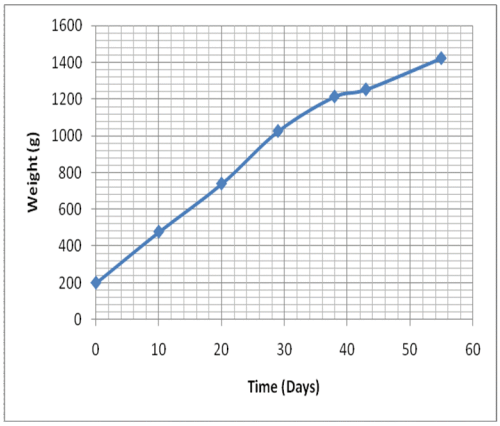


Fig 4.3.1.2. Weight gain of the bunches Vs Time

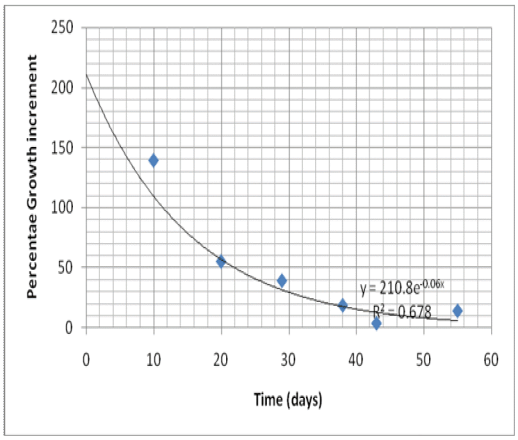


Fig 4.3.1.3: Trend in individual weight gain Vs Time

The study revealed that the individual weight of the propagules doubled within seven days at the beginning of the culture cycle and it takes longer while growing to the large size. With the growth of the propagules may impact with limited space within the cage and less light receiving to the lower branches which might inhibit the initial growth rate. Further it was revealed that the weight increment of then bunches are declining with the time spent. Maximum growth of the bunches could be observed after 10 days of growth at the sea at Devundara which has generally high wave energy compared to northern sheltered areas.

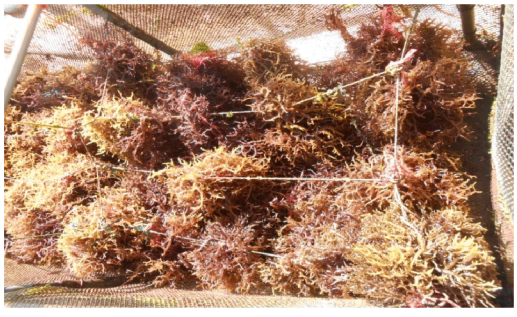


Fig 4.3.1.4. Some stages of seaweed culture

Recommendations

PVC Cages are not durable and easily breakable under the rough sea condition. So Rafts are recommended to culture in such areas during the calm season. Rough sea conditions are not suitable for the sea weed culture because of the high maintenance cost of the cages.

In that sea condition for seeds, multification can be started at very early stages and seed stock can be developed very fast.

Constraints

In Dondra no enough space to expand the project.

Funds are not received at the required time.

Study 2: Pilot scale community based oyster farming research and development

Introduction

The oyster research and culture programme was carried out with a view of providing self-employment opportunities especially for the women fisher communities at Gangewadiya and Kandakuliya in Puttalam District. In addition these two areas are blessed with natural oyster resources which are not used at present. Using these resources culture techniques were introduced to the community.

Objectives

- To study the water quality parameters, spat falling seasons and growth of oysters in the two sites where the natural oyster beds and the community based oyster culture programme is carried out.
- To introduce commercial level bivalve farming to Sri Lanka through introducing correct technology and proper marketing channel.

Activities

- Four wooden racks were constructed in different locations at Gangewadiya and Kandakuliya and monitored the water quality, spat falling, oyster growth, presence of toxic plankton and important plankton
- Different types of collectors were used to identify the spat falling season and the best oyster spat collectors among them. In addition two racks were placed at Puttalam lagoon near NARA premises and Anawasala to find out the suitable alternative locations for the oyster farming.

Result and discussions

Water quality parameters were within the acceptable range for oyster farming except salinity levels at Gangewadiya. Salinity levels during the 4th week of October, month of November,4th week of April and the month of May due to the heavy rain salinity decresed upto zero and the oysters were transferred to a location where the salinity was within the acceptable range. After second week salinity increased to normal levels.

Several spat falling seasons at Gangewadiya and at Kandakuliya were identified during the one year study period. During the one year study period, November was the highest number of spat recorded at Gangewadiya and month May was the highest number of spats recorded at Kandakuliya. Monthly growth rate per month recorded at Kandakuliya ,Kalpitiya and Gangewadiya were 3 .66 mm, 2.1 mm and 4.2mm respectively. Two communities have stocked 20,000 oysrers at Gangewadiya and Kandakuliya. They earned around Rs.10,000/= per month during the end of the year.

Output

Introduction of successful oyster culture programme to the community based on scientific findings. Additional income source for the community.

Constraints

Depuration plant could not be completed as tender procedure was not completed during the period.

Requested chemicals not received during the period

Component 4.3.2 : Study of distribution of micobacteriosis (Fish Tuberculosis) in ornamental fish culture system in Sri Lanka.

Responsible Officer: P.P.M. Heenatigala

The export of ornamental fish in Sri Lanka is a thriving market but over the years has been faced with issues of fishes being reported high rate of dead on arrival (DOA). The reported DOA in fact includes those mortalities on arrival, as well as the mortalities occurring during the first day after the arrival of shipment. DOA can be as a result of several factors which have been reported to include stress, temperature, and lack of food and oxygen, diseases, pollution, wrong handling technique and overcrowding. In Sri Lanka it is believe that micobacteriosis is one of the major reasons resulting the high DOA of the Sri Lankan fish and unfortunately there is a little scientific information available regarding this.

Mycobacteriosis is a disease caused by certain bacterial species within the genus Mycobacterium. Water and biofilms are natural habitat of Mycobacterium. All fish are susceptible to this disease, though some species seem to be at greater risk than others. The disease has been reported in a broad range of fish species from freshwater, marine and brackish water environments and the disease is considered non-treatable once established in the fish host. They can infect other aquatic organisms, as well as protozoan. Ingestion, direct infection of the skin, in certain species (platy fish) trans-ovarian transmission has been demonstrated.

Considering this it is important to study the distribution and species diversity of micobacteriosis within Sri Lanka to minimize quality loses and DOA of ornamental fish produce in Sri Lanka and finally for the development of this valuable foreign exchange earning industry in Sri Lanka.

Objectives

- To study the distribution of micobacteriosis in ornamental fish culture system in Sri Lanka.
- To Identify the causes and minimises the Post-shipment mortality (dead on arrival) of ornamental fish exported from Sri Lanka.
- To source high health ornamental fish from Sri Lanka to the export market.

Activities carried out

- Procument of chemicals, consumables and equipment.

- Collection of background data an export data (Chemical used, stocking facility, Packing density, Mode of transport etc.)
- Sampling from the ornamental fish exporters (Diseased fish).
- Isolation of mycobacteria from samples collected.
- DNA extraction and bacteria species identification.
- Data analysis.
- Report writing.

Results

During the study 138 Guppy fish samples were collected.Samples were received from Kaluthara, Gall, Padukka, Hambanthota, Negombo, Horana, Gampaha,Ingiriya, Bandaragama, Lunugamwehera and Kurunegala areas. Fish were exported to Europe, America, Israel, Netherlands, South Korea, England, Japan, Australia, Turkey, Newzeland and Spain. Fish were transported by exporters from farms to packing sites by Lorries without cold facilities. The maximum internal transport time was one day and International transport time was 2 days. As treatments exporters used Tetracycline, Salt and Triple as pre transport treatments. From the samples collected 80.4% of fish were infected with mycobacteria. According to the PCR analysis isolated Mycobacterial species were identified as non pathogenic species

Conclusion

Approximately eighty one percent (80.6%) of the ornamental fish taken to this study were infected with mycobacteria. However they were free from main pathogenic mycobacterial species of *M. fortitum, M. Chelonae* and *M. Marinum*. Therefore the results obtained in this study revealed that the above main pathogenic mycobacterial species are not affect for the dead on arrival of the export ornamental fish market in Sri Lanka.

Facilitate disease management programme in ornamental fish industry in Sri Lanka.

Output

Facilitate disease management programme in ornamental fish industry in Sri Lanka.

Progress (%) Physical: 95% Financial:

Constraints:

Delay of purchasing of chemicals requested.

Project No 4.4 : Increase culture diversity of aquaculture commodities through development of breeding, larval rearing and grow out technology

Component 4.4.1 : Mariculture development with emphasis on sea cucumber farming in North& Northwestern provinces

Responsible Officer: P.A.D. Ajith

Major constraint for the expansion of mariculture or coastal aquaculture of marine species (fin fish, shell fish and non-fin fish) is the inconsistent supply of seeds in Sri Lanka. Seeds/broodstock requirements for culture operations in respect of some species are met through wild collection and imports. There is a great risk in introducing diseases to Sri Lanka with the imported seeds/broodstock. As sea cucumbers are in wild collection it is caused to depletion of wild stock.

To address the problem of rapid depletion of wild sea cucumber species, the National Aquatic Resources Research and Development Agency (NARA) ventured upon a programme on artificial breeding of sandfish (*Holothuria scabra*) which is one of the economically important sea cucumber species to produce seed for aquaculture and enhance depleted wild population. This programme aims to introduce artificial breeding technology, larval rearing and suitable field grow-out systems for *H. scabra* with collaborative of the fish communities and sector.

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.
- 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.
- Feeding trials for early larval stages.

- Community-based sea cucumber farming.

Results:

1. **Establishment of hatchery facilities for *H. scabra,* collection and conditioning of broodstock and investigate the seasonal breeding performance in order to develop year round seeds production**

The year round seeds availability is an important phenomenon in aquaculture operation. Several breeding trials were performed to identify peak spawning time of cultured brooders throughout the year. These brooders were maintained in natural environment in lagoon pen enclosure. The obtained results are shown in table 1. These results revealed that their breeding season coincide with the natural environs breeding time. Because generally they start spawning in wild with onset of North east monsoon season (mid of September) that drastic temperature variance occur.

Date	**Breeding Performance**	**Male/Female induced ratio**	**No. of fertilized eggs produced**
March 2014	Not success	-	-
May 2014	Not success	-	-
July 2014	Not success	-	-
September(08th) 2014	Not success	-	-
September(15th) 2014	Success	2:1	400,000
October 2014	Success	9:1	300,000

Table 4.4.1.1. Seasonal breeding performances of cultured sand fish

1000 no's of one month old juveniles separate and out of this 700 transferred to the outdoor tanks for rear next year community-based sea cucumber farming work. The juvenile survival rate was below 5%.

(a.) Water Sprinkling

(b.) Dry Treatment

Fig4.4.1. 1. Induced breeding methods of adult sea cucumber

2. Feeding trial

Two different type of formulated feed were introduced to sea cucumber juveniles and their daily food ration, energy budget and growth pattern was studied in respect of water quality parameters. Growth studies are being still conducted. Number of juveniles produced and survival rate can be calculated by the end of December when juveniles introduces to outdoor tanks.

Some preliminary results obtained from this study were prepared as an abstract (abstract No. 3) and has been accepted for oral presentation in NARA annual scientific session 2014.

3. Pilot Project on Community- based Sea Cucumber Farming in Palakuda, Kalpitiya in the North western province of Sri Lanka

First phase of the project was initiated in Puttlam district covering one Grama Niladhari division called Palakuda where the higher percentages of artisanal fishermen are found. The suitable places for sea cucumbers culture were assessed under the rapid site selection procedure. Participatory Rural Appraisal (PRA) method was done to identify fisher-folks. 19 beneficiary families were selected from the St. Anthony Co-operative Fisheries Society and awareness programme was conducted to them covering all the aspects of sea cucumber farming. They were distributed net mending materials to make 20m X 15 m size pen enclosure. 300 no's hatchery-reared juveniles obtained from NARA Regional Research

Center, were stocked (size 26.26±0.67 g) in to this pen (stocking density 1 juvenile per m^2). Another 100 juveniles were introduced to co co-culture with groupers. NARA has been providing technical know-how to conduct the farming activities. All the expenses were born by the project. Average growth, daily growth rate and salinity has been recorded and calculated every month.

Average growth for the five month culture period was 42.66±1.01, 75.57±1.94, 106.75 ±0.14, 103.14±2.39 and 105.86±2.39 in grams. The daily growth rate in respect to salinity was 0.53 g, 1.23 g, 1.04 g, -0.12 and 0.08g. Salinity varied from July to October 38, 38, 34 26 and 30 ppt respectively. Maximum growth attained during the each month from July to October 71.0 g, 132.0g, 180.0 g, 179.0 and 176.0 g respectively. Estimated net revenue to the fishery society through this pilot project is about Rs 204,000.00 at the end of 8-10 month culture period.

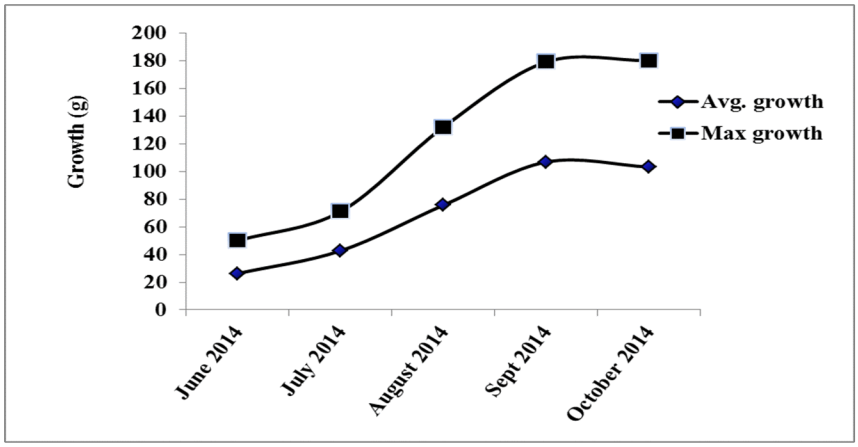


Fig.4.4.1.2. Average growth and maximum growth gained during the study period

Some preliminary results obtained from this study were prepared as an abstract (abstract No. 2) and has been accepted for oral presentation in NARA annual scientific session 2014.

Recommendations:

Sea cucumbers are not fed as they depend on naturally available food inside the pen and this is a major advantage for the society as they don't have to bear any cost for feeding. This activity is also important as a fisher-women empowerment. Introducing low cost materials to facilities develop and increasing extent of the farming site is recommended to further enhance income of the practices. However, this is the first ever community–based sea cucumber farming by using hatchery-reared juveniles in Sri Lanka.

This project is planned to expand substantially to Mannar and Jaffna district. 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.

4. Comparison of body composition between cultured and wild sand fish

The entire required chemical arrived for proximate analysis study by the end of November. But this activity has to postpone up to next year due to unavailability of funds for specimen purchase and other filed expenses.

Progress: Physical 95 % Financial 80%

Constraints:

Around 20% allocated funds were not received therefore, 100% physical target was unable to achieve. Some chemicals ordered for the proximate analysis still not received and rest came in the fourth quarter of the year. Therefore when chemical requirement is fulfilled funds not received for purchasing specimens. As result of that this activity had to postpone up to next year. Although we have planned to collect some wild brooders during the peak fishing time, we were unable to do it due to financial crisis.

Heavy precipitation got to north western and North central provinces throughout the month of December. As a result of spilling of all the perennial and seasonal tanks in two provinces lot of water discharge through Mi Oya and Kala Oya which are the major two rivers connected with the Puttalam lagoon. That has been caused to drastic salinity changes in the lagoon not only during December month but also perhaps, until end of January. We are facing great problem in water exchange process both indoor and outdoor tanks at the present. Therefore, higher juvenile mortalities can be expected. This will eventually cause to adjustment and delay of year 2015 project plan. Because after two successive breeding trials, we have been rearing around 1000 one month old juveniles for next year community-based projects.

Output:

- Built up awareness among fishing communities on sea cucumber farming
- Trained fisher folks on community-based sea cucumber farming
- Identifying the peak breeding time of the year of sea cucumber brooders under captivity in natural environs
- Development and integration of different kind of breeding methods

- Effectiveness of commercial larval feeds and formulate feeds by using locally available ingredients
- Dissemination of the technical *know-how* preparing three scientific abstracts

Component 4.4.2 :Development of low cost highly nutritious feed for the culture of Asian Sea Bass *Lates calcerifer* (Bloch, 1970) with reference to the reduction of production cost.

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

Asian Sea bass (*Lates calcerifer*) a demanded eurihaline fish with high taste and nutritional levels has been an emerging species for aquaculture in Sri Lanka. However, appropriate feed is the most important issue for the development and propagation of local sea bass industry. As trash fish is the traditional method of feeding grows out cultures, and its availability is seasonal, feeding cost is very high issue for the farmer and hence, they tend to avoid culturing sea bass. As such 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 aquaculture.
- To enhance the annual income of small scale fish farmers with sea bass culture.
- To reduce poverty in poor fishing families.
- To improve the health status in the society by making they utilize sea bass fish as a high protein source.

Activities carried out

- Literature survey
- Find out small scale sea bass farmers and gathering of information
- Select some suitable sites/ pond systems to grow out culture
- Purchasing feed ingredients
- Preparing of fish feed
- Weaning of sea bass fish from trash fish to prepared feed
- Conducting experimental trials with the help of outside fish farmers
- Monitoring, sampling and Data collection for growth and survival success
- Report preparation

Results

Sea bass grow out cage culture trial was conducted in the Negombo lagoon with using a new feed formula with 42 % crude protein level. Total 350 fingerlings were stocked with initial length 11.5±0.50 – 14.5±2.50 cm in 10 x10x 6 feet cage. They were given trash fish only for two weeks and then started to wean with formulated feed. After another three weeks they were totally given the formulated feed. Trial was conducted for eight months until they become table size. Survival 100%, average weight (single) 400g. Maximum single weight 900g and minimum was 125g. Total weight to the trial terminating date was 141 kg. Maximum price per kg of feed was varying from 165LKR to 180 LKR during the experimental period ensuring the cost for formulated/prepared feed was lower compared to the market price of the imported feed.

Output

Economically feasible nutritious feed for seabass grow out culture.

Progress % Physical: 95% Financial:

Constraints

Delay to purchase chemicals, equipments, lack of petty cash and/ or special advances, insufficient supporting staff (sometimes).

Project 4.5 : Development of captive breeding/culture techniques for high value endemic and exotic ornamental fish species, aquatic plant propagation and live feed culture

Component 4.5.1 :Development of breeding technology for selected endemic/exotic ornamental fishes and propagation techniques for commercially important aquatic ornamental plant species.

Responsible Officers: Dr. H. M. P. Kithsiri, Dr. Vasantha Pahalawattarachchi , R. R. A. Ramani Shirantha, M.S. Epasinghe

Objectives

- Development of better breeding and culture technologies for the selected endemic ornamental fish species with their distribution studies.
- Development of induced breeding techniques for the selected exotic ornamental fish species *viz. Barbonymus schwanenfeldii* (Tinfoil Barb), *Balantiocheilos melanopterus* (Silver Shark), *Gyrinocheilus aymonieri* (Gold Algae Eater).
- Development of better infrastructure facilities in ornamental fish section.

- Breeding and rearing of highly demanded exotic fishes.
- Development of better infrastructure facilities for ornamental plant propagation.
- Setting up a tissue culture laboratory and development of post harvest technology on ornamental aquatic plants.

The exciting ornamental fish rearing, breeding, and culture facilities at NARA are inadequate and needs to be developed for better research performances. Since the expansion of local and export markets for ornamental fishes throughout the world, requires continuous supply of quality aquaculture exotic ornamental fishes. Supply of quality seeds at required number is vital for the development of the industry. The development of induced breeding techniques for some of the economically important exotic ornamental fishes such as *Gyrinocheilus aymonieri* commonly called as Gold Algae Eater (GAE), *Barbonymus schwanenfeldii* (Tin Foil Barb- TFB) and *Balantiocheilos melanopterus* (Silver Shark-SS) can address the issue certainly.As the national research body for aquatic resources NARA has to address these issues.

Activities carried out

Continuous captivity breeding trails on selected economically and ecologically important endemic fishes were carried out through environmental manipulation procedure on which the technologies have already been developed. The critically endangered endemic fish species *Systomus asoka* was subjected to captive breed experiments through environmental manipulation procedure. Extra attempts were made to develop captivity breeding technologies for the endemic ornamental fish species *Schisrura notostigma* by providing different breeding substrates such as clay pot, coir fiber, Z-lone tube, chip stone and coconut leaves. Distribution studies on the endemic fishes in Kirindi Oya and Mahaweli River catchments were conducted.

Brood stocks development of selected exotic ornamental fishes was conducted whilst developing much better intra facilities for fish culture and rearing. New varieties of some commercially important fish species were purchased and are being reared for quality improved. The induced breeding technology development was initiated on *Barbonymus schwanenfeldii* (Tin Foil Barb) and *Balantiocheilos melanopterus* (Silver Shark) while keeping records on different phases in the induced breeding procedure such as biopsies, egg quality, egg diameters and position of germinal vesicle (GV) etc. The export and import data on the tropical ornamental fish industry in Sri Lanka were collected.

Post harvest technology development on the wild collected *Cryptocoryne* plants was initiated to check presence of root nematode parasites using the dip extraction technology. Infra facility development was done while establishing a floor system and a series of culture tanks in the plant house. The sand-culture on the aquatic plant was initiated with some endemic *Cryptocorynes* and the exotic plants viz. *Bacopa caroliniana.* The hydroponic system was established to culture mother plants of endemic *Cryptocoryne wendtii* and the exotic plants *Azolla caroliniana*. The plant tissue culture development was initiated while surface sterilization of the ex-plant, testing of different hormone concentrations to optimize callus/shoot formation, media preparation for effective shoot formation and testing of antibiotics and fungicides to control contamination of the rhizome ex-plant culture of *Cryptocoryne* plants.

Results

Captive bred stocks of 14 endemic fish species are rearing at NARA viz. Belontia signata**,** Labuaca insularis, L. ruhuna, Puntius kelumi, Pethia nigrofasciatus, P. bandula, P. reval, P. cumingii, P. singhala, P. titteya, P. srilankensis, Rasboroides vaterifloris, Systomus martenstyni and Devario pathirana. The females Systomus asoka once succeeded to bring into the gravid stages but other steps were failed. New potential breeding technology was designed to adopt a water circulation system to bring this species to spawn. About 500 new offspring of very rare fish species P. bandula and S. martensyni were obtained. The adopted captive breeding methods for Schisrura notostigma were not succeeded so far, trails are still going on. The endemic fish species Systomus timberi was rediscovered from the Kirindi Oya at Buthala after 52 years.

New varieties of highly demanded exotic fish species are rearing for quality improvement. Good quality brooders were supplied from time to time especially for small scale ornamental fish farmers. Ninety fish biopsies were carried out to identify germinal vesicle migration stage (GVMS) and it was found that their first maturation is in late October and September in Tin Foil Barb and in Silver Shark respectively. Their mean egg diameters ranged from 1216±30.05µm and1175.13±7.06 µm at GVMS respectively.

Mother plants of *Crypotocoryne bogneri, C. parva*, *C. becketti* and *C. wendtii* were collected from the wild for future experiments. Only *Meloidogyn* species were recorded as a root parasitic worm species in the aquatic plants collected from the wild. However, they could not identify up to species level due to lack of facilities. Better stabilization of the cultured ex plant was obtained through several experiments with 10%-0% reduced contamination. The

conducted tissue culture experiment trails on *Cryptocoryne* species and *Alternantera sessilis* proven that the adopted surface sterilization technique can reduce contamination 10-20% level. It was found that 10mg/L IAA hormone concentration can induce callus formation in *Alternanthra sessilis* leave ex-plant with 100%. The 160ml/L King Coconut sap culture media can develop shoot generation in *Cryptocoryne wendtii* at 50% level.

Conclusions

- *S. asoka* can't be easily bred in captivity through environmental manipulation procedure as well as it is very difficult to it to be tank raised.
- *S. asoka* wild populations are facing threats mainly due to river damming, two populations are in upper catchments of Kelani river need immediately adopted conservation measures.
- Supplying of clay pot, coir fiber, Z-lone tube, chip stone and coconut leaves as breeding substrates is not or less effective to induce *S. notostigma* to breed in captivity.

Output

Mother plant collections of endemic *Cryptocoryne* spp which have been used for tissue culture using hydrophonics and sand culture techniques

Experimental system for breeding endemic fish.

Records of rediscovering of the endemic fish species *Systomus timberi* from the Kirindi Oya at Buthala after 52 years.

Progress Physical: 85% Financial: 100%

Constrains

Due to insufficient number of tanks, rearing and extended captivity breeding research studies on fishes could not be carried out.

Due to unavailability of *G. aymonieri* juveniles and GnRH hormone in early 2014, the target study was aborted.

Due to delay in purchasing of growth hormones and chemicals especially the agar, not sufficient enough tanks the target work cloud not be carried out.

Component 4.5.2 : Micro algae culture & technologic development for important marine ornamental fish species.

Responsible Officer: J.C. Mallawarachchi, Dr. H.M.P. Kithsiri ,Dr. V. Pahalawattarachchi

In recent years, the interest in the trade of tropical fish has increased significantly, by creating direct negative effect on coral reefs and marine ecosystems. Tropical and subtropical countries are among the world's largest exporters of ornamental marine species for the aquarium trade.

However, currently there is a heavy reliance on wild caught marine ornamentals to satisfy consumer demand. People use unmanaged and destructive methods to collect marine ornamentals from coral reefs. To ensure a sustainable marine ornamental industry it is obvious and vital to develop captive breeding techniques for marine ornamental species, in particular, coral reef fish.

However, the marine ornamental aquaculture sector is still receiving limited research attention and very slow development compared to the technical and industrial advances made in food fish and fresh water ornamental fish aquaculture. This project aims to develop technologies for marine ornamental aquaculture.

Production of quality hatchery reared species principally depends on culture practices and the feed quality of brooders, fries and juveniles.

Objectives

- To develop marine ornamental species breeding hatchery.
- To develop marine ornamental species breeding technologies.
- To develop protocol to improve fry survival in captive condition.

Activities carried out

- Recirculation marine hatchery were developed to breed and rear seahorses
- Seahorse Brood stock collection, maturation and conditioning were carried out.
- Experiments were carried out to improve fry survival.
- Develop *Artemia* culture techniques in indoor system.
- Culturing and maintaining indoor algae cultures.
- Report writing

Results

Developed marine recirculation hatchery for fish breeding and culture and micro algae laboratory for indoor algae culture maintenance.Conducted feed trial for seahorse (*Hippocampus kuda*) . Fry obtained from brooders were maintained in the hatchery with 0ppm NH_3, 0-5ppm NO_3^- and NO_2^- levels of sea water. Fry survival and length were recorded in fortnight intervals. Three treatments for the experiment were arranged as *Moina, Artemia*, and mixture of *Artemia* and *Moina.*Highest survival rate were obtained fry fed with *Moina (*65%). Fry fed with *Artemia* and mixture of *Artemia*/ *Moina* survival rates (27% and 30%) were not shown significant difference with each other. There were not any significant differences in growth rates, between all three treatments.

Progress (%) Physical: 95% Financial: 100 %

Constraints:

- Purchasing of materials for hatchery development and algae culture were delayed.
- Balance work of project could not carry out due to financial crisis in NARA.

Project 4.6 : Inland Fisheries

Component 4.6.1 : Utilization of *Pterygolipthys multiradiatus* (tank cleaner) fish silage and dried powder on high valued food fish feeds.

Responsible Officer: R. Weerasinghe

As a result of misuse of tank cleaner in ornamental aquaculture sector, Kalawewa and many tanks in Sri Lanka have been faced with an immense problem. Probably tank cleaner stock in every tank has been increased. Fishermen's records and catch data reveal that tank cleaner abundance has surpassed other every allowable fish stocks. Moreover, this species damages to fishing nets by entangling. When fishermen try to remove them, injuries are occurred by strong and sharp tank cleaner fins. However, this has become a threat to natural breeding processes of other fish species in tanks. We aimed to formulate a feed for seabass by using dried powder of tank cleaner fish to give a solution for this threaten species as well as to reduce feed cost of seabass diets.

Objectives

- Study the effects of tank cleaner as a feed ingredient in seabassfeeds.
- Identification of the potential to substitute expensive imported fish meals.
- To find the possibilities to eradicate the threaten species from local vulnerable tanks.

Activities carried out

- Samples of Scavenger fish were collected to analyze body proximate and dried powder was prepared by using them.
- Proximate compositions of all ingredients were analyzed before formulation separately.
- Two diets ware prepared by using two diet compositions including 40% (T_1) and 30% (T_2) scavenger fish dried powder to achieve 40% Crude protein (CP) level.
- A Control diet (T_3) was formulated by using local fish meal to achieve 40% CP level and trash fish was used as T_4 diet (T_4 also was used to achieve 40% CP level).
- Feeding trial was carried out in 12 cages which established in Negombo lagoon for 75 days.
- Analysis of proximate composition of formulated feeds and experimental fish was performed
- Weight gain, feed conversion ratio, protein efficiency ratio, specific growth rate and somatic index were calculated and statistically analyzed.

Fig4.6.1.1. Experimental cages and feeding trial

Fig 4.6.1.2. Laboratory works with exp. fish

Results

There were significant differences in weight gain (WG), protein efficiency ratio (PER) and feed conversion ratio (FCR) of fish fed T_1 and T_3; T_2 and T_3; and T_4 and T_3. No significant

difference was recorded in WG, PER and FCR of fish fed T_1, T_2 and T_4 diets. Significant difference was observed in whole body proximate and somatic index of fish fed four diets.

Growth performances and retained protein and fat levels of experimental fish fed T_1, T_2, and T_4 diets were higher than T_3 diet.

Recommendations

Dried tank cleaner fish can be crushed and ground by efficient hammer mills to make fine power. If some particles are remaining, it can be sieved. But a trap net has to be developed to catch and eradicate tank cleaner from Sri Lankan stock tanks. It can be used as a free resource to make fish meal in Sri Lanka. Their high and nutritive fat content can be extracted to produce some essential fatty acids. Tank cleaner dried powder can be used to replace local fish meals effectively. Replacing level could be closer to 40%. But elevated levels of tank cleaner dried powder more than 40% could increase FCR of the diet.

Output

- Growth performances of fish fed 40 percent tank cleaner powder based diet showed best performances
- Tank cleaner had been identified as a good protein source and good fish meal replacer.

Progress: Physical: 95% Financial: 100%

Component 4.6.2 : Assessment of productivity and selection of most suitable fish species for stocking in selected tanks in Hambantota district.

Responsible Officer: Dr.A.D.W.R.Rajapakshe

There are huge numbers of perennial and seasonal tanks available in Hambantota district. Millions of fish are stocking in these tanks annually by NAQDA. Major species which produced by NAQDA are Catla, Rohu, Common Carp, Mrigal and Gift Tilapia. From these species 16 million fingerlings have been stocked in perennial and seasonal tanks. Although they are targeted to many metric tons, very less number of production have been achieved. Therefore according to the request of NAQDA this research has been designed. In Hambantota district there is a good potential for food fish culture development and higher number of people are engaged in fishing in these reservoirs. With the help of this research we are targeting to increase the production in selected perennial tanks in Hambantota district.

Objectives:

- Determination of productivity of each tank.
- Selection of most suitable fish species for stocking in each tank.
- To find out the reasons for production losses.
- To enhance the livelihood of fishing community.

Activities carried out

- Two tanks were selected for the study. (Muruthawela tanks from Walasmulla AGA division and Ranmuduwewa from Sooriyawewa AGA division).
- Five sampling point from Ranmuduwewa and six sampling points from Muruthawela tanks were selected.
- Monthly visited each tanks and Monitored the water quality in each sampling points in each tanks.

Results

The parameters tested were Dissolve Oxygen, pH, conductivity, Water Temperature, Secchi depth measurement, density of Zoo and phytoplankton. Mean values of physicochemical parameters of water of each sites of two tanks are given bellow. Analysis of chlorophyll amount and qualitative and quantitative analysis of phytoplankton are being carrying out.

Parameters	Site R_1	Site R_2	Site R_3	Site R_4	Site R_5
DO (mg/l)	6.15	6.19	6.16	6.18	6.12
PH	7.98	7.93	8.02	8.06	8.07
$T_{w\ (C^0)}$	29.05	28.81	28.63	28.57	28.52
Secchi Dep. (cm)	31.8	32	33.75	31.25	31.87
EC ($\mu s\ cm^{-1}$)	211.68	210.30	210.82	211.4	212.3
Chlorophill					

Table 4.6.2.1: Mean Values of physicochemical parameters of five sites of Ranmuduwewa tanks.

Parameters	Site M_1	Site M_2	Site M_3	Site M_4	Site M_5	Site M_6
DO (mg/l)	6.14	5.35	5.42	6.18	5.27	5.94
PH	7.5	6.46	6.46	7.53	6.58	7.5
$T_{w\ (C^0)}$	29.56	21.57	25.55	29.67	26.02	29.7
Secchi Dep. (cm)	67.5	68.12	61.87	66.25	77.56	90.83
EC ($\mu s\ cm^{-1}$)	515.01	491.03	355.76	406.68	420.75	444.9
Chlorophill						

Table 4.6.2.2: Mean Values of physicochemical parameters of six sites of Muruthawela tanks.

Outcome:

Encourage farmers for sustainable aquaculture.

Progress (%) Physical: 75 % Financial: 80%

Constraints

- Lack of vehicles
- As we didn't get the support as expected from NAQDA, we could measure the productivity of the two tank only.
- Difficulties for analyzing samples due to lack of spectrophotometer.

Component 4.6.3 : Development of low cost fish feeds using small fish in reservoirs for Koi-carp grow out culture

Responsible Officers: D. A. Athukorala, R. Weerasinghe

Sri Lankan reservoirs are rich in small indigenous fish species (*Amblypharyngodon melettinus, Puntius chola, P. dorsalis, P. filamentosus, Rasbora daniconius, Hyporhamphus limbatus* etc.). However these small fish varieties are not use for human consumption due to less market and poor consumer acceptability. Recent studies have shown the ability of producing low cost nutritious fish feeds using these small sized fish species. This project is aim at, use of un-tapped fish resources in reservoirs to develop low cost nutritious fish feeds for koi-carp grow out culture.

Objectives

- To use unutilized small fish species in reservoirs to produce fish feeds for Koi-carp grow out culture.
- To develop low cost, nutritious fish feeds for Koi-carp grow out culture.

Activities carried out

- Preparation of concrete tanks for Koi-carp feeding trials
- Fixing of water pipe line for concrete tanks
- Stocking of Koi-carp fingerlings in concrete tanks
- Monitoring of water quality of concrete tanks
- Preparation of minopr cyprinid fish meal
- Preparation of experimental fish feeds
- Fish feeding trials of Koi-carp fingerlings
- Treatments for diseases of Koi-carp fingerlings
- Collection & Entering of data
- Analysis of fish feed ingredients
- Data analysis are in progress

Results

The water quality parameters in experiments ponds were within the suitable ranges for Koi-carp culture. Water Temperature rang ed from 26.7 to 32.0 ^{0}C (Mean ± SD 28.67 ± 1.58), pH ranged from 6.26 to 9.43 mg l^{-1} (Mean ± SD 7.87 ± 0.63), Dissolved Oxygen ranged from 1.69 to 9.36 mg l^{-1} (Mean ± SD 4.61 ± 1.25), Total Alkalinity ranged from 96.0 to 316.0 mg l^{-1} (Mean ± SD 168.04 ± 55.85) and Hardness ranged from 68.0 to 256.0 mg l^{-1} (Mean ± SD 126.98 ± 32.76) (Table 4.6.3.1). Fish growth data analysis is in progress.

	Temp. ^0C	pH	DO mg l^{-1}	Alkalinity mg l^{-1}	Hardness mg l^{-1}
Min	26.7	6.26	1.69	96.0	68.0
Max	32.0	9.43	9.36	316.0	256.0
Mean	28.67	7.87	4.61	168.04	126.98
SD	1.58	0.63	1.25	55.85	32.76

Table 4.6.3.1: Water quality data of experimental mud ponds

Progress: Physical:85% Financial:100%

Output:
Cost-effective minor cyprinid-based fish feed formulas for Koi-carp grow out culture

Constraints:

- Unable to start first experimental fish feed trials in March 2014 as planned, as no fingerlings available on time. However, able to start experimental feeding trials in July 2014.
- Lack of proper fish feed processing facilities and fish feed testing facilities at NARA.

Component 4.6.4 :Appropriate Technology for the Development of Rural Aquaculture in Abundant Clay Pits with Community Participation

Responsible Officer: M.H.S. Ariyaratne

Abandoned clay pits are not use in any other task, its filled with rain water and have created environmental problems which are harmful to the people living surrounding the pits.

Nevertheless these clay pits could be used to promote inland aquaculture integrating other animal husbandry activities and enhance the consumption of inland fish by the community living near to pits. As such it could be practiced as self employment. The different aquaculture practices such as pen culture and cage culture could be used there as food fish production and as fingerling production.

The research findings of NARA on these aquaculture practices and particularly the technology on fish feed preparation could be disseminate to the community to promote this pilot project.


Fig.4.6.4.1. abundant clay pits that used in this pilot project

Objective

Disseminate knowledge with community through Farmer Field School Trainings on fish culture in these clay pits and convert this unused resource in profitable activity

To study the effect of shrimp waste meal incorporated fish feed in Tilapia fingerling rearing up to advanced fingerling in cages in abundant clay pits (**experiment-1**).

To study the effect of shrimp waste meal incorporated fish feed in Tilapia Food fish culture in cages in abundant clay pits (**experiment-2).**

To investigate the possibility to incorporate duckweed as a protein source to aqua feed (Lab experiment)

Activities carried out

Two abandon clay pits in Katana area were selected to start this pilot project. The community who involve in clay mining (as workers and as owners and as transporters) were aware on Aquaculture practices that can be carried out in clay pits and formed a society named "Ekamuthu" Fish culture Society, Katana, Bolawlana to carry out the project work through Farmer Field School Trainings. Twenty two men and 3 women were comprised in this society as members and worked in different aquaculture practices that were done in these 2 clay pits such as (1) Cage culture of Tilapia (*Oreochromis niloticus*) to produce food fish (2) Cage culture of Tilapia to produce fingerlings (3) Cage culture of Indian and Chinese carp to produce food fish (4) Freshwater prawn culture. Six thousand Freshwater prawn larvae were stocked in 2 clay pits.

Furthermore as a request from the community the methodology of the using of "Lift net" was introduced in several clay pits to catch the fish that were stocked previously.

Addition to these activities 2 research trials carried out through this project to test the use of suitability of Shrimp waste meal as the ingredient in fish feed for tilapia food fish culture and Tilapia fingerling production. The final harvest of the trial on Tilapia Food fish culture couldn't be done in December due to heavy rain and floods in the clay pits area.

Three aqua feed that prepared using shrimp waste meal (SWM) as sole protein provider (**Feed-A)** and replacing part of the SWM through Soybean meal (**Feed-B**) and through local fish meal (**Feed –C**) were tested with Tilapia fingerlings in these 2 trials.

The production costs for the 3 feed were Rs.37.00/kg, Rs.68.00/kg and Rs.67.00 in **Feed-A, Feed-B** and **Feed –C** respectively

Duck weed is an aquatic plant grows in paddy fields and many water bodies in Sri Lanka. As this tiny plant rich with protein (43% in dry weight basis), it could be used it in fish feed as a protein rich ingredient. Test the possibility of the inclusion of Duckweed powder to the Tilapia feed (25% protein) as 10% 20% and 30%.

Results

Twenty two male and 3 female were trained on these aquaculture practices. Trainings were carried out as follows.

Trainings carried out	No. of people trained
1.Cage preparation -02 trainings	22
2. Feed preparation-01 training	12
3. Cage reparing-04 trainings	15
4. Cage setting	12
5. Fish stocking and harvesting	10

Fig 4.6.4.2.Learning the proper fish stocking (a) and hand selection (b)

Fig. 4.6.4.3. The "Lift net" prepared by the community (a) learning feed preparation (b)

The stocked freshwater prawns in 2 clay pits were shown approximately 3 inch in length within 3 months period and difficult to catch.

Two experiments were carried out in the cages that install in abundant clay pits to find out a low cost fish feed for Tilapia fish

In Tilapia fingerling rearing, the final length was ranged 6-8cm and final weight was ranged 9-11g. Fish have shown similar growth in all these 3 feed types. Survival in each cage was 90%-100%. No external parasites or tail rot like disease was occurred on fish body. These 3 feed types were eaten by the fish very greedily.

In Tilapia food fish culture, fish ate these 3 feed types very greedily. The Growth of fish fed on these 3 feed types was not very much. The Length of fish after 58 days was 10-15 cm. Fish seemed to be very healthy and not observed external fish parasites or tail rot etc.

Duck weed trial

The Mean weight gain (WG) and Average daily Growth (% ADG) of Tilapia (*Oreochromis niloticus*) fed on these 4 feed types were not significantly different but the highest values were recorded as 0.9658 g, 1.6097 g day^{-1} in the fish fed on 10% DW powder inclusion feed in glass tanks. The same results were given by the Tilapia that reared with same feed types in Fiber glass tanks. The Mean weight gain (WG) and Average daily Growth (% ADG)of Tilapia fed on the feed that included 10% Duck weed powder were 3.3919 g and 4.8455 (g day^{-1}.

Conclusion

The abundant clay pits could be used in aquaculture practices successfully. There were no difficulties in harvesting fish as fish cultured in cages. Accordingly, cage culture is more profitable than pond culture system in clay pits

All these 3 feed types that prepared using Shrimp Waste meal(**Feed-A**), part of the Shrimp waste meal replacing through Soybean meal(**Feed-B**) and part of the Shrimp waste meal replacing through local fishmeal(**Feed-C**) could be use in Tilapia advanced fingerling production and Food fish culture.

As it is essential to provide feed in cage culture, the least cost Feed-A (Rs.37.00) is profitable to use for Tilapia fingerling production and Food fish culture in cages. Inclusion of duck weed powder to the basal feed for Tilapia could be done as 10%, 20% or 30%.

Recommendations

Tilapia fingerling (Small size) rearing up to advanced fingerling in cages using this low cost fish feed (Feed-A) is much profitable than its purchased from NAQDA Stations as Rs.2.00/small fingerling. As such more fingerlings (small size) could be transport at once than the big fingerlings and could be recovering the transport cost too. Fish mortality in transport could be nil in this process.

To extend this project for the benefit of the community, it is necessary to collaboratively work with Geological Mines and Bureau of Sri Lanka as they are responsible to issue the permission for preparing clay pits for cage culture using machines (Backo etc).

Output

Trained community on fish culture in abandoned clay pits

Three low cost fish feed formula for community based fish culture practices

Progress: Physical: 100% Financial: 100%

Special Remark

The required cages for this pilot project were provided by the Ministry of Fisheries, Wayamba Provincial Council. Therefore the estimated cost for cages was not expended.

Constraints

- Lack of staff
- Lack of vehicle for the scheduled date

Component 4.6.5 : Development of rural livelihood through sustainable fish culture & freshwater prawn in Hambanthota, Matara & Kalutara Districts.

Resposible Officer : K.W.R.R. Amaraweera

Objectives

- To maximize aquaculture fish production in rural areas.
- To introduce optional income for rural community.
- To introduce freshwater prawn farming in rural areas.

Activities carried out

- Monitoring water quality parameters.
- Monitoring growth performance of fish / prawns.
- Fertilizing ponds.
- Preparing feeds & feeding freshwater prawns.

Results

This research study lasted 7 months for the Giant freshwater prawn (*Macrobrachium rosenbergii*) & the initial weight of freshwater prawn was 0.017 ± 0.009 g.

Parameter	Treatment			
	T_1	T_2	T_3	T_4
Water Temperature (^{0}C)	$30.20^a \pm 0.05$	$30.50^a \pm 0.08$	$30.50^a \pm 0.06$	$30.70^a \pm 0.05$
P^H	$8.10^a \pm 0.02$	$8.05^a \pm 0.05$	$8.30^a \pm 0.02$	$8.41^a \pm 0.03$
Dissolved Oxygen (mg/l)	$5.60^a \pm 0.09$	$5.67^a \pm 0..04$	$5.09^a \pm 0.05$	$5.54^a \pm 0.04$
Alkalinity (mg/l)	$117.00^a \pm 1.4$	$133.00^a \pm 2.37$	$127.50^a \pm 1.43$	$141.00^a \pm 2.12$
Hardness (mg/l)	$214.50^a \pm 1.19$	$225.00^a \pm 2.37$	$221.00^a \pm 3.08$	$207.00^a \pm 2.97$
Secchi depth (cm)	$27.50^a \pm 1.25$	$27.50^a \pm 1.43.$	$32.50^a \pm 2.10$	$30.50^a \pm 1.48$

Table 4.6.5.1.The ranges of water quality parameters values in ponds during the study period.

The mean values in the same row with different superscripts are significantly different from each other ($p< 0.05$).

At end of the culture period Survival rate freshwater prawn was 60 % - 70% and individual mean weigt of freshwater prawn was 40g – 50g.

Out put

- Introduction of low cost feed for freshwater prawn.
- Preparation & fertilizing abandoned ponds for aquaculture.

Progress (%): Physical: 80 % Financial: 85 %

Constraints

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

External projects handled by the division

- Assessment of management effectiveness, awareness raising and compliance generation of Bar Reef Marine Sanctuary (BRMS).
- Living resources in the Gulf of Mannar: Assessment of key species and habitats for enhancing awareness and for conservation policy formulation.
- Development of community based oyster culture in the Puttalam lagoon
- Feed development for ornamental fish industry in 06 districts in Sri Lanka under "Divi Neguma" programme.

Extention work/ Services provided

To the ornamental industry

- One month Training course on Ornamental Fish Breeding and rearing in 2014
- Provided information and instructions to the ornamental fish farmers on fish diseases on their request.
- Conducted practical training programme on fish breeding for the level 11 students of Fisheries & Aquaculture, University of Ruhuna on 24th April 2014.
- Training on Ornamental fish culture, breeding and disease Management from 17-19 September 2014, for the participant of southern province, organized by Southern provincial Council.
- Training on Ornamental fish culture, breeding and disease Management from 03rd - 05th November 2014, for the participant of southern province, organized by Southern provincial Council.
- Organized one day field training program on Ornamental fish breeding, culture and disease management in RRC/ Rekawa for 30 small scale farmers in Galle district organized by Chamber of Commerce, Galle on 23rd August 2014.
- Providing information on shrimp culture, ornamental fish culture, endemic fish for the school children at Aquaculture Division, Head office, NARA, RRC Kadolkele and RRC Rekawa
- Conducted one day awareness programmes on "Pond Fish Culture" for farmers in Kalutara district Ornamental Societies- Vidatha Resource Center, Bandaragama, 30.03.2014
- Information and instructions were provided to the ornamental fish farmers who engaged with fish induced breeding on their request.
- Advisory service for the people who seek the information on ornamental fish breeding in Southern province
- Participation in the selection committee of participants for AQUARAMA international fish competition organized by the EDB.

- Tested "biowish" a biocatalyst that enhances and restores balance to biological systems on ornamental fish and food fish according to the request made by Citigardens Pvt Ltd.
-

Seacucumbr farming

- On the request made by Ministry of Defence and Urban Development on 02nd January 2014, NARA officials provided theirs observations on "Permission to set up a Sea Cucumber Farm at Kiranchi -Elavankuda Ferry".
- Awareness programme on "Sea Cucumber Farming" was conducted on 12th May 2014 for 19 participants from St. Anthony Fisheries Society in Palakudawa.

Freshwater shrimp/ food fish culture

- Stocking of fresh water prawn seeds in four reservoirs in Kalutara District.
- Stocked 60,000 *Macrobrachium* larvae to Mawella lagoon in Hambantota district with the financial assistant of AGA office Tangalle on 31st Oct.2014.

Health management in aquaculture

- Work on investigations on sudden fish kills. Two investigations were carried out and reports were submitted.
- Dissemination of knowledge on fish breeding and Therapeutic measures for disease conditions for ornamental fish industry people when requested.
- Made the investigation on fish kill incident in Galle area and submitted the report according to the request of Dept. of Irrigation Galle.
- Analyzed disease fish samples and recommended treatments for the disease fish submitted by fish culturists (19 samples) in the southern province.
- Analyzed disease fish samples and recommended treatments for the disease fish submitted by fish culturists (05 samples).
- Conducted one day awareness programmes on "Identification of Fish Parasites and Treatments" for farmers in Kalutara district Ornamental Societies- Vidatha Resource Center, Bandaragama, 20.09.2014
- Laboratory calibration project on white spot disease syndrome is initiated.
- Process of introduction of low cost test kit for detection of WSSV is initiated according to the request made by SLADA.

Conservation and environmental assessment services

- Conduct awareness programmes on mangroves at Rekawa RRC as follows; Uswewa college- 50 students; Godella College, Hambantota - 47 students Rahula College Matara – 87 students; Rahula College Matara – 91 students , Rahula College Matara – 72 students
- Conduct awareness and field guidance to school children and undergraduates on mangrove ecosystems at Kadolkele Mangrove Park.
- Provided the environment report on the suitability of fish and shrimp culture for Kotuattawa lagoon in Hambantota district.

- Conducted six month field sampling in Garanduwa lagoon environment in Mirissa under the financial assistant of AGA office Weligama.
- Delivered lectures on "*Fisheries, aquaculture and related rules & regulation in Sri Lanka*" to student officer of 12th and 13th Post Graduate Diploma in Defence Management (Junior Naval Staff Course), Naval and Maritime Academy, Trincomalee, 09th May 2014 and 3rd Oct.2014, Navy Base, Trincomalee, Sri Lanka.
- Participation of the workshop of mangrove planting programme of Negombo lagoon; along the Colombo-Katunayake express way organized by Sri Lanka Red Cross Society, Gampaha branch.
- Assessment of fish and mangrove conservation area at Bentota for suggestions of development.

Resource personal

- Development of National Competency standards for the occupation of aquaculture technician for NITA, Sri Lanka.
- Resource person on development of competency standards for integrated coastal and marine resource management conducted by NIFNE.
- Resource person to Judge Poster presentations of under graduate research symposium of Wayamba University.
- Lecture delivered on "Sri Lanka's aquatic biodiversity" delivered to School parties visit Aquatic Resource Research and Development Agency (NARA) from time to time.
- Lecture delivered on *"Sri Lanka's aquatic biodiversity* and conservation issues*"* delivered to naval persons visit Aquatic Resource Research and Development Agency (NARA) from time to time.
- Participation as the resource person for the Base-line survey on aquatic fauna and flora in the proposed Ramsar Wetland & National Park Chundikulam/Department of Wildlife Conservation (DWC), Sri Lanka.
- Resource person as fauna specialist at the following workshops Capacity building for identification of Invasive Alien Species (IAS) in Sri Lanka" for the following groups,
  - Customs officers**,** Grand Oriental hotel, Colombo
  - Public officers in Trincomalee district, Seruwila Division Secretariat
  - Forest officers**,** Kurunagala
  - Wildlife officers**,** Kandy
  - Gunner Club, Polonnaruwa, Sri Lanka
- Technical adviser (2014) - Habitat conservation of *Pethia bandula* in Galapitamada area/Department of Wildlife Conservation (DWC), Sri Lanka.
- Expertise/consultant (2014) - Re-checking taxonomic status & inventorying of the fish specimens at National Wildlife Training and Research Center, Department of Wildlife Conservation (DWC), Sri Lanka.

- On the request made by Ministry of Fisheries and Aquatic Resources Development on 05th May 2014, NARA officials provided necessary information on Member Country Questionnaire on Responsible Fisheries and Aquaculture in the Asia -Pacific Region to submit Asia -Pacific Fishery Commission (APFIC).
- Participated as a resource person for the "Ranweli Abhiman-Education Exhibition 2014" at Rathnavali College, Gampaha from March 04th to 08th.
- Visiting lecture on "Fish and Aquatic Ecology"/National Wildlife Training and Research Center (NWLTRC) of DWC, Sri Lanka.
- Visiting lecture on seaweed culture at Wayamba University.

Media conferences

- Participation in Vidu Lowa" live press conference on IAS in Sri Lanka, Sadeshiya Sevaya / Sri Lanka boast casting co-operation, 5 March 2014.
- Participation in Sayura FM live conference at MFAR on broadcasting "Newly introduced aquaculture practices in Sri Lanka and community benefits.

Workshops/meetings conducted

- Inception workshop of FAO / project on "Improving Seabass aquaculture in Sri Lanka through better feed and health management" on 15-16 December 2014 at Pegasus Reef Hotel, Wattala.
- Stakeholder consultation meeting identification the needs of shrimp farming and hatchery industries in Sri Lanka at NARA.
- Workshop conducted for the shrimp farmer and hatchery owners on the past research findings of the research conducted by NARA on shrimp farming industry at Chilaw on 22nd November 2014.
- Training workshops were conducted on the Gulf of Mannar Living resources for the 06 groups of school children and fisherman at Kalpitiya and Mannar.
- Training workshops were conducted for the school children and fisherman on the Bar reef and associated environment

Committees served in

- "UNDP/GEF funded project ON "Capacity building for control, prevent and spreading of Invasive Alien species (IAS) in Sri Lanka, Ministry of Environment and Renewable Energy, Sri Lanka.
- Aquaculture Technical committee – National Aquaculture Development Agency.
- Shrimp culture technical committee – National Aquaculture Development Agency.
- Environment committee – Sri Lanka Association for Advancement of Science.
- Section committee- (agriculture & forestry section) - Sri Lanka Association for Advancement of Science.
- Council member – Institute of Biology Sri lanka.
- Representing district coordinating committee in Hambantota and regional committee in Tangalle.
- Representing district coordinating committee in Gampaha

- Executive committee membership – Sri Lanka Fisheries and Aquatic Resources Association.
- Science education committee – SLAAS.
- Steering committee of scaling up sustainable aquaculture project in Sri Lanka.
- Member of Technical evaluation committee of project on seaweed value chain at Jaffna district held at ministry of economic development on 11th December 2014.

Publications

- **Ajith Kumara, P.A.D.** and D.C.T. Dissanayake (2014). Length and weight changes of five sea cucumber species during processing. 20th Annual Scientific Session of Sri Lanka Association for Fisheries and Aquatic Resources (SLAFAR), **P. 38**.
- **Ajith Kumara P.A.D., J. Pushpakumara, A.J. Jayatissa, C.B. Medagedara, and M.S.M. Fahim** 2014 Community-based Sea Cucumber Farming as a livelihood alternative for fisher folks in Kalpitiya, Sri Lanka. Paper accepted for oral presentation in NARA Annual Scientific Session 2014.
- **Weerasingha, R., P.A.D. Ajith Kumara, M.S.M. Fahim and D. A. Athukorala 2014** Utilization of different types of fish silages on growth of juvenile sea cucumber *Holothuria scabra*. Paper accepted for oral presentation in NARA Annual Scientific Session 2014.
- **Corea A.S.L.E** (2014) Preliminary survey of birds in the Northern region of Puttalam lagoon. – CAR%P research symposium
- **Corea A.S.L.E** & J.M.P.K. Jayasinghe (2014) Use of milk fish Chanoschanos and nile tilapia(Oreochromis niloticus to reduce organic particles in shrimp aquaculture effluents - annual sessions of Institute of Biology
- **Amaraweera, K.W.R.R, U.S.P.K.Liyanage,** N.Y. Hirimuthugoda (2014) Polyculture of Giant freshwater prawn (*Macrobrachiumrosenbergii*) and Nile tilapia (*Oreochromisniloticus*) in earthen ponds at different stocking densities. International symposium on agriculture &environment (27th November 2014) Faculty of Agriculture, University of Ruhuna.
- **Shirantha, R.R.A.R., H.M.P. Kithsiri and J.A. Jayatissa** (2014). Study on invasive characteristics of African jewelfish *Hemichromis bimaculatus* (Cichlidae); another potential IAS in Sri Lanka. In: *Proceeding national symposium on IAS,* 27 November, Sri Lanka Foundation, Colombo, Abstract. 74p.
- **Kithsiri, H.M.P., V. Pahalawattarachchi, M.J.C. Mallawarachchi, M.S. Epasinghe and R.R.A.R. Shirantha** (2014) recent survey on ornamental fish diversity and threats to southern Bar reef area in Sri Lanka. In: *Proceeding International Agricultural Research Symposium 2014,* Sri Lanka Council for Agricultural Research Policy, 11-12 August, Sri Lanka Foundation, Colombo, Sri Lanka.
- Jayasinghe. P.S., **V. Pahalawattaarachchi** and Ranaweera K.K.D.S.(2014) Evaluation of nutritional composition of edible seaweed species and value added products in Sri Lanka. Proceedings of the twentieth sessions of the Sri Lanka Association of Fisheries and Aquatic Resources 22nd May, 2014 at NARA auditorium.

- Hirimuthugoda,N.Y., N.G.L.S.Hansajith; **V.Pahalawattaarachchi** (2014) Bioamass estimation of economically important seaweeds along the Southern Coast of Sri Lanka. Eleventh Academic Sessions, University of Ruhuna, 19th March 2014.
- Athukoorala A.A.S.H., **M.A.J.C. Mallawaarachci, V. Pahalawattarachchi., Kithsiri H.M.P.** (2014) A taxonomic study of Mollusk species found in Bar reef marine sanctuary at Kalpitiya, Proceedings of 2nd international symposium on driving research towards economy opportunities and challenges Sri Lanka academy of young scientist, November 13-14, 2014.

Full Papers

- **Heenatigala., P. P. M.** (2012). Study of the constraints affecting ornamental fish production in Sri Lanka. Journal of the national aquatic resources research and development agency, 2012, Volume 41, pp 87 – 101. **Printed in 2014.**
- **Parakrama, M.G.I.S**, K.D. Rawat, G.Venkateshwaralu and A.K.reddy 2012 Supply of Astraxanthin and its combinations through live feed (*Moina micrura*) enrichment affects the growth, survival and fatty acid profile of *Macrobrachium rosenbergii* larvae. NARA journal, Volume 41. **Printed in 2014.**
- **Rajapakshe,A.D.W.R.,** K.Pani Prasad and S.C. Mukerjee 2012 Gross clinical signs and haematological changes associated with artificial infection of Edwardsiella trada in Kio Carp Journal of the national aquatic resources research and development agency, 2012, Volume 41, pp 87 – 101. **Printed in 2014.**

Short Communications

- **Ajith Kumara, P.A.D., 2014**. Recent training workshop on artificial breeding and larval rearing of *Holothuria scabra*. *SPC Beach–de-mer Information Bulletin* No.43: pp 58.

Field guides

- Field guide to identify fishes in freshwater bodies of Sri Lanka, Department of Wildlife Conservation (DWC), Sri Lanka.- ed. R.Shirantha
- Field guide for identification of brackish water fish and shellfish. ed H.M.P. Kithsiri; M.Gammanpila, K.A.D.S.C. Ratnayake.

News Paper Articles

- News paper article appeared on 12.01.2014 in "Ada" newspaper on "Waarshikawa Rs Miliyana 500 Pamana Upayana Muhudu Kudallanan".
- News paper article appeared on 17.07.2014 in "Lankadeepa" newspaper on "Putthalama Kalapuwe Muhudu Kudalaanta Kuudu Saadai".
- News paper article appeared on 18.07.2014 in "Ada" newspaper on "Ratata Isuru Genena Muhudu Kudallo Kalapuwatath Isuru Genei".
- Paper article on "Adu adayamakata Bahuropana Madhya wagawa" published in DINAMINA news paper on 10th December at "Oruwella" athirekaya.

Participation at workshops/seminars/meetings

- One day Workshop on "Research Ethics" Conducted by National Science Foundation.
- Two day Workshop on "International Ornamental Fish Trade Conference" Conducted by Export development Board SL.
- Workshop on "Improving Seabass Aquaculture in Sri Lanka through better Feed & Health Management, Colombo, 15-16 December 2014.
- Workshop on "Ethics in Research", NSF, Colombo, 27th November 2014,
- International Symposium on Biodiversity, Food & Nutrition, Colombo, Sri Lanka, 8th December 2014.
- Conference on Developing Priorities for Future Aquatic Environmental Research, Sri Lanka Foundation, Colombo 25th November 2014.
- Sri Lanka Association for the Fisheries and Aquatic Resources (SLAFAR)-20th Annual Scientific Sessions 22nd May 2014, NARA, Colombo.
- Sri Lanka Association for the Advancement of Science (SLASS) - 70th Annual Scientific Sessions 1st-5th December 2014, University of Colombo.
- Conference on Costal resources Management. Held in Maura Beach Resort, Matara on 16th September 2014.
- 1st Sri Lankan International Ornamental fish Trade Conference" organized by INFOFISH, Sri Lanka Export Development Board, 10-11 November 2014, Galadari Hotel, Colombo, Sri Lanka.
- Workshop on "Research Proposal Writing, conducted by SL-CARP.
- Training program on "Horticulture", conducted by Young Scientist Association.
- Short Course on Statics, conducted by PGIA, University of Peradeniya.
- Training on plant tissue culture, Botanical Garden, Peradeniya.
- An overview of freshwater biodiversity in Sri Lanka with special reference to food and nutrition, "International Symposium on Biodiversity, Food & Nutrition, Linking Agro-biodiversity and Dietary Diversity; The Sri Lanka Experience, 8th December, Kingsbury Hotel, Colombo, Sri Lanka.
- International Agricultural Research Symposium 2014, Sri Lanka Council for Agricultural Research Policy, 11-12 August, Sri Lanka Foundation, Colombo, Sri Lanka.
- Discussion on integrated progrmme for fisheries and aquatic resources development of the Central government and provincial councils. Held in MFAR 17.07.2014.
- National symposium on IAS, 27 November, Sri Lanka Foundation, Colombo.
- Institute of Biology annual sessions.
- Workshop on crop calendar preparation for shrimp culture.
- Attended Divisional and District coordinating committee meeting in Tangalle AGA division and Hambantota district.
- Workshop on increasing efficiency on 15th August at NARA auditorium.

- HETC (Higher Education for the Twenty first century (HETC) Symposium on National Development through research and Innovation on 7-8th July 2014 at the Hotel Galadari.
- Forum of Technology in balance provincial development –Lessons learnt and actions for the future organized by COSTI at Foundation Institute.
- Coordinating workshop on harnessing biological resources for economic development conducted by COSTI on 22nd August at Sri Lanka Institute of Development Administration (SLIDA).
- Formulation of the National Export Strategy (NES) organized by EDB on 13th August at EDB.
- Workshop on cost of marine fisheries on 7th March 2014 at NARA auditorium.
- Meeting on development of a project proposal on culturing aquatic plants for food security and variety organized secretariat for senior ministers.
- Workshop on finding innovation solutions to address the challenge of food and nutrition security I Sri Lanka on 23rd June, held AT Taj Samudra hotel, Colombo.
- Tenth anniversary celebration of Sri Lanka Aquaculture Development Alliance aon 5th July 2014 at Hotel Anantaya, Chilaw.
- Ceremonial launch of "dry seaweed export" held by Hayleys Aqua Agri (pvt) Ltd., on 21st August 2014.

Foreign

- Technical training course on aquaculture for developing countries in 2014, Hainan, China, May 08 to June 04, 2014.
- Capacity development on Invasive Alien Species (IAS) management and control (6-10 Oct. 2014), International Center for Development Communication, Kasetsart University, Thailand.
- Workshop on working group of Marine protected areas in held at World Fish center, Penang, Malaysia in February 2014 organized by BOBLME.
- Attended to the international training programe on "Utilizing indigenous food resources for food security" on 21-24 September 2014 at Khon Kaen University, Thailand.

Supervision of undergraduate research

- Research project on Study on restoration of *Gracilaria edulis* by artificial propagation in Puttalam lagoon, Sri Lanka (Ms. A.G.S. Sewwandi, Uva Wellassa University, 2014).
- Research project on effect of S*argassum wightii* incorporated feed on vibriosis resistance of Asian sea bass (*Lates calcarifer*) (Ms. Hashini Kodithuwkku, Uva Wellassa University, 2014).
- Research project on Reassessment of Structural and Functional properties of mangroves at Kadolkale in Negambo estuary (Ms. Jayathilaka M.M.J.P., Department of Natural Resources and Management, Sabaragamuwa University, 2014).

- Sea grass distribution in northern part of Negombo lagoon with reference to the present management options (M. M. D. Lakmali, Department of Natural Resources Sabaragamuwa University of Sri Lanka, 2014).
- Composition of spatial distribution of plankton of Mundal lagoon Sri Lanka, (Ms.Kalpana H.Ranawaka, Open University).

Industrial trainings provided on aquaculture

University	No of students
College of Fisheries & Nautical Engineering	03
Faculty of livestock, Fisheries and Nutrition, Wayamba University	08
Food production and technology management; Saragamuwa	06
Department of Zoology, University of Sri Jayawardanapura	05
Department of Zoology University of Kelaniya,	04

Other developments in the divisional/RRCs

- Aquatic plant hatchery
- Recycling system for marine fish breeding
- Renovation of ornamental fish section
- Renovation of PCR laboratory
- Development of Center for Living Aquatic Resources Research and Development (CLARRD) at Panapitiya, Kalutara to conduct community based programmes

5.5 Marine Biological Resources Division

Head of the Division: Dr.R.Maldeniya

Research Staff: The Marine Biological Resources Division (MBRD) is consist of 12, Scientists, 7 Research Assistants and 9 Samplers

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. Five treasury funded research projects were carried out by MBRD in 2014. Major research areas include;

1. Assessment and monitoring of finfish and non-finfish resources in Sri Lanka.
2. A comprehensive study on major sharks fishery in Sri Lanka; study on population dynamics, biology, feeding habits, nursery grounds and quality & safety of shark consumption.
3. Molecular studies on selected marine species (Cephalopods and rays) and establishment of a protocol for sex determination of marine mammals.
4. Study on temporal and spatial distribution of sea turtle in Sri Lanka.
5. Preparation of fishing gear and suitable bait for harvesting of shrimps as a alternative for bottom trawling in the coastal area of Sri Lanka.

Apart from the treasury funded projects, MBRD carried out external funded research projects through the financial assistance of the Bay of Bengal Large Marine Ecosystem (BOBLME). Two projects were carried out under BOBLME funding. Major objective of the study on sharks was to draft a National Plan of Action for the conservation of shark species in Sri Lanka. Biological and stock structure studies of Indian mackerel were also conducted through BOBLME funding. Furthermore, studies on population biology and fishery of the blue swimming crab (*Portunus pelagicus*) in Jaffna district were also started from October 2014 with the financial assist from Seafood Exporters' Association in Sri Lanka.

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) for 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 for sharks.

On court orders, several fish samples were analysed by MBRD in 2014 to decide the cause of death in order to determine whether the fish samples provided by the police were caught by using explosives. In addition, officers in the division were quite interactive with the fishing community right around 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 children to carry out their research projects.

The research staffs of the MBRD was actively engaged in updating the large pelagic and small pelagic databases, analysing the statistics and preparing research papers on trends and prospects of large and small pelagic fisheries in Sri Lanka. The report was prepared "streamlining the statistical data reporting system-IOTC" and sent to the Department of Fisheries to in-cooperate into the EU country report.The paper presented for the Ecosystem and by catch under Resolution 12/06 for the Indian Ocean Tuna Commission (IOTC) on reducing the incidental by catch of seabirds in long line fisheries in Sri Lanka was made non-compliance into comply.

Projects undertaken

Project	**Allocation (Rs.Millions)**	**Officer responsible**	**Period**	
			From	To
1. Assessment and monitoring of finfish and non-finfish resources in Sri Lanka.	3.6	Dr. R. Maldeniya Dr. S.S.K. Haputhantri Dr. H.A.C.C. Perera Mr. U.S.P.K.Liyanage Ms. K.H.K. Bandaranayake Mr.R.A.M. Jayathilake Mr. M.I.G. Rathnasuriya	Continuous	
2. A comprehensive study on major sharks fishery in Sri Lanka; study on population dynamics, biology, feeding habits, nursery grounds and quality & safety of shark consumption	1.4	Dr. S.S.K. Haputhantri Dr. H.A.C.C. Perera Ms. K.H.K. Bandaranayake Mr..R.A.M. Jayathilake Mr. M.I.G. Rathnasuriya Mr. B.K.Kolitha Kamal		

3. Molecular studies on selected marine species (Cephalopods and rays) and establishment of a protocol for sex determination of marine mammals.	0.35	Ms. D.R. Herath Ms. D.N. A. Ranmadugla	2014	
4. Study on temporal and spatial distribution of sea turtle in Sri Lanka	0.35	Mr. R.A.M. Jayathilake	2014	2015
5. Preparation of fishing gear and suitable bait for harvesting of shrimps as a alternative for bottom trawling in the coastal area of Sri Lanka	0.30	Ms.A.A.S.H. Athukorala	2014	2015

Project 1.1 Monitoring and Assessment of Large pelagic fisheries

Marine finfish and non-finfish 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 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. Marine Biological Resources Division is actively engaged in activities with related to the requirements of Indian Ocean Tuna Commission (IOTC). The PELAGOS database handle by MBRD is being used to fulfill the IOTC (Resolution 10/02) requirements continuously as it consist 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 seabirds and turtles were carried out. Some morphological identification on Bullet tuna and frigate tuna were also studied.

Large pelagic database was upgraded and it provides precise reporting system.


Monitoring of fishery

Progress (%): Physical: 100% Financial:

Assessment and monitoring of small pelagic fishery resources in the coastal waters of Sri Lanka

Small pelagic fish landings were monitored at 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. A special emphasis was made to investigate the key features of small pelagic fishery and to study the fishery and biology of *Ambligaster sirm.* Biological fish samples of *A. sirm* taken from the fish landing sites in the west coast were analysed to study the reproductive biology. Gonadosomatic Index (GSI) was used to determine the spawning season(s) of *A. sirm*. Length- Weight relationships separately for males and females were also obtained. The major target fish group in small pelagic fishery is clupeids. This group includes *A. sirm* and *Sardinella spp* etc. *A. sirm* is the dominant species in the catch and it contributes presently around 23% of the small pelagic fish catch. 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). A clear difference in the average Total Fishing Time (TFT- total time taken to the whole fishing operation) was observed among the three boat categories. Average TFT of a fishing operation for OFRP boats was the highest (5.84h) whereas the average TFT for MTRB and NTRB were 4.52h and 3,35h respectively. The observed average sex ratio between male and female of *A. sirm* in the west coast was 1: 1.2. The estimated length-weight relationship for males was $W=0.002685L^{3.438}$ ($R^2= 0.945$) whereas the length-weight relationship for females was $W=0.003L^{3.386}$ ($R^2= 0.940$). The peaks of GSI values concluded the spawning season of *A. sirm* in the west coast belongs to the period from May to July.

Progress (%): Physical: 100% Financial:

Present status of the grouper fishery in Negombo, Chilaw and Beruwala

Fishing methods used to catch groupers were bottom set gill nets, bottom long line, handline and spears. Of the observed methods handline was the most common and traditional method found among all the fishermen. Size of the groupers depending on the gear used and area of fishing. It was noted that groupers caught from both handline and bottom set long line were in better quality. Natural bait types used to catch groupers were Sardines (*Sardinella albella*, *S. gibbosa*), Herings (*Amblygaster sirm*), Squids (*Loligo* sp) using OFRP boats or dugout canoes with 2-3 crew members and 15-20 fathoms. During the study period;14 number of species were identified from Negombo, Chilaw and Beruwala fishery harbours namely; *Cephalopholis formosa, C. leopardus, C. miniata, C. sexmaculata, C. sonnerati, Epinephelus aerolatus, E. caeruleopunctatus, E. chlorostigma, E. fasciatus, E. longispinis, E. malabaricus, E. radiatus, E. undulosus, Variola louti*. The most abundant species found during the survey was *Epinephelus longispinis* (longspine grouper); recorded total length was 12-45 cm. The second most abundant species found during the survey was *C. sonnerati* (tomato hind); recorded total length was 10-50 cm.

Measuring of groupers

Progress (%): Physical: 100% Financial:

Conservation and management of the spiny lobster resources in the South and East costal Fisheries Management areas

Spiny lobster fishery has been identified as a major income source for the small scale artisanal fishes in the South and East coast of Sri Lanka (Tangalle to Oluvil) for decades. This fishery contributed to the foreign income of the country through the export of over 95 percent of its catch to Europe and South East Asia. Depletion of the catch rates due to over exploitation, environmental degradation and the destructive fishing methods (Bottom set Gill net) made variety of problems to the fishes and the stocks. Considering the importance of this

fishery, government of Sri Lanka imposed a set of regulations for the conservation and management of the stock but this was not satisfactorily implemented.

Based on the CENARA fish stock assessment survey results and the recommendations in 2009, spiny lobster fisheries co management committees were established from Weligama to Wakarei at the base of Fisheries Inspector Divisions in 2013.

To study the success of Co management system established, for management and conservation of the stock and weaknesses of the currently implemented legal framework, 6 major lobster landing sites in South and East coasts were visited on a monthly basis throughout the year except in closed seasons. Biological data such as species composition, lengths (Total and Carapace), sex, presence or absence of eggs and spermatogonia on females and economical data including prices catch per unit effort and income were recorded.

As a result of the awareness programmes carried out during the establishment of co management committees, presence of undersized lobsters in the catch are negligible. In tourism areas of the South coast specially Tangalle and Hambantota, it is recorded that small amount of undersized lobsters are being sold to the tourist hotels and restaurants illegally. Further, there is no significant decline of the berried female lobsters in the catch because of the high demand and the price; fishermen are not releasing them back to the sea. Lobster fishermen are always requesting some technical solution to keep berried lobster until their eggs are released. Several attempts were taken at provincial government level, but still it is not successful due to the financial crisis. A detailed report will be given recently after analyzing the data.

1.2 A comprehensive study on major sharks in Sri Lanka: study on population dynamics, biology, feeding habits, nursery grounds and quality & safety of shark consumption

Sri Lanka is one of the major shark fishing countries in the Indian Ocean. Under the present study, shark landings were monitored by the research staff of MBRD at major shark landing sites in the west, southern and eastern coasts of Sri Lanka. The stomach samples from the silky shark were extracted and contents were identified at the landing sites. The silky shark (*Carcharhinus falciformis*) is the dominant species in shark landings in Sri Lanka and silky sharks accounted more than 60% of the total shark landings followed by blue shark, scalloped hammerhead, long fin mako, short fin mako, smooth hammer head, oceanic white tip and great hammerhead etc. Majority of shark catches specifically silky sharks, blue sharks and oceanic white tip shark were landed by tuna longliners (44%) and the rest of the gear, gillnets

(25%), longline/gillnet combination (23%), ring net (6%) and other gears (2%) also contributed. Among the eight fisheries statistical zones in Sri Lanka, the highest shark landings has been reported from southwest zone (31%) followed by west (31%) and south (16%). The estimated sex ratio of blue shark was not significantly different from the expected sex ratio of 1:1 though the sex ratio of silky shark and oceanic white tip shark was significantly different. A remarkable increase in the occurrence of female silky shark in the catch was observed during the south west monsoon period. Among the analyzed stomach samples of silky sharks; fish (skipjack tuna, herrings, flying fish, indo pacific sailfish, *Lutjanus spp.*) and cephalopods (octopus, squids) were present. Since this study is a continuous stuudy, other aspects which were not covered in 2014 will be done in 2015.

Octopus

Lutjanus sp

skipjack

Species found in shark gut

Progress (%): Physical: 90% Financial:

Project 1.3 Molecular studies on selected marine species (Cephalopods and rays) and establishment of a protocol for sex determination of marine mammals.

Molecular identification of commercially important Cephalopods

A large number species of squid, cuttlefish and octopus are eaten locally and are of commercial importance. Morphological identifications of some of these species have been done and a large number of squid, cuttlefish and octopus have been recorded.

Octopus vulgaris, the Common Octopus, is found near shore shallows to as deep as 200 m. It is believed that *O. vulgaris* actually contains a number of related sister species. However, taxonomists have not yet decided how to split the species. *Sepia pharaonis* and *Sepioteuthis lessoniana* are found in abundance in the North. Some species of squid are very abundant seasonally and some of these species have not yet been identified. *Sepioteuthis lessoniana*,

commonly known as the bigfin reef squid or oval squid, is a commercially important species of loliginid squid. It is one of the three currently recognized species belonging to the genus *Sepioteuthis*. Studies in 1993, however, have indicated that big fin reef squids may comprise a cryptic species complex. The species is likely to include several very similar and closely related species. Therefore, it is useful to identify these different species of cephalopods using molecular methods.

Samples were collected from Negombo, Chilaw, Kalpitiya, Beruwela and Mannar. Morphological characteristics were recorded for each for the samples collected. The samples were stored in alcohol and DNA extraction was carried out in the laboratory. PCR reactions were carried out for the extracted DNA and were sequenced. Three samples were identified as belonging to *Loligo singhalensis*, *Sepia pharaonis* and *Octopus vulgaris*.

Molecular identification of chondrichthyes and establishment of a protocol for sex determination of marine mammals

Increase demand for the sharks and ray's in Asia continues to drives these fisheries and therefore urgent research was needed of these vulnerable species. The objective of the study was to promote shark and ray conservation via the application of various genetic and molecular techniques and increase public knowledge and understanding of sharks and 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). Therefore, DNA samples were collected to provide deeper insight into the exact species of Mobulid's which are being taken in these fisheries. 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 PCR analyses were conducted using FISH primers. Approximately 650 bp region of the mtDNA CO1 gene was amplified and sequenced. DNA bar codes of 10 species including Jenkins whip ray, white spotted guitar fish, Oceanic manta ray, cow tail sting ray, spine tail devil ray, sickle fin devil ray, butterfly ray and blue spotted sting ray were generated. The identity of each species was revealed using NCBI BL AST sequence analysis programme.

Zone tail butterfly ray

White spotted eagle ray

A protocol for sex determination technique based on PCR amplification of genomic DNA extracted from muscle and skin tissues was established in stranded marine mammals in Sri Lanka. A Y chromosome specific region (SRY or sex determining Y chromosome gene) of 210-224 bp size in the genome was amplified only in males using specific PCR primers. Future work will be based on amplifying fragment of the SFX/SFY (zinc finger protein genes located both on the X and Y chromosome respectively) in both sexes using another pair of primers simultaneously as positive controls for confirmation of sex and standardizing duplex PCR for the determination of sex in marine mammals.

Progress (%): Physical: 100% Financial: 104%

1.4. A study on temporal and spatial distribution of sea turtle nesting in the west and south west coast 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 , *Lepidochelis olivacea*, hawksbill, *Eretmochelys imbricata* , loggerhead , *Caretta caretta* and leatherback , *Dermochelys coriacea* (Deraniyagala, 1953). **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 the study, study on the sea turtle nesting beaches and survey on the sea turtle hatcheries of Sri Lanka. The study area extends 25.8 km over two administrative districts, Colombo and Galle. Thirteen major nesting beaches belonging to two districts: Mount Lavania, Benthota, Warahena, Induruwa, Mahapalana, Duwemodara, Kosgoda, Ahungalla, Balapitiya, Ambalangoda, Kahawa, Habaraduwa and Koggala. The information was collected by volunteer data collectors and through direct observations by NARA research staff. The estimated total annual number of nesting in the study area was 1752. Out of which 68.6%, 30.3%, 0.5%, 0.3% and 0.3% were made by Green turtle, Olive ridley turtle, Hawksbil turtle, Loggerhead turtle and Leatherback turtle respectively. It is revealed that Green turtle is the most predominant species. The highest nesting density 298 nest km^{-1} $year^{-1}$ and nesting diversity were reported in Kosgoda beach. The highest number of monthly nesting frequencies of Green turtle was observed during the period from February to April. The highest number of monthly nesting frequencies of Olive ridley turtle was observed during the period from November to March.

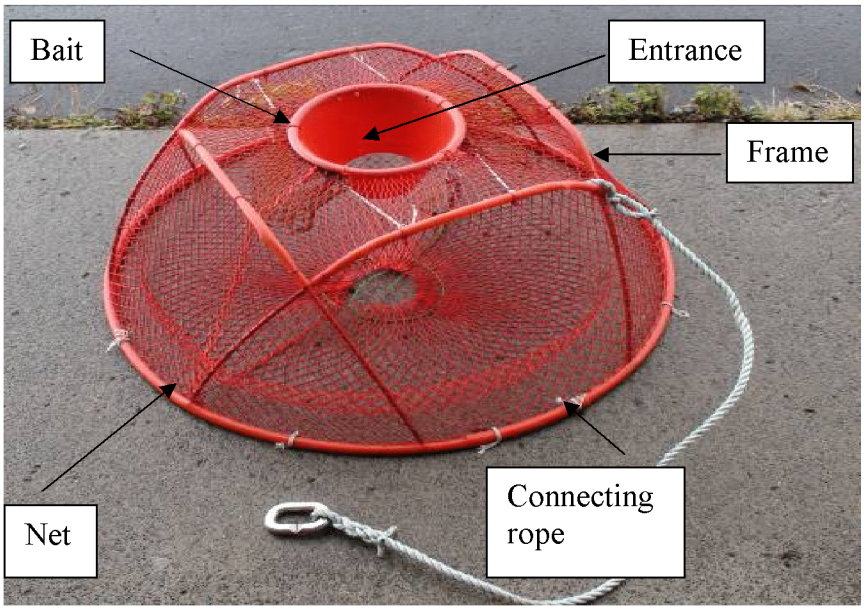
At the time of the study there were 11 operational sea turtle hatcheries situated along the coastal belt from Mount Lavania to Koggala. Hatcheries, normally received eggs from the surrounding beaches, for *ex-situ* conservation activities, the turtle hatchery buried eggs inside the hatchery premises. During the survey period 72,274 green turtle eggs, 24,950 Olive ridley turtle eggs were buried inside hatcheries. The success overall hatching rate was 88% for Green turtle and 82% for Olive ridley turtle. The success rate of Hawksbill turtle, Loggerhead turtle and Leatherback turtle respectively 61.4%, 51.1% and 10.2%. Regression line on

Success and buried eggs of Green turtle is $success = -61.3 + 0.891buried$ and for Olive ridley $success = -51.7 + 0.848\ Buried$

Progress (%): Physical: 91% Financial:

Project: 1.6 Preparation of fishing gear and suitable bait for harvesting of shrimps as a alternative for 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 area to minimize the trawling disturbances on the sea floor. Other objective was the biological study of the catches of bottom trawling in the Negombo coast. The project activities started at the month of February. There are 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, Parapenaeopsis c oromandelica* wich was about 55% of the total catch. The other 44% was the by catch. The experimentally designed shrimp pots, made of fishing net with 20 mm mesh and steel frame with a narrow mouth and traps will set on the sea floor. Shrimps attracted by baits enter from the mouth but they are unable to find the way out.



Completed Shrimp trap

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

Testing Prawn trap in a pond at Panapitiya Regional Research Centre

Progress (%): Physical: 80% Financial:

Externally funded projects

Study the stock structure, some biological aspects, distribution and the abundance of Indian mackerel in the coastal waters around Sri Lanka- ongoing

Indian Mackerel, *Rastrelliger kanagurata* 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 by catch 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 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 for their reproductive biology. Gonado-Somatic Index (GSI), Length at first maturity (L_m), Spawning season with respect to GSI and fecundity, morphological characteristics such as length-length and length-weight relationships were obtained. Stomach contents of the mackerel samples were analyzed to study the variations in food intake. The fishing season of Indian Mackerel vary from area to area and is mostly confined to 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 265mm (TL) for females whereas the respective value for males was in the range of 245mm 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 plank tonic diet dominated by zooplankton varieties with higher abundance of copepods and their nauplii stages.

For the stock identification studies of the Indian mackerel, fin samples from each of the 10 different locations were collected. The samples were collected from the ten areas identified in the initial stages of the project; Negombo, Chilaw, Kalpitiya, Mannar, Jaffna, Trincomalee, Batticaloa, Hambantota, Galle and Beruwela. The fin clips were collected in alcohol and transported to the laboratory. The DNA extractions of these collected samples were completed using the QiaAmp DNAeasy extraction kit and the DNA was quantified. The stock structure is to be determined by microsatellite analysis and the laboratory of the National Bureau of Fish Genetics Resources (NBFGR) in Kochi, India has developed 14 such primers sets. Microsatellite PCR has been done for 8 of the 14 primers and 1 batch of PCR products was sent to India for genotyping.

Progress (%): Physical: 85% Financial:

Living Resources of the Gulf of Mannar: Assessment of key species and habitats for enhancing awareness and for conservation policy formulation

The biodiversity of the ecosystems in the Gulf of Mannar (GOM) is very high and support economically important resources such as finfish, crustaceans, mollusks and marine plants. It is also the area of distribution of the endangered Dugong and sea turtles. Scientific information on the coastal and marine environment is scanty at best and there are large information gaps as the area was out of bounds for scientific research due to the internal conflict that prevailed during the last three decades. As per a signed agreement between

NARA and IUCN Sri Lanka, MBRD and IARD of NARA conducted this assessment. The main objective of the MBRD component was to conduct a rapid survey on resource exploitation in the project area in order to provide necessary scientific information/recommendations to ensure the sustainability of the marine living resources.

The Survey on resource exploitation was carried out along the coast from Mampuri in Puttalam District to Thalaimannar in Mannar District. The NARA research staff involved in this survey visited each and every fish landing centres located within the above coastal sketch. This includes all beach seine centres and day/ multiday boat landing sites etc. Data gathered under the survey includes the information on fishing trip patterns, seasonal use of fishing gear, location where fishing takes place and types of habitats and species. During the survey, fishermen met at the landing sites were interviewed to obtain information about endangered, threatened and protected marine species like dugongs & sea turtles: information on species, information on turtle nesting sites etc. As per the study, the marine environment and the aquatic species are subjected to a great threat at present mainly due to use of harmful fishing methods/gear and extensive use of marine resources. Destructive fishing gear and methods are widely used both in Mannar and Puttalam districts for resource exploitation and law enforcement was found to be weak. The survey provides some scientific information with recommendations on the exploitation of fishery resources in the Gulf of Mannar. Which information could be made use for conservation and sustainable management of the marine environment and the resources in the Gulf of Mannar.

Progress (%): Physical: 100% Financial:

A study of the population biology and blue swimming crab (*Portunus pelagicus*) fishery in Jaffna District (ongoing)

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 northeast coast. However, 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), Vallany (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. Fisheries & biological data collection and biological sample analysis are now in progress.

Progress (%): Physical: 20% Financial:

Other activities undertaken

- Examined and provided reports on fish samples sent by various high courts for blast fishing.
- Examined and provided a report on identification of gastropod shell samples sent by the magistrate courts.
- Examined and provided a report on identification of shark samples sent by the Pvt. Ltd.
- Serving as a member of the National Committee on Agricultural Biotechnology under the CARP since May 2013.
- External Supervision (B.Sc): On a request made by the academic Head, fisheries and marine science division, Ocean University of Sri Lanka,
- Ms. G.A.I.K Gamaarachchi- A study on some aspects of biology, morphometric and feeding ecology of *Auxisthazard* in Sri Lankan waters.
- Ms. E.G.T.P. Wijesinghe- Diversity of batoid fish landed in three major fish landings centers in the west coast of Sri Lanka.
- Lectures were conducted on the importance of biodiversity and coral reefs for coast guard, Sri Lanka
- Three awareness programmes for conservation and management of sharks were organized by MBRD, with Department of Fisheries and Aquatic Resources (DFAR) under the financial support of BOBLME project and workshops were held at Negombo, Beruwala and Valachchenei.
- Scientists of MBRD Supervised the following students of UvaWellassa University for carrying out their final year research projects (2014)
  - Mr. R.A.N. Dharmawardene; Faculty of Animal Science and export Agriculture, for his research on "Morphological variation analysis of Frigate tuna (*Auxisthazard*) in selected coastal water bodies in Sri Lanka;Negombo, Beruwala and Galle fish landing sites".
  - Ms. M.K. Wanniarachchige; Faculty of Animal Science and export Agriculture, for her research on "Stock identification on Bullet tuna (*Auxisrochei)* in Sri Lankan waters comparing morphological characters".

Publications

- Maldeniya R, Ratnasuriya MIG, Jayasekara JHA and Danushka P. Seabirds in the seas around Sri Lanka: their interaction in pelagic fisheries IOTC–2014–WPEB10–30 Rev_1.

- Maldeniya R & Danushka P.Impact of large pelagic fisheries on the survival of sea turtles in SriLanka IOTC–2014–WPEB10–27.
- Maldeniya R. Status of billfish in large pelagic fisheries in Sri Lanka IOTC–2014–WPB12–
- Perera, L and Maldeniya, R. Data collection and reporting system of Sri Lanka; where it was and where it now. IOTC-2014-WPDCS10-14 Rev2
- Athukoorala, A.A.S.H., Bandaranayaka K.H.K., Haputhantri, S.S.K. 2014. A study on some aspects of reproductive biology and population characteristics of *Ambligaster sirm* (Herrings) in the west coast of Sri Lanka. International conference on Fisheries and Aquaculture. Colombo, Sri Lanka.
- Haputhantri, S.S.K., 2014. Analysis of skipjack tuna *(Katsuwonus pelamis)* landings made by Sri Lankan fishing vessels operated during 2005-2012 with special reference to the nature of the fishing operations. IOTC–2014–WPTT16–32. Sixteenth Session of the Indian Ocean Tuna Commission (IOTC) Tropical Tuna Working Party.
- Perera, H.A.C.C., Maldeniya, R. and Bandaranayake, K.H.K. Importance of Neritic tuna in large pelagic fisheries in Sri Lanka. IOTC–2014–WPNT04–12.

Communications

- Documentary done on "Biotechnology in Fisheries" for Sayura FM
- In 2014, Dr. S.S.K. Haputhantri, Principal Scientist of MBRD received the Presidential Award for Scientific Research in 2007, 2008 and 2009 for the research paper titled '' Trophic interactions in the coastal ecosystem of Sri Lanka: an ECOPATH preliminary approach'' and published in 2008 in Estuarine, Coastal and Shelf Science.

Reports

- Haputhantri, Sisira and Kishara Bandaranayake, 2014. 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.
- Haputhantri, Sisira and Kishara Bandaranayake, 2014. Survey of sharks in Sri Lanka. The draft final report of the BOBLME shark study submitted by NARA to BOBLME.
- The report on the rapid survey on the extractive uses of living resources in the Gulf of Mannar. The report submitted by MBRD to IUCN Sri Lanka.
- A study of the population biology and 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 Project.
- Streamlining the statistical data reporting system-IOTC was submitted to the Department of fisheries and aquatic resources.

Trainings/workshops/Meetings attended

- 6th Regional training programme on code of conduct for responsible fisheries, India 20th September to 2nd October 2014.
- 2nd Annual South Asia Biosafety conference 15-16th September 2014.
- Training course on Multivariate data analysis 10th-12th March 2014.
- Workshop on Experimental Design held on 11th September 2014 at the Postgraduate Institute of Agroculture, University of Peradeniya, organized by the Yound Scientist Forum of National Science and Technology Commision.
- Regional workshop on the identification of the Deep Sea Cartilaginous Fishes of the Indian Ocean, Mauritius June 10th to 13th 2014.
- Bay of Bengal Large Marine Ecosystem (BOBLME) project Ecosystem Characterisation meeting held in Phuket, Thailand on 10th- 12th February, 2014.
- Bay of Bengal Large Marine Ecosystem (BOBLME) project Ecosystem Characterisation meeting II held in Bangkok, Thailand on 3rd - 6th November, 2014.
- Fourth Session of the Indian Ocean Tuna Commission (IOTC) Working Party on Neritic Tunas (WPNT 04) held in Phuket, Thailand, from 29 June to 2 July 2014.
- Sixteenth Session of the Indian Ocean Tuna Commission (IOTC) Tropical Tuna Working Party held in Bali, Indonesia on 15-19 November, 2014.
- Bali Tuna Conference held on 20th November, 2014 in Bali, Indonesia.

5.6 National institute of Oceanography and Marine sciences

Head of the Division: Dr. T.K.D. Tennakoon

Progress of research projects

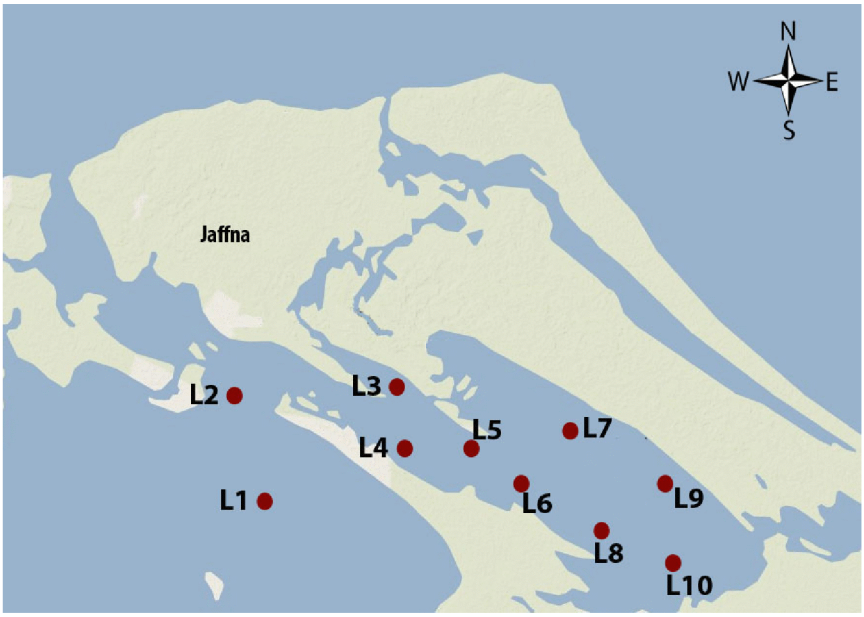
There were five main projects carried out during the year 2014. The projects to be discussed are listed below. The progresses of the each project are given separately.

5.1. Monitoring and modeling of hydrology and circulation of coastal waters

Allocated amount : Rs. 1.52 million

Responsible Officer : H.B. Jayasiri

This study was carried out during 2014 in Jaffna lagoon at ten randomly selected locations (Fig.1). Water samples were collected for the laboratory analysis of nutrients, TSS and zooplanktons. In situ data collection on physiochemical properties (temperature, pH, salinity, and dissolved oxygen) were measured using digital multiparameter. Visibility was measured using secchi disk. Sediment samples were analysed to access the total abundance and composition of macro-benthic categories (polychaetes, crustaceans, bivalves, gastropods and others) at different areas (mouth, middle, and head) of the Jaffna Lagoon. Mean highest zooplankton abundance was recorded near to the Sangupiddi Bridge as 137085 individuals per liter during the entire study period. Salinity, DO, visibility, nitrite, nitrate and phosphate levels have shown significant positive correlation with the zooplankton abundance of the Jaffna lagoon. It reveals that abundance of zooplanktons are related to the physiochemical parameters of the lagoon.



A total of 56 species of benthic invertebrates were found, belonging to 46 families, including 10 polychaetes, 8 crustaceans, 14 bivalves, and 14 gastropods. The total abundance of organisms varied from 4 to 1504 individuals per liter. The composition of polychaete families varied from 28-72% Eunicidae, 4-14% Captilidae, 3-14% Paraonidae and 1-11% Goniadidae. The composition of crustacean families varied from 1–37% Cyproideidae, 30–79% Colomastigidae, 1-13% Ampeliscidae and 1-13% Aoridae. Bivalve families were Hemidonacidae (52-58%), Lucinidae (10-20%), and Veneridae (10-24%). Gastropods were Potamididae (3 -60%) and Trochidae (24 -36%). This study provides baseline data of benthic organisms on diversity and abundance in Jaffna lagoon during the southwest monsoon. Gathering information on zooplankton and benthic organisms with related to the present environmental conditions can be useful for the future conservation and also to minimize the adverse effects of development and pollution.

Fig.1. Two B.Sc students of university of UvaWellassa and Ocean University completed their research projects using gathered data. An extended abstract on "Diversity and abundance of macro-benthic organisms at Jaffna Lagoon in relation to sediment quality parameters"is submitted to the annual scientific session 2015, NARA

Progress (%):- Physical: 95% Financial: 100 %

5.2. Improvements of an existing tuna forecasting system of NARA incorporating data from satellites and in-situ ocean observations

Allocated amount : Rs. 375,000.00
Responsible Officer : J.K. Rajapaksha

Fish forecast maps were generated every week and disseminated to major fishery harbors throughout the year. The information also has sent by email to registered users. However, expected fishery data did not collect for verification of the forecast. The model developed in 2013 to predict fishing depth was further improved in terms of methodology improvements and the accuracy was improved (Fig. 2). A research paper was submitted to an International journal and subjected to revise and accepted for publication.

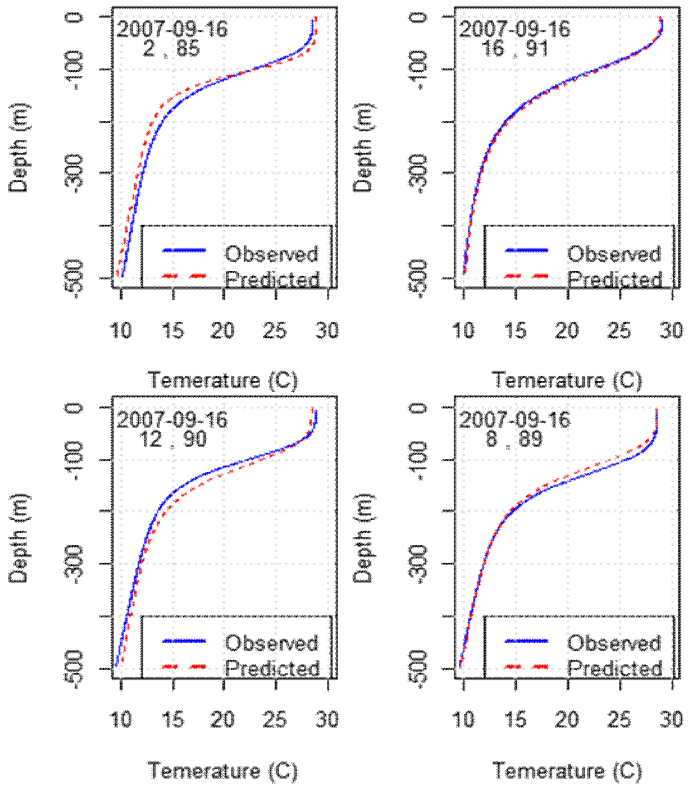


Fig.2. Comparison of model predicted temperature profiles (dashed line) and observed Argo profiles (solid line) at the four locations on2007.09.16.

Preliminary analyses of TDR (Temperature depth recorders) data were done. This data were collected to investigate tuna aggregation depth and temperature. Longline hook sinking rate was about 0.10 ms^{-1} (Fig.3). According to this rate a hook reach its average depth within 10-12 minutes. Changing depth and temperature around a hook is due to prevailing currents and the temperature change is due to both depth changes and different water masses passing the hook. The temperature at hooks depth is around 27^{o}C and this can be changed depending on the temperature vertical profile that seasonally changed. This temperature is too high for adult yellowfin tuna aggregation (about 21^{o}C) and as a result catch rates of shallow long line is low compared to deeper longlines.

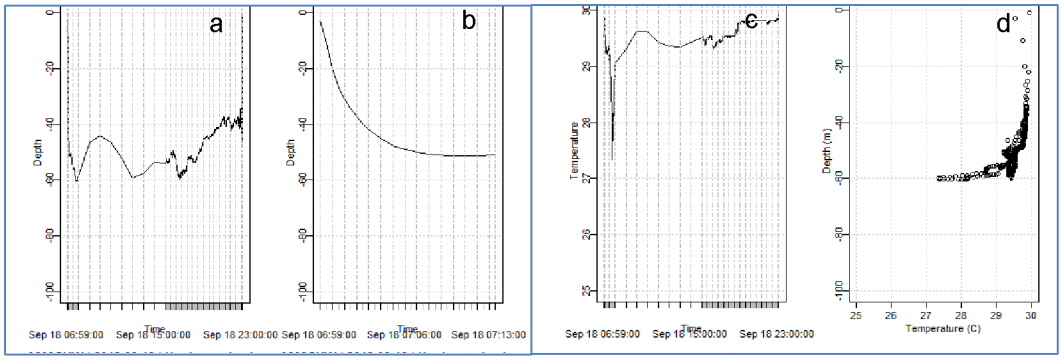


Fig.3. (a) hooking depth behavior with time, (b) Hook sinking rate, (c) Temperature change with time around a hook and (d) temperature change with the depth of a particular hook.

Progress (%):- Physical: 85 % Financial: 100 %

5.3. Exploration of non-living resources on the continental shelf of Sri Lanka

Allocated amount : Rs. 200,000.00

Responsible Officer : S.U.P. Jinadasa

The exploration survey was conducted associated inKelani river mouth with expectation of possible placer mineral deposits in this area. Bottom sampling and sub-bottom profiler survey was conducted in the area. Sub-bottom survey was conducted with 50 m line spacing across the river. The identified sediment layer thickness was about 4-5meters. Possible heavy mineral occurrences of this area were ilmenite. The ilmenite concentration varies from 15-20 percent from the total. However, rutile is present as minor quantities (~5-8 percent).

In addition to field survey, two newly recruited scientists were trained under the project and they are capable to conduct similar type of projects by themselves in future. The detailed investigations need to be carried out in year 2015 for quantification of the deposit.

Progress (%):- Physical: 90 % Financial: 100 %

5.4. Ocean Observation and forecasting for mitigation of ocean based disasters

Allocated amount : Rs. 1,560,000.00

Responsible Officer : K.Arulananthan

The Ocean observation center (OOC) of NARA established after the Indian ocean mega tsunami in 2004. The aim of establishing ocean observation center is to develop and implement an observing system for monitoring the real time and near real time ocean conditions around Sri Lankan waters. Such observations are vital during ocean based

disasters to minimize impact and mitigate the disaster. 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 is running on 24 hrs x 7 days basis and monitoring, gathering real time and near real time ocean environmental data around Sri Lanka.

The center generates new information and provides information products to meet the need of coastal and scientific community. The data, which are intended for use in oceanographic and other interdisciplinary scientific research, is freely available in OOC database. However, these freely available products are only for scientists, researchers and university students. The available products are coastal 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. As a supplementary, OOC has been monitoring and collecting earthquake data for tsunami early warning and for statistics.

With respect to ocean based disasters, the center collaborates with the Ministry of Fisheries and Aquatic Resources, Disaster Management Centre (DMC), Geological Survey and Mines Bureau (GSMB) and the Department of Meteorology to provide the necessary technical support and guidance for early warning and mitigation of impacts from ocean based disasters. Centre is also maintaining a physical ocean environmental database for future needs. Awareness programs were conducted to aware the OOC activities specially ocean based disasters for three security forces, red cross, DMC and university students and school children etc.

Other activities carried out under this project were to maintenance and data acquisition from the sea level stations located 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 including Ministry of Fisheries and Aquatic Resources. Data are used by many undergraduate and postgraduate researches. Data were analyzed to study the long-term sea level variability around Sri Lanka.

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

5.7. Seasonal variability of coastal and oceanic process around Sri Lanka

Allocated amount : Rs. 750,000.00

Responsible Officers : S.U.P. Jinadasa, H.B. Jayasiri, K.Arulananthan

Objectives of this project were to collect met oceanic parameters around Sri Lanka to study the seasonal variability. During the year 2014, 19 SVP drifters were released at the 50km, 75km and 100km distances from the coast. The equipment measures the water movements by tracing the path of a water particle over a long time interval (Lagrangian current).The buoy utilizes the dependable bi-directional iridium satellite system to communicate and transmit essential data. Also, they provide sea surface temperature (SST) variability along the drifter trajectories. The main idea of this program was to study the seasonal behavior of East Indian coastal currents aroundSri Lanka. Additionally, these oceanographic data can be utilized to study the climate change and other oceanographic applications such as fishery forecasting. The map in the figure 4 illustrates circulation during year 2015.

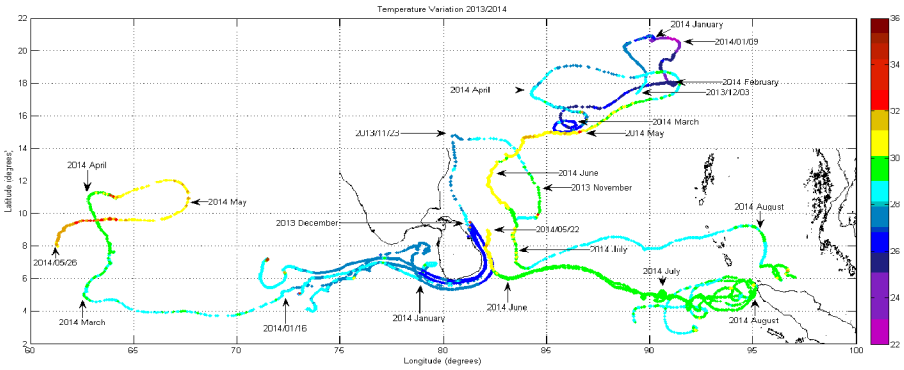


Fig.4. Drifter trajectory showing the circulation patterns in the Indian Ocean

During 2014, two Samuddrika research cruises were conducted perpendicular to east and south coasts of off Baticaloa and Weligama areas respectively. The location map of the study area and salinity, temperature, density variations are given in figure 5. Survey is conducted as a transect starting from Weligama area. Conductivity temperature depth (CTD), vertical microstructure profiler (VMP) measurements, water and plankton samples were collected from 50 m depth to more than 1000 water depth during the survey. In addition to CTD and VMP measurements, ADCP data were taken though out the survey.

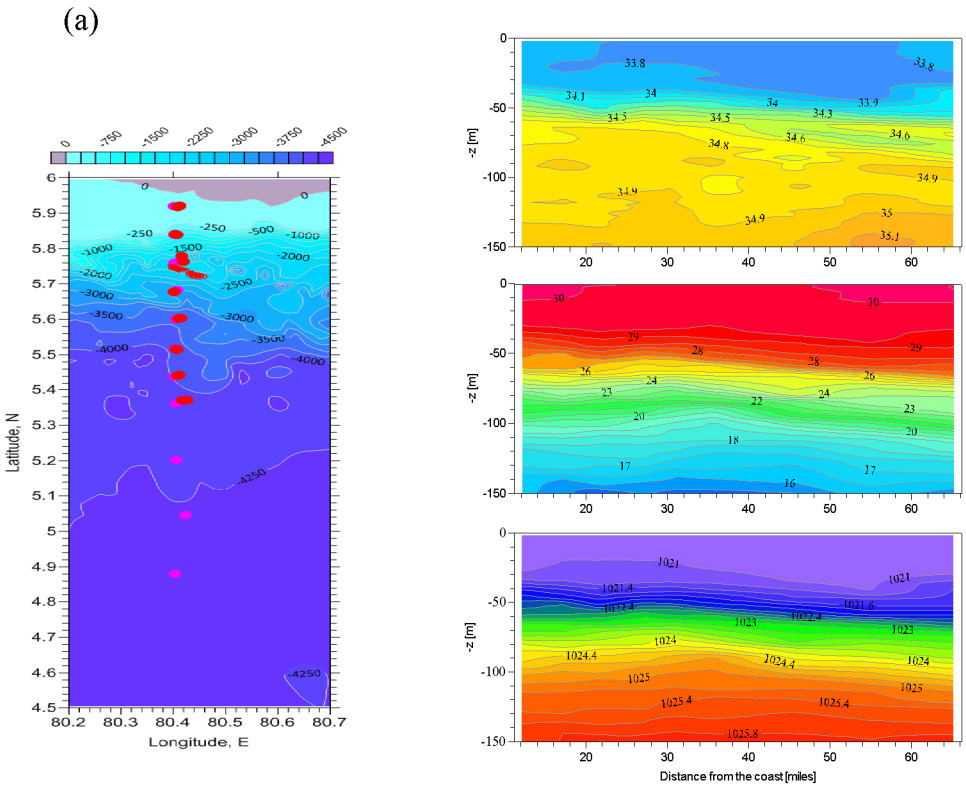


Fig.5. illustrates location map of the CTD sampling and salinity in upper panel, temperature in middle panel and density in lower panel along the transect during the survey.

During the inter-monsoon season (April, Fig.5), the depth of the relatively well-mixed surface layer in blue water (> 12 miles from the coast) appears to be approximately constant (about 40 m) across the entire southern branch of the current. Lenses of slightly fresher and cooler water near the sea surface did not affect much of the near-surface density structure, as evidenced by a uniformly mixed upper layer and a sharp pycnocline. In general, the pycnocline became shallower towards the south, pointing to predominantly easterly geostrophic transport at the end of April. According to VMP measurements along the same section near the shelf break (Fig. 5a), the depth of the surface homogeneous layer in April is ~ 60 m, indicating the possibility of substantial convective cooling and/or strong wind mixing in the upper layer south of Sri Lanka during the winter monsoon.

Zooplankton samples were collected from off the southwest coast of Sri Lanka during April 2014. Sampling stations were grouped into four areas (A, B, C, D) spatially according to the depth and location. The areas A and B cover the coastal area (defined here as coastal waters

inshore of the 100m isobath) while areas C and D cover the offshore area where the depth exceeds 750 m. Samples were analyzed for abundance, taxonomy and biomass. The estimated zooplankton abundance of the area showed that there was no significant difference among the study sites A, B, C, and D. Mean zooplankton abundance of the area was 1365±391indiv. l^{-1}. Zooplankton biomass varied from 0.1 to0.29 ml m^{-3} in displacement volume, from 25 to 342 mg m^{-3} in wet weight, from 3.2 to 17.3 mg m^{-3} in dry weight, and from 1.42 to 9.56 mg m^{-3} in ash-free dry weight. Diversity indices were used to assess the zooplankton diversity in the study area. This study provides the information on secondary production during the 1st inter-monsoon off of the southwest coast of Sri Lanka.

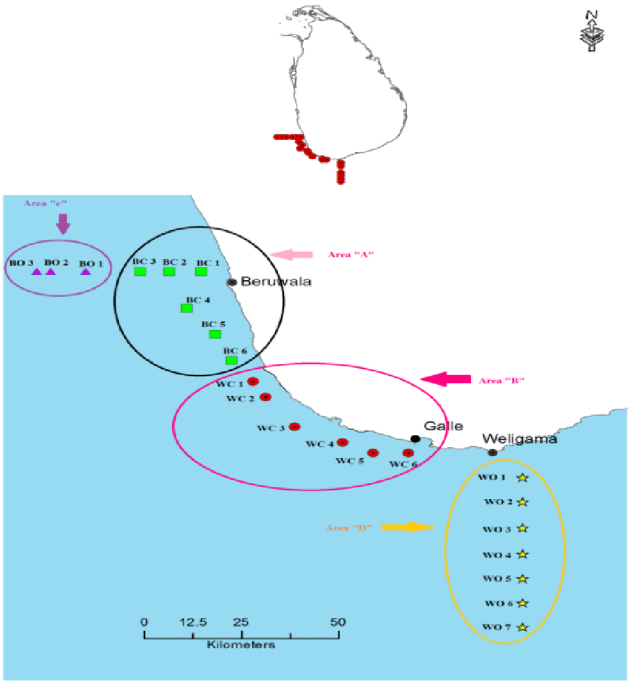


Fig.6. Location map of biological and water sampling

B.Sc studentof University of UvaWellassacompleted her research project using gathered data. An extended abstract on "Variability of zooplankton abundance and biomass in coastal and offshore waters, off southwest coast of Sri Lanka" is submitted to the annual scientific session 2015, NARA.

Progress (%):- Physical: 95 % Financial: 100 %

Publications

Full papers

- J. Lucas, E. L. Shroyer, H. W. Wijesekera, H.J.S. Fernando, E. D'Asaro, M. Ravichandran, **S.U.P. Jinadasa**, J. A. MacKinnon, J. D. Nash, R. Sharma, L. Centurioni, J.T.Farrar, R. Weller, R. Pinkel, A. Mahadevan, D. Sengupta and A. Tandon. (2014). From Monsoons to Mixing: the Multi-scale Mosaic of Air-Sea Interactions in the Bay of Bengal, EOS, American Geophysical Union Transactions.

- **Jayasiri, H.B,**Arulananthan, K. and Jinadasa, S.U.P. (2014). Characterization of bio-physical features in Thalawila fishing ground, North-western coast of Sri Lanka. ***Journal of National Science Foundation Sri Lanka,*** 42 (3): 229-238.

- Vennila, **H. B. Jayasiri** and P. K. Pandey (2014). Plastic debris in the coastal and marine ecosystem: a menace that needs concerted efforts, ***International Journal of Fisheries and Aquatic Studies,***2(1): 24-29.

- **H. B. Jayasiri**, C. S. Purushothaman and A. Vennila. (2014). Occurrence of Polycyclic Aromatic Hydrocarbons (PAHs) in Beached Plastic Pellets from Mumbai Coast, India, ***Journal of Tropical Forestry and Environment***, 4(1):61-73.

- **JK. Rajapaksha**, Satsuki Matsumura, LalSamarakoon, JagathGunatilake (2014) Multispectral Satellite Data on Ocean Surface to Predict its Temperature Vertical Profiles, a Simple Model, ***Asian Journal of Geoinformatics***.

Abstracts

- ***S.U.P. Jinadasa***, I. Lozovatsky, H.J.S. Fernando, C.-S. Hong and J.-H. Lee. Bottom Boundary-Layer Dynamics of Shallow Waters in East China Sea, Ocean Science meeting, Honolulu, Hawaii.February 23-28, 2014.

- I.Lozovatsky, ***S.U.P.Jinadasa***, A. Lucas, J.A. MacKinnon, H.J. Fernando, H.W.Wijesekera. Weakly Penetrative Mixing in the Surface Layer of the Bay of Bengal: AGU fall meeting, San Francisco, USA.December 15-19, 2014.

- H.W.Wijesekera, E. Jarosz, W.J. Teague, T.G. Jensen, E.J.Metzger, ***S.U.P.Jinadasa,K.Arulananthan,*** L.Centurioni, H.J. Fernando. Sub-Surface Currents andHigh-Salinity Intrusions in the Southern Bay ofBengal during the Northeast Monsoon, AGU fall meeting, San Francisco, USA. December 15-19, 2014.

- ***H.B. Jayasiri***, Purushothaman, C. S., Vennila, Occurrence of polycyclic aromatic hydrocarbons (PAHs) in beached plastic pellets from Mumbai coast, India. 18th International Forestry and Environmental Symposium, MAS Fabric Park, Thulhiriya, Sri Lanka on 15thand 16thof November, 2014.

- ***AkilaHarishchandra***and ***K. Arulananthan***. 2014.*Spatial distribution of Barrier Layer Thickness in the central Bay of Bengal during inter monsoon period,* 2nd International Conference on Fisheries Science, International Center for Research and Development, Sri Lanka

- ***S.S.Gunasekara***, A. K.Mishra. 2014. Mapping the coverage of seagrass meadows of gulf of mannar and palk bay (india) using landsat ETM+ data, Peradeniya University International Research Sessions - iPURSE- 2014, University of Peradeniya, Sri Lanka, University of Peradeniya.

Foreign trainings/ Conferences/Seminar

Names	Training
H.B. Jayasiri	Bay of Bengal Large Marine Ecosystem (BOBLME) – 2ndEcosystem characterization workshop. 03-06, November 2014, Bangkok, Thailand
H.B. Jayasiri, T.K.D. Tennakoon, J.K. Rajapaksha	Bilateral meeting to initiate collaborative marine research between First Institute of Oceanography, (FIO) Qingdao, China and NARA, Sri Lanka. 18-22, Qingdao, China
H.B. Jayasiri	Bay of Bengal Large Marine Ecosystem (BOBLME) – Ecosystem characterization workshop. 10-12, February 2014, Phuket, Thailand
S.U.P. Jinadasa	Oceanographic training in University of Notre Dame – February 28 – June 30, 2014, Notre Dame, USA
JK Rajapaksha	UNESCO/IOC Regional Training and Research Center on Ocean Dynamics and Climate, Qingdao, China, 03-14 Nov. 2014
AkilaHarischadra	5th Western Indian Ocean Data Buoy Cooperation Panel (WIO-DBCP), Port Elizabeth, South Africa, 2014
K.W. Indika	Operators of Sea Level Stations, Royal Thai Navy Hydro-graphy Department. Thailand

Local trainings/ Conferences/Seminar

Name	Training
Akila Harischandra	Short course on Multivariate Data Analysis (MDA), *University of Peradeniya*, Peradeniya, Sri Lanka
	Workshop on INSPIRE and ESCAPE software application for Tsunami Hazard and Risk Assessment and Evacuation planning, *Regional Integrated Multi-Hazard Early Warning System (RIMES),* Hambantota, Sri Lanka
K. Aulananthan, H.B. Jayasiri, J.K.Rajapaksha,S.U.P.Jinadasa, A.Harischandra,K. Dalpathadu, N.Suriyaarachchi,	Workshop on Project Cycle Management, *NARA and Sri Lanka, Norway Bilateral Project*, Kanneliya, Sri Lanka
DilekaSamaranayake	Conference on water management by IWMI, Disaster Management center
	Workshop on "Writing of effective research proposal", National Science Foundation
	Workshop on "Experimental designs", Postgraduate institute of Agriculture, Peradeniya.
KasunDalpathadu	Conference on UN Convention on the Law of the Sea and Bay of Bengal Exception held at Hotel Taj
	Work shop on application of ESCAPE and INSPIRE soft-wares for tsunami prediction
NuwanSuriyaarachchi	Workshop on "Preparation SOP for Disaster Management of Sri Lanka", Disaster Management Centre
J.K. Rajapaksha, S.S.Gunasekara	Short course on Analysis of count and rank data, Postgraduate institute of Agriculture, Peradeniya
J.K. Rajapaksha, S.S.Gunasekara	Conference on Developing Priorities for Future Aquatic Environmental Research

K.W. Indika	Short Course on GIS & Applications, The Postgraduate Institute of Science University of Peradeniya

Postgraduate's studies

- Ruchira Jayatilaka left the country to attend the M.Sc. in Netherland.
- W.N.C. Priyadharshani left the country to attend Ph.D studies in China.

Technical services and Consultancies

- Port city development project-Water quality and current measurements, 2014-2016.
- Port biological baseline survey (Trincomalee, Galle and Hambantota harbour) conducted by Marine Environment Protection Agency.

Supervised students

- Ms. Hansini, UvaWellassa University; B.ScResearch Project titled distribution and diversity of offshore zooplankton, off south-western coast.
- A.M.C.P. Kumara, Ocean university, Tangalle; B.Sc. Research Project titled Diversity and abundance of macro-benthic organisms at Jaffna Lagoon in relation to sediment quality parameters
- GayanPathirana, University of Ruhuna; B.Sc Research Project on Seasonal Variability of Circulation in the Northern Bay of Bengal with special reference to Sri Lanka Coastal Currents
- Ms. R.M. Jayasundara and Ms. N.M.P.S. Navarathne, University of Sri Jayewardenapura; Industrial training
- Ms. PornimaWimalasiri, University of UwaWellassa, B.Sc. degree final year project
- Ms. Perl Gunesekara, Ocean University of Sri Lanka, M.Sc. degree project

5.7 Institute of Post Harvest Technology

Head of the division: Dr. G. J. Ganegama Arachchi

Institute of Post Harvest Technology (IPHT) of NARA has conducted five research projects under research program titled "Reduction of post harvest losses and value addition". Several projects were conducted using funds provided by Ministry of Finance, foreign grants and local industry. In addition, IPHT has provided Testing Services and consultancies, training programs, awareness programs for stake holders in Sri Lanka.

Projects funded by Ministry of Finance

Project 3.1: Assessment the quality of fish based products in the local market

Responsible Officers: Sujeewa Ariyawansa, Pavithra Ginigaddarage

Introduction

Dried fish products are popular among local communities and become one of main protein source in their diet. In the year 2013, local dried fish production was 78,600 Mt and total dried fish imports including sprats were 38,340Mt (Ministry of fisheries, 2014). About 33% of the dried fish requirement is fulfilled by the imports. At present, information on quality of imported dried fish consumed in Sri Lanka is not abundant. In this study, imported and locally manufactured dried fish samples were analyzed and compared for microbiological, chemical and physical parameters.

Methodology and results

Both locally manufactured and imported samples comprising *Katta*, *Hurulla*, Shark, prawn, Tuna, Sprat, Catfish, Sailfish, *Singalaya* and *panna* samples were the species analyzed in this study.

were collected for this study. Locally manufactured samples (n=52) were collected from retail outlets and imported samples were collected from Sri Lanka Customs (n=100) prior to the distribution and from retail outlets (n=27). Collected samples were packed in sterile polythene bags and transported to the laboratory. The samples were analyzed for aerobic plate count (SLS 516: Part 1:1991), total coliforms (SLS 516:Part 3: 1982), *E. coli* (SLS 516:Part 3: 1982), *Staphylococcus aureus* (SLS 516 : Part 6 : 1992), Yeast and mould (SLS

516: Part 2:1991), halophilic count (SLS 643:2007), salt (SLS 643:2007), histamine (HPLC method) and water activity (A_w Sprint water activity meter).

Locally manufactured samples:

According to the mean values of obtained results in locally manufactured samples, only sprat samples are in the acceptable limits of APC. All the other samples exceeded the APC limits established for dried fish by Sri Lanka Standard Institution (SLSI). All the samples were in the acceptable range for TC, *E.coli, S. aureus* and halophilic bacteria. Although *Katta*, *Hurulla* and prawn samples were in the marginally acceptable range. None of the samples were containing yeast and mould content more than the rejection level. Only *hurulla* samples exceeded the water activity level prescribed by the SLSI. All the other samples showed a water activity of less than 0.75. *Katta*, Shark, Sprat and Catfish samples exceeded the limit of salt percentage which is 12%. All the samples analyzed for histamine, contained less than 100 mg/kg which are in the acceptable range.

Imported samples collected from Sea freight containers at the Sri Lanka Customs

Tuna, Sailfish, *Singalaya* and *Panna* samples obtained from Sri Lanka Customs were within the acceptable limits for APC. All the other samples exceeded the APC limit. 33% of sprat samples contained unacceptable levels of TC. All the other samples didn't contain TC and *E.coli*. None of the samples contained *S. aureus* and halophilic bacteria. *Panna*, Sailfish and Tuna samples contained unacceptable level of yeast and mould count while *Katta*, *Hurulla*, prawn, sprat and *Singalaya* samples contained acceptable amounts of yeast and mould counts. Shark and catfish samples were in the marginally acceptable levels. All the samples were acceptable with regards to water activity level. Only shark and prawn samples contained less than 12% of salt. Tuna samples exceed the histamine acceptable level whereas *Hurulla* and sprat samples contained less than 100 mg/kg.

Imported samples obtained from retail market

Tuna and Sailfish samples contained acceptable values for APC. Catfish samples were in the marginally acceptable level of APC whereas Shark, prawn, *Katta* and sprats samples were more than the rejection level. TC, *E.coli*, *S. aureus* and halophilic bacteria were not present in any of the samples. Shark and Tuna samples contained acceptable levels of yeast and mould count whereas *Katta*, prawn, sprats, catfish and sailfish contained marginally acceptable

levels. Prawn samples contained water activity more than 0.75. All the other samples were less than 0.75 of water activity. Prawn samples contained salt less than 12% which is acceptable. Tuna samples contained unacceptable levels of histamine whereas sprats were less than the 100 mg/kg.

Conclusion

From the results obtained it can be seen that a considerable amount of samples are with unacceptable chemical, microbiological and physical levels. Therefore, the quality of dried fish should be improved.

Progress (%):- Physical: 95% Financial: 100 %

Project 3.2: Assessment of the economic viability of production of Tuna fish oil using tuna waste generated from processing factories in Sri Lanka

Responsible Officer: Suseema Ariyarathne

Introduction

There are about 28 numbers of tuna processing factories which supply tuna loins as chilled and frozen products to Europe, China, Japan and USA. About 6249 mt of yellow fin tuna exported while total production was about 42,270 mt in the year 2012 according to the Statistical unit of Ministry of Fisheries and Aquatic Resources Development. Nearly 50 % of the each fish is considered as waste during processing .Waste material generated in tuna processing industry are head, belly flaps, black meat and viscera .Those waste, generated during processing is purchased by local vendors to produce fish meal and dried fish. The important factor is that the raw material of those waste materials is high in quality suitable for export market. Therefore this waste can be considered as a good quality raw material for a valuable product like Tuna fish oil since most important factor of the processing of fish oil is superior quality raw material.

At present people are very much concern about the healthy and nutritious food products around the world. Fish oil is a well-known health product around the world due to omega 3 fatty acids content such as DHA and EPA which help to improve and maintain mental and physical health. Tuna fish oil has a high demand and nutritional importance among other types of fish oils. Objectives of this study were to 1) Extract fish oil from tuna fish waste and

estimate the quantity and quality of tuna oil, 2) Evaluate the seasonal variation of quality and quantity of fish oil.

Methodology and results

Samples of tuna fish waste were collected from fish processing factories. Extraction was done using Bligh and dyer method and fish oil was analyzed for the fatty acid profile.

Tuna fish oil can be extracted using tuna head, belly flap, black meat, and viscera. Extracted fish oil contained 26 % saturated, 28% mono unsaturated, 45% poly unsaturated and 39 % omega-3 fatty acid. Results of the study revealed that there is no significant difference in fish oil content of fish waste material throughout the year.

Other activities

Production of fish soup cube using Tuna fish powder.

Conclusions

One Liter of good quality tuna fish oil can be extracted using 100 kg of Tuna fish waste. Estimated amount of fish oil that can be extracted using Tuna fish waste is about 34 Mt per year.

Progress (%):- Physical: 95 % Financial: 100 %

Project 3.3: Assessment of nutritional quality of underutilized aquatic resources and food safety

Responsible Officers: Kolitha Jinadasa, S. B. N. Ahamed

Sea urchins (*Stomopneustes variolaris*) gonads (roe) have high nutritional value than other sea foods with organic and inorganic components. This study was carried to identify the common edible species of sea urchin of the selected areas, to assess nutritional analysis of identified common species' gonads and to assess trace metals accumulation of identified common species' gonads, due to lack of studies on sea urchin gonads in Sri Lanka.

Methodology and results

Samples were collected from Beruwala (n=96), Mount-lavinia (n=43) and Tangalle (n=54) reefs and study was conducted from May 2014 to October 2014.Chemical analysis of gonad samples collected from all the sites showed average value of; moisture content (%) 69.79(±0.07), ash content (%) 2.45(±0.06), crude lipid content (%) 8.08(±0.73), crude protein

content (%) 14.11(±0.75), carbohydrate (%) 05.57(±0.61) and energy (KJ/g) 25.48(±0.61). The highest total saturated fatty acids (SFA) level (53.96%) was observed in the samples collected from Mt. Lavinia. High level of total mono unsaturated fatty acids (MUFA) content was recorded (14.98%) at Beruwala sample and highest total poly unsaturated fatty acids (PUFA) content was reported (14.91%) at Tangalle sample. SFA content of all samples was significantly higher ($p<0.005$) than the total amount of MUFA and PUFA. The fatty acids of *S. variolaris* gonads, C14:0, C16:0 and C18:1 (n-9) were predominant and C12:0, C22:5(n-6) and C22:6(n-3) were lower in the gonads. A variation of trace metal accumulation was observed from the samples collected from different study areas as; in Beruwala-samples Fe > Zn > Cu > As > Ni > Cr > Cd > Pb > Hg, in Mt. Lavinia- samples Zn > Fe > As > Cr > Ni > Cd > Cu > Hg > Pb and Tanagalle- samples Zn > Fe > Cd > As > Cu > Ni > Cr > Pb > Hg.

Conclusion

Results of this study indicate that native edible sea urchin species has potential to introduce in seafood industry especially targeting the export market.

Progress (%):- Physical: 98% Financial: 100 %

Project 3.4: Evaluation of the quality and value addition of edible seaweed species in Sri Lanka

Responsible Officers: P. S. Jayasinghe, Rohan Karawita (resigned from NARA), G. J. Ganegama Arachchi

Activity 1. Formulation of seaweed based jam as a sources of health food

Introduction

Seaweed is known as source of minerals, protein, vitamins and dietary iodine. Seaweed jam which can be considered as nutritive source of minerals, vitamins and amino acids in health diets can be produced at is low cost. There is no scientific data on nutritional content of locally produced seaweed jams. Therefore, present study was focused on utilization of seaweed extract as a thickening agent of the jam recipes.

Methodology and results

Fruits (wood apple, orange, and mango) and sugar were purchased from a Super Market at Mattakkuliya in Colombo. The citric acid and sodium benzoate were purchased from a Food

Ingredient shop in Colombo. The fresh *Gracilaria* and *Kappaphycus species* were collected from Northwestern and Southwestern coastal belt of Sri Lanka respectively and kept in an insulated box, and transported to the laboratory within the same day. In addition to that *Ulva lactuca* were collected from Southwestern coastal belt of Sri Lanka. The collected each seaweed species were washed, cleaned and epiphytes were removed for several times. The washed and cleaned seaweeds were dried well at 45 ^{o}C in an electrical oven for 1-2 days.

The dehydrated seaweed species were powdered and kept in air tight containers and stored at 4 ^{o}C and each batch was used up in jam formulations within one month. The dried and ground seaweed powder of *Gracilaria verrucosa* හා *Kappaphycus species* (carrageenophyta) were used to extract agar agar (SOS, 1983) and Carrageenan (FAO, 1990). The *Ulva* species powder were manufactured accordingly (Anon, 1985). The jam formula was done according to the (Anon, 1995). Four different jam types were prepared using wood apple, orange, and mango and *Ulva* species powder. Each jam prepared with fruits, sugar, other chemical additives (citric acid and sodium benzoate) and different levels of agar agar or carrageen an percentages [6 ,5, 4, 3, 2, and 1% (w/w)] were used to evaluate sensory quality parameters, color, aroma, taste, consistency using train panelists. The spread ability of the jam was evaluated by sensory assessments and improved to market standards by incorporating varied level of agar and carrageen an. In addition, ulva containing jam type was developed by adding ulva powder to boiling sugar syrup. Each jam sample was filled in glass jars to contain 250 g and tightly capped with lids. The shelf life studies were carried out for different fruit jams and ulva jam developed in this study for over six month period. The highest spread ability of each jam was evaluated with agar agar or carrageenan by sensory evaluation (Hedonic scale, 1983). Seaweed jam types developed in this study together with commercial available orange jam (containing pectin) were analyzed for nutritionally important elements (potassium and iodine) content (AOAC, 1983),and proximate composition (AOAC, 1983), as well as physical properties such as viscosity (Brook field viscosity meter), water activity (water activity meter). Shelf life of jam types were assessed over six month period for overall sensory quality and microbiological (total bacterial Count and Mould count) quality.

All jam types containing 6% agar agar or 3% carageenan as gelling agents had highest acceptable spreadability. The pectin content in commercial available jam was 2%. The 6% agar incorporated jams were recorded viscosity 144, 76.4, 251, 57.7 171cp. Values

respectively for wood apple, orange, *ulva*, mango higher than but lower than that of commercial available market jam sample (171c**p)**. It was found that maximum percentages of agar and carrageenan are the best level kept on maintains standard spread ability of jam in commercial marke**t**. The most acceptable selected compositions consists of crude protein (5.698%, 6.3%, 9.6%, 5.92%, 3.26%: iodine value 0.35, 0.32, 0.56, 0.24,0.mg/L: in wood apple, orange, Ulva, mango jam respectively. The commercial market jam showed zero iodine content and the lowest protein value (3.26%). The nutritional content is higher in agar or carrageenan mixed jam sample than that of commercial market orange jam. The water activity values (0.823, 0.803, 0.888, 0.847, and 0.834). There weren't significantly different among water activity percentage of laboratory prepared and commercial market sample. The total plate counts were in the range of $2.3x10^1$ to $6.3x10^1$ and below the rejection levels. The macro and micro elements are highest in the sample of the present study than market samples. The yeast and mold were not present during six month period of shelf life. All the samples showed more than six months shelf life.

Conclusions

The two seaweed extracts of carrageenan and agar were most suitable nutritive thickener agent of the food substitute industry. The texture and spreadability can be also improved by addition of agar agar or *carrageenan* powder and sugar in the standard ratio. It can be concluded that consumption of Ulva jam is high healthy functional food to the diet and nutritional value is five times higher than that of the presently improved seaweed base jam available jam in the market. The shelf life of the different jam concentrations valid more than six months. The keeping quality and nutrition value show highest and same levels until six months storage. The agar-agar 6% and carrageenan 3% content were recommended jam recipes. This can be recommended as medicinal health food for high nutritional value.

Activity 2: Development of suitable technology for extraction of agar-agar applicable in local small scale industry

Using an acid treatment, about 30% of agar agar has been extracted from *Glacilaria verrucosa* (Kanghi passi) that were harvested from Trincomalee area. Crude agar-agar were semi purified using a pressure based dewatering method to obtain food grade agar-agar (<3% soluble ash). Seaweed agar incorporated set yoghurt product has been developed.

Conclusion

Local technology for seaweed extraction has been developed in NARA and there is potential to develop variety of healthy food products using seaweed extractives locally.

Progress (%):- Physical: 95% Financial: 100 %

Project 3.5: Assessment and monitoring of quality of fish and infrastructure facilities in Peliyagoda Central Fish Market and selected fishery harbours

Responsible Officers: G. J. Ganegama Arachchi, Sujeewa Ariyawansa, Kolitha Jinadasa, Pavithra Ginigaddarage, G.D.T.M. Jayasinghe

Introduction

This study was plan to investigate current status of quality of fish handled in Central Fish Market (CFM) in Peliyagoda (Colombo) and main fish landing harbours in Sri Lanka. The staffs of IPHT, Quality Control staff accommodated in CFM and Public Health Inspector (PHI) in Peliyagoda Provincial Council were involved in the investigation. This study was aimed 1) to identify gaps to establish a systematically operated local fish marketing system 2) to assess quality of fish display on fish stalls and unloaded in fishery harbours.

Methodology and results

In Central Fish Market, official fish samples obtained by PHI were analyzed for microbiological (Faecal coliforms, *Escherichia coli* and *Salmonella)* and chemical (Total Volatile Nitrogen and Histamine) parameters in Accredited (ISO/IEC:17025) laboratories in IPHT in NARA. The temperature of fish lots on the display in CFM were monitored using a Digital Infrared Thermometer (Gun-Type) daily. Fish from fishery harbours were sampled and analyzed for above parameters. In addition ice and water and samples were also analyzed for Faecal coliforms, *Escherichia coli* and faecal streptococci. Harbour water was also assessed for potential petroleum oil contaminations.

The survey was conducted on present handling practices and status of infrastructure available for fish handling operations including the sanitary facilities and hygienic measures in fish handling locations by direct observations and onsite interviews with fish handlers and supervisors.

Quality of fish samples in CFM

Most of fish lots (about 80%) packed in containers that are sold in early morning hours were found acceptable sensory attributes and below 4 ^{o}C storage temperature. However, most of fish retailed in open surfaces without ice (20-30 ^{o}C) in late morning hours (around 10-11am) at Central fish market are not in acceptable quality. Out of 62 samples, 33 (53%) were found not acceptable either by microbiological or chemical quality. *Salmonella* contaminations were also found among these unacceptable fish lots.

Present handling and sanitary practices in CFM

The fiberglass-decks of many of stalls found damaged indicating another way for fish contaminations. Different types of un-cleaned fish handling boxes made up with plastic, fiber glass, Styrofoam and wood were in use. Fish handlers in stalls seemed unaware or disregarded of hygienic and sanitary practices. This was reflected by the cross-walking of some fish handlers over decks, pavements, out of the market building to reach fish transport vehicles and toilets without changing the foot-wares. Fish placed on pavements was also seen. Stray dogs and crows were found in the premises in CFM and also seen on decks of fish stalls. Warm blooded animals and birds can become main contamination routes for human pathogenic flora in food fish handling premises.

Quality of fish samples in fishery harbours

Fish samples were collected once from main fishery harbours or main anchorages (Tangalle, Galle, Valachcheni, Trincomalee, Jaffna, Mannar, Kalpitiya, Negombo, Chilaw, Mulathive) from March to September in 2014. Skipjack, mullet species, Spanish mackerel, Indian Scad (Linna) Indian mackerel, *Sardinella* species, sprat, prawns, Kawakawa (Atawlla), and coral grouper (Kossa) were sampled at unloading places. Three to two sample lots (one fish sample lot was comprised of five sample-units) was obtained from each field location. Each unit (one large fish or several numbers of small fish) was analyzed as separate analytical sample in both microbiological and chemical analysis. At all places, fish found contaminated with *E.coli* in low counts (4-23 MPN/10g) except high contaminations (1100 MPN/10g) in sprat collected from Negombo. *Salmonella* contamination was found in, Indian Scad from Negombo, Kawakwa from Mulathivu. Histamine contents of fish samples were within acceptable range (<100ppm) and remained at very low levels (<50 ppm). However, TVBN contents of fish were above acceptable limit (<35 mg/100g) and were found in the range of 36-143 mg/100 g except low level (4.8-6.4) found in coral grouper from Kalpitiya. All

harbor water samples were found high contaminations with feacal coliforms and fecal streptococci. The harbor water of Trincomalee and Negombo harbours which are used to clean the fish, boat and utensils were also contained unacceptable levels petrolium oils (44-52 ppm). Ice samples from all places were also not in suitable quality to store fish. Ice from Mannar, water and ice from Chilaw were contaminated with *Salmonella.*

Conclusions

Findings of this study indicate urgent need for repairing and upgrading of infrastructure facilities together with implementation of proper fish handling system in CFM in Peliyagoda and fishery harbours/ fish landing sites.

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

Projects funded by industry of foreign grants

Project 1: Fish quality, Food Safety and Post Harvest Aspects

Source of funds: Sri Lanka Norway Bilateral Project on Sri Lankan Fisheries and Aquaculture (LKA3124-12-0045). This project was funded from March to June 2014.

Responsible Officers: Sujeewa Ariyawansa, Pavithra Ginigaddarage, Kolitha Jinadasa, Suseema Ariyaratne

Activity 1: Identify and provide advice on required technical solutions, processing practices and training related to handling of fish onboard and handling and processing of fish at landing sites

Training materials:

Three leaflets (on proper fish handling, usage of ice and Identification of fresh fish) were prepared. Thirty eight awareness programmes were conducted over 2419 stakeholders (For details, see extension programs of IPHT given below).

Activity 2: Assessment of microbiological, chemical, nutritional and sensory quality of seafood in the supply and marketing chain

Two categories of fish as large (two fish species in five occasions) and small fish (four species in six occasions) were analyzed for some test parameters. Large fish samples have been taken from four stages whereas small fish were taken from two stages along the fish distribution channel as given below.

Methodology and results

Samples were drawn from Negombo area in Gampaha District. Two categories (large and small) of fish were subjected to analysis in this study. One category (large fish) was comprised of tuna fish samples from multiday fishing boats (Skip jack tuna in 4 occasions and *Euthynnus affinis* in 1 occasion) and other category (small fish) was comprised of small fish species from one day fishing boats (*Amblygaster sirm*, *Pterocaesio chrysozona*, *Stolephorus commersoni* and *Sardinella albella*).

Quality of large fish was assessed at four consequent stages of the distribution channel

1) in multiday boat anchored at landing site, 2) At pier after 2 h of unloading, 3) Immediately after transporting in a vehicle to the next destination (after about 2 h) and 4)At retailing place after about 2 h of display.

Quality of small fish was assessed at two consequent stages of a distribution channel

Stage1)- samples from one day boat at landing site and 2) During retailing (after about 2 h of display in a stall).

Fish Samples were analyzed for Aerobic plate count (APC) at 37 °C (Petri films and SLS 516: Part 1:1991), Coliforms (Using Petri films; SLS 516: Part 3:1982, SLS 614: Part 2:1983) , Faecal coliforms (Using Petri films; SLS 516: Part 3:1982, SLS 614: Part 2:1983), *E.coli* (Using Petri films; and SLS 516: Part 3:1982, SLS 614: Part 2:1983), *Salmonella* spp. (SLS 516: Part 5:1992), *Listeria monocytogenes (*ISO 11290:1996), Histamine (Fluorometric method), Total Volatile Nitrogen (TVN) (Kjeldhal distillation method). In addition to fish samples, samples from harbor basin water, water from an ice plant, water from fishery harbour water supply, ice from ice plants and ice from multiday boats were also analyzed for microbiological parameters.

From the results it can be seen that the aerobic plate count of fish samples (tuna from multiday fishing boats) were ranged from $2.0 \times 10^2 - 2.0 \times 10^6$ cfu/g. Tuna samples were contaminated with Faecal coliforms, *E.coli*, *Salmonella spp.* (3%) and *L. monocytogenes* (8%). Presence of pathogenic bacteria shows that there is a cross contamination. This can occur either from water used to wash fish, surfaces fish stored or trucks used to transport fish. High Histamine and TVB-N levels were observed along fish distribution channel. 80% fish samples showed TVB-N above permissible level whereas 25% samples were above the limit for histamine level in fish.

From the results it can be seen that the levels of aerobic plate count, coliforms, feacal coliforms, *E.coli*, *Faecal streptococci* and *Salmonella* spp. of harbor basin water are very high. Therefore it is not recommended to wash fish and other utensils using harbour basin water as it may lead to cross contaminate fish. The tap water and tube-well water supplies are also not comply with potable quality and contaminated with pathogenic bacteria. About 20% of ice samples from one ice plant contained *Salmonella* spp. Water of ice plant contain unacceptable levels of total bacteria counts high amounts of bacteria, coliforms, feacal coliforms, *E.coli* and *Faecal streptococci.*

Conclusion

Quality of water and ice directly affects the quality of fish. Therefore measures should be taken to supply good quality water and ice for handling and storing of fish.

Activity 3: Development of value added seafood based products and ways to utilize fish waste

- Crude fish oil has been extracted from tuna fish waste using Bligh and dyer (AOAC 983.23) over one month period (June, 2014). The percentage of fish oil extracted from tuna head, liver, and flesh were 2.4%, 2.5% and 1.6%, respectively.
- HACCP plans have been developed for multiday fishing, one day fishing and dry fish processing.
- A team of four members representing IPHT, NARA participated in a workshop in Norway from 17th -21st November 2014.

Project 2: Monitoring the Safety of Oysters and Value Addition

Source of funds: International Development Research Centre (**IDRC) in Canada**

Responsible Officers: Sujeewa Ariyawansa, Pavithra Ginigaddarage, Kolitha Jinadasa

Methodology and results

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 analyzed 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 and chemical parameters including pathogenic bacteria) and chemical (heavy metals namely Hg, Cd, As and Pb).

Water from Gangewadiya and Kandakuliya were often contaminated with high densities of Coliforms, Faecal coliforms, *E.coli* and *Faecal streptococci.* In 2 occasions water samples collected from Gangewadiya were contaminated with Salmonella spp. whereas all water samples tested from Kandakuliya were free from Salmonella spp. All water samples tested from Gangewadiya and Kandakuliya were free from *Vibrio parahaemolyticus* and *Vibrio cholerae.* All oyster samples tested were free from *Vibrio parahaemolyticus*, and *Vibrio cholerae*. Levels of some heavy metals (such as Hg, Cd and Pb) detected in oysters were below the maximum permissible limits. Oyster harvested from Gangewadiya and Kandakuliya should be depurated before consumption. A training manual on oyster handling and processing was prepared.

Product Development and Value Addition:

Oyster based value added products (Oysters with natural brine, Smoked oysters in sunflower oil, Oyster pickle and Oysters in sugar syrup) were have been developed under this project.

Project 3: Extraction and characterization of Collagen from Sri Lankan fish waste

Source of funding- John Keels Holdings PLC, Sri Lanka
Responsible Officers: Sujeewa Ariyawansa, Suseema Ariyaratne,
Activity completed

A Survey report on fish waste was prepared and submitted. A form was designed for the survey and information was obtained from the almost all fish processing establishments and other possible main routes. Information has been gathered by site visits, by contacting stakeholders and also by phone.

Testing services of IPHT

Quality Control Laboratory of IPHT which has obtained ISO/IEC 17025 standards for several analysis parameters provided Testing Services for industry, especially, for fish exporting companies; Ministries, academic institutes and other stake holders. Total of 1835 samples were analyzed for microbiological (679), chemical (957) and sensory/physical (199) quality. Relevant to these samples, 615 of test reports were issued by IPHT. Total revenue received from the clients was LKR 6393405.00. Forty percent (40%) of the total revenue of IPHT will go as royalty for NARA.

Participation at workshops/Trainings (Overseas):

A team of eight members representing IPHT, NARA participated in a workshop in Norway from 17th -21st November 2014.

National symposium:

NARA Scientific Sessions in Post Harvest Technology

Extension programs of IPHT

- Awareness programs conducted under Norway-NARA bilateral project: Thirty eight awareness programmes were conducted over 2419 stakeholders comprising 29 sessions for Fishers of one-day and multi-day boats (1915), 01 session for Ice producers (23), six sessions for Dry fish processors (403), one session for Fisheries Inspectors and Fisheries harbour staff (56) and another one session for Public Health Inspectors (56) in Gampaha district over three months period (March to May, 2014) .
- Training program for undergraduates of Rajarata University on Post Harvest Technology, Value added fish products and Biological / Chemical analysis (10/02/2014 to 13/02/2014)
- One day training on production of dry fish/ post harvest technology processing of fish products for fisher community in Kanthale-Mahaweli authority of Sri Lanka (10/06/2014).
- Two workshops for fisher community in Kalpitiya area on post harvest technology and value added fish products- dry fish, Maldive fish and jaddi (11/12/2014 to 15/12/2014).
- Transferred technological knowledge "on post harvest technology and value added fish products- dry fish, Maldive fish and jaddi" to 09 persons who consulted us at NARA, for year 2014.
- National Exhibitions: Preparation of fish soup cubs and partition of Exhibition'' boat show 2014''.

Attended meetings

- Divinaguma programme, seafood advisory committee and National committee on post harvest technology and value addition.
- Attended steering committee meeting of Sri Lanka Norway Bilateral Project on Sri Lankan Fisheries and Aquaculture.
- Participated for committee meeting on preparation of draft of Free Trade Agreement between Sri Lanka and China in 2014.

Publications

- B.K.K.K. Jianadasa, P.H. Ginigaddarage, S. Ariyawansa. 2014. A Comparative Quality Assessment of Five Types of Selected Fishes Collected from Retail Market in Sri Lanka. *American Journal of Food Science and Technology* 2:21-27.
- Evaluation of microbiological and chemical characteristics of selected dried species available at Sri Lankan market. 2014. W.K.S.R. Weththewa, P. Ginigaddarage,

B.K.K.K.Jinadasa, K.W.S. Ariyawansa and V.P.N.Prasadi. Undergraduate Research Symposium 2013, University of Wayamba.5th November 2014. Pp 39.

- E.G.T.P. Wijesinghe, K.W.S. Ariyawansa, P.H. Ginigaddarage and S.P.S.D. Senadeera 2014. Dynamics of total bacterial flora in selected food fish along the distribution chain from Negombo fishery harbor. Proceedings of the 34th annual sessions of the institute of biology. 26th September 2014. Pp. 56.
- Preliminary assessment of microbiological safety in fish retailed in Gampaha district.K.W.S. Ariyawansa, P.H. Ginigaddarage and S.P.S.D. Senadeera 2014. Proceedings of the 34th annual sessions of the institute of biology. 26th September 2014. Pp76.
- Suseema Ariayratne (2014) "Evaluation of importance of Orinoco Sailfin Catfish (*Pterygoplichthysmultiradiatus)* as a food source"for theInternational Institute of Fisheries Economics& Trade conference (IIFET) from6th to 13th July 2014, Brisbane, Australia.
- Effect of lactic acid on total aerobic and faecal coliform bacteria counts of fresh whole Malabar Grouper (*Epinephelus malabaricus*) fish (2014). D.E.S. Abeywickrama, P.H. Ginigaddarage and H.W. Cyril. Proceedings of faculty of agriculture undergraduate research symposium, 23rd December, 2014.

5.8 Socio-economic and Marketing Research Division

Head of the division: Mr. 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 2014

- Women participation in Sri Lankan Fisheries – Chillaw. Puttalam, Matara, Galle, Hambantota
- The fisheries information centre (FIC) of NARA

Activities

- Under the above Women participation in Sri Lankan Fisheries project 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 providing all the information which is inquired by fisheries stakeholders via telephone.

Programme	Project	Allocation(Rs)	Responsible Officer	Duration
Socio-economic & Marketing	1. Women participation in Sri Lankan Fisheries (4.2)	1000,000.00	M. M. A. S Maheepala & H.D. Wimalasena	Two year
	2. The fisheries information centre (FIC) of NARA (6.4)	1000,000.00	K.H.M.L. Amaralal	Continues

Performance

Project 4.2: Women participation in Sri Lankan with special reference to Chillaw. Puttalam, Matara, Galle, Hambantota 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 Chillaw. Puttalam, Matara, Galle, Hambantota districts from January to October 2014, with the aim of identifying the role of women in the fisheries family and their contribution to fishing industry. The data of Chillaw and Puttlam were analyzed by using SPSS software. The result of these two districts is given here.

Average income for Chillaw and Puttlam are Rs 45455/= and Rs. 41014/= 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. 31237.00. In Puttalam and Rs.30866.00 in Chillaw over 80% 0f the sample belongs to Rs. 15,000-Rs 45,000 expenditure range. All fishers of Sri Lanka earn income under high income uncertainty. 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 neighbouring 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 63% of fisherwomen provide side support to their husband for net cleaning, net repairing, net lording and fish sorting activities. 48% of women in overall sample engage with homemade dry fish processing. Fish selling is famous among the women of Chillaw 38% of them sell fish but it is not popular among the women of Puttalam only 3% of women sell fish in Puttalam.

73% of women in the samples have no occupation but 83% perceived that these days' women should do a job to support for family income and 96% 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 13 hours for effective house hold works and they spent 11 hour as non-working hours.

All the important decisions are taken by both husband and wife together after discussed with each other. It means the women in this community have equal right to involve decision making process in the family.

Nearly 45% of the sample accepted domestic violence prevailing in their community. Most of the domestic violence occurred due to liquor and drug addiction of husbands. Second reason is poor education. Economic problem also affect for increase domestic violence. Lack of mutual understanding between wife and husband create environment for domestic violence in the house.

Figure 1. Fish seller

Figure 2. Women removing fish from the net

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

Project 6.4: The fisheries information centre (FIC) of NARA

Our division maintains a fisheries information center to provide necessary information for any stakeholder of Sri Lankan fisheries industry. Since the inception until end of the year 2014, a total number of 205 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	74	36
Consumer and Industry related Services	68	33
General Complains and Comments	34	17
Fisherman Welfare and Disasters Related Services	20	10
Trade and Investment Related Services	9	4
Total	205	

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 were recruited to the Fisheries Information Centre on Contract basis.

To promote the information center among stakeholder of fisheries sector more than 500 posters were pasted 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.

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

Publications

Reports

- Women participation in Sri Lankan Fisheries
- Socio-economic aspects of Bar reef marine sanctuary and associated ecosystems
- Socio-economic impacts assessment of proposed sand extraction for Colombo port city development project on fishing communities (Phase II)

Abstract presentations

- Amaralal K.H.M.L., Wimalasena H.D., and Maheepala M.M.A.S. (2014).

  Impact of fishing boat/craft and gear combinations operating in coastal fishery on fisher income in Sri Lanka, In proceedings of the International Forestry and Environment Symposium 2013, 10-11, January, 2014, , MAS Fabric Park, Thulhiriya, Sri Lanka.

- Amaralal K.H.M.L., Wimalasena, H.D. and Maheepala M.M.A.S. (2014).

  Economics of marine ornamental fishery in the Bar reef marine sanctuary in Sri Lanka, In proceedings of the SLCARP International Agricultural research symposium 2014, 11-12, August, 2014, Sri Lanka Foundation, Sri Lanka.

- Maheepala M.M.A.S., Wimalasena, H.D. and Amaralal K.H.M.L (2014).

  An economic evaluation and visitor pressure of recreational tourism on Bar reef marine sanctuary in Sri Lanka, In proceedings of the SLCARP International Agricultural research symposium 2014, 11-12, August, 2014, Sri Lanka Foundation, Sri Lanka.

Trainings

Local

- Mrs. D.W.L.U De Silva participated in a workshop on "Training on effective proposal writing", on 21th August, 2014, conducted by the National Science Foundation, Colombo, Sri Lanka.
- Mr. K.P.G.L.Sandaruwan and Mrs. D.W.L.U De Silva participated in a training workshop on "Research Methodology",On 15th December 2014conducted by the Sri Lanka Council for Agriculture Research Policy, Colombo, Sri Lanka.

Other developments

- Two Scientists and one Research Assistant recruited to the Division.

5.9 Monitoring and Evaluation Division

Head of the Division: Mr. A.B.A.K. Gunarathne (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. Information Technology unit, Library and Information unit and Extension unit are placed under the Monitoring and Evaluation division.

Information Technology unit

Overview of the Year

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	2,000,000.00	A.B.A.K. Gunaratne	2014	
	6.2 Development of a coastal spatial database	400,000.00	A.B.A.K. Gunaratne D.D.D.Weragodatenna	2014	

Performance

Project 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. Staff engaged with PC assembling, repairing and upgrading, 60 computers were repaired and 10 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 69 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 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

1. Provide data and mitigation measures for the sand extraction site - proposed Colombo port city development project.

a. Total value of the consultancy – Rs: 2,600,000

b. 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 Gunarathne, Director, M&E
Mr. K.H.M.L. Amaralal, Principle Scientist, SED
Mr. H.D. Wimalasena, Senior Scientist, SED
Ms. D. Ranmadugala, Senior Scientist, MBRD
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
Ms. D.Samaranayake,Scientist,NIOMS

Research thesis supervised

Student Name	University	Degree	Thesis Topic
M.Naveenan	Uwawellassa	B.Sc	Remote sensing and GIS approach in assessment and conservation of seagrass beds in the coastal stretch, Gulf of Mannar,
R.M.H.N.K Nisansala	Uwawellassa	B.Sc	Assessment of the impact of aquaculture practices in the Puttalam lagoon on the mangrove ecosystem by using remote sensing and GIS technology,

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

Library and Information Unit

Overview of the Unit

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.

The routine flow of effective services and the development activities could be much better if the Library cadre vacancies were fulfilled.

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 Conservation and Re-arranged the library collection		BGS Kariyawasam RS Liyanarachchi BGS Kariyawasam	Jan– Dec
3. Information Retrieval	3.1 Current Awareness Services (CAS) 3.2 Selective Dissemination of Information		BGS Kariyawasam RS Liyanarachchi BGS Kariyawasam	Monthly Jan- Dec

	Service (SDI) 3.3 Indexing Services 3.4Informatio Re-packaging 3.5 Exchange Service 3.6 Literature Survey 3.7 Compilation of digital collection		 BGS Kariyawasam RS Liyanarachchi -Do - BGS Kariyawasam	
4. Publishing Journal & Publicity Service	4.1Assisting for Publishing NARA journal vol. 41 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 BGS Kariyawasam RS Liyanarachchi	Jan- Dec

Performance

Project 6.2: 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, was collected information relevant to NARA.

Purchases:

Journal Titles:

05 Journals were requested for the year 2014, out of them only 02 were subscribed.

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

Book Titles - 16 Nos.

Online Databases - 02 Nos. (AGORA & CABI)

Donations & Exchange :

Received 129 nos. (Books, Reports, Newsletters, Travel Reports, CD-ROM).

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

Project 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. New arrivals to the Library were visualized monthly.

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 software. Summary of data entered for the year as given below.

Name of the Database	Quantity of Data
Journal Article Index (JAI)	**5043**
Theses Database	**63**
Research Reports Index	**195**
Research Article Index	**434**
Newspaper Article Index	**1315**

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 compiled using GSDL software and entered 150 articles to the database.

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 564nos.

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. 2285\= and 390 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, 4012pages were added.

1.4.2 Re-arranged CD collection and BOBP Collection successfully.

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

Library Networks

Assist to compile National Agriculture Bibliography.

Publication and Publicity Service

1.5.1 NARA journal Vol. 41 was 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. 64,165.00/= and distributed 390 items free of charge. Displayed and sold NARA publications at the workshop held at Foundation Institute, organized by ESD Division.

Training Programmes, Workshops & Committee Meetings attended :

Local

- National Institute of Library and Information Sciences (NILIS) Symposium 2014
- Organized by NILIS, University of Colombo.
- 11th National Conference on Library & Information Science - Organized by Sri Lanka Library Association.
- 24th anniversary seminar on activities of special libraries- Organized by National Library

- Seminar on intellectual property by National Library.
- Workshop on information management framework - Organized by Institute of Policy Studies.
- Attended committee meetings- SLISTINET meeting - Organized by National Science Foundation.
- AGRINET advisory meeting - Organized by Council for Agrarians Research Policy.
- Compilation of National Union Catalogue - Organized by National Library.
- National Library Friends \Association committee - Organized by National Library.
- Sri Lanka Library Association Council meeting and Executive committee meeting.
- Assist to compilation of guidelines for the National Union Catalogue- Organized by National Library.
- Participated workshop on SWOT analysis on the Sri Lanka Library Association (SLLA) - Organized by SLLA.
- Workshop on Library standards - Organized by National Library.

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

EXTENSION UNIT

Objectives of the unit

Transfer the useful technology experiences and knowledge obtained by the researchers to fishermen and other stakeholder.To conduct public awareness programme to enhance efficient fishing, suitable fishing method and sustainable management of ocean and aquatic resources.

Project 6.3: Extension services

The unit carried out public awareness programs, providing auditorium facilitates, printing services for printing Posters Leaflet report, forms etc.15 Requests had been received from various institutions to take part their exhibitions. However, only 04 exhibitions could be attended due to financial constraints.15 Educational visits (school navy & government institution) consisting more than 1000 students & officers were noted during the year.

Education Visit

No	Institution	No of participhents	Date
01	Happy Kids Nursery	65	24th March 2014
02	Kosgama Maha vidyalaya - Kosgama	80	25th March 2014
03	Naval & Maritime Academy - Trincomalee	39	29th March 2014
04	Pilimatalawa Mahavidyalaya - Pilimatalawa	60	04th April 2014
05	Educational Officers - matugama	40	05th April 2014
06	Ambewela Sinhala Vidyalaya - Nuwaraeliya	70	26th April 2014
07	Naval & Maritime Academy - Trincomalee	30	05st May 2014
08	Naval & Maritime Academy - Trincomalee	30	16th June 2014
09	Anurathapura Central College-Anuradhapura	54	05th July 2014
10	Wellassa Central Collage - Bibila	70	30TH July 2014
11	Faculty of Agriculture - Jafna	55	13th August 2014
12	Naval & Maritime Academy – Trincomalee, Sub Lieutenant Technical course	45	03rd September2014
13	Naval & Maritime Academy Trincomale Intake Officer Cadets	79	23rd September 2014
14	Naval & Maritime Academy Trincomale-Sallors	22	25th November 2014

Exhibitions

No.	Exhibition / School	Place	Period
1	Deyatakirula	Kuliyapitiya	22th -28th February 2014
2	Aqua life 2014 - Kurunegala	Kurunegala	25th – 28th September 2014
3	Boat show 2014	Dikkovita	10th – 12th October2014
4	Ananda collage	Colombo	23rd October 2014

Media Work

- Media Articles & Advertisements were published in News Papers and Electronics Media.

Other Activities

- Minmuthu surya udanaya was Held on 30th April 2014 at Owel Ground. Supported to Extension work For the Festival.
- Center for Ocean and Fisheries Information (COFI) was opened on 17th July 2014 Supported to Extension work For the Opening Ceremony.
- Financial and Scientist Support to Training programme for Teachers in Kalutara District. Held on 12th September 2014.
- Auditorium Facilities for Annual Scientific Sessions of the Sri Lanka Association for Fisheries and Aquatic Resources (SLAFAR). Held on 16 – 17 May 2014.

6. Ancillary Services

6.1 Purchasing & Supply Unit

Head Of Division:- Mr.N.M.K.S Ranjith / Director Finance

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 2014 & 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 2014, the division has maintained about 135 Tenders following the tender procedures.

A. 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.
B. 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.
C. Arrange for Tender Elevation Committee & Tender Board Meeting
D. 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.
E. 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 (01/10/2014 - 31/12/2014)

Mrs. P M R Chandrasekara (01/01/2014 – 30/09/2014)

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 2014 below mentioned work has been completed and some activities are continuous.

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

1. Renovation of Panapitiya Mud pond and site cleaning
2. Repairing of rain water drains
3. Construction of rain water drainage system
4. Repairing of NARA entrance floor
5. Repairing of IARAD water plant tanks with Quarantine building
6. Repairing of IPHT building
7. Repairing of PCR roof
8. Repairing of PCR outer side.
9. Repairing of Purchasing Officer's room and corridor
10. Construction of new toilet at quarters.
11. Repairing and painting work at NARA main building and Chairman's office building
12. Construction of observation Gallery (Roof work).
13. Repairing of pond area roof and summer hut
14. Construction of diving unit at Kalpitiya Centre.
15. Repairing of Stores.

16. Repair of PCR pavement.
17. Repair of roof of Driver's rest room.
18. Construction of shade net (IARAD).
19. Repair of lab table at Oceanography division.
20. Painting of Wadiya.

2. Installation and maintenance of air conditioners & electric/electronic appliances

1. Supply and installation of an air conditioner at main stores
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.

3. 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.

4. Vehicles Maintenance and repair

Nara Transport unit has operated a fleet of vehicles including 26 four wheel vehicles 14 motorcycles and one three wheeler. NARA vehicle fleet has completed a running distance of 716324 km for research & Development work and managerial works, in the year 2014.

The repair cost and maintenance cost of vehicle was Rs,.5,980,320.00 & Rs.4,980,768.00 respectively in the year 2014.

Major Repairs have been done for vehicles bearing registered numbers 61-4803,WP GY-0027,WP NA 7487, WP PB 8107, 32-2931 and 61-6251. Four vehicles and 9 motorcycles have been identified and made arrangements to dispose due to uneconomical repair and maintenance cost.

23 drivers have deployed for the operations of the NARA vehicle fleet and one mechanic & two service Assistants have deployed for repair and maintenance work.

NATIONAL AQUATIC RESOURCES RESEARCH AND DEVELOPMENT AGENCY		
CONSOLIDATED CASH FLOW STATEMENT FOR THE YEAR ENDED 31 ST DECEMBER 2014		
	31.12.2014	**31.12.2013**
	Rs. cts.	**Rs. cts.**
CASH FLOWS FROM OPERATING ACTIVITIES		
SURPLUS (DEFICIT) FROM ORDINERY ACTIVITIES	(117,261,228.27)	(120,061,820.40)
ADJUSTMENT FOR:		
DEPRECIATION ON PROPERTY, PLANT AND EQUIPMENT	104,179,425.05	104,287,377.42
AMORTIZATION OF DEFERRED EXPENDITURE	(15,758,678.67)	(15,758,677.67)
PROVISION FOR RETIRING GRATUITY	16,445,908.12	12,809,645.26
INVESTMENT INCOME	-	2,155,829.67
PROCEED FROM SALE OF PROPERTY PLANT & EQUIPMENTS	38,500.00	491,893.52
OPERATING PROFIT/ (LOSS) BEFORE WORKING CAPITAL CHANGES	**(12,356,073.77)**	**(16,075,752.20)**
WORKING CAPITAL CHANGES		
(INCREASE)/DECREASE IN INVENTORIES	(970,043.71)	540,371.60
(INCREASE)/DECREASE IN TRADE & OTHER RECEIVABLE	9,290,965.14	9,125,095.31
(INCREASE)/DECREASE IN PREPAYMENTS	(43,595.96)	(2,119,133.22)
INCREASE/(DECREASE) IN ACCOUNTS PAYABLES	(3,336,337.27)	(12,629,673.37)
INCREASE/(DECREASE) IN ACCRUED EXPENSES	13,797,385.41	(17,312,231.14)
CASH GENERATED FROM/(USED IN) OPERATIONS	**6,382,299.84**	**(38,471,323.02)**
RETIRING GRATUITY PAID	**(3,176,493.50)**	(3,077,884.76)
INTEREST PAID		
NET CASH GENERATED FROM / (USED IN) OPERATING ACTIVITIES	**3,205,806.34**	**(41,549,207.78)**
CASH FLOWS FROM INVESTING ACTIVITIES		
PURCHASE OF PROPERTY PLANT AND EQUIPMENT	(36,810,010.21)	(13,522,454.01)
RESEARCH VESSEL	(5,199,182.11)	(12,550,500.00)
CAPITAL WORK IN PROGRESS	38,500.00	972,800.00
PROCEED FROM SALE OF PROPERTY PLANT & EQUIPMENTS	-	(2,155,829.67)
INTEREST ON TREASURY BILLS & FIXED DEPOSITS	-	-
		-
NET CASH GENERATED FROM/ (USED IN) INVESTING ACTIVITIES	**41,932,192.32**	**(27,255,983.68)**
CASH FLOWS FROM FINANCING ACTIVITIES		
CAPITAL GRANTS RECEIVED	29,364,297.71	49,030,350.11
FOREIGN GRANT RECEIVED		3,000,000.00
NET CASH GENERATED FROM/ (USED IN) FINANCING ACTIVITIES	**29,364,297.71**	**52,030,350.11**
NET INCREASE / (DECREASE) IN CASH AND CASH EQUIVALENTS		
DURING THE YEAR	(9,400,588.27)	(16,774,840.39)

CASH AND CASH EQUIVALENTS AT THE BEGINNING OF THE YEAR	15,215,485.01	31,990,325.76
CASH AND CASH EQUIVALENTS AT THE END OF THE YEAR	**5,814,896.74**	**15,215,485.01**
ANALYSIS OF CASH & CASH EQUIVALENTS AT THE END OF THE YEAR		
CASH AT BANK	5,814,896.74	15,215,485.01
SHORT TEARM INVESTMENTS	-	-
	5,814,896.74	**15,215,485.01**
THE SIGNIFICANT ACCOUNTING POLICIES AND NOTES ANNEXED FORM AN INTEGRAL PART OF THESE FINANCIAL STATEMENTS.		

NATIONAL AQUATIC RESOURCES RESEARCH AND DEVELOPMENT AGENCY			
STATEMENT OF FINANCIAL POSITION AS AT 31 ST DECEMBER 2014			
		31.12.2014	31.12.2013
	Notes	Rs. Cts.	Rs. Cts.
ASSETS			
CURRENT ASSETS			
CASH AND CASH EQUIVALENTS	1	5,814,896.74	15,215,485.01
TRADE AND OTHER RECEIVABLES	2	16,841,238.96	26,132,204.10
INVENTORIES	3	2,750,186.10	1,780,142.39
PREPAYMENTS	4	2,455,240.57	2,411,644.61
		27,861,562.37	**45,539,476.11**
NON-CURRENT ASSETS			
INFRUSTRUCTURE, PLANT AND EQUIPMENT	5	369,635,333.14	409,744,153.91
LAND AND BUILDINGS	5	854,115,467.52	878,087,669.62
CAPITAL WORK IN PROGRESS	6	21,508,558.68	16,736,347.08
		1,245,259,359.34	**1,304,568,170.61**
TOTAL ASSETS		**1,273,120,921.71**	**1,350,107,646.72**
LIABILITIES			
CURRENT LIABILITIES			
ACCOUNTS PAYABLES	7	13,516,282.84	16,852,620.11
ACCRUED EXPENSES	8	61,237,045.71	47,439,660.30
		74,753,328.55	64,292,280.41
NON-CURRENT LIABILITIES			
PROVISION FOR GRATUITY	9	90,768,450.00	77,499,035.38
		90,768,450.00	77,499,035.38
TOTAL LIABILITIES		165,521,778.55	141,791,315.79
NET ASSET		**1,107,599,143.16**	**1,208,316,330.93**
ACCUMULATED FUNDS	10	1,124,499,664.28	1,107,955,623.78
RESERVES	11	(16,900,521.12)	100,360,707.15
TOTAL EQUITY AND LIABILITIES		**1,107,599,143.16**	**1,208,316,330.93**
THE SIGNIFICANT ACCOUNTING POLICIES AND NOTES ANNEXED FORM AN INTEGRAL PART OF THESE FINANCIAL STATEMENTS.			
			
N.M.K.S. Ranjith			
DIRECTOR/FINANCE			

APPROVED AND SIGNED ON BEHALF OF THE BOARD.		
		
Prasanna Silva		**Vadivel Sathyanandan**
CHAIRMAN		**DIRECTOR GENERAL**
COLOMBO 15		
8th July, 2015		

NATIONAL AQUATIC RESOURCES RESEARCH AND DEVELOPMENT AGENCY			
PERFORMANCE STATEMENT FOR THE YEAR ENDED 31 ST DECEMBER 2014			
		2014	2013
	NOTE	Rs. Cts.	Rs. Cts.
REVENUE			
GOVERNMENT GRANT	12	266,607,002.29	236,135,855.13
OTHER INCOME	13	16,060,763.36	10,095,388.81
AMORTIZATION OF LOCAL & FOREIGN GRANT	14	15,758,678.67	15,758,677.67
TOTAL REVENUE		**298,426,444.32**	**261,989,921.61**
EXPENSES			
PERSONNEL EMOLUMENTS	15	185,815,229.20	152,108,480.96
TRAVELLING & SUBSISTENCE	16	1,532,513.16	1,602,089.68
SUPPLIES & CONSUMABLES USED	17	2,317,668.42	2,492,276.58
MAINTENANCE EXPENDITURE	18	13,425,106.81	15,783,412.83
CONTRACTUAL SERVICES	19	29,071,219.10	29,158,332.49
RESEARCH & DEVELOPMENT EXPENDITURE	20	70,635,702.29	69,241,855.13
DEPRECIATION & AMORTIZATION EXPENSES	21	104,179,425.05	104,287,377.42
OTHER OPERATING EXPENSES	22	8,710,808.56	7,377,917.02
TOTAL EXPENSES		**415,687,672.59**	**382,051,742.11**
SURPLUS (DEFICIT) FOR THE YEAR		**(117,261,228.27)**	**(120,061,820.50)**
THE SIGNIFICANT ACCOUNTING POLICIES AND NOTES ANNEXED FORM AN INTEGRAL PART OF THESE FINANCIAL STATEMENTS.			

විගණකාධිපති දෙපාර්තමේන්තුව
கணக்காய்வாளர் தலைமை அதிபதி திணைக்களம்
AUDITOR GENERAL'S DEPARTMENT

මගේ අංකය / எனது இல. / My No. LP/B/NARA/1/14/27 මෙහි අංකය / உமது இல. / Your No. දිනය / திகதி / Date 14 December 2015

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 2014 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 2014 comprising the statement of financial position as at 31 December 2013 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 25 (2) of the National Aquatic Research and Development Agency 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, was issued to the Chairman of the Authority on 07 September 2015.

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 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 misstatements 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 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 National Aquatic Resources Research and Development Agency as at 31 December 2014 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 Standards

The following observations are made.

(a.) According to the Sri Lanka Public Sector Accounting Standard 01, assets expected to be recovered before and after 12 months since the reporting date should be disclosed in the financial statements separately in accordance with the liquidity, irrespective of the method of presentation. However, action had not been so done .

(b.) Even though assets had been revalued in accordance with Sri Lanka Public Sector Accounting Standard 07, adjustments required in that connection had not been made even up to the year under review. Hence, the value of non-current assets had been understated by a sum of Rs. 2,820,421,436 in the financial statements than the revalued amount.

2.2.2 Accounting Deficiencies

The following observations are made.

(a.) Assets worth Rs. 80,000 that had been disposed in the year under review, had been added to the retained receipts by deducting from the revaluation reserve.

(b.) Due to computational errors, balance of 4 items of account in the provision for depreciation account had been overstated by a sum of Rs. 6,883,045, whereas the balance of 3 items of account had been understated by a sum of Rs. 1,928,826.

(c.) Cost of buildings amounting to Rs. 152,245,007 that had been made usable after being completed during the year under review, had been still shown as work in progress.

(d.) Although a motor vehicle valued at Rs. 9,390,000 had been granted by the Treasury in the year under review, the entire transaction had been omitted from the accounts.

2.3 Non-compliances with Laws, Rules, Regulations, and Management Decisions

The following Non-compliances with Laws, Rules, Regulations, and etc. were observed.

Reference to Laws, Rules, Regulations and Management Decisions	Non-compliance
(a) National Aquatic Research and Development Agency Act, No. 32 of 1996	A sum of Rs. 152,245,007 had been spent on the construction of a fish market contrary to the objectives of the Act.
(b) Section 9.6 of Chapter XV of the Establishments Code of the Democratic Socialist Republic of Sri Lanka	Bills had not been presented to verify that warm cloths had been bought utilizing the advance of Rs. 49,390 given to 03 officers in the year under review to buy warm clothes
(c) Financial Regulations of the Democratic Socialist Republic of Sri Lanka	
(i) Financial Regulation 110	A register for losses and damages had not been maintained.

(ii)	Financial Regulation 371	The advances obtained should be settled as soon as the intended purpose is completed. However, it had taken more than 2 months to settle advances amounting to Rs. 6,142,200 given to officers in 88 instances.
(iii)	Financial Regulation 757(2)	Board of survey reports relating to the year under review , had not been presented to audit even up to 23 August 2015.
(d)	Treasury Circular No. 842 dated 19 December 1978	Register of fixed assets relating to the fixed assets of the Agency worth Rs. 1,931,330,957, had not been maintained in an updated manner.
(e)	Treasury Circular No. IAI/2002/02 dated 28 November 2002	Although it is necessary to maintain a register of fixed assets relating to computers and software in an updated manner, action had not been so taken with regard to computers valued at Rs. 8,265,784.
(f)	Public Administration Circular No 06/97 of 03 February 1997	Contrary to the provisions of the Circular, the Agency had paid a sum of Rs. 528,326 to 10 officers as acting allowances in the year under review.
(g)	Circular No. 28 dated 10 April 2006 of the Department of the Management Services	Contrary to the provisions of the Circular, and without an agreement, a consultant had been appointed for a monthly allowance of Rs. 50,000 with effect from 01 April 2013, and an allowance totaling Rs. 950,000 had been paid up to October of the year under review. Furthermore, the Agency had not been provided with the reports relating to the consultancy services provided by this consultant.

3. Financial Review

3.1 Financial Results

According to the financial statements presented, the operation of the Agency for the year under review had resulted in a deficit of Rs.117,261,228 as compared with the deficit of Rs.120,061,820 for the preceding year. Accordingly, an increase of Rs.2, 800,592 in the deficit for the year under review was shown. Increase in other income , and decrease in the expenses incurred on maintenance activities had been the main reasons for this increase. Expenses of 08 items of accounts had increased from 12 per cent to 87 per cent in the year under review as compared with the preceding year.

4. Operating Review

4.1 Performance

The following observations are made in connection with the grants received for the research and development expenses of the Agency for the year under review and 4 of the preceding years, and the expenses incurred therefrom.

(a.) The decrease in the total grants received for research and development expenses in the year under review amounted to Rs. 67 million as compared with the preceding year, whereas the growth in the total expense incurred thereon amounted to Rs. 02 million. Furthermore, a sum of Rs. 04 million had been incurred by exceeding the total grants received as research and development expenses in the year under review.

(b.) As the grants received annually had not been utilized for the intended purposes, the utilization was Rs. 277 million despite a sum of Rs. 1,004 million had been allocated to the Agency for research and development expenses for the year under review and 4 preceding years. Accordingly, the utilization of the grants was 28 per cent.

4.2 Management Inefficiencies

Despite being decided that 08 motorcycles valued at Rs. 220,560, two double cabs valued at Rs. 1,990,280, and 02 vans valued at Rs. 1,520,400 that had been withdrawn from use for over a period of 03 years be disposed, the disposal had not been effected even by 20 May 2015.

4.3 Transactions of Contentious Nature

The Agency had been paid a sum of Rs. 2,500,000 by the private sector for the preparation of feasibility reports relating to 06 Government fishery harbours to be improved by the private sector, whereas the Agency had spent a sum of Rs. 4,112,898 in that connection. The feasibility reports had been issued to the private sector without recovering the sum of Rs. 1,612,898 that had been overspent by the Agency.

4.4 Idle and Underutilized Assets

The following observations are made.

(a.) The research vessel built at an expense of Rs. 15,685,682 in the year 2011, had not been used for research activities up to the date of audit as it had not been built with the specific technology.

(b.) The Mobile 3D Scanner purchased in the year 2013 at a cost of Rs. 7,086,700 to be used in the researches of microorganisms , had not been used in research activities up to the date of audit.

(c.) Although a sum of Rs. 272,160 had been incurred for purchasing a computer software in the year 2009, the software had not been made use of even up to 30 August 2015.

(d.) A sum of Rs. 2,626,384 had been spent on the construction of a cafeteria in the year 2011. However, the cafeteria had not been used even up to the end of the year under review.

(e.) Two boat engines (HP 200) worth Rs. 4,493,052 that had been purchased without a proper evaluation, had remained unused for over a period of 3 years.

4.5 Identified Losses

The following observations are made.

(a.) Goods worth Rs. 978,715 that had been purchased by the Agency in the year 2014 for the Deyata Kirula exhibition held in the premises of Wayamba University , had been insecurely dumped without being reused.

(b.) A surcharge of Rs. 31,732 had been paid, as the contributions to the ETF had not been paid on time for the year under review.

4.6 Resources of the Agency Given to Other Public Institutions.

It is not authorized for the resources owned by the institute be used by the relevant Ministry, or any other Public institutions , or to incur expenses in accordance with Section 8.3.9 of the Public Enterprises Circular No. PED/12 of 02 June 2003. However, the human resources of the Agency had been released to the Line Ministry and other Public institutions by paying a sum of Rs. 1,027,742 as salaries and allowances despite 169 vacancies existed as at 31 December 2014. The Agency had issued fuel valued at Rs. 158,998 for the vehicles of the Ministry.

4.7 Personnel Administration

The approved cadre of the Agency as at the last date of the year under review was 499 , whereas the actual cadre was 343, and as such, there were 156 vacancies. The number of casual employees recruited on contract basis was 11.

5. Accountability and Good Governance

5.1 Presentation of Financial Statements

In accordance with Section 6.5.1 of the Public Enterprises Circular, No. PED/12 dated 02 June 2003, financial statements should be presented within 60 days after lapse of the financial year. However, the Agency had presented financial statements for the year under review on 23 July 2015.

5.2 Budgetary Control

As the variance between the budgeted and the actual figures ranged from 10-146 per cent, the budget had not been made use of as an effective instrument of management control.

5.3 Fulfilment of Environmental and Social Responsibilities

Having failed to identify the disposable goods and take actions to promptly dispose them, such goods had been dumped carelessly and haphazardly paving the way for the mosquitos to breed in the rain water accumulated therein. Owing to this, the court had fined the Agency.

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 following areas of control.

(a.) Budgetary Control
(b.) Control of Fixed Assets
(c.) Payment of Advances
(d.) Procurement Process
(e.) Personnel Administration

H.M. Gamini Wijesinghe
Auditor General

16/03/2016

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

ACTIONS TAKEN BY 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 FINANCIAL STATEMENT FOR THE YEAR ENDED 31ST DECEMBER 2014

2.2 Expression of Opinion on Financial Statements

2.2.1 Shortcomings in accounting statements

(A) Receivable would be disclosed separately according to liquidity when preparing financial statements as at 31/12/2015.

(B) Adjustments were not made in the year 2014 due to errors in the Assets Revaluation Report. These adjustments will be made in the Final Accounts for the year 2015.

2.2.2 Deficiencies in Accounting

(a) Agree. Steps have been taken to rectify when preparing accounts for the year 2015

(b) Not agree.

(c) Agree. Steps have been taken to rectify when preparing accounts for the year 2015.

(d) Agree. Steps have been taken to rectify when preparing accounts for the year 2015.

2.3 Non compliance with Laws, Practices, and Management Decisions

(a) It cannot be accepted both statements; The maintenance of a Model Fish Market with the foremost objective of minimizing the high percentage of post harvest losses and retaining quality and it is highest priority of the NARA. At the request of the fishing community, part of the building was used for Ocean Observation Centre. This is also high priority area of the NARA since these data are used for disaster prediction.

(b) Agree with the audit observation. Actions will be taken to correctly implement in the future.

1

(c) (I) Agree with the audit observation. Steps will be taken to implement procedure correctly in the future

(II) Internal Circular (Procedure for payment of special advances) issued on the approval of the Board on 4th January 2012 regarding obtaining and settlement of special cash advances states in No.03 that in the normal circumstances, an advance of Rs 30,000/- with the approval of the Director General and in special circumstances an advance of Rs 100,000/-, with the approval of the Chairman can be obtained . All those advances have been regularized and as per a decision taken at the Audit and Management Committee meetings. Actions have been taken to stop salaries of those who do not settle cash on the due date. As a result regularizing of advances are under control.

(III) The physical verification report for the year 2014 has been prepared and can be submitted for audit observation.

(A) Fixed Assets Register is being updated

(B) Computer Assets Register is being updated

(C) Acting allowance has not been paid to 10 persons and acting allowance has been paid for 9 persons as stated in the Government Administrative Circular No. 06/97 dated 3rd February 1997.

Name	Position	Acting Post	Acting Period
Mrs R A L T Rupasinghe	Asst Director (HR)	Director (Admn & HR)	5/11/2014 to date
Mr B L S Wimalasinghe	Transport Officer	Asst Director(S & O)	10/01/2014 to-date
Mrs Manel Chanrasekera	Asst Director(Admn)	Director (S & O)	From 3/6/2013 to 1/10/2014
Mrs D C Udawatta	Draughtsman	Technical Officer (Civil)	24/2/2014 to-date
Mr K W Indika	Lab Assistant	Research Asst	24/2/2014 to-date
Mr W Antony Fernando	Wood Technician	Wood Technician	1/8/2008 to-date
Mr A M J Costa	Accounts Clerk	Accounts Clerk	From17/3/2014 to 27/8/2014
Mrs G W N Pavithra	Asst Director (Finance)	Director Finance	From 1/11/2013 to 7/7/2014
Mr S Muralidaran	Helper	Care Taker of Bungalow	3/7/2014 to-date

By now, the acting allowance is paid for only 05 positions. A request has been sent to get allocation from the Department of Management Services to fill these vacancies. No sooner the approval is received, recruitments can be made.

(D) Department of Management Services Circular No. 28 dated 10th April 2006.

This Officer should have been recruited at a salary of Rs 75,000/- as per the instructions of the then Minister of Fisheries and Aquatic Resources. However, recruitment has been made at a salary of Rs 50,000/- on approval of the Board and extensions have been granted on the instructions of the then Chairman. However, service has not been obtained after the month of October 2014.

3 Financial Review

3.1 Financial Results

Agree with financial review on financial statements for the year 2014.

4 Review of Operations

4.1 Performance

(a) While we do not agree with the statement that the decline in total grants received for research and development during the year under review, compared to the previous year was Rs 67 million , the growth in expenditure was Rs 1.4 million. Further, the expenditure incurred over the allocations was Rs 3 million.

(b) Do not agree with the statement that the amount allocated during the last 4 years relevant to the year under review was Rs 1004 million. Also, wish to mention that the sum exploited during that period was Rs 238 million.

4.2 Management inefficiencies

Subsequent to calling for competitive Bidders by a News paper advertisement based on the Technical Evaluation Committee report dated 18th December 2014, and the Procurement Committee decision on 28/04/2015, vehicles were sold for cash on the under mentioned dates.

Vehicle No	Assessed Value	Tender Price Offered	Date of Disposal
Motor Cycles			
T F- 2327	14,000/-	45,800/-	22/05/2015
TF- 2329	14,000/-	45,800/-	22/05/2015
TF- 2325	14,000/-	42,800/-	22/05/2015
TF- 2324	14,000/-	42,800/-	22/05/2015
TF- 2334	14,000/-	38,800/-	22/05/2015
135-9738	3,000/-	2,280/-	-
149-1421	3,000/-	2,280/-	-
Double Cabs			
57-4053	700,000/-	980,000/-	22/05/2015
54-2074	650,000/-	1,010,280/-	25/05/2015
Vans			
61-0046	700,000/-	716,850/-	19/05/2015
62-2177	750,000/-	803,550/-	21/05/2015

Accordingly, it is informed that disposals were made on the foregoing dates.

4.3 Contentious Transactions

While the total sum expended on that project up to 31/12/2014 was Rs 4,112,198/- , that exceeded the sum actually received by Rs 1,612,898/-. This sum had to be paid since a feasibility report had to be produced to obtain the balance sum on the recommendation of the Chairman.

4.4 idling and underutilized assets

(A) We accept that the vessel had not been effectively used for research work and during the COPE meeting in November 2015, it was informed to dispose this boat without incurring further expenses. Steps have been taken to carry out future actions accordingly.

(B) Do not agree with the audit observation. According to the Head/Marine Biological Resources Division , 3D scanner had been used for research activities

(C) Steps are being initiated to take legal action to recover the advances paid to the Supplier of computer software and on the recommendation of the committee, steps have been taken to purchase a more suitable software.

(D) Now all constructions of the Dining Hall have been completed and it is used on special occasions of the institute.

(E) An investigation is being carried out by the Commission on Bribery and Corruption in this regard and appropriate action will be taken in the future.

4.5 Identified Losses

(A) The actual expenditure made for purchasing goods was Rs. 239,740/- . Purchasing of these goods had been done due to advice given by the Ministry indicating that a prize would be awarded to the best stall in the exhibition. However, those goods had been used for subsequent exhibitions. According to the observation water seeping has been taken place from the floor above floor It was also noted that Improper laying of floor tiles in the washing room in that floor had caused that . Due to the use of the floor by outside parties, the expediting of repairs had become problematic. Due to these facts , it is expected to take-over that floor from the outside party and water seeping areas need to be repaired speedily. Actions are being taken to keep those goods in a secure place pending restoration and returning to normal.

(B) Although cheques had been sent to Employees Trust Fund before the due dates, this surcharge had to be paid due to invalidation of the cheque.

4.6 Resources of the Agency assigned to other Government Institutions

Based on audit observations made even earlier in this regard, institutions to which staff have been released were informed as per the decision of the 355th Board, to permanently absorb them into those institutions. However, arrangements had been made to pay only their salaries. Releases had been made on requests made by the relevant Deputy Minister from time to time.

4.7 Staff Administration

Data on the number of staff members as at 31/12/2014 referred, had been amended from 19/12/2014. Department of Management Services by 19/11/2014 had suppressed 06 positions and had approved an increased number of 47 positions including 8 new

positions. Accordingly, the total number of increased positions is 55. On the approved cadre becoming 499 as at 31/12/2014 positions, number of staff members, vacant positions, excess number of staff members are amended as follows:

Type of Employee	Approved Cadre	Actual Cadre	Staff shortage	Excess Staff
Higher Management	15	20	02	05
Middle Management	128	77	53	02
Junior Management	24	21	06	-
Management Assistant	177	123	63	04
Primary	155	113	45	02
	499	354	169	13

In order to fill the 102 vacancies out of 169, in the approved Cadre of NARA as at 31/12/2014, applications had been called on 12/05/2015 and 15/05/2015 through newspaper advertisements. Out of that, on 02/07/2015, appointment letters were issued for 13 positions to fill 65 vacancies . Out of that, 56 persons had reported for work. Since the National Budget Department had not made allocations to fill vacancies in recruited positions, no recruitments had been made. Therefore, this had not been included in 2016 budget estimates. Recruitment would be made no sooner allocations are received from National Budget Department.

5. Accountability and Good Governance

5.1 Presenting financial statements

Although financial statements could have been presented before the due date, the Board of the Institute was not appointed, as per Department of Public Enterprise Circular No: PED/12. As a result, Financial Statement was unable to the Auditor General in time and the Auditor General was informed regarding this. No sooner the Governing Board is appointed, the financial report will be drafted and submitted to the Auditor General.

5.2 It was noted that the payments for electricity expenses, telephone expenses, vehicle maintenance, water bills, security bills etc. without sufficient allocations for recurrent expenditure has been gone up . This is the main reason for this

5.3 Performance of environmental and social responsibilities

Agree regarding the payment of fine. Action has been taken to take all necessary steps to avoid a similar situation after that by making the relevant officers aware.

Dr Anil Premaratne
Chairman/NARA