



ANNUAL REPORT & ACCOUNTS 2013



National Aquatic Resources Research and Development Agency

Crow Island, Colombo 15

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TABLE OF CONTENTS

1. Corporate Information.....	1
2. Research Highlights.....	7
3. Financial Highlights.....	11
4. Human Resources Information.....	14
5. Research Divisions	29
5.1 Environmental Studies Division.....	29
5.2 Fishing Technology Division	44
5.3 National Hydrographic Office.....	46
5.4 Inland Aquatic Resources And Aquaculture.....	53
5.5 Marine Biological Resources Division	78
5.6 National Institute Of Oceanography And Marine Science	96
5.7 Institute Of Post Harvest Technology.....	106
5.8 Socio-Economic And Marketing Research Division.....	114
5.9 Information Technology Division	120
5.10 Library And Information Division.....	127
5.11 Extension Division.....	132
6. Ancillary Services.....	134
6.1 Purchasing & Supply Division	134
6.2 Service And Operation Division.....	136

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-ordinating 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 2013 and Nine Board Meetings were held during the year.

Appointed Members

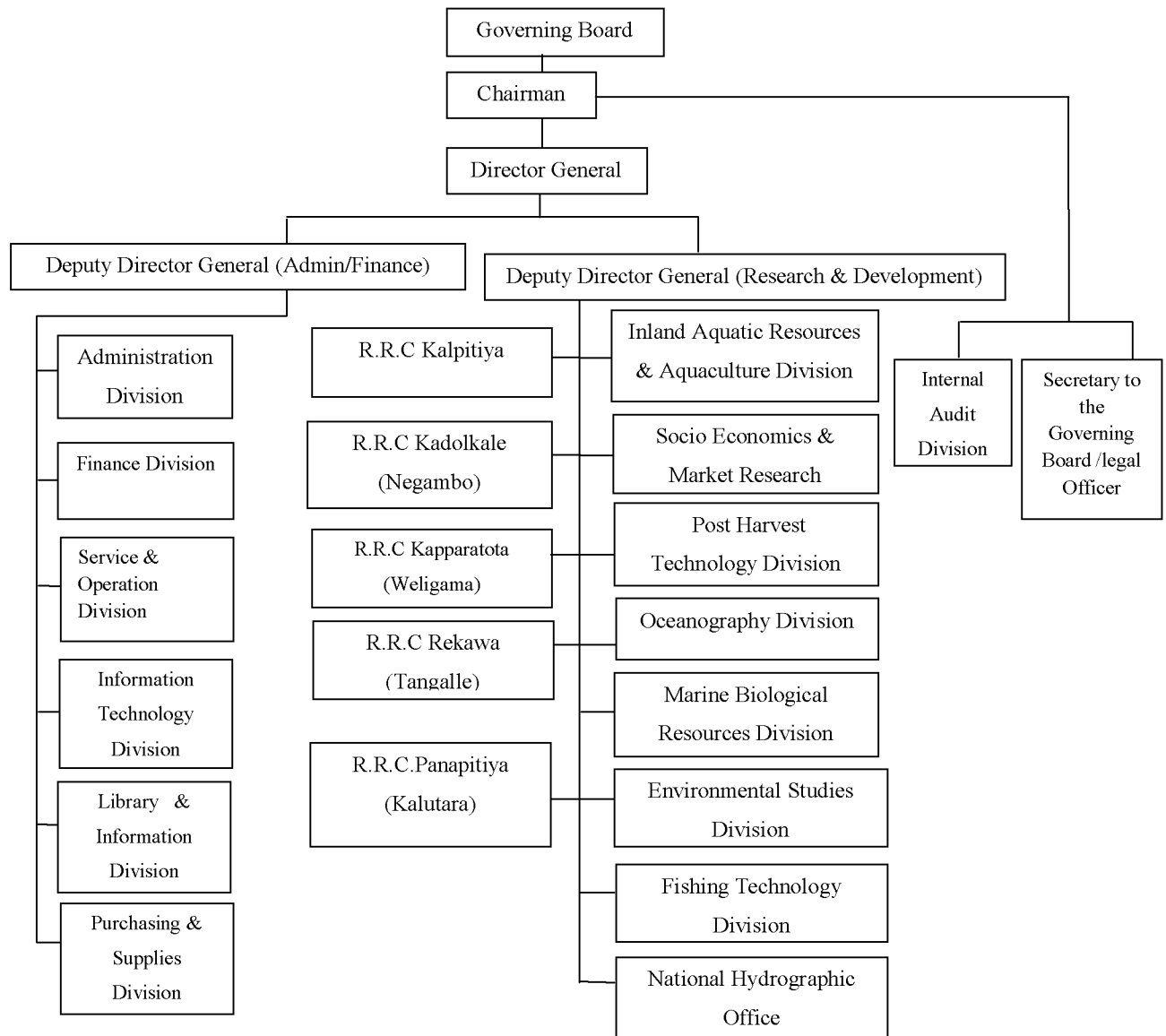
Dr S G Samarasundera	Chairman
Professor W M T B Wanninayake	Member
Professor T S G Fonseka	Member
Mr. Dunstan Fernando	Member
Mr. K. N. Rienzie Perera	Member
Mr. M. J. Irshad Rummy Jauffer	Member
Mr P N N Fernando	Member
Mr.Roshan Fernando	Member

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 S.A.M.J. Perera (up to May 2013)	Director General /Operations, Sri Lanka Navy
Mr. A.R.Wickramarathne (Up to January 2013)	Deputy Director, Department of National Budget
Mr. S.M.W.Fernando (Up to March 2013)	Surveyor General, Department of Survey
Ms.Anusha Amarasinghe	Director, Ministry of Science & Technology
Rear Admiral N.J.B Rosayro (Since July 2013)	Director General /Operations, Sri Lanka Navy
Ms.M.A.G.Thushari (Since July 2013)	Asst. Director, Department of National Planning
Dr.K Thavalingam (Since October 2013)	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 ten Research and Technical/Services Divisions, Environmental Studies, Fishing Technology, Hydrographic Office, Information and Technology, Inland Aquatic Resources & Aquaculture, Library & Information, 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 Finance Division and Purchasing Divisions.

Following officials officiated as Heads of Divisions during the year 2012.

Research Divisions

Mr. S. A. M. Azmy	Environmental Studies Division
Mr. N. B. P. Punyadeva	Fishing Technology Division
Mr. M. A. Ariyawansa	Hydrographic Office Division
Mr. A. B. A. K. Gunaratne	Information Technology Division
Dr. V. Pahalawattaarachchi	Inland Aquatic Resources & Aquaculture Division
Mrs. K. G. B. S. Kariyawasam	Library & Information Division
Dr S S K Haputhantri (01.01.2013 – 09.12.2013) Dr. R. R. P. Maldeniya (10.12.2013 - 31.12.2013)	Marine Biological Resources Division
Dr. K. Arulanathan0 (1.01.2013 – 08.05.2013) Mr.J.K.Rajapakshe (13.05.2013 – 04.06.2013) Dr H B Jayasiri (05.06.2013 - 08.12.2013) Dr T K D Tennakoon (09.12.2013 – 31.12.2013)	National Institute of Oceanography & Marine Sciences
Dr.(Mrs.) K. W. S. Ariyawansa 01.01.2013 – 08.12.2013) Dr.G.J.Ganegamaarachchi (09.12.2013 – 31.12.2013)	Institute of Post Harvest Technology
Mr. K. H. M. L. Amaralal	Socio Economics & Mark Research Division

Support Services Divisions

Mrs. P A M R Chandrasekara	Administration Division
Mrs. R. H. P. Ranasinghe (01.01.2013 – Ms..A.M.D.Gunawardena (21.01.2013 – 31.10.2013) Ms.G.W.N.Pavithra (01.11.2013 – 31.12.2013)	Finance Division
Mr C H T Gamage (01.01.2013-28.02.2013) Miss A.K.M.P.Silva (01.03.2013- 30.05.2013) Mrs. P A M R Chandrasekara (03.06.2013-31.03.2013)	Services & Operation Division
Mr. M. D. Senarathne	Internal Audit Division
Ms. A.T.P.K.De Silva	Purchasing Division
Mr.L.K.G.T.Buddhika	Extension Division

2. RESEARCH HIGHLIGHTS

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

Marine Fish Resource: The research staff 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, with special reference to further development of the Large pelagic fisheries. Apart from the treasury funded projects, MBRD carried out external funded research projects through the financial support of the Bay of Bengal Large Marine Ecosystem (BOBLME). Two projects on sharks and Indian mackerel were carried out under BOBLME funding. Small pelagic fish landings including the IM were monitored at major fish landing sites in the west, southern and the east coasts of Sri Lanka during January- December, 2013. Data on Indian mackerel were entered to the Small Pelagic Database of NARA and fisheries data analysis is now in progress. Indian mackerel samples for genetic analysis were collected from 10 different locations and DNA was extracted from the samples for further analysis. A total of 262 individuals of *Rastrelliger kanagurta* were obtained from Sri Lankan waters and samples were analyzed for the reproductive biology. Fecundity was estimated and the frequency of occurrence of food items was calculated. Under the BOBLME shark project, the NARA PELAGOS database was upgraded enabling to enter shark species wise data.

Environmental research: Three fish kill incidents in Kiribathgoda Canal, Aththidiya Canal, Wattawan Lagoon – Wakarei 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. Plankton identification produced interesting results. Cyanophyceae was the most abundant class of the six main phytoplankton pollutant tolerance zooplanktons such as *Brachinonus sp.* and *Keratella sp.* were recorded in Parakrama Samudraya in the reservoir. Sites for grouper fish culture in Negombo Lagoon were identified and conditions studied.

Aquaculture and inland Fisheries: Division contributes to the fisheries sector development mainly focusing on research and development related to inland and

brackish water aquaculture through sustainable utilization of the natural resources. Sea cucumber breeding technology has been transferred to the community and research on larval rearing technology development is in progress. Oyster culture and research and development programme was carried out with community participation at Gangewadiya and Kandakuliya in Puttalam district. Low cost high quality fish feeds were prepared and tested for fresh water fish, ornamental fish and sea bass. Economically important Cottoni seaweed seed stock is maintained for development of nursery techniques and caters to the commercial level farming. Brown seaweed experimental *Sargassum* culture was successfully done in the Southern coast. Induced breeding and proper larval rearing techniques for *Garra ceylonensis* and *Pangasius suchie* were conducted. Study is being carrying out to determine the distribution of mycobacteriosis in ornamental fish culture system in Sri Lanka, to identify the causes and minimizes the *Post-shipment mortality* (dead on arrival) of ornamental fish exported from Sri Lanka in order to increase the survival of healthy fish stocks on the destination in the export market.

Oceanography: NIOMS carried out six research projects during year 2014 related to different oceanographic disciplines. Under the Improvement of existing tuna forecasting system, fishermen were disseminated weekly fish forecast through fishery harbors and 500 log books distributed among fishermen. Hooking depth prediction method for tuna long liner was developed and could implemented in 2014 targeting the fishery efficiency. Ocean Observation center activities were operated during the year as usual while disseminating data and technical reports to stakeholders for necessary warnings and education purposes. Bio-geochemical properties of Periya kalapuwa was documented so as to use by government authorities for future development purposes. Environmental impacts on Harmful Algal Blooms and Coral community were observed focusing climatic changes on coral communities at Bar Reef. Sea Level changes monitoring were conducted and stations maintained to obtain real time data for research development programs on navigational safety and coastal development planning. Under the geophysical and geological mapping of marine protected areas, feasibility study was carried out at Kapparatota to boat anchorage. Seasonal variability of coastal and ocean processes around Sri Lanka subjected to deploy two drifters and four ARGO floats for collecting data which could use in climatic change studies and fishery.

In Addition, Two research cruises, R/S/V Dr. Fridtjof Nansen and R/V Roger Revelle were carried out eastern part of the country away from EEZ. During year 2013, three undergraduates were trained for the field of Oceanography.

Minimize post harvest loses value addition: The Institute of Post Harvest Technology (IPHT) has conducted researches mainly on quality of fish products and development of value added products from underutilized aquatic resources. Fish samples were collected from retail stalls of CFC and Central Fish Market in Peliyagoda. Fish samples obtained from 38 stalls of Western province (out of 39 stalls). Status reports of stalls were handed over to the Ceylon Fisheries Corporation. About 70% of the samples had *E. coli* content <11 MPN/g and 2% of the samples contained >10³MPN/g. *Salmonella* spp. was present in 16% of the samples and all the samples were negative for *Staphylococcus aureus*. Several laboratory trials were conducted for extraction of fish oil according to Bligh & Dyer. The quality control laboratory of IPHT has provided Test Services (ISO/IEC 17025) by analyzing 704 samples to provide total of 398 test reports to export fishery industry and were issued.

Fishing gear Technology: Study was carried out from January 2013 to December 2013 in Southern Sri Lanka to compare catch composition of a offshore ring net fishery (Kandan course) associated with floating objects with that of drift gillnet/longline catches. Forty eight boats sampled, were categorized into three groups; (i) boats with catches only from ring nets (R) (ii) those from ring nets plus drift Gillnetting/Longline (RGL), and (iii) those only from drift Gillnetting/Longlining (GL). Catch per boat per trip was estimated for each species from the above three categories.

Decapterus russelli (Rüppell), *Elagatis bipinnulata* (Quoy & Gaimard), *Coryphaena hippurus* L. and *Abalistes stellatus* contributed significantly to catches in R and RGL boats, which in contrast were insignificant in the catches of GL boats. In ring nets, juvenile *Katsuwonus pelamis* (L.) and *Thunnus albacares* (Bonnaterre) 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 encountered during the sampling

period. There is a clear-cut difference in the catchabilities of different species in the three categories of boats. The small sized tunas (*K. pelamis* and *T. albacores*), which were present in ring net catches were fetched at lower prices than large-sized ones.

Hydrography and navigational charts: The prime objective of National Hydrographic Office is to provide services to safe and efficient navigation in Sri Lankan water. For the year 2013 the division Upgraded 1:10000 Nautical chart of Trincomalee, Harbour, 1:50,000 nautical chart of Trincomalee Approaches, Bathymetric data acquisition for fill the gap between Colombo and Negombo Nautical charts using Tharani Boat, Calibration & Testing of ADCP and on board training on ADCP with RV Sammudirka. ARGOs Deployment and ADCP data collection with RV Sammudrika. Fish Aggregation Devices (FAD) was deployed at Batticaloa and Pottuwil with RV Sammudrika.

Socio-economic and marketing research: One study was carried out to identify current issues and problems of ornamental fish industry with special reference to Kalutara district. Among the main findings the high variable cost is the prime factor affects the long term sustainability of the industry. Therefore, innovations in local feed alternatives should be promoted by providing research grants to post graduate studies. The price stability and increased demand for ornamental fish is essential to safe guard new entrants to the industry. The popularization of aquarium hobby among Sri Lankans can create extra demand for ornamental fish other than export demand. The other study was carried out to explore the seaweed industry of Sri Lanka mainly based on the wild collection. Because of that the production cannot be met the foreign demand and to maintain of continues supply. The inherent features of the industry were poor processing and storage system, low quality of processed seaweed. Therefore, it is essential to introduce product development and improved quality along the supply chain of seaweed for the betterment of the industry.

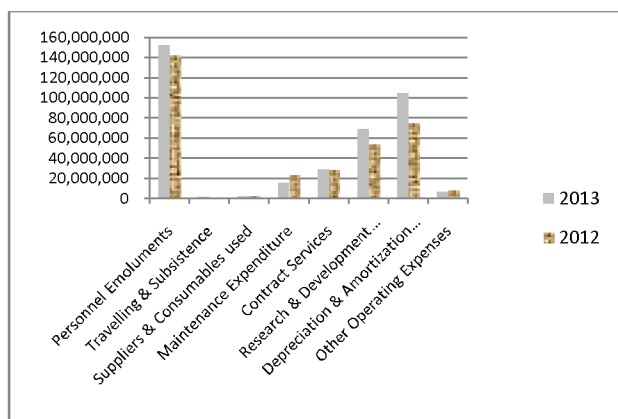
3. FINANCIAL HIGHLIGHTS

Following highlights are reported for the information of the Board.

Operating Expenses

GOSL Grants

Description	2013	2012	%
Personnel Emoluments	152,112,823	142,392,013	6.8
Travelling & Subsistence	1,602,090	1,364,526	17.4
Suppliers & Consumables used	2,492,277	2,629,602	-5.2
Maintenance Expenditure	15,783,413	23,380,740	32.5
Contract Services	29,158,332	28,464,677	2.4
Research & Development Expenditure	69,241,856	54,053,593	28.1
Depreciation & Amortization Expenses	104,287,377	75,011,504	39.0
Other Operating Expenses	7,377,917	8,017,030	-8.0
Total	382,056,085	335,313,685	13.9



Depreciation & Amortization expenses were increased by 40% due to purchase the new vessel to NHO in the year 2012.

Self Generated Income

Year	Amount Rs.cts.
2011	16,946,910.75
2012	5,637,562.46
2013	10,177,551.16

Considerable increase in self generated income was observed due to starting of major projects & consultancy in the year 2013.

Operating Expenses

Vehicle Pool at a Glance

Vehicle - In Running Condition

Type	Nos. of Vehicle	Age
Cars	1	14,19,17,17,16,16,14
Double Cab	8	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	

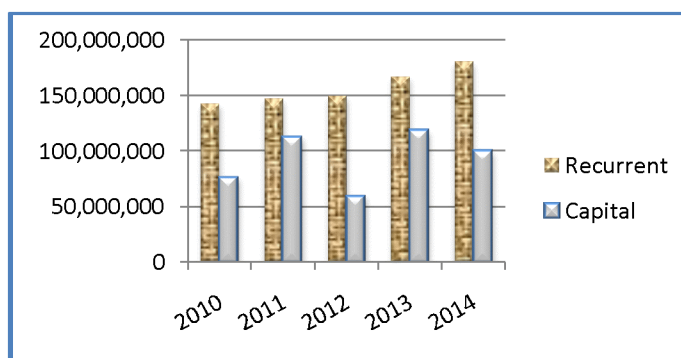
70% of vehicles from the fleet are, more than 10 years old.

Age Analysis – All Vehicles

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

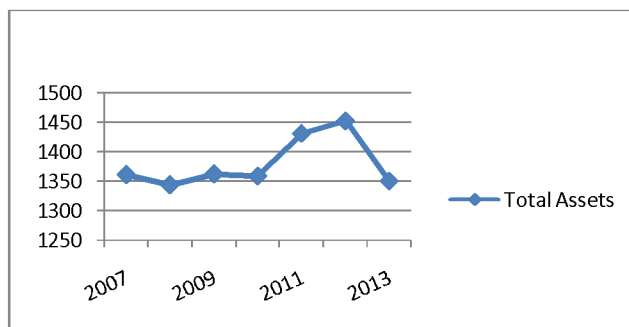
Allocations at a Glance – GOSL

	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
Total Assets	1361.09	1343.698	1362.354	1358.65	1431.65	1452.6	1350.1



Considerable reduction in total assets for 2013 due to withdrawal of investment.

4. HUMAN RESOURCES INFORMATION

New System of Recruitments/Promotions

Obtaining the approval for new SOR as per the Management Service Department Circular No:30, for the new procedure of the Recruitment and Promotion was a major success of HR Division, during the year under review. According to the new procedure, the absorption of cadre with effect from 01.07.2008 has been completed by the end of the year 2013 and few vacancies have been filled according to the Scheme of recruitment. Further, a committee has been appointed including a representative of the Ministry of Fisheries & Aquatic Resources Development to observe and make a reasonable solutions for the issues raised on the said absorption.

Recruitments

Name	Designation	Date of Appointment
Mr.J.L.T.M.Silva	Research Assistant	01/01/2013
Mr.W.D.J.Prasanna	Research Assistant	01/02/2013
Ms.E.A.R.De.Zoysa	Dash Board	15/01/2013
Ms.Anoma Mihiri Dias	Director/Finance	21/01/2013
MS.W.Thilini Nuwanthika	Clerk	13/02/2013
Ms.S.S.P.Samaranayake	Clerk	20/02/2013
Ms.V.Kaumadhi Ranasinghe	Research Assistant	01/03/2013
Ms.A.K.M.P.Silva	Assistant Director/S&O	01/03/2013
Mr.H.D.L.Madusanka	Helper	03/04/2013
Ms.Y.K.Pavithra Surakshi	Helper	03/04/2013
Ms.M.B.Fathima Suhada	Helper	03/04/2013
Ms.H.S.I.P.Fernando	Helper	03/04/2013
Mr.T.Jayawardane	Skipper	17/04/2013
Ms.A.H.Mangalika	Research Assistant	02/05/2013
Mr.M.I.G.Rathnasuriya	Scientist	17/06/2013
Mr.Dr.K.R.S.Karawita	Scientist	13/06/2013
Mr.Y.M.Abeygunawardane	Consultant	01/03/2013
Mr.P.Suntharalingam	Consultant	01/04/2013
Mr.A.I.M.Rifky	Scientist	11/06/2013

Mr.H.M.Herath	Shroff	10/06/2013
Mr.P.A.D.Wijerathne	Consultant	10/06/2013
Ms.I.Hasanthi Rajapakse	Assistant Director(Admin)	15/07/2013
Ms.Nisahmani Darmarathne	Personal Assistant to Director General	15/07/2013
Ms.G.W.N.Pavithra	Assistant Director(Finance)	15/07/2013
Mr.G.G.Nishantha	Helper	01/06/2013
Mr.S.D.G.Neranja	Technical Assistant(Mechanical)	05/08/2013
Mr.K.S.Croos	Sampler	02/05/2013
Mr.Navjeevan Sugatha	Sampler	02/05/2013
Mr.T.Sutharsan	Sampler	02/05/2013
Mr.M.A.Ariyawansa	Consulter	20/09/2013
Ms.W.K.M.Chamari	Management Assistant	03/10/2013
Ms.H.D.C.Prasanna	TraineeResearch Assistant	01/10/2013
Mr.Sajith Priyankara	Helper	01/11/2013
Mr.R.D.S.C.Jayasena	Helper	01/11/2013

Departures of the Service

Name	Designation	Departure Date	Reason
Mr.W.G.Ferando	Skipper	9/2/2013	Complete Contract Period
Mr.C.H.T.Gamage	Director Service & Operation	1/3/2013	Complete Contract Period
Ms.A.K.M.P.Silva	Assistant Director/S&O	30/05/2013	Complete Contract Period
Mr.R.K.A.Gamini	Unskilled Labourer	4/4/2013	Dead
Mr.Sanath Kuruppu	Welder	26/05/2013	Resigned
Mr.Sunethsiri De Silva	Research Assistant	17/06/2013	Vacation of Post
Ms.D.A.Wijayadewa	RO	8/7/2013	Resigned
Mr.D.T.Mendis	Research Assistant	20/08/2013	Pension
Mr.P.Jayasooriya	Hydrographic Surveyor	30/10/2013	Resigned
Ms.Anoma Mihiri Dias	Director/Finance	31/10/2013	Complete Contract Period
Mr.W.D.J.Prasanna	Research Assistant	1/11/2013	Resigned

Unfilled Vacancies

Designation	Salary Code	Vacant
Dy. Director General (Admin & Finance/HR)	HM 2-1	1
Dy. Director General (R&D)	HM 2-1	1
Director (Finance)	HM1-3	1
Director (Monitoring & Evaluation)	HM1-3	1
Director (Services & Operation)	HM1-3	1
Senior Scientist	AR-2	13
Scientist	AR-1	51
Hydrographic Surveyor	AR-1	1
Senior Land Surveyor	MM 1-2	1
Senior Cartographer	MM 1-2	1
Senior System Analyst/Programmer	MM 1-2	1
Data Analyst	MM 1-2	1
Asst. Director (Service & Operation)	MM 1-2	1
Asst. Director (HR)	MM 1-2	1
Asst. Director (Information Technology)	MM 1-2	1
Senior Librarian	MM 1-2	1
Senior Extension Officer	MM 1-2	1
Asst. Information Technology Officer	JM1-2	1
Technical Officer-(Electronic)	JM1-2	1
Internal Audit Officer	JM1-2	1
Asst. Project Monitoring Officer	JM1-2	1
Librarian	JM1-2	1
Stores Officer	JM1-2	1
Administration Officer (HR)	JM1-2	1

Technical Officer (Mechanical)	JM1-2	1
Cartographer Data Analyst (Nautical)	JM1-2	1
Cartographer Data Analyst (ENC)	JM1-2	1
Cartographer Data Analyst (GIS)	JM1-2	1
System Analyst /Programmer	JM1-2	1
Technical Officer (Civil)	JM1-2	1
Land Surveyor	JM1-2	1
Translator	MA 4	3
Development Officer(Project)	MA 3	20
Assistant Network Administrator	MA 2-2	1
Sampler	MA 2-2	4
Research Assistant	MA 2-2	3
Head Driver/Marine	MA 2-2	1
Malti Media Designer	MA 2-2	1
Management Assistant (Transport)	MA 2-2	1
Diver	MA 2-2	1
Technical Assistant (Electrical)	MA 2-2	1
Mgt.Asst. (Library)	MA 2-2	1
Hydrographic Assistant	MA1-2	1
Boatswain	MA1-2	1
Book-Binder	PL-3	1
Plumber	PL-3	2
Carpenter	PL-3	2
Mason	PL-3	3
Boat Operator	PL-3	0
Assistant Bungalow Keeper	PL-2	1
Lab Attendant	PL-2	4

Caretaker/Cook	PL-2	2
Helper	PL-1	6
Total Vacancies		153

Promotions

Name	Designation	Effective date	Promote	
			From	To
Ms. P.P.M.Heenatigala	Research Officer/ Scientist	25.01.2010	Research Officer/ Scientist	Research Officer/ Scientist
Ms. K. A. W. S. Weerasekara	Research Officer/ Scientist	05.07.2012	III(AR -1)	II(AR-2)
Mr. R. P. P. K. Jayasinghe	Research Officer/ Scientist	23.07.2012	III(AR -1)	II(AR-2)
Dr. V. Pahalawattaarachchi	Research Officer	24.10.2012	Grade I (HM1-2)	Special Grade (HM 102)
Mr H D Wimalasena	Research Officer (Sociologist)/Scientist	18.01.2013	III(AR -1)	II(AR-2)
Ms. V. K. G. Jayasena	Administrative Asst.	08.07.2013	MA 1-2	JM 1-2
Mr. R. Madawala	Accounts Clerk	12.07.2013	MA 2-2	JM 1-1
Dr. H. M. P. Kithsiri	Research Officer	01.07.2008	HM 1-2	HM 1-3
Dr. R. R. P. Maldeniya	Research Officer	01.07.2008	HM 1-2	HM 1-3
Dr. T. K. D. Tennakoon	Research Officer	01.07.2008	HM 1-2	HM 1-3
Dr G.J. Ganegamaarachchi	Research Officer	01.07.2008	HM 1-2	HM 1-3

Local Training

No.	Name	Name of the course	Institute	Duration	Ammount (rs)
1	I.J.J Fernando Management Asst.	Personal Files Maintain	Prag Institute	22- 23/01/2013	9,500.00
2	P.A.M.R Chandrasekara Head/Admin	Personal Files Maintain	Prag Institute	22- 23/01/2014	9,500.00
3	Nuwandani Udawattha Management Asst.	Human Resource Management	Lalith Atulathmudali Vocational Training Center	12/1/2013	21,000.00

4	M.D. Manjula Asanka Hydrographic Asst	Ship's Engine Room Raiting	Srilanka Post Authority	20/02/2013	16,100.00
5	M.H.S Ariyaratna Principal Scientist	Workshop on Patent Drafting	National Science Foundation	1/2/2013	12,000.00
6	M. A. N Nadeeshan Management Asst.	Insitute of supply & Materials Management	Insitute of supply & Materials Management	17/02/ 2013	16,500.00
7	M.W Gayani Chathurika Management Asst.	Human Resource Managment	Construction Equipment Training Center	03 months	15,000.00
8	A. Nisansala Perera	Human Resource Managment	Construction Equipment Training Center	03 months	15,000.00
9	S.A.R Rasanga Management Asst.	Human Resource Managment	Construction Equipment Training Center	03 months	15,000.00
10	M.D Manjula Asanka Hydrographic Asst	Ship's Engine Room Raiting	Srilanka Ports Authority	16/02/2013	24,900.00
11	N.D Hettige Scientist	Short course on GIS and Application's	University of Peradeniya	04- 09/03/2013	30,000.00
12	M.D.C Jayanthi Management Asst.	Certificate in SLIDA Computer Driving Licenes Course	Sri lanka Institute of Development Administration	04- 16/03/2013	20,000.00
13	K.C. De silva Management Asst.	Certificate in SLIDA Computer Driving Licenes Course	Sri lanka Institute of Development Administration	04- 16/03/2014	20,000.00
14	M.D Senarathna Internal Auditor	Oneday Workshop on Effective Internal Auditing	Skills Development Fund Limited	7/3/2013	4,500.00
15	M.B.N Lakshan Helper	Haibrath Vehicle Technical	Construction Equipment Training Center	8/3/2013	3,000.00
16	D.M.N Disanayaka Skilled Labourer	Haibrath Vehical Technical	Construction Equipment Training Center	8/432013	3,000.00
17	Muditha Alawatugoda Management Asst.	Higher Certificate Course on Computing	NIFNE	30/03/ 2013	10,000.00
18	N.D Hettige Scientist	SLAAS Membership	SLAAS	3/4/2013	5,500.00
19	B.R Chandani Mendis Scientist	SLAAS Membership	SLAAS	3/4/2013	5,500.00
20	S.S.G Nelumdeniya Management Asst.	One day workshop on Effective Internal Auditing	Prag Institute	2/4/2013	8,500.00
21	K.K.T.E Kahatapitiya Management Asst.	One day workshop on Effective Internal Auditing	Prag Institute	2/4/2013	8,500.00

22	G.P Roshan Research Asst.	Training on ISO/IEC 17025:2005 Internal Auditing of Laboratory Management System	Sri Lanka Accreditation Board	10/4/2013	7,000.00
23	G.P Roshan Research Asst.	Training programme on Food Hygiene & GMP	Sri Lanka Standards Institution	13-14/05/2013	6,720.00
24	K.S Hettiarachchi Research Asst.	Training programme on Food Hygiene & GMP	Sri Lanka Standards Institution	13-14/05/2014	6,720.00
25	W.A Lalith Wickramasingha Research Asst.	Msc in Fisheries and Aquatic Resource Management	University of Jayawardena	2013-2015	155,000.00
26	S.H.U Chaturani Research Asst.	Msc in Fisheries and Aquatic Resource Management	University of Jayawardena	2013-2015	165,500.00
27	M.M.C Karunarathna Diver Asst.	Msc in Environment Science	University of Peradeniya	2013-2015	120,150.00
28	M.D Senarathna internal auditor	SLFRS and LKAS	Prag Institute	8/5/2013	8,000.00
31	All Executive Staff members	Building positive mind set	NARA	7/6/2013	60,000.00
32	M.B.F Suhadha	Official Letter writing and Filing procedure	Prag Institute	5/6/2013	7,500.00
33	M.W Gayani Chaturika			5/6/2013	7,500.00
34	I.J.J Fernando			5/6/2013	7,500.00
35	A.Nisansala Perera			5/6/2013	7,500.00
36	M.A.B.H Kumarasiri	Short course for Renewal of CDC	Lanka Academy of technological (pvt) ltd.	10.550.00	
37	Sunethra Liyanaarachchi	Workshop for Information Professional	National Institute of Library and Information Science	27/06/2013	4,000.00
38	All non-executive Staff members	Productivity and Quality for supporting staff	NARA	26/06/2013	60,000.00
39	Gayathri Amarakoon Research Asst.	Workshop on Molecular Biology	Industrial Technology Institute	10/7/2013	28,000.00
40	M.M.A.S Maheepala Senior Scientist	Membership of the Sri Lanka Association for the Advancement of Science	SLAAS	11/7/2013	5,700.00

41	N.B.P Punyadewa Senior Scientist	M phill/phd	University of Kelaniya	2013-2015	31,000.00
42	SA.R Rasanga Management Asst.	Diploma course of Web Development	Lalith Atulathmudali Vocational Training Center	28/07/2013	17,700.00
43	P.A.D. Ajith Kumara Senior Scientist	53 rd short course on GIS and Applications	University of Pearadeniya	5- 10/08/2013	30.000.00
44	K.H.M.L Amaralal Research Officer(Market Research)			5- 10/08/2013	30.000.00
45	Sunethra Liyanaarachchi - Librarian	Diploma in Information Management	National Institute of Library and Information Science	100 contract hours	25.000.00
46	M.D Senarathna Internal Auditor	Awareness Programme on Sri Lanka public Sector Accounting standards (SLPSAS)	Accociation of Public finance	27/08/2013	1,000.00
47	A.M.D Gunawardena Director /Finance			27/08/2014	1,000.00
48	Pavithra Ginigaddarage Scientist	Short course on sampling Techniques Survey Design and Analysis	University of Peradeniya	4-6/09/2013	7,500.00
49	Sunethra Kariyawasam Chief Librarian	Training Programme on Total Quality Management	Sri Lanka Standards Institution	9- 10/09/2013	8,960.00
50	K.H.M.L Amaralal Research Officer (Market Research)	Appoint Technical Team to Recommend the Survey Methodology	Ministry of Fisheries	23/09/2013	Free of charge
51	H.D Wimalasena	Appoint Technical Team to Recommend the Survey Methodology	Ministry of Fisheries	23/09/2014	Free of charge
52	H.M.S. Herath Shroff	Cash Protection & Safe Transportation	Prag Institute	17/09/2013	8,000.00
53	N.D Hettige Scientist	National Conference on Livelihoods	Ministry of Environment and Renewable Energy	26- 27/09/2013	Free of charge
54	P.A.M.R Chandrasekara Head/Admin	Total Quality Management	National Productivity Secretariat	10/10/2013	3,000.00
55	A.M.D Gunawardena Director /Finance	SLFRS and LKAS	Prag Institute	2/10/2013	8,000.00
56	M.d Senarathna Internal Auditor	SLFRS and LKAS	Prag Institute	2/10/2013	8,000.00

57	G.W.N. Pavithra Asst.Director/Finance	SLFRS and LKAS	Prag Institute	2/10/2013	8,000.00
58	K.G.Irangani Book Keeper	SLFRS and LKAS	Prag Institute	2/10/2013	8,000.00
59	W.A.K.R Mallika Management Asst.	Salary Management	Prag Institute	10/10/2013	8,000.00
60	A.M Gunathilaka Accounts Clerk	Salary Management	Prag Institute	10/11/2013	8,000.00
61	K.K.T.E Kahatapitiya Management Asst.	Salary Management	Prag Institute	10/12/2013	8,000.00
62	P.A.M.R Chandrasekara	Master of public Management	SLIDA	2yrs.	225,000.00
63	M.M. Alawatugoda Management Asst.	Diploma in Disaster Management	University of Kelaniya	2013/2014	46,750.00
64	P.A.M.R Chandrasekara Head/Admin	Workshop on Green Productivity	National Productivity Secretariat	21, 22 /11/2013	4,000.00
65	I.H Rajapaksha Asst.Director (Admin)	Workshop on Green Productivity	National Productivity Secretariat	21, 22/11/2013	4,000.00
66	P.A.M.R Chandrasekara Head/Admin	Knowledge Management	National Productivity Secretariat	1/11/2013	3,000.00
67	V.K.G. Jayasena Admin Officer (Admin)	Knowledge Management	National Productivity Secretariat	1/11/2013	3,000.00
68	W.A.A.P Wijesundara Hydrographic Surveyor	International Conference on Business and Information	University of Kelaniya	2/12/2013	7,000.00
69	P.S Ranaweera Management Asst.	Maintenance Performance	Institute for Construction Training and Development	4/12/2013	Free of charge
70	P.A.A Pathmasiri Welder	Maintenance of Water Pump & Compressor	Institute for construction Training and Development	17/12/2013	10,000.00
71	H.D Sunil Shantha Electrician	Maintenance of Water Pump & Compressor	Institute for Construction Training and Development	18/12/2013	10,000.00
72	W.A.A.P Wijesundara Hydrographic Surveyor	International Conference on Social Science	Colombo	31/12/ 2013	18,000.00

Foreign travels

No	Name & Designation	Country	Purpose of the Travel	Period
1	Ms.P.H.Ginigaddarage Scientist	India	Training Programme on sea food quality assurance	13.01.2013 - 26.01.2013
2	SRC Ranaweera Senior Hydrographic Surveyor	Bangladesh	Indian Ocean Bathymetric Compilation Meeting	18.01.2013 - 24.01.2013
3	Mr.M.M.A.S.Maheepala Senior Scientist	India	5th Regional Training Course on Code of Conduct for Resaponsible Fisheries	19.01.2013 - 01.02.2013
4	Mr.D.S. Ariyaratne Scientist	Spain	Programme on Seafood prosseing: Modern Technologies & New product development	03.02.2013 - 09.02.2013
5	Dr. S.S.K. Haputhantri Principal Scientist	Oman	2 nd IOTC Technical committee on allocation criteria & management option workshop	15.02.2013 - 21.02.2013
6	Dr. S G.Samarasundara Chairman	Myanmar	To attend 13 th North Indian Ocean Hydrographic Commission Meeting	18.02.2013 - 23.02.2013
7	Mr. M.A.Ariyawansha Consulter - Hydrographer	Myanmar	To attend 13 th North Indian Ocean Hydrographic Commission Meeting	18.02.2013 - 23.02.2013
8	Dr. S.S.K. Haputhantri Principal Scientist	Thailand	BOBLME project work plan development meeting	26.02.2013 - 01.03.2013
9	Dr R R P Maldeniya Principal Scientist (Marine Biology)	India	Regional Workshop on Fisheries in Areas Beyond National Jurisdiction (ABNJ)	03.03.2013 - 06.03.2013
10	Mr.S.U.P.Jinadasa Principal Scientist	USA	To continue for PhD Studies	13.03.2013 - 20.07.2013
11	Dr. H.M.P.Kithsiri Principal Scientist (Aquatic Resources)	China	Seminar on Aquaculture Promotion	24.04.2013 - 16.05.2013
12	Dr R R P Maldeniya Principal Scientist (Marine Biology)	Mauritius	IOTC Meeting	01.05.2013 - 12.05.2013

13	Dr. S G.Samarasundera Chairman	Thailand	To attend official visit with Hon. Minister	12.05.2013 - 15.05.2013
14	Dr. S.S.K. Haputhantri Principal Scientist	Thailand	BOBLME IOTC Fisheries Stock Assessment Training workshop	19.05.2013 - 25.05.2013
15	Mr. U.S.P.K.Liyanage Scientist	Thailand	BOBLME IOTC Fisheries Stock Assessment Training workshop	19.05.2013 - 25.05.2013
16	Mr R M R M Jayathilaka Scientist	Belgium	Ocean Teacher Academy Training Course Fundamentals of Ocean Data Management	25.05.2013 - 02.06.2013
17	Ms.K A W S Weerasekara Senior Scientist	Malaysia	IAEA/RCA Regional Training Course in Basic Ocean sampling practices in member status	25.05.2013 - 31.05.2013
18	Dr.K.Arulananthan Principal Scientist	Australia	Meeting of IOR - ARC Ocean Forecasting Officials	27.05.2013 - 31.05.2013
19	Dr. S.S.K. Haputhantri Principal Scientist	India	Inspection Workshop on Living Resources in Gulf of Mannar	29.05.2013 - 31.05.2013
20	Dr. V.Pahalawattarachchi Principal Scientist	India	Inspection Workshop on Living Resources in Gulf of Mannar	29.05.2013 - 31.05.2013
21	Mr. J.K.Rajapaksha Principal Scientist	Japan	Attend the Space Applications for Environment joint Workshop	01.06.2013 - 09.06.2013
22	Dr. S G.Samarasundera Chairman	Seychelles	To attend to the Meeting on Aquaculture and Mariculture	06.06.2013 - 13.06.2013
23	Mr.S.A.M.Azmy Scientist	Indonesia	Indian Ocean & Pacific Conference(IO PAC) - 2013	17.06.2013 - 22.06.2013
24	Ms.K.A.A.N.Jayarathna Secretary to the Governing Board & Legal Officer	Australia	Attend the PSLP Training at Wollongong - 2013. (Law of the Sea)	22.06.2013 - 29.06.2013
25	Mr J S Jayanatha Scientist	Korea	For MSc Studies	26.06.2013 - 29.08.2014
26	Dr. S.S.K. Haputhantri Principal Scientist	Indonesia	To attend the 3rd IOTC working party on Neritic Tunas	01.07.2013 - 06.07.2013
27	Ms D D D Weragodatenna Scientist	Thailand	Workshop on Survey Data Processing & DEM Generation	22.07.2013 - 22.08.2013
28	Mr R M R M Jayathilaka Scientist	Thailand	Workshop on Survey Data Processing & DEM Generation	22.07.2013 - 22.08.2013

29	Mr D D G L Dahanayake Scientist	Japan	Continuation for Ph.D studies	09.08.2013 - 30.06.2015
30	Mr. H K A D A Tharindaka Scientist	China	WESTPAC Training course on Air-Sea Interaction & Modelling	11.08.2013 - 25.08.2013
31	Ms.M.H.S.Ariyaratne Principal Scientist	Pakistan	To attend Pakistan Aquaculture and Fisheries Society Annual Conference.	15.08.2013 - 18.08.2013
32	Mr N B P Punyadewa Senior Scientist	Malaysia	Fourth WESTPA Summer School on the SEAGOOS Monsoon Onset Monitoring and its Social & Ecosystem Impacts. (MOMSEI)	18.08.2013 - 24.08.2013
33	Ms W N C Priyadarshanie Scientist	Malaysia	Fourth WESTPA Summer School on the SEAGOOS Monsoon Onset Monitoring and its Social & Ecosystem Impacts. (MOMSEI)	18.08.2013 - 24.08.2013
34	Ms D N A Ranmadugala Senior Scientist	India	BOBLME Indian Mackerel Genetics Harmonisation Training Workshop	19.08.2013 - 28.08.2013
35	Ms.D.R.Herath Senior Scientist	India	BOBLME Indian Mackerel Genetics Harmonisation Training Workshop	19.08.2013 - 28.08.2013
36	Mr.M.Gammanpila Senior Scientist	Indonesia	Training Course on Marine Aquaculture	24.08.2013 - 09.09.2013
37	Dr. S G.Samarasundara Chairman	China	Implementation of the MOU between Ministry of Defence and Urban Development & the State Oceanic Administration	25.08.2013 - 31.08.2013
38	Mr R K A Ariyaratne Hydrographic Surveyor	UK	5th Course in Hydrographic Data Processing and Marine Cartography , including special ism in Electronic Navigational Chart.	31.08.2013 - 15.12.2013
39	Mr.U.W.S.Adikari Research Assistant	USA	Training for Oceanographic Instruments University of Notre Dame	01.09.2013 - 03.10.2013

40	Mrs.P.P.M.Heenatigala Senior Scientist	Singapore	Technical Assistance programme and SCP for Ornamental Fish Industry in Sri Lanka	01.09.2013 - 07.09.2013
41	Ms J A C Mallawaarachchi Scientist	Singapore	Technical Assistance programme and SCP for Ornamental Fish Industry in Sri Lanka	01.09.2013 - 07.09.2013
42	Mr.M.Gammanpila Senior Scientist	India	Tranining Course on Mangrove Biodiversity and Ecosystems	22.09.2013 - 08.10.2013
43	Dr R R P Maldeniya Principal Scientist (Marine Biology)	Bangladesh	8th Meeting of the TAC of the Bay of Bangal Programme	24.09.2013 - 27.09.2013
44	Dr. S G.Samarasundara Chairman	Rusia	The Seventh Session of the Sub – Committee on Aquaculture of the Committee on Fisheries,to be held in St. Petersburg	09.10.2013 - 17.10.2013
45	Mr R M R M Jayathilaka Scientist	Netherlands	For MSc Studies	13.10.2013 - 30.04.2015
46	Dr.T.K.D.Tennakoon Principal Scientist (Oceanography)	Mauritius	To attend IOGOOS Workshop and 10th Annual Meeting	19.10.2013 - 26.10.2013
47	Dr. H.M.P.Kithsiri Principal Scientist (Aquatic Resources)	Korea	KMI - NARA Experts Workshop in Seoul	21.10.2013 - 27.10.2013
48	Ms.R.R.A.R.Shirantha Scientist	Oman	Workshop on Fishes Otolith-based Ageing and Stock Assessment 2013	23.10.2013 - 31.10.2013
49	Ms B H B Jayamalee Silva Cartographic Draughman	UK	Category "B" Course in Marine Cartography & Data Assessment	08.11.2013 - 14.12.2013
50	Dr.K.W.S.Ariyawansa Principal Scientist	Norway	Workshop within Seafood Quality and Sefety	10.11.2013 - 17.11.2013
51	Mr.D.S. Ariyarathe Scientist	Norway	Workshop within Seafood Quality and Sefety	10.11.2013 - 17.11.2013
52	Ms.P.H.Ginigaddarage Scientist	Norway	Workshop within Seafood Quality and Sefety	10.11.2013 - 17.11.2013
53	Mr.M.Ruchitha Perera Research Assistant	Norway	Workshop within Seafood Quality and Sefety	10.11.2013 - 17.11.2013

54	Mr. G.P.Roshan Research Assistant	Norway	Workshop within Seafood Quality and Sefety	10.11.2013 - 17.11.2013
55	Mrs.E.M.M.Seneviratna Pro.Asst.(Mangement)	Norway	Workshop within Seafood Quality and Sefety	10.11.2013 - 17.11.2013
56	Mrs.K.S.Hettiarachchi Research Assistant	Norway	Workshop within Seafood Quality and Sefety	10.11.2013 - 17.11.2013
57	Dr.T.K.D.Tennakoon Principal Scientist (Oceanography)	Thailand	To attend the Indo Pacific Ocean Forum on Charting the Future of Sustained Ocean Observations & Services	25.11.2013 - 30.11.2013
58	Dr R R P Maldeniya Principal Scientist (Marine Biology)	South Korea	9th Working Party on data Collection and Statistics and 16th Scientific Committee	28.11.2013 - 08.12.2013
59	Ms A.A.S.H.Athukorala Scientist	India	Training Programme on Fisheries Management	08.12.2013 - 22.12.2013
60	Dr.K.W.S.Ariyawansa Principal Scientist	Vietnam	Utilization of waste/rest raw materials and by – products in the fish processing industry Opportunities and Challenges	08.12.2013 - 12.12.2013

Court Cases and Disciplinary Inquiries Labour Tribunal

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

With regard to the application made by Mr. J .B. A. Magammana at the Additional Labour Tribunal, the Application is now at the inquiry stage.

District Courts

- a) Case No : 3894/10/DMR – District Courts, Colombo

The case 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 at the moment.

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

The case 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 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 is reside 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, one Senior Scientist, four Scientists, one Research Assistant, a Word Processing Operator and two Laboratory helpers contributed to implement the work program 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.

Programs		Project		Allocation (Rs.)	Officer Responsible	Period	
						From	To
1	Environment	2.1	Emergency Studies (Assessment of Causes for Water pollution and Fish kill incidents) [Continuous Project]	350,000.00	N.D.Hettige S.A.M. Azmy K.A.W. S. Weerasekara	Jan 2013	Dec 2013
2	Environment	2.2	Assessment of health of the ocean – Coastal Water quality monitoring program - All Island	1,000,000.00	S.A.M. Azmy K.A.W. S. Weerasekara N.D.Hettige	Jan 2013	Dec 2013

3	Environment	2.3	Assessment of Current Status of Water Quality & Plankton Diversity in selected reservoirs in Polonnaruwa District	650,000.00	K.A.W. S. Weerasekara N.D.Hettige S.A.M. Azmy	Jan 2013	Dec 2013
4	Environment	4.9	Study of current status of water pollution levels and, recruitment pattern and culture of grouper (Epinephelus sp.) in the Negombo estuary	500,000.00	M.Gammanpila S.A.M. Azmy B.R.C. Mendis	Jan 2013	Dec 2013

Progress

Project 1

A high number of aquatic pollution incidents in recent years due to fish kill incidents were recorded specially in the reservoirs and lagoons of Sri Lanka. The objective of the study was to assess and investigate the causes for emergency situations in terms of water pollution, oil spills, fish kill incidents, and algal blooms etc. and finally give recommendations to overcome the situation.

Three fish kill incidents in Kiribathgoda Canal, Aththidiya Canal, Wattawan Lagoon – Wakarei were inspected by the division in coordination with the Inland Aquatic Resources and Aquaculture division. It was determined that majority of the fish kills occurred due to poor aquatic health conditions owing to water pollution.

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 kill incidents was also given through media.



Some photographs from recorded kill fish incidents

Water Body	Causes	Remedies
Kiribathgoda Canal	Discharge of factory effluent load. High nutrient levels including ammonia and phosphate, BOD and COD which exceed the standard limits for the survival of fish and aquatic life.	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.
Aththidiya Canal	BOD and COD indicated higher values which were not within the Proposed Ambient Water Quality Standards for fish and aquatic life as proposed by CEA, 2001.	Avoid discharging of untreated water or prevent discharging effluents into water bodies which do not follow the guidelines and general standards limits for discharge of effluents into inland surface waters using recommended dilution factors.
Wattawan Lagoon –	BOD, Nitrite - N, Nitrate - N and Ammoniacal - N concentrations	Proper management should be taken to water pollutant sources,

Wakarei	indicated higher values which were not within the Proposed Ambient Water Quality Standards for fish and aquatic life as proposed by CEA, 2001.	which increase the depth of the water level by reducing the sedimentation with sand and silt accumulated organic matter from the lagoon. Actions should be taken to facilitate better water circulation.
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Progress (%):-

Financial: 48%

Physical: 100%

Project 2

Most reservoirs in Sri Lanka are getting polluted due to human activities. Chemical and physical changes of lakes and reservoirs lead to changes in the biological composition and may ultimately affect the ecological balance of these systems. Certain phytoplankton and zooplankton organisms are sensitive to such changes and could be used as indicator organisms.

Therefore main objective of the project is to determine the current status of water quality (including physical, Chemical and biological) and plankton diversity of the selected reservoirs located in Polonnaruwa District.

Parakrama Samudraya was selected as the study site. Current status of water quality and abundance of plankton was assessed by selecting total of 20 sampling locations including the main water channel from the Amban Ganga, where the inflow is regulated at the anicut at Angammedilla, the outlets and reservoir sites.

Field visits, sample collection and sample analysis were carried out. Output of this research is a list of plankton species, and water quality data from collected water samples, publications including research papers, reports, posters and dissertations and research and industrial oriented training for university students. Mainly two undergraduate students from Sabaragamuwa University of Sri Lanka were supervised for their final year project using this project.



Project Highlights

Cyanophyceae was the most abundant class of the six main phytoplankton encountered in Parakrama Samudraya during the study period. Also pollutant tolerance zooplanktons such as *Brachinonus sp.* and *Keratella sp.* were recorded in the reservoir.

Progress (%):- Financial: 88% Physical: 100%

Project 3

This project included ocean health monitoring and coastal water quality monitoring programs to assess the health of the coastal and marine waters. The ultimate objective was to take necessary actions to utilize the ocean resources to its maximum use, enhancing the employment opportunities and contribute to increase the fish production.

Sampling was carried out in the coastal waters of Kalpitiya, Puttalam Lagoon, Hambanthota, Jaffna, Batticola and Mannar region. Sample collection and sample analysis were carried out. Output of this research is industrial oriented training for university students.

An average value determined for BOD (12.08 ± 4.47) mg/l was much higher than the permissible threshold limit (>5 mg/l) which indicates the gross organic and inorganic pollution in all selected sampling locations in western coast.

Marine Litter was found in several locations floating in the coastal waters and along the beaches. This project has served to establish baseline values which will be useful

in future assessments in considering the health of the ocean in relation to biota and general condition of the waters.



Project Highlights

Progress (%):- Financial: 102.21 % Physical: 100 %

Project 4

Project was initiated with the objectives of monitoring the surface water quality, assessment of pollution levels in surface waters, and identification of possible pollutants and sources. The other specific objective is to assess of aquatic pollution levels in selected point sources of municipal, Industrial and tourism areas. This is a one year project and sixteen sampling locations were selected for the study, which included points in the estuary, effluent from most of the industries Ja-ela and Katunayeke free trade zones, the large number of boats using the area for anchoring and waste water from houses are discharged into lagoon without any treatment selected, water quality parameters were studied. During field sampling, it was observed that heavy sedimentation due to deposit within the northern part of the lagoon.

The study was mainly focused on physico-chemical parameters of water including pH, TSS, Turbidity, COD,BOD, Salinity, DO, Ammonia, Nitrate, Nitrite, Phosphate, Oil and Grease and Chlorophyll-a and heavy metals. Zooplankton samples were collected using plankton net with a mesh size of 100µm and analyzed by using a binocular microscope with a sedgewick rafter counting chamber.

The survey was determined the seasonal occurrence and relative abundance of groupers (*Epinephelus* sp) in the estuary. The specimens came from two sources: 1) Trammel net 2) brush-pile fishery. For each specimen, the total length and total weight were measured.



Project Highlights

The results for the most parameters indicate that, the BOD, COD and TSS levels are highest in northern part of the lagoon area. Hence, the main reason for the above results was highest values indicated the discharge of sewage and dumping of solid waste from homes and other anthropogenic activities and accelerating sedimentation. It drains water carrying nutrients and organic matter from the heavily populated catchment area and has faced the threat of the degradation of water quality.

Progress (%):- Financial: 100.12 % Physical: 100 %

Consultancies and Test services done by the Division

Consultancies

1. Environmental monitoring around the drilling locations in SL-2007-01-001 block, Gulf of Mannar (Second Stage) - 2013

The Environmental Studies Division has conducted environmental impact monitoring during the proposed offshore drilling in SL-2007-01-001 block in coordination with some other divisions of NARA (MBRD and FTD).

The physic-chemical parameters of waters were analyzed to determine the quality of water in the selected study sites of the Gulf of Mannar region. Sea water sampling was carried out by selecting of four locations neighboring the Wallago well at 50 m, 250 m, 500 m and 1000 m in the direction of the prevailing current at the time of monitoring and a control point. A control point was selected approx. 1000 m in the direction opposite to the prevailing current was used as control point to allow comparison of environmental conditions between potentially affected and unaffected sites and to discern between project-related impacts and natural variations.

Additionally, one sampling location was selected at Talawila Reef and four at Bar Reef Marine Sanctuary for reef water quality monitoring. A total of 25 samples were collected and analyzed during pre and post drilling operations.

Final report was submitted and accepted. The total earning of the project was Rs.3, 245,000.00(Us \$ 24,770.99).

Test Services

During the period, 18 clients have been provided with test reports by Environmental studies division and the total earnings is **Rs.160, 870.00.**

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

1. Mangroves for the Future, 7th meeting of working group on Atlas of coastal Ecosystems –IUCN.
2. Technical committee meeting on proposed of 35 Roomed Tourist resort with 23 water bungalows.
3. Meeting on proposed project to set up an industrial park for Leather tanning and leather goods manufacturing complex at Marichchikatti (G/N) Musal (D/S) in Mannar District.

4. Meeting on proposed project on reclamation of Sea Adjacent to the South Break water & construction of a Naval Berth Adjacent of the East Break water at Hambantota Port Development project.
5. Meeting on “Status of water quality and suitability for Aquaculture on Silliya Ela, Beruwala”.
6. Advisory council meeting on Coast Conservation & Coastal Resource Management (02 meetings).
7. Technical evaluation committee meeting proposed of 60 Roomed Vandaloo Bay Resort & SPA – Kayenkerni, Vakarai.
8. Initial Environmental Examination (IEE) meeting on proposed 66 Roomed Jetwing Reef Hotel Project.
9. Preliminary meeting proposed 20 roomed boutique hotel projects at Balapitiya.
10. Scoping committee meeting on development of Hamilton Canal Development Project (03 Meetings).
11. Meeting on offshore sand mining and pumping to replenish the stock pile at Kerawalapitiya, Muthurajawela.
12. Special meeting on the disposal of treated wastewater at the sea outfall at Lunawa and use of the sea in the area.
13. Meeting on Implementation of National Oil Spill Contingence plan (AOSCOP).
14. Meeting on Greater Colombo Wastewater Management Project Rehabilitation of Sea Outfalls of the Colombo System.
15. Technical evaluation committee meeting for basic environmental examination of the proposed construction of bridge cum causeway across Kokillai Lagoon.
16. Meeting on Minamata convention of Mercury.
17. Meeting on adaptation of interim water quality criteria for Sea bathing sites.
18. Meeting Convene for Expertise Advice on Scope of Work and TOR for Marine Environmental Baseline Study within Mannar and Cauvery Basin.
19. Meeting on proposed offshore sand mining project for camp at Maha Oya Lansigama.
20. Ministerial Committee on Wrecks and Underwater Cultural Heritage of Sri Lanka.
21. Meeting on of Risk Assessment on MOUSTI side.

22. Meeting at Mount Lavinia Divisional secretariat on establishment of “Mount Lavinia” Coastal zone Management Plan”.

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
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

Lectures

1. Lecture on “Detail Description of coastal eco system of Galle District and its present status” conducted by Marine Environmental Protection Authority (MEPA) on 28 February 2013.K.A.W.S. Weerasekara
2. Lecture on “Environmental Importance of Madu Ganga Estuary” conducted by Marine Environmental Protection Authority (MEPA) on 28 February 2013.
N.D.Hettige

Presentations

1. Presentation on “Basic Ocean Sampling Practices” at Atomic Energy Authority (07th October 2013).
K.A.W.S. Weerasekara
2. Presentation on “Marine pollution” conducted by NARA to Sailors of Naval and Maritime Academy on 25 November 2013.
B.R.C.Mendis
3. Presentation on “Marine pollution” conducted by IOMAC at the Marine Conservation Conference on 14th December 2013.
S.A.M. Azmy

TV Programs – Voice Cuts

Voice cut given for “Reasons for fish kill incident occurred at Aththidiya canal on “Sirasa TV” and “Rupavahini” on 11th May, 2013. S.A.M. Azmy and B.R.C.Mendis

Radio Program

“Vidu Lowa” Radio Programme conducted by Sri Lanka Broadcasting Cooperation (SLBC) - K.A.W. S. Weerasekara (December 2013)

Posters

1. A Preliminary Survey of Phytoplankton Diversity in Hambanthota International Harbour, Sri Lanka. K.A.W.S. Weerasekara, N.D.Hettige and S.A.M.Azmy.
2. The impact of suspended sediment variation on aquatic invertebrates in Gin Ganga Basin. A.A.D. Amarathunga, K.A.W.S. Weerasekara, S.A.M. Azmy and W.D.N. Wickramarachchi

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

1. Water Quality Analysis and Identification of Zooplankton Abundance in the Parakrama Samudraya - Final year student B.Sc. (Special) in Environmental Sciences and Natural Resource Management.
Supervised by K.A.W.S. Weerasekara and S.A.M.Azmy
2. Determination of phytoplankton abundance and diversity in Parakrama Samudraya with reference to the existing water quality - Final year student B.Sc. (Special) in Environmental Sciences and Natural Resource Management.
Supervised by K.A.W. S. Weerasekara and S.A.M.Azmy

Training of Research Students as an External Supervisor – Industrial Training

1. Post graduate student from University of Sri Jayewardenepura from Aquatic Resource Management Field.
2. Two third year students from University of Sri Jayewardenepura following Aquatic Resource Management special degree.
3. Two third year students from Ocean University following Fisheries and Marine Science degree.

Internal Reports

1. Report on Basic Short Course about GIS and Application (April 2013) N.D.Hettige.
2. Internal report on fish kill incident at Aththidiya Canal (May 2013) B.R.C.Mendis.
3. Report on Work shop on Incident Command System (May 2013) N.D.Hettige.
4. Internal report on “Addressing Climate Change Impacts on Marginalized Agricultural Committees Living in the Mahaweli River Basin of Sri Lanka” (June 2013). B.R.C.Mendis
5. Internal report on fish kill incident at Wattawan Lagoon - Wakarei (July 2012) S.A.M.Azmy, K.A.W.S. Weerasekara, N.D.Hettige and B.R.C.Mendis.
6. Report on National Conference on Livelihoods, Biodiversity and Ecosystem Services (October 2013). N.D.Hettige

EXTERNAL REPORTS

1. Travel report on Training Course on Basic Ocean Sampling Practices in Kuala Terengganu Malaysia. K.A.W. S. Weerasekara
2. Environmental Monitoring of the oil exploration activities in the Mannar Basin, Sri Lanka (Second Stage) before and after drilling – 2013. S.A.M.Azmy, K.A.W. S Weerasekara, N.D.Hettige and B.R.C.Mendis (As contributors)
3. Dissertation submitted as a partial fulfillment of Master of Science in Environmental Science.

Title: Deterioration of Coastal Water Quality from Land Based activities: Western Province, Sri Lanka by N.D.Hettige - (April 2013)

Supervised by Dr. K.B.S.N. Jinadasa, K.A.W.S. Weerasekara and S.A.M.Azmy

Training Obtained

Local

1. Residential short course on “GIS and applications” conducted by postgraduate of science (PGIS), university of Peradeniya, Sri Lanka (4th – 9th march 2013).
N.D. Hettige
2. Training on Port Biological baseline survey conducted by Marine Environmental Protection Authority (27th April 2013). K.A.W. S. Weerasekara, N.D. Hettige and B.R.C.Mendis
3. Training on the use of Incident Command System for Oil Spill Contingency Management jointly organized by Disaster Management Center and Marine Environment Protection Authority, Sri Lanka (13th – 16th May 2013).
N.D.Hettige
4. Training on scientific writing conducted by Sri Lanka Association for Fisheries and Aquatic Resources (SLAFAR) and Bay of Bengal Large Marine Ecosystem Project (BOBLME) (11th - 1th September 2013).
K.A.W. S. Weerasekara and N.D. Hettige
5. Training on quality management systems for those with limited experience at Colombo, Sri Lanka (09 -13th December 2013). K.A.W. S. Weerasekara

Foreign

1. Regional Training Course on Basic Ocean Sampling Practices in Kuala Terengganu
Malaysia (26 – 30th May 2013). K.A.W. S. Weerasekara
2. Indian Ocean and Pacific Conference (IOPAC) in Nusa Dua Bali (18th – 20th June 2013). S.A.M. Azmy

Workshops

1. Workshop on oil spill emergency response (27th February 2013). S.A.M. Azmy, K.A.W. S. Weerasekara and N.D.Hettige
2. Stakeholder workshop to prepare the Technology Action Plan for Adaptation of Technology Needs Assessment Project on Climate Change (10th August 2013). K.A.W. S. Weerasekara

3. Workshop on finalization of proposed Alien Invasive Species Pre – Entry Risk Assessment Protocol (24th August 2013). K.A.W.S. Weerasekara
4. Workshop on stakeholder consultation on best practice demonstration of IAS control GEF project on strengthening capacity to control the introduction and spread of invasive alliance species in Sri Lanka. B.R.C.Mendis
5. Inception Workshop of the Project on “Addressing Climate Change Impacts on Marginalized Agricultural Committees Living in the Mahaweli River Basin of Sri Lanka” (June 2013). B.R.C.Mendis
6. Awareness workshop on National Red List 2012 and EIA Progress of Sri Lanka organized by organized by Ministry of Environmental and Renewable Energy (August 2013). N.D.Hettige and B.R.C.Mendis
7. First National Conference on Livelihood, Biodiversity and Ecosystem Services (26-27th September 2013). N.D.Hettige
8. National workshop for finalize National Ballast Water Management Strategy (NBWMS) (29th October 2013). K.A.W. S. Weerasekara

Research Publications

Local – 02 Abstracts

- Weerasekara, K.A.W.S., Hettige, N.D., Azmy, S.A.M., 2013. A Preliminary Survey of Phytoplankton Diversity in Hambanthota International Harbour, Sri Lanka, NARA Scientific Sessions, pp.44
- Amarathunga, A.A.D, Weerasekara, K.A.W.S, Azmy, S.A.M. and Wickramarachchi, W.D.N. 2013. The impact of suspended sediment variation on aquatic invertebrates in Gin Ganga Basin, NARA Scientific Sessions, pp.39

International – 02 Abstracts

- Madurangi, T.K.D., Jayawardana, J.M.C.K., Azmy, S.A.M. and Weerasekara, K.A.W.S. 2013, Investigation of Alien Marine Phytoplankton in Ballast Water of Ships visiting Colombo Harbour, Proceedings of the 4th International Symposium, Sabaragamuwa University of Sri Lanka, pp70
- Wickramasinghe, Y.H.S.D., Jayawardana, J.M.C.K., Azmy, S.A.M. and Weerasekara, K.A.W.S. 2013, A Survey of Zooplankton in Ballast Water of Ships visiting Colombo Harbour and the Surrounding area, Proceedings of the 4th International Symposium, Sabaragamuwa University of Sri Lanka, pp76

Journal Papers – 02

- Amarathunga, A. A. D., Jinadasa, S. U. P. and Azmy, S. A. M., 2013. Sedimentary characteristics and status of water quality in Polwatta river and Weligama bay in Sri Lanka, *Journal of Environmental Professionals Sri Lanka*, Vol.2(1),pp. 38-51
- Amarathunga, A. A. D., Weerasekara, K. A. W. S., Azmy, S. A. M., Sureshkumar, N., Wickramaarchchi, W. D. N. Kazama, F. Behavior and Loading of Suspended Sediment and Nutrients from River Basins in the Hilly Catena under Intensive Agriculture Cropping: A Case Study in Upper Kotmale Basin in Sri Lanka. *Journal of Environmental Professionals Sri Lanka*, Vol. 2 – No. 2 – 2013, pp. 13-31

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* (Submitted).
- 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* (Submitted).

5.2 FISHING TECHNOLOGY DIVISION

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

Progress

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

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.

Performance

The project activities, data collection from the main fishery harbor 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.

Program	Project	Allocation (Rs.)	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	1 Million	NBP Punyadewa	2013 January to December	T-100% P- 95%	T- 100 % P- 123 %

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.

Abstract will be published on findings from the research and it will be presented at NARA sessions in 2014.

Training / Awareness programs 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.

5.3 NATIONAL HYDROGRAPHIC OFFICE

Head of the Division M.A. Ariyawansa

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 2013 the following surveys and activities were conducted.

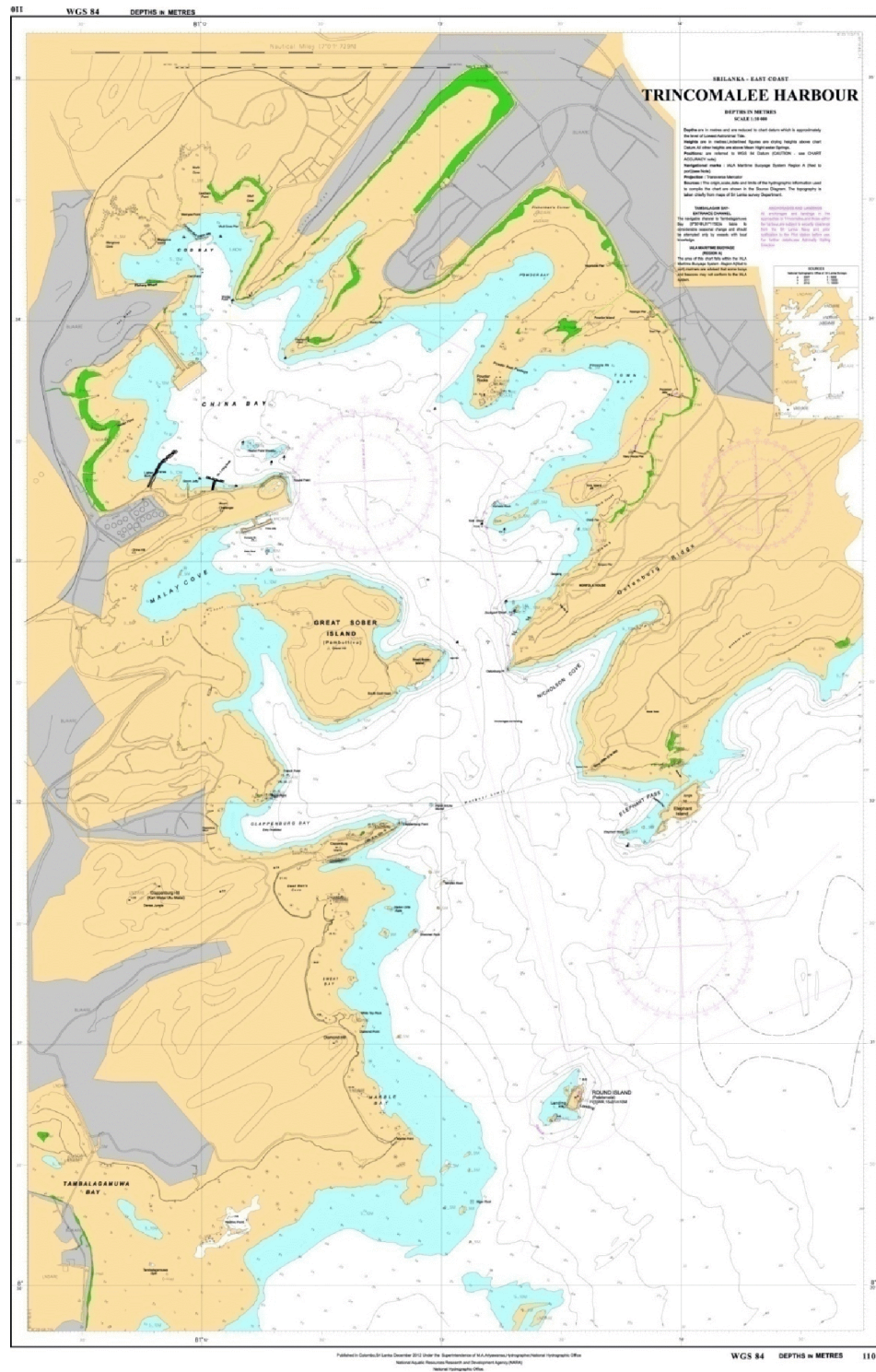
1. Upgraded 1:10000 Nautical chart of Trincomalee Harbour.
2. 1:50,000 nautical charts of Trincomalee Approaches.
3. Surveys conducted for special request.
4. Special Surveys undertaken for NARA Research & Development work.
5. Bathymetric data acquisition for fill the gap between Colombo and Negombo Nautical charts using Tharani Boat.
6. Calibration & Testing of ADCP and on board training on ADCP with RV Sammudirka.
7. ARGOs Deployment and ADCP data collection with RV Sammudrika.
8. Fish Aggregation Devices (FAD) was deployed at Batticaloa and Pottuwil with RV Sammudrika.
9. Seismic Survey with Boskalis International B.V hiring RV Sammudrika.

Activities undertaken

Program	No.	Project	Officer Responsible	Period
1. National Nautical Charting	1.1	Data Acquisition for gap filling between Colombo to Negombo nautical charts	S.R.C.Ranaweera C.K. Amarasinghe	Jan-Dec
	1.2	Data Acquisition for 1:50,000 Trincomalee Approaches	S.W.S.Weerasinghe Y.M.R.Nilupa Kumari	

	1.3	Data Acquisition of Trincomalee Harbour upgrading		
	1.4	Data processing and Cartography		
2. Surveys conducted for special request	2.1	Bathymetric Survey for Thalaramba, Mirissa for CC & CRMD	S.R.C.Ranaweera C.K. Amarasinghe S.W.S.Weerasinghe Y.M.R.Nilupa Kumari	Jan-Dec
	2.2	Bathymetric Survey and shore profile for CC and CRMD at Dickowita		
	2.3	Bathymetric Survey for CEB coal power project at Puttalam		
	2.4	Bathymetric Survey at Uswatakeiyawa for NEM construction		
	2.5	Geo Physical Survey with Boskalis International BV		
3. Surveys conducted with RV Sannudrika	3.1	Bathymetric Surveys	M.A.Ariyawansa Head,NHO	Jan-Dec
	3.2	Argo Deployment and ADCP Data Collection		
	3.3	Hiring the research vessel for seismic survey		
	3.4	purposes FAD Deployment		

Nautical Chart of Trincomalee Harbor



1:50,000 Trincomalee Approaches



Progress

Project 1.1 Data Acquisition for gap filling between Colombo & Negombo nautical charts

The data acquisition for the gap filling between Colombo to Negombo is completed under National Charting Program using Tharani boat. . 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.

Progress (%)	Physical: - 100	Financial: - 100
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Project 1.2 Data Acquisition to 1:50,000 Trincomalee Approaches

The data acquisition for the 1:50,000 Trincomalee approaches are 50% 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.

Progress (%)	Physical: - 50	Financial: - 100
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Project 1.3 Data Acquisition for upgrading the Trincomalee Harbour

The Nautical Chart has been designed to approach to the Trincomalee Harbour from the International Sea Route. All bathymetric data has been incorporated to the bathymetric data base of NHO. Producing of sea chart is fulfillment of one of the requirement of International Maritime Organization's SOLAS Convention.

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

Project 1.4 Data processing and Cartography

1:50,000 Trincomalee approaches are 50% completed.

Cartographic work related to production of the nautical chart of Trincomalee Harbour is 100% completed.

Data processing for the acquired bathymetry for the gap filling between Colombo and Negombo is completed.

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

Project 2.0 Surveys conducted for special request from Government and Other institutions

2.1 Bathymetric Survey at Thalaramba, Mirissa for CC & CRMD

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

2.2 Bathymetric Survey and shore profile for CC and CRMD at Dickowita

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

2.3 Bathymetric Survey for Puttalam coal power project for CEB

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

2.4 Bathymetric Survey at Uswatakeiyawa for NEM construction

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

2.5 Geo Physical Survey with Boskalis International BV

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

Project 3.0: Surveys conducted with RV Samudrika

3.1 Bathymetric Surveys

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

3.2 Argo Deployment and ADCP Data Collection

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

3.3 Hiring the research vessel for seismic survey purposes

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

3.4 FAD Deployment

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

Publications / Maps

- Nautical Chart of Trincomalee Harbor.

Training / Awareness programme conducted:

- Routine awareness program 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 100 undergraduates from Faculty of Geomatics, University of Sabaragamuwa at Trincomalee Harbour.

Foreign Training

No. of Officer 01 – Cat B Nautical Cartography Training under Japan Nippon Foundation Program at United Kingdom Hydrographic Office (UKHO). Cartographic Draughtman 01 – ENC Training 05 weeks at UKHO.

Non Scheduled Activities / Consultancies

Project	Contract Amount
Bathymetric Survey at Thalaramba, Mirissa for Coast Conservation and Coastal Resource Management Department	Rs.1,155,310.00
Bathymetric Survey and Shore profile for Coast Conservation and Coastal Resource Management Department at Dickowita	Rs.1,133,087.00
Bathymetric Survey for Puttalam coal Power Project for CEB	Rs.305,172.05
Geo Physical Survey with Boskalis International BV	Rs.1,015,679.00
Bathymetric Survey at Uswetakeiyawa for NEM Construction	Rs.470,080.00
Total	Rs.4,079,328.05

5.4 INLAND AQUATIC RESOURCES AND AQUACULTURE DIVISION

Head of the division: Dr.V.Pahalawattaarachchi

Overview of the Year

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 2012 division has carried out 11 research projects on the following thrust areas of Aquaculture, Health Management, Ornamental fish breeding and culture as well as conservation of aquatic habitats.

In summary major outputs of the Mari culture projects were breeding of *Holothuria scabra* using broodstock adopt by hatchery reared larvae for the first time in Sri Lanka. The larval rearing practice is still improving with different feed trials. Alternative nursery kept in South and North Coast's were carried out and seeds were transferred to the commercial scale culture of private sector. Growth trials for *Sargassum* species were carried out as the species has economic applications for the industrial usage. As it is awarded that feed development to be done with the aquaculture development the field based trails using untapped fish resources in inland tanks, fish waste from Central fish market using as protein source. Technology transfer on feed development for selected community people for ornamental industry in 06 districts has become a turning point of sustainable community based ornamental industry in those districts. Initiatives have been taken for formulation of high quality nutrient rich feed for sea bass culture. Induced breeding and proper larval rearing techniques for *Garra ceylonensis* and *Pangasius suchie* were conducted. Captive breeding of Black Ruby Barb, Cumnigii's barb, Red Fin Barb, Blotch filamented barb, Filamented Barb, Kelumi Barb, Gaint Danio, Cherry barb, Bandula Barb, Paradise fish and other indigenous fishes were continuously done. Study was initiated to determine the distribution of mycobacteriaosis in ornamental fish culture system in Sri Lanka, to identify the causes and minimizes the Post-shipment mortality

(dead on arrival) of ornamental fish exported from Sri Lanka in order to increase the survival of healthy fish stocks on the destination in the export market.

It was recorded that parasitic and fungal diseases are the most common diseases found in the ornamental fish reared in Kalutara district. On site advice made for the improvements for health conditions. Organic pollution prevailed several locations of Negombo lagoon and the peak occurrence of juvenile groupers within the year was highly variable. Year round occurrence of juveniles was also observed but peak months fell on the November. The division produced 16 no of abstracts in various symposiums and published papers in peer reviewed journals. Attraction of external/foreign funds for 05 projects and sign of 05 number of memorandum of understandings (MOUs) revealed the initiation of collaborative research and development with other scientific organizations as well as private sector.

Activities Undertaken

Project No.	Project Name	Allocation (Rs. Mn)	Officer Responsible
4.1	Improvement breeding and culture techniques for Sandfish (<i>Holothuria scabra</i>)	1.00	P.A.D. Ajith Kumara, R. Weerasinghe
4.2	Development of fish feed using locally available ingredients for aquaculture.	1.3	A. Athukorale, R. Weerasinghe, M.H.S. Ariyaratne
4.3	Seaweed culture and Mollusc resource management program	1.3	V.Pahalawattarachchi Dr.H.M.P.Kithsiri
4.4	Development of low cost highly nutritious feed for culture of Asian Sea Bass <i>Lates calcarifer</i> / <i>Ephinephalus</i> spp with reference to reduction of production cost.	0.8	M.G.I.S. Parakrama,
4.5	Development of breeding and culture technology for high value endemic and exotic ornamental fishes and propagation techniques for aquatic plant.	1.5	H.M.P.Kithsiri, V. Pahalawattarachchi, S. Epasinghe, R. Shirantha

4.6	Study of distribution of micobacteriosis (Fish Tuberculosis) in ornamental fish culture system in Sri Lanka.	0.7	P.P.M. Heenatigala,
4.7	Investigation on the impact of management options on hydrobiology and emerging diseases in promoting sustainable shrimp culture.	1.0	A.S.L.E.Corea, P.Heenatigala
4.8	Development of microalgae culture techniques and study on commercially important marine ornamental species and use of microalgae in aquaculture practices.	1.0	J. C. Mallawarachchi
4.9	Study on environmental parameters, recruitment pattern and culture of grouper (<i>Epinephelus</i> sp.) in Negombo lagoon.	0.5	M.Gammanpila
4.10	Development of high quality brood stocks and investigation on factors affecting for disease occurrence in ornamental fish out-grower systems in Southern province.	1.0	A.D.W.R.Rajapakshe R. Amaraweera
4.11	Captive breeding and larval rearing of Clown Fish is using lagoon water.	0.8	J.S.Jayanatha
	Total allocation	10.9	

Progress

Projec 4.1: Improvement breeding and culture techniques for Sandfish (*Holothuria scabra*),

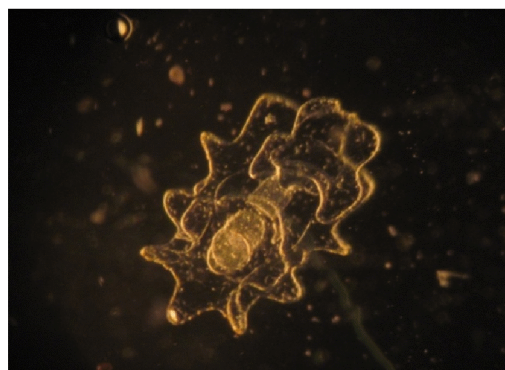
Officer Responsible: P.A.D. Ajith Kumara

Objectives of the project were to improve breeding and culture techniques for sandfish (*Holothuria scabra*), to develop/monitor of suitable grow-out systems for sandfish (*H. scabra*) and to conduct feeding trials and replenish of wild population

Hatchery produced juveniles in October 2011 and March 2012 reared in captivity both fiberglass tank and lagoon pen until they become fully ripe. By using this virgin stock an attempt was taken to produce seeds in September 2013 but failed. Then this broodstock has been conditioned for another two month controlling photo period and giving nutrients enriched feed. Then they were successfully induced in November 2013 and produced 700,000 larvae marking the first ripened broodstock obtained from hatchery reared larvae in Sri Lanka. The research is going on to increase the larval survival by using different type of imported formulated feeds.



Spawning behavior of adult sea cucumbers



Early life stage of sea cucumber larvae 6 days after hatching (late auricularia)

The effects of four different types of fish silage based diets were observed on growth performance of juvenile Sea Cucumber (*Holothuria scabra*) for 8 weeks. A total of 120 juvenile sea cucumber averaging 5.51 ± 0.27 g (mean \pm SD) were randomly distributed in twelve round fiberglass tanks, and each tank was randomly assigned to one of three replicates of four diets containing fish meal (FM):100% (T₁); 50% FM: 50% Fresh water fish Silage (FWFS) (T₂); 50% Fish Waste Silage (FWS): 50% FM (T₃) and 50% Fresh water fish Silage (FWFS): 50% Fish Waste Silage (FWS) (T₄) . At the end of feeding trial, final body weight (FW), weight gain (WG) of fish fed T₃ was higher than the fish fed T₁, T₂ and T₄ ($P > 0.05$). However there were no significant differences in WG among fish fed T₁ and T₄ diets ($P < 0.05$). Although, significant differences were recorded in the proximate composition of juvenile Sea cucumber fed experimental diets. The results indicate that the use of fish waste and fresh water minor cyprinid species to make fish silage for replacing expensive fish meal varieties in Sea cucumber diets would be efficient and feasible.

The possibility of culturing *Holothuria scabra* (sandfish) with milk fishes (*Chanos chanos*) was tested in the mud ponds located at NARA premises in Kalpitiya, from May to June 2013. They were reared 2 month period without supplementary period. Allochthanas input came to the pond when tidal water fluctuations occur and water pumping. At the end of culture period final average weight gained of sea cucumber and milkfish was 130 ± 13 g 58 ± 6.8 g respectively. The observed survival rate was 38% sea cucumber while 15% of milk fish.

It was observed that there is no any negative impact from *H. scabra* on growth and survival of *C. chanos* and vice versa. The reason for the low survival rate of milk fishes was high predatory pressure of cormorants. The study should conduct for more periods to come in to a strong recommendation. Replenish the wild population by releasing of hatchery produced sandfish (*Holothuria scabra*) to bar Reef Marine Sanctuary was conducted under Project no1.6.

Project 4.2 : Development of fish feed using locally available ingredients for aquaculture.

Officers Responsible: D. A. Athukorale, R. Weerasinghe, M.H.S. Ariyaratne

Feed cost is the highest operating cost in semi-intensive aquaculture practices in Asia and it is identified that feed development is one of the national requirements of the country. Hence the above project was carried out with objectives of using unutilized fishery resources in reservoirs to produce fish feeds for selected food fish and ornamental fish culture, using fish offal discard from fish market to produce fish feeds for selected food fish and ornamental fish culture and to introduce low cost, nutritious fish feeds for food fish and ornamental fish culture

Proximate analysis of minor cyprinid and making diets by using minor cyprinid fish powder were done in the first quarter of the year. Different types of diets were prepared for food fish culture trial in Kattakaduwa and koi carp feeding trail in NARA.

In first experiment, nine mud ponds for food fish culture were prepared parallel to fish feed formulation and preparation. Significant differences were observed in growth performances of fish fed minor cyprinid based diets than the fish fed diets which farmers normally used. The results indicate that the two minor cyprinid species could be utilized cost effectively in food fish culture.

In second experiment, the effects of two minor cyprinid fish based diets (*Dawkinsia singhala* and *Puntius chola*) on growth performance of juvenile koi carp (*Cyprinus carpio carpio*) were studied for 6 weeks. A total of 900 juvenile fish (*Cyprinus carpio carpio*) averaging 0.58 ± 0.03 g (mean \pm SD) were randomly distributed in nine square cement tanks, and each tank was randomly assigned to one of three replicates of three diets containing *D. singhala* fish powder; 305 (T₁) and *P. chola* fish powder; 330 (T₂) g/kg diet with commercial diet (T₃). At the end of feeding trial, final body weight (FW), weight gain (WG), specific growth rate (SGR), feed conversion ratio (FCR) and protein efficiency ratio (PER) of fish fed T₁ and T₂ were higher than the fish fed T₃. However there were no significant differences in WG, SGR, FCR, PER and survival rate among fish fed three different diets ($P > 0.05$). Although significant differences were not recorded in the proximate composition of juvenile koi carp fed experimental diets. The total cost for T₁ and T₂ feeds were 160 and 165 LKR (Sri Lankan Rupees) respectively while commercial feed was available for 180 LKR. The results indicate that the two minor cyprinid species could be utilized cost effectively as a protein supplement in juvenile koi carp feeds to replace high cost fish meals.

Instead of that fish waste in Paliyagoda fish market was analyzed and diets were prepared by dried powder as well as silage was produced by using fish waste in Peliyagoda fish market and minor cyprinid species in reservoirs. Couple of diets was prepared by fish silages which produced in NARA. Feeding trial of koicarp with use of those formulated feeds has been completed. Data analysis is being done.

Under this project, indoor trials were carried out to test the no-cost feed ingredients such as wasted shrimp meal and duckweed (An aquatic plant growing in stagnant water) in Ornamental and Food fish culture to reduce the feed cost. Locally prepared pumpking powder was tested as colour enhancing agent in Guppy culture.

Wasted shrimp meal couldn't be used as sole protein provider in fish feed due to the higher % of Ash (22.21 ± 0.9179). It should be incorporated with fish meal as protein provider to the feed. The feed for Gold fish (*Carassius auratus*) that prepared using fishmeal and incorporated shrimp waste meal as the protein provider was given better result than the feed using shrimp waste meal as sole protein provider. Pumpkin powder could be incorporated to the fish feed to enhance body colour of Guppy fish. Duckweed powder could be incorporated into the fish feed as protein provider until 30% without any growth reduction of Molly fish (*Poecilia latipinna*), Koi carp (*Cyprinus carpio*) and Tilapia (GIFT) strain (*Oreochromis niloticus*) early and advance fry rearing.

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

Constraints

1. Unable to start first experimental fish feed trials in April 2013 and second experimental fish feed trials in September 2013 as planned, as no fingerlings available on time. However able to start first experimental feed trials in July 2013 and second experimental feed trials in November 2013.
2. Lack of proper fish feed processing facilities and fish feed testing facilities at NARA.
3. Lack of vehicle in sometimes and to be done other extension work such as Divi Neguma Program.

Project 4.3: Seaweed culture and Mollusc resource management program

Officers Responsible: V.Pahalawattarachchi, R. Weerasinghe; Upul Liyanage
Dr.H.M.P.Kithsiri

The carrageenophytes *Kappaphycus alvarezii* has being remain as the tropical world's most important seaweed species. For almost three decades now, commercial Farming of this seaweed has been done through vegetative regeneration of thalli. Experimental culture and pilot scale culture of *Kappaphycus alvarezii* have been done in Sri Lanka there are some problems and needs related to farm production *Kappaphycus alvarezii*. Adders of the problems and to keep the seedling bank/gene

bank, to serve the needs of farmers were the main aims of the project. Main issues identified were seasonality problems in growth/ production, understanding and developing the capability to mitigate or eliminate pests. Seedling bank was maintained at Killinochci district from May to October and it was transferred to Southern coast Dewundara during the North East monsoons. The growth rates of the favourable seasons of Killinochchi and Dewundara were 7% /day and 6% /day respectively. Seeds were provided for the commercial cultures for Heylis Company, ANN Associates (Pvt) Ltd and NAQDA. The capacity of the seed bank was 1000MT. Growth study carried out in commercial scale culture of Waleipadu revealed that the growth rate in rafts was 7-13% /day.



The oyster research and culture program was carried out with a view of providing self employment opportunities especially for the women fisher communities at Gangewadiya and Kandakuliya in Puttalam District. Highest oyster growth was recorded at Anawasala (10mm/month) and Kalpitiya (6.66mm/ month). Monthly growth rate recorded at Kandakuliya and Gangewadiya were 4.75mm and 4.55mm respectively.



Progress (%)

Physical:

Financial: %

Project 4.4: 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.

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

Objectives of the study are preparation of low cost nutritious feed for Sea bass fry and fingerling and evaluation of growth and survival performance of sea bass culture in experimental level. Cage construction and pond preparation were done. Three cages were constructed for fingerling stocking. Feed formulation was completed. Prepared 3 feed types using available low cost feed ingredients/ materials and proximate analysis were done. Protein percentage of the prepared feeds was 38%, 47% and 49%. As the availability of fish seeds was limited, pond culture practices are being waiting for required sized fingerlings. Project is continuing for next year.

Progress (%) Physical: Financial: %

Project 4.5: Development of breeding and culture technology for high value endemic and exotic ornamental fishes and propagation techniques for aquatic plant.

Officers Responsible: Dr. H. M. P. Kithsiri

Dr. Vasantha Pahalawattarachchi

Mr. Santha Epasinghe

Ms. R. R. A. Ramani Shirantha

Objectives of the project are to develop breeding and culture techniques for selected endemic/exotic fishes, to setting up a tissue culture laboratory, a new fish hatchery and renovation of existing aquaria and study on wild population of *P. asoka*. Two fragmented wild populations of *Puntius asoka*; in Kithulgala and Deraniyagala was reported and their approximate population size that assess with Catch Per Unit Effort data was 0.05 individuals/Km² and 0.01 individuals/Km² in Kitulgala and Deraniyagala respectively. It was found this species needs immediate adopted conservation measures.

It was succeeded to bring few females to gravid stage but failed bring them to lay eggs and died due to unidentified reason. The 2nd breeding trail also failed die due to sudden occurrence of white the spot disease. However, further experiments are still continuing. Induced breeding and proper larval rearing techniques for *Garra ceylonensis* and *Pangasis suchie* were conducted.

Captive breeding of Black Ruby Barb, Cumnigii's barb, Red Fin Barb, Blotch filamented barb, Filamented Barb, Kelumi Barb, Gaint Danio, Cherry barb, Bandula Barb, Paradise fish and other indigenous fishes were continuously done.

Aquatic plant house construction was partly completed with available financial support and tank system constructed. Some small scale experiments for sand culture, controlling algal bloom in culture tanks, culturing of *Cryptocorine* sp. in different media were done and some are in progress. Installment of springer system and designing of sand culture system with the waste water discharge from fish tanks was done.

The Outcomes:

- Aquaria with developed infra facilities
- Aquatic plant house

Progress (%): Physical 85% Financial %

Constraints:

Due to delay in net house renovation and insufficient number of tanks, rearing and more comprehensive captivity breeding research studies on fishes could not be carried out.

Project 4.6: Study of distribution of micobacteriosis (Fish Tuberculosis) in ornamental fish culture system in Sri Lanka.

Officers Responsible: P.P.M. Heenatigala

The objectives of the project were to study the distribution of mycobacteriaosis 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 and to source high health ornamental fish from Sri Lanka to the export market. Collection of background data (Chemical used, stocking facility, Mode of transport etc.) and Sampling from the ornamental fish farms. (Water samples, diseased fish) were carried out for the first year.

Progress (%) Physical: 35% Financial: %

Constraints:

1. Unable to carryout Lab analysis during the first ten months of the year due to delay of the required chemicals. Sampling was started from October 2013 just after receiving the necessary chemicals. Therefore study will be continued for next year.
2. Lack of vehicles.

Project 4.7: Impact of management options on hydrobiology and emerging diseases in promoting sustainable shrimp culture & White spot disease surveillance

Officers Responsible: A.S.L.E.Corea, P.P.M. Heenatigala

Districts: Batticaloa and Puttalam

The activities carried out in the project were monitoring of water quality in farms, collection of data on disease conditions and use of chemicals and monitoring of growth & observations on any disease symptoms with respect to water management. Awareness programs were carried out on disease management and water management for farmers.

The water quality along the main water bodies was studied and there was not much of a change in water quality throughout the year. Even the salinity range did not increase beyond 40ppt. The disease symptoms observed were not mainly related to water quality as the major problem recorded was white spot disease. However few farms from Mundel and Thoduwawa were affected by shrimp mortality due to use of probiotics which had caused severe water quality changes resulting in algal collapse and reduction of pH. The algae crash also resulted in elevating ammonia and nitrite levels. However the in general other water quality related disease conditions were low during the year. Good growth was observed throughout the year and salinity was maintained as there was rains throughout the year and no specific dry conditions were reported. However an awareness program on managing water quality and disease conditions during high salinity periods were carried out at farm level.

The chemicals and probiotics were not able to control the vibrio counts during rainy seasons when salinity was very low.

This indicates that the use of these products would be beneficial only when the environmental conditions are suitable and are within optimal levels. The samples and data collected from Batticaloa district showed that they do not use any chemicals or probiotics at present but the lagoon water quality were within acceptable limits for shrimp culture. Further monitoring of use of chemicals and probiotics is recommended.

Target – 100% Achieved

Progress (%): Physical: Financial: %

Constraints:

Work was affected due to not receiving necessary equipment and chemicals throughout the year and unavailability of funds and vehicles during some parts of the year. Some parameters which needed to be checked were not carried out due to unavailability of chemicals. The chemicals requested at the beginning of the year and chemicals requested as urgently needed during mid year were not received.

Project 4.8: Development of microalgae culture techniques and study on commercially important marine ornamental species and use of microalgae in aquaculture practices

Officers Responsible: J. C. Mallawarachchi

The objectives of the project were to develop micro algae culture techniques for indoor algae culture and to develop breeding and culture technology for marine ornamental species. Within the period, it was developed micro algae culture laboratory and purchased chemicals to start micro algae culture. For the second objective it was needed to establish marine recirculation system to breed and culture ornamental species in the NARA head office premises. It was constructed marine recirculation hatchery system in ornamental fish culture area of the NARA to carry out breeding and culture process.

Progress (%): Physical: 65% Financial: %

Constraints

Purchasing of materials for hatchery development and algae culture were delayed.

Project 4.9: Study on environmental parameters, recruitment pattern and culture of grouper (*Epinephelus* sp.) in Negombo lagoon

Officers Responsible: M. Gammanpila, S. A. M Azmy, B.R.C Mendis

Project was initiated with the objectives of monitoring the surface water quality, assessment of pollution levels in surface waters, identification of possible pollutants sources and collecting of reliable information on migration pattern of grouper and thereby contributes to sustainable management of grouper fisheries in the estuary. The other specific objective is to assess of aquatic pollution levels in selected point sources of municipal, Industrial and tourism areas. This is a one year project and sixteen sampling locations were selected for the study, which included points in the estuary, effluent from most of the industries Ja-ela and Katunayeke free trade zones, the large number of boats using the area for anchoring and waste water from houses

are discharged into lagoon without any treatment selected, water quality parameters were studied. During field sampling, it was observed that heavy sedimentation due to deposit within the northern part of the lagoon.

According to the results of water quality analysis, surface water temperature varies between 27.6 to 32.2 °C. The levels of pH, Dissolved Oxygen and Electrical Conductivity are 6.1 to 9.21 and 3.1 mg/l to 9.53 mg/l, 0.5 ms/cm to 58.4 ms/cm during the study period respectively. Pollution parameters such as identified the values of nitrate nitrogen, nitrite nitrogen, ammonical nitrogen and dissolve phosphate in lagoon catchment were 0.0123 mg/l to 2.5 mg/l, 0.003 mg/l to 1.30 mg/l, 0.01 mg/l to 1.90mg/l, and 0.006mg/l to 2.8 mg/l respectively. Total suspended sediment in above area was observed in the range of 1.0 mg/l to 55.0 mg/l and turbidity levels were varied from 1.71 NTU to 25.5 NTU respectively. Chemical Oxygen Demand and Biochemical Oxygen Demand were varied between 5.0 mg/l to 300.0 mg/l and 3.0 to 45.0 mg/l. The chlorophyll - content in above lagoon was varied between 0.79 mg/m³ to 54.16 mg/m³ respectively.

The results for the most parameters indicate that, the Bio-chemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD) and Total Suspended Solids levels are highest in Northern part of the lagoon area. Relatively higher amount of nutrient and pollution indicator organisms such as rotifers (0 – 97 organism/l) were recorded in many sampling locations

Based on the results, the peak occurrence of juvenile groupers within the year was highly variable. Year round occurrence of juveniles was also observed but peak months fell on the November.

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

Constraints

Delay of purchasing of chemicals

Project 4.10: Development of high quality brood stocks and investigation on factors affecting for disease occurrence in ornamental fish out-grower systems in Southern province. One year, NARA.

Officers Responsible: Dr. A.D.W.R. Rajapaksha, R. Amaraweera

Objectives of the project were to establish good quality brood stocks in RRC/Rekawa for the future, to educate the farmers to overcome the disease problems and to develop livelihood of farmers through better income. In order to meet the objectives good quality brooders of gold fish, Angles. Fighters and molly species were reared and maintained in the hatchery RRC, Rekawa. Identified the peoples who have engaged in ornamental industry in Kalutara area with the support of NAQDA and monthly monitored the water quality and disease occurrence in their ponds.

Conducted field visit to select ornamental out growers in Kalutara district in April and May. Six farms were selected where as two from Bandaragama two from Kautara North and rest from Nagoda area. Farms located in Kalutara North are large and mainly oriented export market and growing only guppies. Other four farms are medium scale and oriented local market. Out of these four farms one only culture fighter fish and other three farms grow more than one variety of fish. Mainly Angels, Fishers Gold Mollusc resource fish and carps.

All farms were visited once a month from June to December and collected data regarding water quality and prevailing disease conditions. According to the data PH ranged from 6.5 to 9.5, Dissolve Oxygen 2.19 to 8.16 and water temperature range from 26.8 to 31 C. Trichodina and Gyridactylus are mainly encounter in some farms. Oodinium condition for fighters, fungus attack for gold fish fry, tail rot and dropsy conditions for fighter fish were found. Trichodina infections were found in one large farm throughout the study period due to lack of sanitary measures. But other large scale farm maintains good conditions and taken precautions to avoid disease condition by reducing the stocking density and using proper management practice. All farms mainly use antibiotics for bacterial conditions, Tripal and Neguwan for parasitic infections.

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

Constraints: Lack of disease diagnostic and water quality testing facility in Rekawa.

Project 4.11: Captive breeding and larval rearing of Clown Fish using Lagoon water.

Officers Responsible: S. Jayanatha

Objectives of the project are captive breeding clown fish using lagoon water (brackish water); Increasing of larval survival and suitable feed development for larval stages and Find out possibilities of doing artificial breeding for other valuable species such as (*Amphiprion clarkii*)

Adult pairs of clown fish were collected by divers from the in-shore areas of Gulf of Mannar and transported to the marine aquarium facility of the institute. They were domesticated for 3 months in brooder tanks with lagoon water with the salinity of 29 to 30 ppt fitted with biological filters. The fishes were fed with different feeds such as fish and bivalve meat, polychaete worms regularly twice a day. The excess feed was removed daily to avoid water spoilage. Several pieces of asbestos sheet were placed in the tanks as substratum for deposition of eggs.

Initial attempt on breeding the fish was failed due to a fluctuation in salinity during salinity drop from 30 ppt to 27 ppt. 60 pairs of brooder stocks were replaced due to this temperature and salinity fluctuation.

Progress (%): Physical: 35% Financial: %

Extension work/ Services provided:

1. On the request made by Ministry of Fisheries and Aquatic Resources Development on 30th May 2013, NARA officials provided necessary information and supporting report to Eambassy of Japan regarding construction of sea cucumber aquaculture facilities in Pooneryn, Jaffna district.
2. NARA achieved another landmark in the field of sea cucumber aquaculture sector in the country, by selling 500 no's of 15-25 g sea cucumber juveniles to the Green Movement of Sri Lanka an IUCN funded NGO who has been carrying out community-based sea cucumber farming activities in Manner area, at the rate of Rs 40 per individual. The total income of Rs 20,000.00 was credited to NARA consultancy vote.

3. Two day residential training program will be conducted on “Sea cucumber breeding and larval rearing techniques” at NARA Regional Research Center in Kalpitiya from 14th December to 15th December 2013. This will mark the first ever sea cucumber training program carry out by the local expertise to commercial seed production.
4. Training course conducted on Ornamental Fish Breeding and rearing, Feb.-March 2013.
5. Conducted trainings on Fish Feed Preparation as self employment- for 83 people in Puttalam(15), Gampaha(25), Kalutara, Hambantota, Gall and Kandy districts under the DIVI NEGUMA national program.
6. Investigate the suitability of abandoned paddy field for fish culture in Beruwala, Boossa and Koggala area and provided the report to Chairman NAQDA.
7. Site survey on abundant clay pits in Katana area according to the request made by Hon MP Dr (Mrs) Jeyaraj Fernandopulle.
8. Technical support - given to Sri Lanka Custom Department to identify suspicious fish species.
9. Conducted a training program on “Disease diagnosis in ornamental fish”.
10. Provided information and instructions to the ornamental fish farmers on fish diseases on their request.
11. Sold seaweed seed materials to Heylis Company limited and ANN Company. Seed stocks were transferred to NAQDA for their grow out trails.
12. Organized exhibition stall including Mangrove, Ornamental and Endemic fish species to hold in Servesius College, Matara, from 14th. To 16th May 2013.
13. Organized exhibition stall including Mangrove, Ornamental and Endemic fish species to “Dakshina Krushi Navodaya”held in Thelijjawila Farm, Galle from 24th. To 28th July 2013.
14. Dissemination of knowledge on fish breeding and Therapeutic measures for disease conditions of ornamental fish industry people when requested.
15. Organized and act as resource person three day training program me on Ornamental fish breeding, culture and disease management in RRC/ Rekawa for 25 people in Hamantota District, on 03rd -05th September 2013.

16. Organized three day training program on Ornamental fish breeding, culture and disease management in Vidatha Center at Akmeemana and RRC/ Rekawa for the participant of Galle district, on 22nd -24th October 2013.
17. Five awareness programs for wildlife officers.
18. Conduct one day Technology Transfer Training Program on Diagnosis of Diseases of ornamental Fish (27th September 2013).
19. Conducted field visit on 11.11.2013 and provided report on fish kill incident in Kankanamgama wewa, Agunakolapelessa.
20. Guiding school children for their A/L projects in Hambantota district
21. Guiding school children for their A/L projects in Gamapaha district.
22. Resource person to curriculum Development for NVQ certificates for Aquaculture and Fisheries Management, National Institute of Fisheries and Nautical Engineering, Mattakkuliya, Colombo-15.
23. Resource person on “Field identification and conservation issues of freshwater fishes of Sri Lanka” organized by Department of Wildlife Conservation, Sri Lanka at Forest Training Center at Kan-Eliya forest from 18th – 22nd June 2013.
24. Workshop on “Field identification of freshwater fishes of Sri Lanka” organized by National Wildlife Training and Research Center, Department of Wildlife Conservation, Sri Lanka, from 14– 16 August 2013.
25. Resource Person on Workshop on “Field identification of freshwater fishes of Sri Lanka” organized by Department of Wildlife Conservation, Sri Lanka at Wasgomuwa National Park, from 13– 16 October 2013.
26. Resource Person on the workshop on “Capacity enhancement prevent to entry and spreading of Invasive Alien Species in Sri Lanka”/GEF funded project, Ministry of Environment and renewable Energy.
27. Resource Person on the workshops on “Ornamental fish breeding, culture and management” organized by NARA in 2013.
28. Expert reviewer on the evaluation on “Conservation status of the freshwater fish fauna of Sri Lanka for Global Red listing” under the Red listing project 2013, Bio Diversity Secretariat, Ministry of Environment and Renewable Energy, Sri Lanka.

29. Five technical expertise meetings to revise **“existing rules and regulation on export and import ornamental fish species”** of Sri Lanka, organized by Ministry of Economic Development. Sri Lanka.
30. Guest lectures on “aquatic biodiversity and fundamental of aquatic ecology” delivered to Wildlife officers, at National Wildlife Training and Research Center, Department of Wildlife Conservation, Sri Lanka.
31. Lectures on “Aquatic biodiversity and their conservation issues” delivered school children who are on education tour to NARA from time to time.
32. Workshop on Aquaculture development of Sri Lanka at Ceylon Chamber of Commerce on 2nd December 2013.

Consultancy work carried out:

1. Analyzed disease fish samples and recommended treatments for the disease fish submitted by fish culturists (12samples).
2. Participation in workshop on scientific writing development organized by SLAFAR.
3. Participation in hatchery grading activities of NAQDA.
4. Provided services to create Aquarium at Temple Trees in Jaffna.
5. Provided services to carry out consultancy service on Kokilai lagoon.

Committees served in

1. Aquaculture Technical committee – National Aquaculture Development Agency.
2. Shrimp culture technical committee – National Aquaculture Development Agency.
3. Environment committee – Sri Lanka Association for Advancement of Science.
4. Section committee- (agriculture & forestry section) - Sri Lanka Association for Advancement of Science.
5. Council member – Institute of Biology Sri Lanka.
6. Representing district coordinating committee in Hambantota and regional committee in Tangalle.

7. Representing district coordinating committee in Gampaha.
8. Executive committee membership – Sri Lanka Fisheries and Aquatic Resources Association.
9. Committee member of National committee on Livestock Fisheries and Aquaculture conduct by CARP.
10. Committee member of National committee on Research programmes and projects conduct by CARP.
11. Advisory committee ornamental fish conducted by Export Development Board.
12. Member of panel of judges on National awards for excellency in agricultural research.
13. Steering committee on Scaling up sustainable aquaculture project in Sri Lanka conduct by North Western Provincial Councils.
14. Wild life research committee.

Other activities

Project proposals for funding:

1. Funds received from BOBLME for the Project on Education, capacity development and monitoring in support of Bar Reef Marine Sanctuary management.
2. Funds received from the Mangroves for the Future (MFF) fund for the project on assessment of Living resources of Gulf of Mannar.
3. Wild Life funds raised for the consultancy on field guide on the fish species record in freshwaters of Sri Lanka” for law enforcement purpose of the Department of Wildlife Conservation of Sri Lanka.
4. Funds received from FAO for development of field guide on Marine fish identification.
5. Funds received from IDRC to carry out Scaling-up Sustainable Aquaculture Development in Sri Lanka.

MOUs signed

1. MOU signed with Korean Maritime Institute

2. MOU signed with BOBLME project
3. MOU signed with IUCN
4. MOU signed with Senura Aquaculture project
5. MOU signed with Sea fruit aquaculture limited

Poster presentations

Immunostimulant Activity and Growth Performances of *Cyprinus carpio* fed with *Coriandum sativum* through diet enrichment.

University students guided

- Industrial trainings

Industrial trainings were offered to following number of students from following universities

Uva Welassa University	-08 no
University of Peradeniya	-01 no
University of Sabaragamuwa	-02 no
University of Kelaniya	-03 no
University of Ruhuna	-02 no

- Under graduate Research projects

Uvawellassa University	-03 no
University of Peradeniya	-01 no
Ocean University	- 02 no

- Visiting lectures

Wayamba University
Uva Wellassa University

Publications

Full papers submitted/ published

1. **Ajith Kumara, P.A.D.**, J.S. Jayanatha, J. Pushpakumara and D.C.T. Dissanayake (2013). Artificial breeding and larval rearing of three tropical sea cucumber species: *Holothuria scabra*, *Pseudocolochirus violaceus* and *Colochirus quadrangularis* in Sri Lanka.

2. Ariyaratne, M.H.S. (2013). Alien Invasive Duck Weed (*Wolffia* sp) as Feed for Tilapia (GIFT Strain) (*Oreochromis niloticus*) Fingerling Production. In Proceedings of the 24th Asian-Pacific Weed Science Society Conference, 22-25 October 2013, in Bandung, Indonesia Lanka. *SPC Beche-de-mer Information Bulletin*, **33**: 30-36 (ISSN 1025 4943)
3. Growth performance and fatty acid profile of *Macrobrachium rosenbergii* larvae fed with vitamins, HUFA and astaxanthin enriched live feed, *Moina micrura* (**full paper**) Submitted and accepted to *Journal of Sustainable Agriculture*, 2013.
4. Growth, survival and immune responses of juvenile common carp *Cyprinus carpio* fed with diets enriched with α -tocopheryl acetate (**full paper**) Submitted to SLAFAR journal 2013.
5. Silva, E.I.L, H. Manthretilake, M.D. Piyathilak, D. Pitigala and **R.R.A.R. Shiratha** (2013). Cascade of Mini-Hydropower Plants on Sudu Ganga and its potential impacts on riverine fish fauna. In: *Proceedings of the Symposium on the Water Professionals' Day "Water Resources Research in Sri Lanka*. Cap-Net Lanka, Postgraduate Institute of Agriculture and Geo-Informatic Society of Sri Lanka, 1st October 2013, University of Peradeniya, Sri Lanka. 115p.

Abstracts

1. **Ajith Kumara, P.A.D.** and D.C.T. Dissanayake (2013). Grow-out trials for *Holothuria scabra* (sandfish) in Sri Lanka. 19th Annual Scientific Session of Sri Lanka Association for Fisheries and Aquatic Resources (SLAFAR), P.10.
2. Sivanthan, S. **Ajith Kumara, P.A.D.**, D.C.T. Dissanayake and De Croos, M.D.S.T. (2013). Daily burrowing behaviour of the sea cucumber *Holothuria scabra*. 19th Annual Scientific Session of Sri Lanka Association for Fisheries and Aquatic Resources (SLAFAR), P.11.
3. Ariyaratne, M.H.S. (2013). Alien Invasive Duck Weed (*Wolffia* sp) as Feed for Tilapia (GIFT Strain) (*Oreochromis niloticus*) Fingerling Production. 24th Asian-Pacific Weed Science Society Conference, 22-25 October 2013, Bandung, Indonesia.
4. Ariyaratne, M.H.S. and Jayantha Alahapperume (2013). Fish Offal Feed Fish viscera-based aqua feed for GIFT (*Oreochromis niloticus*) food fish culture, 10th International Symposium on Tilapia in Aquaculture, Jerusalem, Israel, 6-10 October, 2013.
5. Jayasinghe P.S., **V. Pahalawattaarachchi**, K.K.D. S. Ranaweera on 2013. "Chemical properties of edible *Gracilaria* species" and mineral composition of

- edible seaweed species” International symposium on seaweed 2013 April, Indonesia,
6. Jayasinghe P.S., **V. Pahalawattaarachchi**, K.K.D. S. Ranaweera on 2013. “The Major Pigment Content and Solvent Effectiveness of Edible Seaweed Species available in Sri Lanka”, International symposium on Agriculture and Environment on 28th November.
 7. Jayasinghe P.S., **Pahalawattarachchi V.**, Ranaweera, K.K.D.N. 2013 “Effect of seaweed liquid fertilizer on germination and growth of Vegetable seeds; Eighteenth annual scientific session of Sri Lanka Association for Fisheries and Resources in V. 24th May 2013.
 8. P.S. Jayasinghe, **V. Pahalawattaarachchi**, K.K.D. S. Ranaweera.2013 “An Assesment of the antioxidant and Antimicrobial activity of selected seaweed available in Sri Lanka". A poster presented at Annual scientific session of NARA.
 9. A comparative study on growth enhancement of an endemic fish *Dawkinsia srilankensis* advanced fry through dietary supplementation of vitamin E and cod liver oil (Abstract) Proceedings in the International Conference on Asian Fisheries and Aquaculture Forum (AFAF- 2013) symposium , Apr 30th – May 4th, 2013 Yeosu, Korea.
 10. Immunostimulant Activity and Growth Performances of *Cyprinus carpio* fed with *Coriandum sativum* through diet enrichment. Proceedings under NARA annual sessions November 29th 2013.
 11. **Heenatigala, P.** and Fernando, U. (2013) Characterization of two commonly found disease causing *Vibrio* species with respect to water quality of shrimp pond culture systems in Sri Lanka. Proceedings of international conference on Agriculture & Animal Sciences, Agri Animal – 2013, Colombo, Sri Lanka: pp 42.
 12. Parakrama, I., **Heenatigala, P.** and Rajapakshe, W. (2013) Growth responses and immune assurance to *Aeromonas* bacteria of juvenile Common carp *Cyprinus carpio* fed a prepared ratio augmented with different levels of Tocopheryl Acetate through enrichment. Proceedings of international conference on Agriculture & Animal Sciences, Agri Animal – 2013, Colombo, Sri Lanka: pp 47.
 13. **Rajapakshe, A.D.W.R.**, K.Pani Prasad, Kundan kumar, (2013). Immunological status of Koi carp (*Cyprinus carpio* L.) with artificial infection of three bacterial pathogens. Proceeding of NARA Annual Scientific Sessions on 29th November 2013. Pp.28-29.

14. **Wasantha Rajapakshe**, Anusha Dilmini and Saman Athauda (2013).Development of Immunity of Koi carp (*Cyprinus carpio* L.) by using medicinal plant *Solanum xanthocarpum*. Proceeding of International conference on Agriculture and Animal Sciences on 8th -9th July 2013.pp.49.
15. W.G.C.U. Soorasena, **R. Weerasingha***, **D.A. Athukorala** and N.P.P. Liyanage (2013) Utilization of untapped fish species in reservoirs on growth of juvenile Koi Carp (*Cyprinus carpio carpio*) *proceedings of the National Aquatic Resources Research and development Agency (NARA) Scientific Sessions 2013: 4pp.*
16. Epasinghe, E.D.M; Karunarathne, T.A.D.W and **H.M.P.Kithsiri** Induces breeding of Rainbow shark minnow *Epalzeorhynchos frenatus*(family: *Cyprinidea*) using Ovaprim.
Proc. of the National Aquatic Resources Research and Development Agency, Scientific sessions.

Reports

1. Preliminary study on Octopus resource in Sri Lanka.
2. Report on investigation of the Fish kill incident at, Bellanwila.
3. Study on the impact of development of Colombo-Katunayake express way on the benthic habitats in Negombo lagoon. (Dissertation).

Training/ Conference /meetings (Foreign / Local)

Foreign

1. 1st Annual Conference of Pakistan Aquaculture and Fisheries Society, 16- 17 August , 2013, Karachchi, Pakistan-Presented a Keynote Lecture.
2. Attended meeting In Korea.
3. Attended meeting in China.
4. Attended meeting in India for the discussions on Gulf of Mannar Living resources project.
5. Workshop on “Otolith Based Fish Aging and Fish Stock Assessment” organized by IOR-ARC Fisheries Support Unit (FSU), in Oman from 23-31 October, 2013.
6. Training programme on “Ornamental fish Culture & Packing”, Technical Assistance programme under SCP for Ornamental fish industry in Sri Lanka in Singapore from 02nd September – 06th September 2013.
7. Training on marine fish breeding Indonesia.

8. Training on Mangrove management India.
9. Colombo Harbor baseline Survey” conducted by Marine Environment Protection Authority in 2013.

Local

1. Annual sessions of SLAFAR in the NARA Auditorium in 2013.
2. Work shop on National Oil Dispersion management plan for the government officers organized by MEPA on 30.09.2013, in Human Development Center at Hambantota.
3. Meeting on ‘Ornamental fish culture Development for Export’ in AGA office Thissamaharamaya on 11th May 2013.
4. Meeting on educating the Govt. officers regarding the 2014 Budget by Dr.P.B.Jayasundara, in Hall De Galle on 07th 2013.
5. Building a Positive Mindset-Key Link to Success, 17th June 2013, NARA Colombo.
6. Four day work shop on “Scientific Writing skills” conducted by SLARFAR-BOBLEME at Thulhiriya
7. Effective proposal writing workshop organized by NSF.
8. Scientific paper writing workshop organized by SLAFAR.
9. International conference on Agriculture & Animal Sciences, Agrianimal – 2013, Foundation institute, Colombo, Sri Lanka.
10. NARA scientific sessions.
11. Meeting Chamber of commerce for Aquaculture.
12. Divi Neguma progress meetings. Institutional heads meetings at MFAR.

5.5 MARINE BIOLOGICAL RESOURCES DIVISION

Head of the Division: Dr. Sisira Haputhantri (01.01.2013-09.12.2013)

Dr. R R P Maldeniya (10.12.2013-31.12.2013)

Overview of the year

The Marine Biological Resources Division (MBRD) is responsible for carrying out research towards management, development and conservation of marine living resources. Six treasury funded research projects were carried out by MBRD in 2013. Major research areas focused in 2013 by the MBRD include;

1. Monitoring and assessment of finfish fisheries which include large pelagic (tuna, shark, billfish, seer fish etc.), small pelagic (sardines, herrings, anchovies, scads etc.) in the coastal and offshore waters.
2. Assessment of fishery resources and Biodiversity.
3. Genetic studies with regard to the identification of species/ stocks of selected marine fish, marine mammals and sex determination of marine mammals.
4. Studying the East coast spiny lobster resources for preparation of a new spiny lobster management regulations Surveys and stock assessment of edible oyster stocks in Manner.

Apart from the treasury funded projects, MBRD carried out external funded research projects through the financial support 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 studies and stock structure studies of Indian mackerel were also conducted through BOBLME funding.

The Head of the MBRD also acts as the National Coordinator (NC) of the Bay of Bengal Large Marine Ecosystem (BOBLME) regional project. All ongoing national activities conducted by Sri Lanka under the above project are coordinated by the National Coordinator of the Project for 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 Department of Fisheries and Aquatic Resources (DFAR) for providing recommendations to resolve problems on the exploitation of marine fishery resources. MBRD provided technical assistance to DFAR in the preparation of several management plans for a few marine fisheries; in particular export oriented marine species such as sea cucumber.

On court orders, several fish samples were analysed by MBRD in 2013 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 very 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 staff 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, with special reference to further development of the Large pelagic fisheries: Impact of the industrial fishing for developing the fishing industry in the coastal CPCs of the Indian Ocean Tuna Commission (IOTC) with special reference to Sri Lanka has also been studied. In addition, information and statistics with regard to the exploitation of large pelagic fish in 2013 by Sri Lankan fishing crafts has been provided to the MFARD for submitting official statistics to the Central Bank of Sri Lanka and also to the IOTC and FAO for the management of tuna and tuna like fish in the Indian Ocean.

In 2013, two new scientists joined MBRD. Also, one Research Officer of the Division is reading for a PhD in Spain. Ms.Chintha Perera returned after completing her PhD.

Projects undertaken

Project	Allocation (Rs. Millions)	Officer responsible	Period	
			From	To
1.1. Monitoring and Assessment of Large pelagic fisheries	1.9	Dr. R. Maldeniya Ms. K.H.K. Bandaranayake	continuous	
1.2 Assessment and Monitoring of Small Pelagic fishery resources in the coastal waters of Sri Lanka	0.8	Dr. S.S.K. Haputhantri Ms.K.H.K. Bandaranayake	continuous	
1.3 Assessment of fishery resources and Biodiversity of Bar reef	0.7	Dr. R. Maldeniya	2013	
1.4 study on Indian Mackerel stocks of Sri Lanka	0.3	Ms. D.R. Herath	2012	2013
1.5 Molecular studies on selected Marine fish stranded Marine mammals and sex determination of marine mammals	0.3	Ms. D.N. A. Ranmadugla	2012	2013
1.10 Studying the East coast spiny lobster resources for preparation of a new spiny lobster management regulations	0.15	Mr. U. Liyanage	2012	2013

Progress

Project 1.1 Monitoring and Assessment of Large pelagic fisheries

Large pelagic fish landings, which include mainly tuna and tuna like species such as billfish, shark and seer fish were monitored at fishery harbours and major fish landing sites in the western, southern and the eastern coasts of Sri Lanka. This included 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. Biological fish samples taken at landing sites were also analysed to study the reproductive biology of a few marine fish species.

The total production of tuna and tuna like species in 2013 was 68570t. Skipjack tuna (*Katsuwonus pelamis*) dominated the catches and amounted to 25759 t while yellow

fin tuna (*Thunnus albacares*) is the second most dominating species representing 12,148 t of the catch.

Bill fish comes as the second most abundant group of catch in the large pelagic fishery. It makes up 2703 t of the total catch. The three species of marlin; black marlin (*Makaira indica*), blue marlin (*Makaira nigricans*) and striped marlin (*Tetrapturus audax*), sail fish (*Istiophorus platypterus*) and the sword fish (*Xiphias gladius*) are being reported in Sri Lanka.

Sharks are mostly caught as by catch species in the tuna fishery. The silky sharks account for a higher proportion in the shark landings (more than 60% of the total shark landings by weight). Oceanic white tip shark and blue shark are the next dominant species.

Project 1.2. 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, southern 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. Biological fish samples of key species taken at landing sites were also analysed to study the reproductive biology. A special emphasis was made to investigate the small mesh gillnet fishery in the west coast and to study the fishery, biology and population dynamics of *Decapterus spp.* The major target fish group in small pelagic fishery in the west coast is clupeids. This group includes *Amblygaster sirm* and *Sardinella spp* etc. *A. sirm* is the dominant species in the catches and it provides around 46% of the small mesh gillnet catch. Relationships between length-length parameters (Standard Length –SL, Fork Length –FL and Total Length –TL) were also obtained for the key target species (*A. sirm*): $TL = 0.938SL$, $TL = 0.981FL$ and $SL = 0.940FL$. All L-L relationships were significant. The relationship between length and weight was also obtained ($W = 0.0119L^{2.9}$). Again, the relationship was significant. An increasing trend in the CPUE in terms of catch in kilogram per boat per day was observed in the west coast small mesh gillnet fishery. This has been possible because of increased usage of gillnet pieces, usage of high engine power, long fishing time and increased depth of fishing.

A total of 70 specimens of *Decapterus spp* were examined. 98% of the samples were *D. macarellus*. *Decapterus russelli* is recorded in small quantities. Both day boats and multiday boats target *Decapterus spp*. But, the relative contribution of day boats is negligible when compared with the contribution of multiday boats. The main fishing gear used by multiday boats for catching *Decapterus spp* is ring net whereas day boats widely use gillnets. Even though, there is no specific fishing season for this fishery, July to December is the peak season. Mean total length of male *D. macarellus* was 27.91 ± 2.71 cm and female was 28.73 ± 1.58 cm. Length weight relationship of females and males were $W = 0.0098TL^3$ and $W = 0.0262TL^{2.71}$ respectively.



Small-mesh gillnet fishing

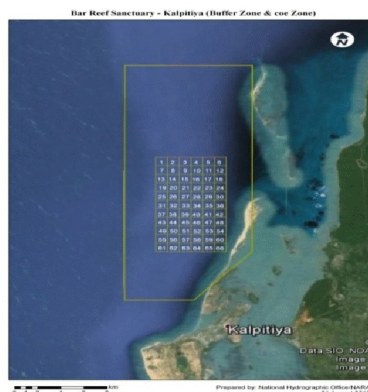


Small pelagic fish catch

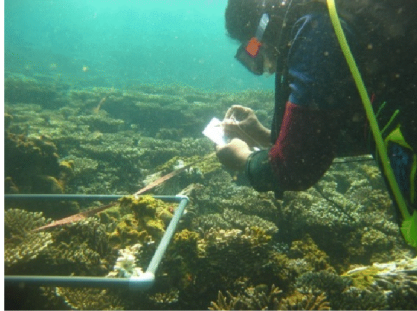
Progress (%): Physical: 95% Financial: 100%

Project 1.3 Assessment of fishery resources and biodiversity in Bar Reef

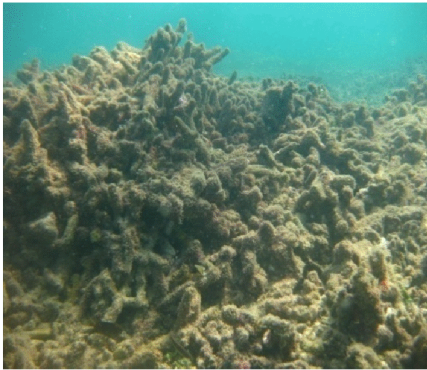
The primary goal of the study was to strengthen the scientific understanding of the status and trends of the Bar Reef. The study was also focused on the nature and extends of anthropogenic and natural stress on the core area of the Bar Reef ecosystem, which supports true core reefs. Underwater Visual Census (UVC) method was used in the assessment of faunal and floral composition in the reef.



The study revealed that the coral distribution in the area is quite patchy and the total cover consists of about 32% of the total core area which is of 70 sq. km. Several patches of coral covering a somewhat larger area were seen destroyed or broken. *Acropora* species dominated coral cover in the area. 81 coral associated finfish species belonging to 29 families were identified during the study period.



Ecological assessment



Destroyed corals patches



Coral predator –Crown of Thrones star fish Boats anchoring Major treats to Bar Reef

- | | |
|----------------------|-------------------------------------------------------------------------|
| Natural treats | – Crown of thrones starfish |
| | – coral bleaching |
| Anthropologic treats | – Use of destructive fishing methods |
| | – Bottom set gillnets |
| | – Trammel nets |
| | – Lyla nets (bottom encircling nets) |
| | – Anchoring of boats |
| | – Uncontrolled harvesting of ornamental fish and other edible reef fish |

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

Project 1.4 Genetic study on Indian Mackerel stocks of Sri Lanka

The Indian mackerel (*Rastrelliger kanagurta*) is a species of mackerel belonging to the family Scombridae of order Perciformes. It is an important food fish and is commonly used in South and South-East Asian cuisine. It is commonly found in warm shallow waters along the coasts of the Indian and West Pacific oceans, and their surrounding seas. 3 main gear types are used to catch Indian Mackerel in Sri Lanka, namely: Small mesh gillnets (2.5 – 3 cm mesh), Small mesh gillnets (4-4.5 cm mesh) and Beach seine (<1 cm mesh).

The Indian Mackerel stock structure is poorly understood. To understand relatedness, and temporal and spatial variability in stocks off the Sri Lankan western, north western and southern coasts, identification of stocks of these various areas need to be carried out.

RAPD analysis was carried out in this study. Samples of Indian mackerel were collected from Jaffna, Mullativu, Trincomalee, Batticaloa, Hambanthota, Galle, Beruwela, Negombo, Chilaw, Kalpitiya and Mannar. Ten RAPD primers were tested for the DNA extracted from the samples collected. None of the primers showed a large variation in the banding pattern for a single primer. Therefore, it can be inferred that all Indian mackerel populations of Sri Lanka have a common origin.



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

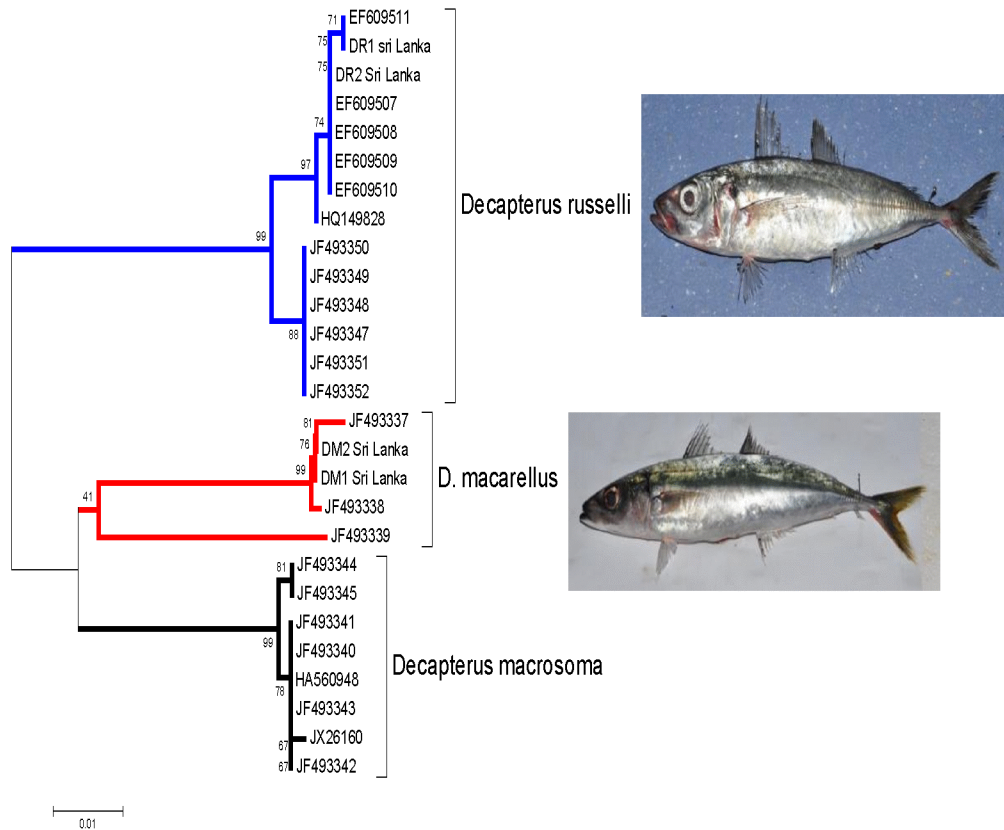
Project 1.5 Molecular identification of selected marine fish, stranded marine mammal and sex determination of marine mammals

The future status of sharks is an issue of widespread conservation concern due to the fact that sharks can no longer compensate for the immense pressure which the fishing industry puts on their populations with their slow growth, late maturation and limited number of offspring. Despite the importance of assessing shark catch and trade on a species specific basis to detect potential overexploitation of individual species, achieving this goal has proven elusive due to lack of species specific data on the landings and additionally because the available data are often of suspected quality due to uncertainty about species composition of market names used by traders. Therefore, PCR assay utilizing primers based on mitochondrial COI was used for identification of shark species in the Sri Lankan market. Reference barcode sequences of ~645 bp were generated for 12 species of sharks; smooth hammerhead, tiger shark, blue shark, silky shark, black tip reef shark, shortfin mako, longfin mako, sandbar shark, bigeye thresher shark, scalloped hammerhead shark, smooth hammerhead shark, silvertip shark, sharks from four families (Lamnidae, Alopiidae, Sphyrnidae, Carcharhinidae.).

Molecular identification of *Decapterus* sp (Scads)

The exact number of species belonging to the genus *Decapterus* in Sri Lankan waters is still debated and morphological similarities, the lack of adequate field keys and reliable inventory has resulted in misidentification of the species. Therefore, a preliminary investigation was carried out for development of a molecular taxonomy and to bring clarity to the *Decapterus* sp. (scad fish) present in Sri Lankan waters. Detailed analyses were made on the catch composition of *Decapterus* species landed in the West, North-West, South, South-West and the East coasts of Sri Lanka. A ~630bp region of mitochondrial DNA (mtDNA), Cytochrome C oxidase 1 (CO1) was sequenced from 4 individuals from the two putative *Decapterus* species. The species identity was confirmed by placing them with confidence (75-90% bootstrap support) by their CO1 sequence to the species level within the neighbor-joining phylogenetic tree. Phylogenetic reconstruction of sample sequences with the reference sequences available from the portals of GenBank (NCBI) and BOLD systems unambiguously identified the oceanic *Decapterus* sp., targeted by multiday boats using ring nets in the South coast, as *Decapterus macarellus* (more than 99% sequence similarity). *D. macarellus* was by far the more abundant species. The coastal

schooling species caught in gill nets with Outboard Fiber Reinforced Plastic (OFRP) boats was confirmed as *Decapterus russelli* (more than 99% sequence similarity).



Molecular identification of stranded marine mammals

Partial sequencing of mitochondrial control region was carried out for specimens of marine mammal strandings to distinguish specimens that otherwise, could not have been identified using conventional approaches. Approximately 550bp fragment of the mtDNA control region was amplified by PCR following standard protocols. Molecular identification of species was done by phylogenetic reconstruction of the sequences using portals GenBank.

Sex determination of marine mammals

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: 98% Financial: 104%

Project 1.10 Studying the East coast spiny lobster resources for preparation of a new spiny lobster management regulations

The major objectives of the project were to study the impact of the newly introduced co- management system on the spiny lobster fishery management by the Department of Fisheries and Aquatic Resources with the assistance of NARA.

All the lobster collecting companies and some sites from Panama to Valaichchenai was visited once a month and collected information on length parameters, sex species, gear, presence of eggs & tar spot, catch and fishermen's income. All the companies in the east coast are purchasing the lobsters above the minimum legal size. Fishermen don't land them and release them to the sea while collecting the net. The entire lobster fishermen go to fishing with a measuring ruler. This is a positive trend expected from the co-management system. However, still female lobsters with eggs are brought to the land and sell them after removing the eggs. During the months of January, July, November and December, over 60 percent of the females had external eggs. To implement a separate closed season for the east coast, the research should be extended by another year. The length frequency analysis revealed that the recruiting period to the fishery is from April to June. During this period, the majority of the catch represents small lobsters. *P. homarus* is the major species representing 91% of the commercial catch. When compared with the annual length frequencies of *P. versicolour*, it shows a high fishing pressure on the *P. homarus* species.

Progress (%): Physical: 90% Financial:

Externally funded projects

Survey of shark fisheries & National Plan of Action (NPOA) for conservation and management of shark resources under the BOBLME project

One year survey on sharks was conducted to prepare the Sri Lanka NPOA for sharks. This survey included to collect information on shark landings, specifically with regard to species, size composition, weight and value of catches, fishing methods, fishing areas, etc. This survey was in progress since November, 2012 at the major shark landing sites namely Negombo, Beruwala, Galle, Mirissa, Tangalle, Valaichchenai and Trincomalee. Data were collected by nine field samplers and five Research Assistants under the supervision of the Scientists of MBRD. Biological data specifically length, weight, and sex were also collected. In addition, economic data, trade data and data about shark products were also collected. MBRD PELAGOS database was upgraded with the technical support of IOTC so that enabling to enter shark species wise data. Awareness materials including leaflets and a shark poster were also prepared under this project.

The contribution of sharks to the total large pelagic fish production clearly indicates a gradual decline with time. Although the contribution of sharks had accounted more than 45% of the total large pelagic fish production until mid 70's, it has become less than 5 % over the last five year period. The silky shark (*Carcharhinus falciformis*) is the dominant species in shark landings in Sri Lanka followed by the blue shark (*Prionace glauca*). Sharks are utilized as fresh fish and dry fish for local consumption while fins and skin are used for export. Shark fins are mostly exported to Hong Kong, Korea, The Maldives, Singapore, United States and Taiwan. The silky shark, oceanic white-tip shark and blue shark are the species that are mainly used for extraction of fins. Fins are dried and exported without much processing or value addition. As per the survey, the price of shark fins has declined drastically as shark fin exports have reduced due to international initiatives that discourage the global shark fin trade. The study revealed that total shark fin exports in 2012 amounted to 82,544 kg. Only 5520 kg has been exported in the first half of 2013. Dried skin is exported to China to make shoes and belts while shark jaws, teeth and skin are exported to Maldives. Shark liver oil is extracted from spiny dogfish sharks and it is exported mainly to Japan.

However, due to the low scale of production and the lack of appropriate technology, production of shark oil in Sri Lanka has not developed as a commercial industry. The preparation work of NPOA for sharks has almost been completed and shark survey results were incorporated for preparing it.

Progress (%): Physical: 95% Financial:

Study the stock structure, some biological aspects, distribution and the abundance of Indian Mackerel in the coastal waters around Sri Lanka under the BOBLME project

The biological studies of *Rastrelliger kanagurta* (Indian mackerel) were mainly focused on reproductive biology and feeding ecology studies with the objective of providing scientific advice for fisheries management in order to enable sustainable exploitation of the species with respect to biological characteristics.

Individuals of *Rastrelliger kanagurta* obtained from Sri Lankan waters were analyzed for the reproductive biology where freshly caught samples were transported to the laboratory in ice and individual fish were examined for Total length (cm), Fork length (cm), Standard length (cm), total weight (g), gonad and gut weight, fecundity and maturity stage (immature, maturing, ripe and spent). Maturity stages were recorded based on the macroscopic observations of the gonads. Fecundity was estimated using the gravimetric method.

Stomach contents of freshly caught Mackerel samples were analyzed to study the variations in food intake. The frequency of occurrence of food items were calculated according to the equation of $F_i = 100 * N_i / N$ where F_i is the frequency of occurrence of the i food item in the sample; N_i = number of stomach in which the i^{th} item was found and N = total number of stomachs with food examined. The present data concluded that more than 90% of the total examined fish has taken adult copepods as their food source followed by fish eggs.

Samples for the stock structure analysis were taken from ten different locations around Sri Lanka (Negombo, Chilaw, Kalpitiya, Mannar, Jaffna, Trincomalee,

Batticaloa, Hambanthota, Galle and Beruwela). The DNA of these samples have been extracted and quantified. The microsatellite analysis for these samples from the different locations will be carried out in 2014.



Progress (%): Physical: 80% Financial:

East coast fishery resources survey

The fisheries sector plays an indispensable role in the economy of Sri Lanka contributing around 1.2% to the GDP. Fish products are an important source of animal protein, providing around 70% of the animal protein consumed in the country (Food Balance Sheet, Department of Census and Statistics). The sector provides direct and indirect employment to around 650,000 people and is directly linked with the lives of approximately 50% of the population who resides in the coastal belt. Fisheries sector contribution to the total export earnings of the country is around 2.5%. The fisheries sector has a significant scope for increasing the contribution to the national economy, exploiting the huge untapped potential.

Fishing industry in the Northern and Eastern provinces, which was hampered to a greater extent during the past two decades owing to the ethnic conflict is expected to revive with the dawn of peace. The Northern and Eastern provinces which accounts for around 60% of the coastline of the island have a huge unexploited potential. The damaged infrastructure and facilities as well as the curtailment of fishing activities on security grounds has resulted in a considerable fall in production from these parts during the past two decades. With the opening up of seas around the Northern and Eastern parts, the country expects a rapid boost in the fishing and allied activities and hence the increase in contribution to the GDP.

The east coast pilot survey on marine fishery sector was started in July 2013 as a supporting study to the Fish stock assessment survey, which was proposed to be completed during 2014 with the support of the Norwegian Research vessel Fridtjof Nansen. Apart from this survey no any other comprehensive study has been carried out in the area after the dawn of peace.

Information on landing site, location, craft & gear types, fishing population (Migratory & resident), fishing season, fishing species found and facilities available, were collected by interviewing the fishing community, officers of the fisheries organizations and the DOFAR officers.

However, after finishing the civil war the fisheries sector of the area started to bloom. Fishing community has access to many new craft, gears, and technologies and they started fishing in the deep sea. The survey was started from Okanda in the Ampara district and all the landing sites harbors and the anchorages in the east coast were covered. The numbers of multiday boats are very limited in the area because of the lack of anchorage facilities and harbors in Vallachcheni. Over 90 % of the fishermen are using traditional small canoes and FRP boats. In the Ampara district and the Baticaloa district majority of the fishing population are Muslims and they don't spend more than six days in the sea at a time due to religious reasons. So the catch is comparatively lower than the other part of the country.

Still beach seine are playing an important role in the coastal fisheries sector. The former beach seine wadies were invaded by the locals and the original owners did not come to some places. Some former owners and migratory fishermen came to the fishing sites, were threatened by the villagers and they don't receive any facility from the residents. Many of the beach seine wadies and fish landing sites were invaded by the large scale tourism based projects set at the coast.

The east coast fishermen are having a less income because of the poor economy of the area and lack of facilities such as ice and storage facilities. Most of the beach seine catch are used to make dry fish during the dry season. The majority of the product cannot be send to the demanded far areas due to these reasons.

Data are analysis and further data collection is in progress for the completion of the final report.

Other activities undertaken

1. Examined and provided reports on fish samples sent by various high courts for blast fishing.
2. Examined and provided a report on identification of a meet sample sent by the magistrate courts of Kilinochchi.
3. Examined and provided a report on identification of a sea urchin sample sent by the Ceylon foods exports Pvt. Ltd.
4. Examined and provided a report on bioluminescence of *Amblygaster sirm* sent by the Public Health Inspector of Ratnapura.
5. Examined and provided a report on the identification of sea turtle eggs.
6. Serving as a member of the National Committee on Agricultural Biotechnology under the CARP since May 2013.
7. External Supervision (B.Sc): On a request made by the academic Head, fisheries and marine science division, Ocean University of Sri Lanka, an undergraduate student was supervised for her final year research project.
8. Lectures were conducted on the importance of biodiversity and coral reefs for coast guard, Sri Lanka.
9. Participated as a resource person for postgraduate diploma in Defence management and public.
10. Three consultative workshops were organized by MBRD in June, 2013 with Department of Fisheries and Aquatic Resources (DFAR) under the financial support of BOBLME project and workshops were held at Negombo, Beruwala and Mirissawith the participation of relevant stakeholders for preparing the Sri Lanka National Plan of Actions for conservation and management of sharks.
11. A national workshop was organized by MBRD in December, 2013 with DFAR under the financial support of BOBLME project for adopting the NPOA for sharks.

12. Scientists of MBRD Supervised the following students of Uva Wellassa University for carrying out their final year research projects (2013)
 - Mr. Kuliypitiya K.B.N.P.M., Faculty of Animal Science and export Agriculture, for his research on “Studying the fishery and Biology of Indian scad (*Decapterus sp*) in the EEZ of Sri Lanka”.
 - Ms. Dissanayake D.M.I.M., Faculty of Animal Science and export Agriculture, for her research on “An analysis of recent trends of small meshed gillnet fishery in West coast of Sri Lanka”.
 - Mr. Kiyas N.M., Faculty of Animal Science and export Agriculture, for his research on “Molecular Identification of scad fish (*Decapterus sp*)”.
13. Reviewed a scientific paper on “Factors determining the catch per unit effort of *Aristeus antennatus* from the Barcelona (NW Mediterranean) trawl fleet” submitted to Fisheries Research (an international journal) for possible publication (2013).
14. Reviewed a scientific paper on “An update of diversity of crab and species composition in Navanthurai coastal area, Jaffna Sri Lanka” submitted to the 25th Annual Congress of PGIA (Postgraduate Institute of Agriculture)-2013. University of Peradeniya, Sri Lanka.

Publications

1. Herath, H.L.N.S. and R. Maldeniya 2013. Status of shark fishery in Sri Lanka. IOTC-2013-WPEB09-18 Ninth Session of the Indian Ocean Tuna Commission (IOTC) working party on Ecosystem and Bycatch
2. Herath, H.L.N.S. and R. Maldeniya 2013. A review on billfish fishery in Sri Lanka. IOTC-2013-WPB11-16 Ninth Session of the Indian Ocean Tuna Commission (IOTC) working party on Ecosystem and Bycatch
3. Maldeniya, R., L. Perera, P. Premawardane and M. Anupam 2013. Fisheries data collection and reporting system in Sri Lanka. IOTC-2013-WPDCS-09-16.
4. Hewapathirana, H.P.K. and R. Maldeniya 2013. Sri Lanka National Report to the Scientific Committee of the Indian Ocean Tuna Commission, IOTC-2013-SC16-NR25.
5. Haputhantri, S.S.K. and Bandaranayake, K.H.K. 2013. Analysis of Kawakawa (*Euthynnus affinis*) landings in Sri Lanka and estimation of the length-weight and length-length relationships. WPNT-03. Third Session of the Indian Ocean Tuna Commission (IOTC) Neritic Tuna Working Party.

6. Perera H.A.C.C., Haputhantri S.S.K. and Bandaranayake, K.H.K. 2013. A review on oceanic tuna fishery in Sri Lanka and estimation of the length-weight relationships for yellowfin tuna and bigeye tuna. IOTC-2013-WPTT 15-16 Fifteen Session of the Indian Ocean Tuna Commission (IOTC) Tropical Tuna Working Party.
7. Herath D.R. and Ranmadugala D.N.A. Establishment of a molecular method for identification of marine turtles of Sri Lanka. Proceedings of the National Aquatic Resources Research and Development Agency (NARA) scientific sessions, 29th November, 2013, pp.27
8. Ranmadugala D.N.A., Haputhantri S.S.K. and Kiyaz, M. Morphological and molecular identification of *Decapterus* sp. (scads) in Sri Lanka. Proceedings of the National Aquatic Resources Research and Development Agency (NARA) scientific sessions, 29th November, 2013, pp.25-26
9. Bandaranayake, K.H.K., H.A.C.C. Perera and S.S.K. Haputhantri. A study on some aspects of reproductive biology and morphometrics of Indian mackerel (*Rastrelliger kanagurta*) in Sri Lankan waters. Proceedings of the National Aquatic Resources Research and Development Agency (NARA) scientific sessions, 29th November, 2013, pp.5
10. Hirimuthugoda. N.Y, Liyanage, U and Jayathilaka. A (2013). Present status of lobster fishery industry in Annual Scientific sessions, faculty of Agriculture, University of Ruhuna Matara, Sri Lanka.
11. U.S.P.K. Liyanage, S.P. Jayasuriya (2012) Assessment of the South coast spiny lobster stock: a case study. Presented at annual scientific session, NARA, Colombo 15.

Communications

1. Media presentation on the impact of building the Colombo -Katunayake Highway on lagoon shrimps in the Madabokka.
2. Media presentation on Environmental issues and fisheries impact on the biodiversity in the Bar- reef.
3. Media presentation on marine mammals broadcasted by the Sri Lanka Broadcasting Cooperation (SLBC).

Trainings/workshops/Meetings attended

1. BOBLME Indian mackerel genetics harmonization training workshop. 20-27 August 2013. Kochi, India.
2. Coordinating workshop for Biotech stakeholders. Organized by COSTI and NSF. 21st November 2013. Colombo.
3. IOTC Workshop on Management Options and the 2nd meeting of the Technical Committee on Allocation Criteria (TCAC) held in Oman from 16-20, February, 2013.
4. Bay of Bengal Large Marine Ecosystem (BOBLME) project annual regional work plan development meeting held in Phuket, Thailand on 27th – 28th February, 2013.
5. Bay of Bengal Large Marine Ecosystem (BOBLME) project and Indian Ocean Tuna Commission (IOTC) jointly organized advance stock assessment training workshop held in Bangkok, Thailand on 19th – 25th May, 2013.
6. Inception workshop for MFF regional project of living resources of the Gulf of Mannar: Assessment of key species and habitats for enhancing awareness and for conservation policy formulation held in New Delhi, India on 30 - 31 May 2013.
7. Third Session of the Indian Ocean Tuna Commission (IOTC) Working Party on Neritic Tunas (WPNT 03) held in Bali, Indonesia, from 2 to 5 July 2013.
8. Fish Stock Assessment Training Workshop. Organized by Bay of Bengal Large Marine Ecosystem Project and Indian Ocean Tuna Commission. 20-24 May 2013 Bangkok Thailand.

5.6 NATIONAL INSTITUTE OF OCEANOGRAPHY AND MARINE SCIENCES

Head of the Division: Dr.K.Arulananthan(01.01.2013 – 08.05.2013)
Mr.J.K.rajapakshe(13.05.2013-04.06.2013)
Dr.H.B.jayasiri(05.06.2013-08.12.2013)
Dr. T.K.D. Tennakoon(09.12.2013-31.12.2013)

Progress of research projects

Six research projects were carried out during the year 2013. Progress of the each project has given below separately.

1.7 Improvement of the existing tuna forecasting system of NARA incorporating data from satellites and in-situ ocean observation

Allocated amount : Rs. 1000000
Responsible Officer : J.K. Rajapaksha

Weekly fish forecast were generated using satellite derived oceanographic status incorporating fishery data collected. The forecast information was disseminated to major fishery harbors by FAX. The information also distributed via email for registered users. Fish forecast was hampered during the last two months due to computer failure and a request has been made to the purchasing division to purchase new computers urgently. Temperature depth recorders (TDR) data on long-line were collected. Logbooks were printed (nos.500) and distributed and fishery data were collected from those logbooks. A methodology has developed to predict hooking depth for tuna long-liners and will be complimented in 2014 to improve the fishing efficiency of predicted fishing grounds.

5.1 Observation of oceanographic conditions for ocean based disaster early warning – Operation of Ocean Observation Centre

Allocated amount Rs. 8000000

Responsible Officer: K.Arulananthan

The ocean observation Centre (OOC) was established to develop and implement and observing system for monitoring the real time and near Real Time Ocean conditions around Sri Lanka Waters. Main goal is 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. Since its establishment, centre is operational on 24 hrs, 7 days basis and monitoring and gathering real time and near real time ocean physical environmental data around Sri Lanka waters from reliable sources. Data are analyzed and synthesized to generate new information and information products are being designed to meet the need of scientific community. The data, which are intended for use in oceanographic and other interdisciplinary scientific research, is freely available in OOC database. Products include coastal sea level, sea surface topography, ocean wind, sea surface temperature, salinity and temperature profiles, chlorophyll, wave climate, and deep ocean pressure data. In addition, OOC has been monitoring and collecting earthquake data for tsunami early warning and for statistics.

With respect to ocean based disasters, the centre collaborates with the Ministry of Fisheries and Aquatic Resources, Disaster Management Centre (DMC) and the Department of Meteorology to provide the necessary technical information and guidance for early warning and mitigation of impacts from natural ocean disasters. Centre is also maintaining a physical ocean environmental database for future needs. Awareness programs were conducted out to aware the OOC activities especially ocean based disasters for three forces and school children etc.

5.2 Bio-geochemical studies of Periya Kalapu lagoon

Allocated amount Rs. 400000

Responsible Officer: Akila Harishchandra

Bio-geochemical parameters were monitored in the lagoon. The water in lagoons can vary in salinity from brackish (owing to dilution of seawater by freshwater) to hyper saline (i.e. more salty than seawater as a result of evaporation). The plant and animal communities of lagoons vary according to the physical characteristics and salinity regime of the lagoon, and consequently there are significant differences between sites. Although, compared to other marine habitats, there is usually only a limited range of species present, they are especially adapted to the varying salinity regimes of lagoons and some are unique to lagoon habitats.

In the absence of a outfall in the lagoon fresh water lake or a reservoir, short residence time suggest that water quality will be determined by inflow quality and long residence time suggest that water quality will be determined by quality of inflow surface and bottom input, and or from physical and biological activity. Periyakalapuwa is a freshwater reservoir with an absence of an outfall. So water quality of this ecosystem is determined by quality of inflow surface and bottom input, and or from physical and biological activity. Average chlorophyll concentration of 45 ug/l is very higher than water quality threshold of 10 ug/l associated with eutrophic condition. This chlorophyll a concentration is consistent with Carlson's TSI value of 68, which is indicative of a eutrophic state. It describes the low transparency and high phytoplankton biomass in the lagoon. Mean Secchi depth of the lagoon is 0.5 m and this value is corresponds to Carlson's TSI value of 69, which is in the eutrophic range (50-70). Results show that the content of chlorophyll a in Periya kalapu was quite high.

Observations

- Favourable water quality for higher productivity.
- Higher hydrological residence time and poor flushing rate.
- Possibilities of algal bloom and fish kill during the peak dry seasons.

Recommendation

- Maintain the status quo of the lagoon – i.e. as a freshwater lake except for the limited seawater inflow during the opening of the mouth to release the flood water.
- Develop strategies for management of agricultural runoff.

5.3 Study on environmental impacts on harmful algal blooms and coral Community

Allocated budget: Rs 1,000,000

Officer Responsible: W.N.C.Priyadarshani and Akila Harischandra

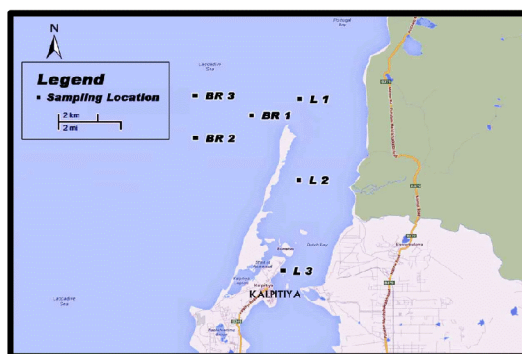


Fig 01. Sampling sites



Fig. 02. Deployment of mooring for SPATT resin

The project was proposed to carry out for 2 years (2013-2014) and focused on harmful algal bloom monitoring with microscopic identification and biotoxin extractions for six sites (Fig 01). During the year 2013, field activities carried out for 10 months and samples were collected for nutrients (nitrate, nitrite, phosphate and silicate), plankton (phytoplankton and zooplankton) chlorophyll a and total suspended solids. On board observations were done for salinity, temperature, pH and dissolved oxygen. Meantime, SPATT resin deployment (Fig 02) which is absorbed the harmful algal chemicals of the surrounding environment, were carried out at two sampling sites; Bar reef and inside the Puttalam lagoon. Recovered resin packages were sent to NIO, Goa, India for further analysis and this was funded by POGO regional program for HABs monitoring. Laboratory works were completed for nutrients and other chemical parameters while waiting biotoxin results from Goa. Phytoplankton analysis

and computation is still in progress and final report will be released in end of January. Two students from Uva Wellassa University and Ocean University were trained under this project.

5.4 Sea level station operation and ocean data base management

Allocated budget: Rs 600000

Officer Responsible: R. Jayathilaka

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. Real time sea level data are collected from established tide stations from Trincomalie, Hambantota and Colombo. Data are analyzed and predicted for year 2014. Weekly tide information 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.

5.5. Geological and geophysical mapping of marine protected areas

Allocated budget: Rs. 400000

Officer Responsible: Amali

Feasibility study was carried out for preliminary assessment of Kapparatota for boat anchorage.

- It is not advisable to set up a landing site at the mouth of Polwatta Modera River as folding and monsoonal conditions may cause heavy damage.
- Bottom erosion conditions of the bay due to bottom turbulence need to be studied to give explanation for outsource generation of sediment.
- Supplementary number of sediment samples from both the erosional and accretional beaches must be collected to get high resolution seamless sediment information.

Sand deposits have been investigated off Negombo for exploration purposes.

7.4 Seasonal variability of coastal and oceanic processes around Sri Lanka

Allocated budget: Rs.1500000

Officer Responsible: S.U.P. Jinadasa, H.B jayasiri, K.Arulananthan

The aim of this project is to collect oceanographic data around Sri Lanka. Two surface drifters donated by Laboratoire d'Etudes en Géophysique et Océanographie Spatiale (LEGOS), France were released to the ocean (50 km off Trincomalee) during May 2013. The equipment measures the water movements by tracing the path of a water particle over a long time interval (Lagrangian current). They also monitor continuously SST (sea surface temperature) and sea surface salinity along their trajectory. The buoy utilizes the dependable bi-directional iridium satellite system to communicate and transmit essential data. These oceanographic data can be used to study the climate change and other oceanographic applications such as fishery forecasting.

Four ARGO floats also are donated by same institute and released to the ocean during June. These instruments give vertical profiles of salinity and temperature with depth. Another 15 drifters were donated by University of Notre Dame, USA. Three drifters were released during July by a NAVY vessel and 3 were released by the RV “Dr. Fridtjof Nansen. Another three were released by r/V Rogger Revelle.

R/V “Dr. Fridtjof Nansen

Dr. K. Arulananthan, Mr. Priyantha, Ms Priyadarshanie, Mr. KW Indika were participated the research cruise of RV “Dr. Fridtjof Nansen from 22 October- 03 November.

R/V Roger Revelle

Officers of NIOMS participated and trained on sampling and data collection for fisheries, plankton and salinity and temperature. Following officers were participated in these cruises.

Leg	Participants	Period
Leg 1	S.U.P Jinadasa, U.Adikari, K.W. Indika	Nov 10-27
Leg 2	Akila Harischandra	Nov 27-Dec 13
Leg 3	K.Arulanantha, H.B Jayasiri, S.U.P Jinadasa, W.N.C Priyadarshanie	Dec 17-25

Postgraduates

- H.B Jayasiri completed his Ph.D at Central Institute Fisheries Education, Mumbai, India under the CARP scholarship.
- Ruchira Jayatilaka left the country to attend the M.Sc. in Netherland.

Foreign trainings/ Conferences/Seminar

SNO	Name	Training	Country	Duration
1	R. Jayathilaka	Inundation mapping	Thailand	August
2	A.Harshchandra	Air- sea interaction	China	August
	U.Adikari	Technical Training For Oceanographic Instruments, University Of Notre Dame	USA	1 September - 3 October
3	W.N.C Priyadarshanie	Fourth WESTPAC Summer School on Monsoon Onset Monitoring and its Social & Ecosystem Impacts (MOMSEI)	Malaysia	19-23 August
4	T.K.D. Tennakoon		Thailand	December
	S.U.P Jinadasa	Ph.D training	USA	26 March-20 July

Local trainings/ Conferences/Seminar

SNO	Name	Training	Duration
1	H.B Jayasiri, S.U.P Jinadasa	National Training on Forecast Interpretation, Translation, Communication and Application	9- 11 October
2	H.B Jayasiri	8 th Monsoon forum, Meteorological Dept	6 th December
3	W.N.C	Scientific writing residential	11-14

	Priyadarshanie	workshop, Tamarind Tree hotel, Minuwangoda organized by SLAFAR and BOBLME	September
4	W. Prabavi	Advanced GIS short course, PGIS	-

Publications

Ph.D. Thesis

- Assessment of persistent organic pollutants in plastic debris and sediment in Mumbai beaches, India, Central Institute of Fisheries Education, Mumbai, India. March, 2013.

Full papers

1. H. B. Jayasiri, C. S. Purushothaman and A. Vennila. (2013). Quantitative analysis of plastic debris on recreational beaches in Mumbai, India. *Marine Pollution Bulletin*, 77(1-2), 107-112.
<http://dx.doi.org/10.1016/j.marpolbul.2013.10.024>.
2. H. B. Jayasiri, C. S. Purushothaman and A. Vennila. (2013) Spatial and temporal variability of metals in inter-tidal beach sediment of Mumbai, India. *Environmental Monitoring and Assessment*, 10.1007/s10661-013-3441-7. Online publication date: 25-Sep-2013.
3. H. B. Jayasiri, C. S. Purushothaman and A. Vennila. (2013) Plastic litter accumulation on high-water strandline of urban beaches in Mumbai, India. *Environmental Monitoring and Assessment* 185:9, 7709-7719.
4. J.K Rajapaksha, L.Samarakoon and A.A.J.K Gunathilaka, 2013. Environmental preferences of Yellowfin Tuna in the north East Indian Ocean: An application of satellite data of longline catches: *International journal of Fisheries and aquatic science*, 2(4):72-80.
5. A.A.D. Amaratunga, S.U.P. Jinadasa and S.A.M. Azmy, (2013), Sedimentary characteristics and status of water quality in Polwatta River and Weligama bay in Sri Lanka, *Journal of Environmental professional Sri Lanka*, Vol.2, p 38-51.
6. S.U.P. Jinadasa, I.D. Lozovatsky and H.J.S. Fernando (2013), Small scale and lateral intermittency of oceanic microstructure in the pycnocline, *Physica Scripta*, doi: 10.1088/0031-8949/2013/T155/014035.

Abstracts

1. M. I. U. Mendis, H. B. Jayasiri and M. F. M. Fairoz. A preliminary study on abundance and composition of plankton in Kalpitiya Bar Reef, Sri Lanka. NARA Scientific Sessions, 29, November, 2013. NARA auditorium, Colombo 15.
2. Jayasiri, H. B., Purushothaman, C. S., Vennila, A. Contamination of polychlorinated biphenyls (PCBs) and organochlorine pesticides (OCPs) in inter-tidal sediment of Mumbai coast, India, August, 2013. First National Symposium on Marine Environment. 27-28, Induruwa Beach Resort, Bentota, Sri Lanka.
3. A.Harishchandra and K. Arulananthan. Seasonal variability of the mixed layer depth in the Bay of Bengal. NARA Scientific Sessions, 29, November, 2013. NARA auditorium, Colombo 15.
4. W.N.C.Priyadarshani and K. Arulananthan, 2013.Seasonal changes in physico-chemical characteristics and plankton population at Trincomalee Bay and adjacent Sea, East Coast Sri Lanka. Proceedings of first National Symposium on Marine Environment at Induruwa Beach Resort, 27-28 August, 2013.
5. W.N.C.Priyadarshani and M.W.Lomas , 2013. Variability of phytoplankton in relation to Carbon flux in the Bermuda Time Series –Study Site. NARA Scientific Sessions, 2013. 29th November 2013. NARA, Colombo 15.
6. J.S.Madushanka, N.P.P. Liyanage, G.G.N Thushari and W.N.C. Priyadarshani,Impact of nutrient availability on photoplankton during southwest monsoon at bar reef marine sanctuary, sri lanka.2013.NARA Scientific sessions,2013,29th November 2013.NARA, Colombo 15.
7. S.U.P. Jinadasa, L. Centurioni, K.P.P. Patirana, I.D. Lozovatsky and H.J.S. Fernando (2013) Uses of surface drifter trajectory to investigate large scale eddy formation in the Bay of Bengal during summer monsoon, NARA scientific session, NARA, Colombo 15.
8. S.U.P. Jinadasa, K.P.P. Patirana, I.D. Lozovatsky and H.J.S. Fernando (2013), Defining bottom boundary layer structure in the East China Sea,NARA scientific session, NARA, Colombo 15.
9. S.U.P. Jinadasa (2013), Status of the dynamics in the Weligama bay, Sri Lanka,NARA scientific session, NARA, Colombo 15.
10. M. Rila M. Rila, G.G.N. Thushari N.P.P. Liyanage, A.J.M. Gunasekara, H.B. Jayasiri. 2013. Impact of cooling water discharge of coal power plant on marine phytoplankton in Norochcholai coast, Kalpitiya peninsula: A preliminary Study. NARA Scientific Sessions, 29, November, 2013. NARA auditorium, Colombo 15.

National Surveys

- H.B. Jayasiri and W.N.C Priyadarshanie participated the Port Biological Baseline Survey. 06-12 September, 2013 organized by Marine Environment Protection Authority.

Awareness programs

- Seven educational Presentations on Oceanographic Applications for Naval and Maritime Academy personals from Different Ranks.
- ‘ Widu Lowa’ Scientific program conducted by Sri Lanka Broadcasting Cooperation, October, 2013.

Workshops conducted

- Workshop on institutional cooperation contract (icc) for implementation of the Sri lanka – Norway bilateral project on the Sri Lankan fisheries and aquaculture sectors. Athurigiriya, 10-11 September.

Leaflets

- Oceanographic research and Sri Lanka, 2013.

Consultancy

- Report on Oceanographic data for feasibility study on proposed LNG project for Oriental Consultants Co., Ltd. Japan, Rs. 50,000.00.
- Report on marine condition information for feasibility study on proposed project of power plant for PENTA-OCEAN Construction Co., Ltd. Colombo Office, Rs 100, 000.00.

Supervised students

1. M. I. U. Mendis - Ocean University.
2. J.S.Madushanka - Uva Wellassa University.
3. H.M.G.T.B Senarathna - Ocean University.

5.7 INSTITUTE OF POST HARVEST TECHNOLOGY

Head of the division: Dr. Sujeewa Ariyawansa (01.01.2013 – 08.12.2013)

Dr. G.J.Ganegamaarachchi(09.12.2013-31.12.2013)

Overview of the Year

The Institute of Post Harvest Technology (IPHT) has implemented three research projects to fulfill the requirements of the trust area (reduction of post harvest losses and value addition) during the year 2013. In addition to the research programs the division offered some training programs to the stake holders to disseminate the Knowledge in the areas of quality management, fish handling and processing.

Several undergraduate/graduate students undertook implant trainings and research Programs under the supervision of the research staff.

The quality control laboratory of IPHT provides test service to the industry. Both microbiological and chemical analysis laboratories have been engaging with expanding the services as per ISO/IEC 17025(2005) quality certification. Chemistry laboratory was assessed (pre assessment) by Sri Lanka Accreditation board for granting of accreditation. 704 samples received from the export fishery industry were analyzed and 398 test reports were issued. In 2013 total earnings from the test service were Rs. 3411225.00.

Projects

Trust area	Project	Allocation (LKR)	Officer/s Responsible
	3.1 Assessment and certification of the quality of fish and fishery products available fish stalls in Sri Lanka	2.4Million	S. Ariyawansa P. Ginigaddarage
	3.2 Estimation of quality and quantity of fish oil extracted from Yellow fin tuna offal's generated in fish processing plants.	0.7 Million	S. Ariyaratne
	3.3 Utilization of economically important seaweed species	0.3 Million	P.S.Jaysinghe

3.1 Assessment and certification of the quality of fish and fishery products available fish stalls in Sri Lanka

Quality of fish sold in the Ceylon Fisheries Corporation stalls of Western province was assessed under this component. Quality parameters such as total plate count (TPC), pathogenic bacteria (*Salmonella* spp., *Staphylococcus aureus*, Coliforms, *E.coli*), histamine and total volatile base nitrogen were the parameters tested. 174 samples were collected from 38 stalls of Western province (out of 39 stalls). Status reports of stalls were handed over to the Ceylon Fisheries Corporation.

Results

When considering the microbial quality of samples, TPC was obtained in the range of 2.5×10^2 to 1.0×10^8 cfu/g. 45% of the samples had TPC $< 5.0 \times 10^5$ cfu/g and 15% of the samples contained $> 1.0 \times 10^7$ cfu/g of TPC. 31% of the samples contained $> 10^3$ MPN/g of total Coliforms and 5% of samples had $> 10^3$ MPN/g of faecal coliforms. 70% of the samples had *E.coli* content < 11 MPN/g and 2% of the samples contained $> 10^3$ MPN/g. *Salmonella* spp. was present in 16% of the samples and all the samples were negative for *Staphylococcus aureus*. TVB-N was obtained in the range of 15 – 800 mgN/100 g with 13% of samples containing > 35 mgN/100 g. Rest of the samples had TVB-N content < 35 mgN/100 g. 4% of the samples contained > 100 mg/kg of histamine and rest of the samples contained a histamine content of < 100 mg/kg.

Quality Control Programme at Peliyagoda Central Fish Market (PCFM)

Two research assistants were recruited to work in the PCMF and trained in the post harvest technology division of NARA. Samples that have been withdrawn by public health inspector (PHI) were analysed at IPHT and test reports were submitted to PHI for further action. Fish sellers who sold samples which were unfit for human consumption were penalized.

Progress :

Physical: 100%

Financial: %

3.2 Estimation of quality and quantity of fish oil extracted from Yellow fin tuna offal's generated in fish processing plants

Purchasing of chemicals and glassware were ended up in December of 2013. Collection of samples was done according to the plan. Several laboratory trials were conducted for extraction of fish oil according to Bligh & Dyer. However it could not be able to finish due to break down of centrifuge.

1. MOU was signed with a dry fish exporter in private sector to transfer the technology for the production of heavy salted Kattawa fish.

2. Development of salted mince product using Catla (*Catla catla*) fish mince

Project conducted with the assistance of university student and findings were presented at NARA Symposium 2013. It was possible to prepare a product with acceptable sensory properties by mixing fish with salt. Appearance and the texture of product is close to the soya bean curd available in the market.

3. Evaluation of nutritional value, trace metal and mince yield of scavenger fish

Project was conducted with the assistance of university student. Findings revealed the economic importance of fish as a food source due to presence of considerable amount of PUFA and DHA fatty acids. Abstract of the study was submitted for the IIFET-2014 Australia.

Progress : Physical: 100% Financial: %

Utilization of economically important seaweed species

This study was carried out to evaluate the antimicrobial and antioxidant activity of methanol extracts of seaweeds, with view to developing safer food preservatives. Five edible seaweeds and their extracts were collected from Matara, Trincomalee, Kllinochchi districts in Sri Lanka and evaluated for antioxidant activity and antimicrobial activity against food borne pathogens.

Six seaweed species were collected (*S. wighti*, *U. lactuca*, *U. eticulata*, *Gracilaria edulis*, *Gracilaria verucosa*, *Eucemmia cottani*, (alginic acid, carrageena)), and determined the antioxidant activity according to Prieto et.al.(1999), and DPPH radical scavenging activity according to the Biois method 1985, total flavonoid, phenolic according to the Folin-Ciocalteu method 1997 and antimicrobial activity according (Agar-Disc Diffusion method) to Bansemir et.al. 2006: kuda et.al.2007: Shanmughapriya et.al. 2008.

The total phenolic content of methanolic extract was 1.23mg GAE and 0.61 mg GAE, the total phenolic content and antioxidant activity was higher in *S. wighti* 1.54mg GAE. All these results indicated that flavonoids extracted from *S. wighti* and *U. lactuca* could be an important source of antioxidant molecules. The antibacterial activity of Methanol extract of four seaweeds against bacterial strains was presented in Table-1.

The zone of inhibition ranged between 1.23-8.8 mm. The maximum activity (8.8) mm was recorded by *G. edulis* against *S. aureus*. The minimum activity was recorded by *U. lactuca* against *E. coli*. In the present investigation show, higher activity was recorded from the red algae *G. edulis* followed by the brown algae *S. wighti*. Antimicrobial activity of the nine species of seaweeds belonging to brown, red and green algae revealed that red and brown seaweeds had greater antimicrobial activity than the green algae. Of the ten seaweed species *S. wighti* species showed antimicrobial activity against *S. aureus* which was the significantly ($P>0.05$) higher than the standard .antimicrobial agent, sodium benzoate (200 mg/ml).

The antibacterial activity of Methanol extract of four seaweeds against bacterial strains was presented in Table-1.

Seaweed Species	<i>S. aureus</i>	<i>V. cholerae</i>	<i>E. coli</i>	<i>Salmonella</i>
<i>U.lactuca</i>	0.0± 0.0	0.0±	1.23±	1.23±0.86
<i>S. wighti</i>	5.3± 0.21	4.46 ± 0.23	3.54 ±0.71	2.4±0.47
<i>G. edulis</i>	8.8± 0.21	5.46±0.35	2.32±0.42	2.3±0.73
<i>U. eticulata</i>	0.0 ± 0.30	0.0 ± 0.20	1.32±0.34	2.5±0.56

<i>S. flendinalis</i>	5.1 ± 0.02	5.43±0.32	3.2 ± 0.36	1.2±0.36
Alginate	2.36± 0.03	3.46 ± 0.56	5.4 ± 0.26	2.2±0.31
Agar	4.53 ± 0.02	2.35± 0.43	3.2±0.45	1.4±0.32
<i>Eucheammadacottani</i>	0.47± 1.23	4.56 ± 0.74	4.3±0.75	1.2±0.34

The inhibition growth of *S. aureus* by *S. w.* reveals that it can be used as an antimicrobial agent against *S. aureus* which causes vomiting diarrhea abdominal cramps and prostration and which also spoils raw meats poultry dairy products salad, shrimp and ham.

Discussion:

There was no inhibitory effect from *U.lactuca* extracts against *S. aureus* and *V. corella*

G. edulis and *S. wigiti* was only seaweed active against all the tested pathogens. This may be due to the active components which are present in plant extracts. However every plant extracts were unable to exhibit antibacterial activity against tested. Bacterial strains may have some kind of resistance mechanisms. Enzymatic inactivation, target sites modification and decrease intercellular during accumulation or the concentration of the used may not be sufficient. These seaweeds could be utilized effectively in product preparation for the beneficial of mankind. Further research studies are being carried out on the other species of seaweeds from the same habitats in order to provide completed.

Progress :

Physical: 100%

Financial: %

Training/Awareness programs conducted in 2013

Stake holders were trained on good handling practices of fish and processing of fish products.

Date / Dates	Institute	Training	Number of participants
21 st January 2013	Ceylon Fisheries Corporation	Quality Management of fish in supply chain.	130
21-22/05/2013	SGS Lanka (pvt) Ltd.	Quality Management during handling and processing of fish.	06
01-02/06/2013	Industrial Development Board	Awareness program for fisherman at Pothuvil on preparation of fish products.	50
06/06/2013	Ceylon Fisheries Corporation	Quality Management of fish in supply chain.	70

Other Activities of IPHT during 2013

- Fish based products were displayed in Dayata Kirula exhibition.
- Attended several meetings of divinaguma program, advisory committee meetings of export development board, National codex committee meetings, and National committee on post harvest technology and value addition etc.
- Involved in curriculum development of university of vocational technology
- Involved in organizing of the inception workshop of project Norway funded project

Scientists attached to IPHT were participated to Inception workshop from 11-13 September 2013.

Publications

1. **S. Ariyawansa, P. Ginigaddarage and K. Hettiarachchi.** 2013. An assessment of the effectiveness of cleaning and sanitation practices adopted by five fish processing establishments in Sri Lanka. 4th International symposium Sabaragamuwa University of Sri Lanka 11-12 January,.Pp 3.
2. **H.P.E. De Zoysa, P.H. Ginigaddarage, K.W.S. Ariyawansa and I. Wickramasinghe.** 2013. Sources of faecal contamination of fresh fish harvested by

multi-day boats. 4th International symposium Sabaragamuwa University of Sri Lanka 11-12 January, 2013. Pp 8.

3. **P.H. Ginigaddarage, K.W.S. Ariyawansa, M.Senavirathne, J.M.Chandrika, K.S. Hettiarachchi, S. Abhayarathne and G.P. Roshan.** 2013. Quality assessment of fish sold in retail markets of Western province, Sri Lanka. Annual scientific session of NARA.
4. S.S.G. Silva, **S. Ariyawansa**, S.B.N. Ahamed, K.A.P. Manamperi and C.V.L. Jayasinghe. 2013. Effect of legume flour extenders on keeping quality of Tilapia fish nuggets. Annual scientific session of NARA.
5. A.M.Gammanpila, S.P.S.D.Senadeera, M.P. Kumara and **K.W.S. Ariyawansa.** 2013. Preliminary quality evaluation of Maldivian fish: Comparison between Southern Sri Lanka and imported products. Annual scientific session of NARA.
6. **Sujeewa Ariyawansa** 2013. Utilization of fish waste in Sri Lanka: An overview. An International conference on utilization of waste/rest materials and by-products in the fish processing industry: opportunities and challenges. 9th-10th December 2013, Nha Trang Vietnam.
7. H.M.L.G.M.P. Herath, **P.H. Ginigaddarage, K.W.S. Ariyawansa** and R.G.S. Wijesekara. 2013. Microbiological Quality of Retail Fish of Ceylon Fisheries Corporation in Colombo District.
8. **B.K.K.K. Jinadasa**, E.M.R.K.B. Edirisinghe and I. Wickramasinghe, 2013. Total mercury content, length and weight relationship in Swordfish (*Xiphias gladius*), in Sri Lanka. Published international journal of food additives and contaminants (Taylor & Francis). <http://dx.doi.org/10.1080/19393210.2013.807521>
9. **B.K.K.K. Jinadasa** and E.M.R.K.B. Edirisinghe, 2013. Assessment of Heavy Metals (Cadmium, Lead and Total Mercury) in Tilapia sp. in Sri Lanka. Published international journal of food additives and contaminants (Taylor & Francis). <http://www.tandfonline.com/doi/abs/10.1080/19393210.2013.849761#.Ukm2XIZpm7g>
10. **Jinadasa B.K.K.K.**, Thayalan K., Subasinghe M.M., DE. Silva M.S.W., Wickramasinghe I. And D.N. Liyanage, 2013. Determination of trace metal concentration in inland fish species of North-Central province-Sri Lanka. Ceylon journal of science 42 (2): 39-47.
11. N.T. Warnakula, **D.S. Ariyaratne, B.K.K.K. Jinadasa**, M.R. Perera, N.P.P. Liyanage and M.K. Ranasinghe 2013. Development of a salted mince product using Catla (Catlacatla) fish mince, National Aquatic Resources Research &

Development Agency, scientific session, 2013 Nov. 29, Colombo, Sri Lanka; 54 pp.

12. C.K. Galhena, **B.K.K.K. Jinadasa**, **D.S. Ariyaratne**, N.P.P. Liyanage and S.B.N. Ahmad 2013. Effect of storage conditions on fresh yellowfin tuna (*Thunnusalbaca*res). National Colombo, Sri Lanka; 58 pp. Aquatic Resources Research & Development Agency, scientific session, 2013 Nov. 29,

Staff Trainings/ Workshops/ Conferences

1. Pavithra Ginigaddarage. Training on Seafood Quality Assurance from 14/01/2013 – 25/01/2013 at Central Institute of Fisheries Technology (CIFT), Cochin, Kerala, India.
2. Suseema Ariyaratne. Training on “Sea food processing: modern technology and new product development” held in Vigo (Spain) from 4th to 8th February 2013, jointly organized by CIHEAM, IAMZ and FAO
3. Sujeewa Ariyawansa, Suseema Ariyaratne, Pavithra Ginigaddarage, Manoja Seneviratne, Kumudu Hettiarachchi, Ruchita Perera, G.P.Roshan. Workshop on Seafood Quality and Safety, Norway from 11/11/2013 -15/11/2013.
4. Sujeewa Ariyawansa. An International conference on utilization of waste/rest materials and by-products in the fish processing industry: opportunities and challenges. From 9th to 10th December 2013, Nha Trang Vietnam.
5. M.H.S.K. Abhayaratna - Training on ISO/IEC 17025:2005 - Estimation on Uncertainty of Measurement 13.02.2013 - 14.02.2013.
6. Mr. G.P. Roshan - Training Programme on ISO / IEC 17025: 2005 Internal Auditing of Laboratory Management (SLAB) from 09.04.2013 - 10.04.2013.
7. Ms. M. Senaviratna, Ms. K. S. Hettiarachi and G.P Roshan- Training Programme on Food Hygiene 13.05.2013 - 14. 05.2013.
- 04 Ms. P. Ginigaddarage -Short course on sampling techniques, survey design and analysis 04.09.2013 - 06.09.2013.

5.8 SOCIO-ECONOMIC AND MARKETING RESEARCH DIVISION

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

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

Projects

1. Fisheries Industry Outlook 2012
2. Ornamental fish industry of Sri Lanka with special reference to Kalutagara District
3. Study on Market and its potential of seaweeds in Sri Lanka

Activities

Under the above 03 projects following activities were carried out by the research team of the division.

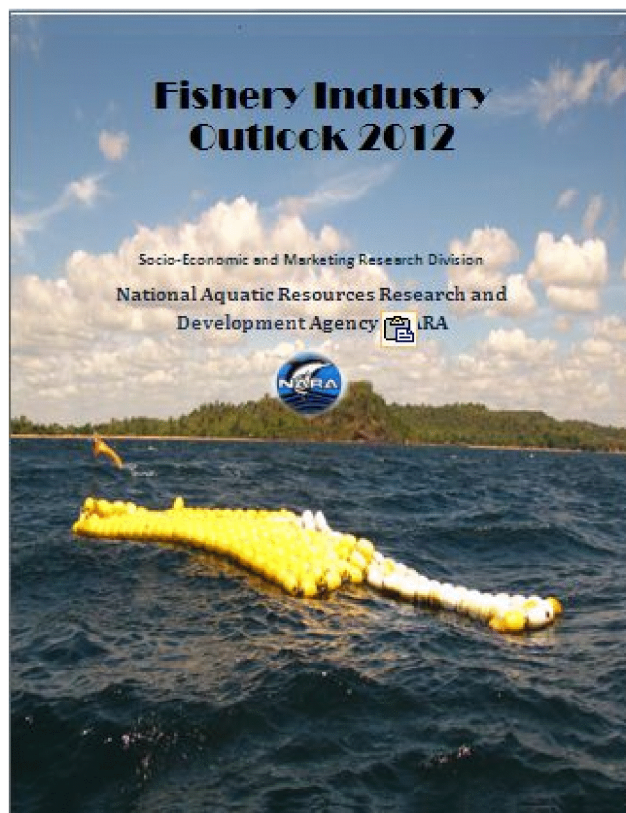
- Data collection
- Data analysis
- Report writing/annual publications

Program	Project	Allocation(Rs)	Responsible Officer	Duration
Socio-economic & Marketing	1. Fisheries Industry Outlook 2012 (6.4)	-	M. M. A. S Maheepala & K.H.M.L Amaralal	One year
	2. Ornamental fish industry of Sri Lanka with special reference to Kalutagara District (1.11)	300,000.00	H.D.Wimalasena & K.H.M.L. Amaralal	One year
	3. Study on Market and its potential of seaweeds in Sri Lanka (1.12)	600,000.00	M.M.A.S. Maheepala & K.H.M.L. Amaralal	One year

Progress

Project 6.4: Publication of Fisheries Industry Outlook- 2012

The publication of Fisheries Industry Outlook- 2012 has been completed and Published on the NARA website



Project 1.11: Ornamental fish industry of Sri Lanka with special reference to Kalutara District

The ornamental fish industry of Sri Lanka is one of the emerging areas which indicate unique potential for a rapid growth in generating self employment opportunities and substantial amount of export earnings. The main competitors of Sri Lanka in the export market for ornamental fish are predominantly from East Asian countries such as Singapore, Thailand, Malaysia and Indonesia and Japan while target markets are USA, UK, Germany, Italy, Canada and France.

A study was carried on the current status of ornamental fish industry in the Kalutara district from January to October 2013, with the aim of identifying socio-economic

aspects of the industry. Out of 183 ornamental fish breeders/growers who registered with the National Aquaculture Development Authority (NAQDA) 45 were interviewed to collect data and information.



Figure 1. A view of mud ponds

There were two types of growing methods practice in the Kalutara district. They were cement tanks and mud ponds. In terms of unit investment cost and variable cost, cement tanks are costly compared to mud ponds. But by means of production cement tanks show higher unit production than that of mud ponds.



Figure 2. Ornamental fish breeder

However, revenue and gross profit per surface square feet of a mud pond show better off situation. Moreover, economic indicators such as rate of return on the investment (ROI) and payback period (PBP) were more favorable for mud ponds. But economic indicators for cement tanks were above average compared to the other industries with similar amount of investment. Hence, cement tanks method is more suitable for small scale growers while mud ponds method for medium and large scale entrepreneurs.

Among the burning issues of breeders and growers lack of capital for expansion, high feed cost, lower producer price of fish and lack of supply of apparatus and equipment were ranked accordingly. It is essential to establish a mechanism to provide capital requirements to small and medium scale breeders and growers under the guarantee of Rural Fisher Organizations.

The high variable cost is the prime factor affects the long term sustainability of the industry in which feed cost incurs about 66 %. Therefore, innovations in local feed alternatives should be promoted by providing research grants to post graduate studies. The youth and women participation in the ornamental fish industry should be encouraged by adopting suitable policy measures. The price stability and increasing demand for ornamental fish is essential to safe guard new entrants to the industry. The popularization of aquarium hobby among Sri Lankans can create extra demand for ornamental fish other than export demand.

Project 1.12: Study on Market and its potential of seaweeds in Sri Lanka

There is a long history for Sri Lankan seaweed industry which is mainly based in the Trincomalee area. However it is rare to find market and economic studies carried out regarding seaweed industry in the country. Hence, this study fulfills the requirement of the information on the market and its potential. Data and information collected from 30 Seaweed collectors, 5 Intermediaries, 1 local whole sale distributor, 1 exporter, 1 retailer and a super market supplier. In addition, reports of Sri Lanka Customs were referred as a secondary data source to collect export import data. The seaweed season is from July to November in each year and around 150 to 200 people are engaged in collection of raw seaweed during the seaweed season. Around Rs: 30000.00 earned per collector during the seaweed season. Drying is the main technique of the process and that is done by the collector. A few quantities of seaweed that is used to distribute local market, washed and dried by the intermediaries as a processing method. According to the average export figures in last five years, around 90 Mt of seaweed has been exported and the main buyers were India and Japan. The seaweed industry of Sri Lanka mainly based on the wild collection, and therefore the production cannot be met the foreign demand and to maintain of continues supply. As a result of poor processing and storage system, quality of the seaweed is in a very poor condition. Since there is no any recorded statistics about the seaweed production,

it is important to record production data of seaweed. Compared to the products developed by other Asian countries, Sri Lankan seaweed products are still in the primary stage. Therefore it is suggested the product development and the promotion is essentially important to expand seaweed market in the country. More than 95% of the requirement of the world seaweed demand is fulfilled by cultured seaweed and the rest come from the wild collection. However, 100% Sri Lankan seaweed production come from wild collection. Therefore, culture of high valued seaweed species is vital factor to develop seaweed industry in Sri Lanka.



Figure 3. Seaweed collector



Figure 4. Raw seaweed for sale

Publications

Reports

- Ornamental fish industry in Sri Lanka with special reference to Kalutara district
- Abstract presentations

National

- M.M.A.S. Maheepala, Amaralal K.H.M.L. and Wimalasena H.D. (2013). **Some Insights into Sport Fishing Industry of Sri Lanka.** In proceedings of First National Symposium on Marine Environment, 27-28 August, Induruwa Beach Hotel, Induruwa, Sri Lanka.

Trainings

Local

- Mr. HD Wimalasena participated in workshop on “Revisiting Traditional Knowledge”, on 27th August, 2013, conducted by the National Science Foundation, Colombo, Sri Lanka
- Mr. H.D.Wimalasena and Mr. M.M.A.S. Maheepala participated in a training workshop on “Strategic Planning”, from 1st to 3rd July 2013 conducted by the Sri Lanka Institute of Development Administration, Colombo, Sri Lanka

Foreign

- Mr.M.M.A.S Maheepala participated in Regional training course on code of conduct for responsible fisheries from 19 January to 2 February 2013, Chennai, India.

Other activities

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

5.9 INFORMATION TECHNOLOGY DIVISION

Head of the Division: Mr. A.B.A.K. Gunaratne

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

Program	Project	Allocation (Rs)	Officer Responsible	Period	
				From	To
Promotion of Sustainable aquaculture and inland fisheries production	Identification of potential areas for shrimp farming and salt industry in Puttalam District	500,000.00	A.B.A.K. Gunaratne Dilhari Weragodatenna	2013	
Open access to knowledge and dissemination of information	Internet services and online information system	2,000,000.00	A.B.A.K. Gunaratne	2013	
	Production of NARA publication	600,000.00	A.B.A.K. Gunaratne	2013	
	NARA Scientific Session	100,000.00	A.B.A.K. Gunaratne	2013	

Progress

Project 4.12: Identification of potential areas for shrimp farming and salt industry in Puttalam District

Shrimp farming in North Western Province was rapidly expanded in 1980. Conversely, unsustainable practices and devastating outbreaks of diseases resulted in decline of shrimp production at the later stages. Apparently, 75% of the farms are not operating due to the losses incurred to farm owners. Better Management Practices (BMP) has been introduced by the NAQDA to craft the sustainable shrimp industry by identifying sites feasible for better management. The unplanned expansion of salt

pans has potential of negative impact on the important habitats of mangroves and salt marshes. NAQDA and North Western Province Provincial Council are in need of zonation and management plan for successful sustainable utilization of resources. Zoning of the area for shrimp farm, salt industry and protected area are therefore, very important in the environmental management perspective. Puttalam Lagoon and Mundel Lagoon in the Puttlam District have great potential to develop shrimp and the salt industry to provide income sources for rural people. However, some of the abandoned shrimp farms have been converted into salt ponds, generating potential user conflict among the shrimp farmers and salt producer for brackish water and land resources. Therefore the main objectives of this study were identification of most suitable areas for shrimp farming and salt industry, minimize user conflicts between different resource user groups, sustainable use of environmental resources, and protect the environment, while allowing the development process to continue in a planned manner.

Initially existing shrimp farms, abandoned shrimp farms and areas of saltern industry as well as land use pattern in the area were captured by Google earth images. Aerial photographs used to analyze the changes from 1956 to 2011. Ground truthing carried out further verification of areas of shrimp farms, salt industry, mangroves and salt marsh habitats. ENVI 4.8 and ArcMap10 softwares utilized for the data analysis.

Results

1. Change detection of shrimp farm and salt industry between 2009 and 2013 (Figure 1)
2. Current distribution of active shrimp ponds, abandoned shrimp ponds and saltpans (Figure 2)
3. Identification of suitable areas for shrimp farming and Salt Industry (Figure 3)

Figure 1: Change detection of shrimp farm and salt industry between 2009 and 2013

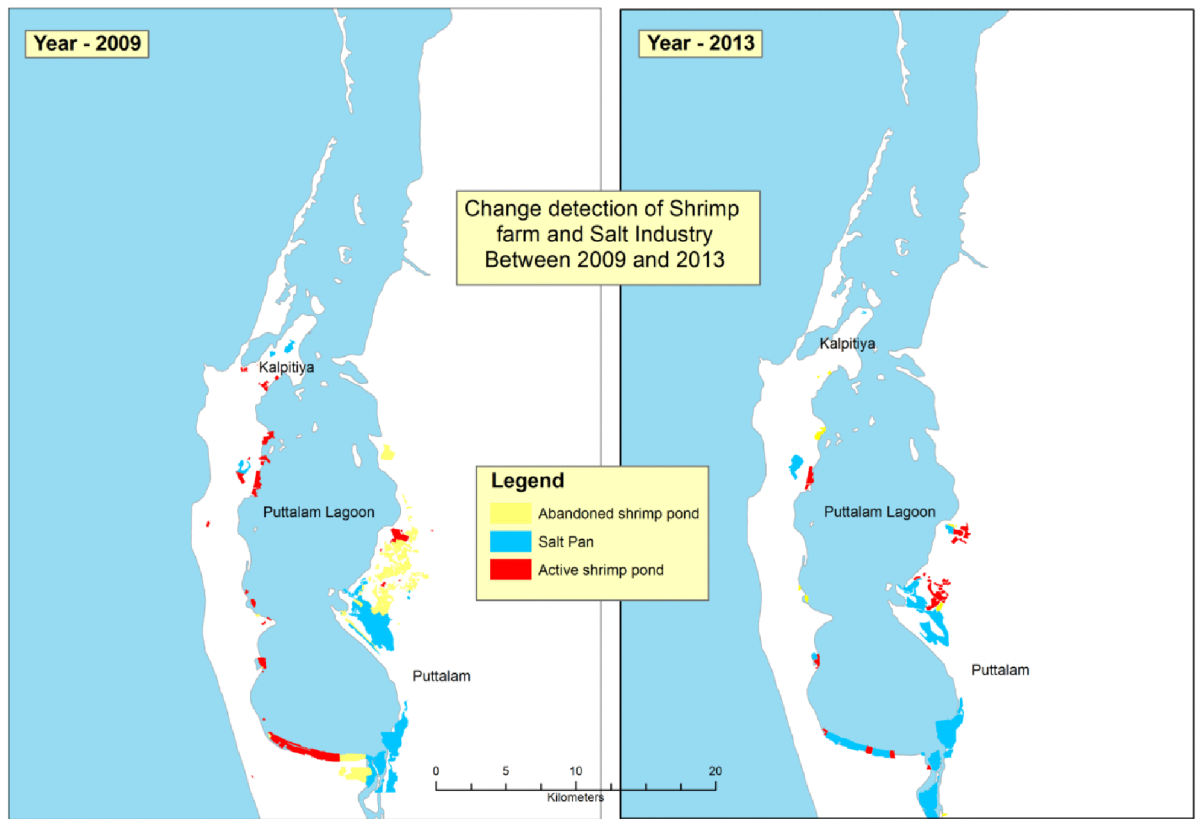
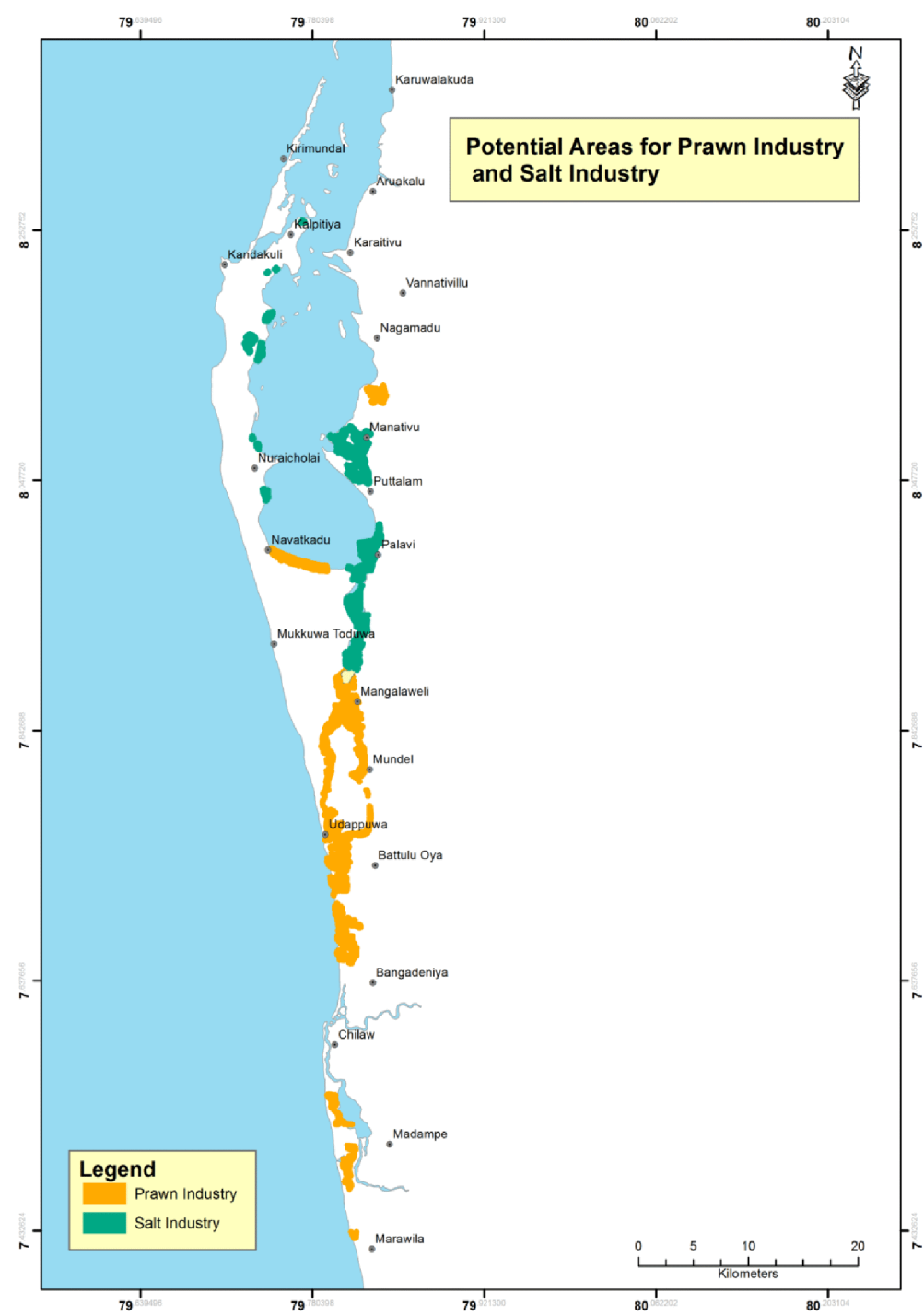


Figure 2: Current distribution of active shrimp ponds, abandoned shrimp ponds and salt pans



Figure 3: Identification of suitable areas for shrimp farming and Salt Industry



Progress (%) : Physical : 95% Financial: 90

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, 64 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 6.3: Extension

- Dayeta Kirulla Exhibition: The exhibition stall was designed setup at the Dayeta Kirulla Exhibition premises at Amapara
- Video documentary for Investors Forum - CHOGM: 10 minutes video documentary was produced to disseminate investment opportunities in the fields of aquaculture and fishing industry in the country.
- NARA Annual Scientific Session -2013: Scientific session was held on 29th November 2013. Main theme of the session was “Fisheries and Aquatic Resources Development for a Quality Life”. Number of 62 abstracts has been published under the several themes after the reviewing by a professional committee.

Publications

Abstract

- Dilhari Weragodatenna and Jayathilaka R.M.R.M, “Modeling of Tsunami inundation and hazard mitigation - A case study of Hambantota urban area”, 2013, proceeding of Journal of National Aquatic Resources Research and Development Agency Scientific Sessions, p 89

5.10 LIBRARY AND INFORMATION DIVISION

Head of the Division – B G Sunethra Kariyawasam

Overview of the subject

NARA Library is a special Library with collection of Fisheries and aquatic resources related information, and the main responsibility of the library and information division is to ensure the information needs of the Scientists of the Institute and users engaged in the study and research of aquatic resources, through collecting, disseminating and providing information needs via printed, electronic, statistics and social media to end users, motivating in their innovative research studies.

The online catalogue was updated, strengthening the collection by purchase of resource, donations, and downloads from the web and freely available e-resources. NARA Library at present giving better service to the scholars using modern Library facilities.

Activities undertaken

Project	Activities	Allocation	Office Responsible	Period(from-to)
1. Collection Development of Library Resources	1.1 Procurement of books and Journals	2.00	BGS Kariyawasam RS Liyanarachchi	Jan. - Dec
	1.2 Collecting Research Reports and Papers		BGS Kariyawasam	Jan. - Dec
	1.3 Obtaining Donation		-do-	
	1.4 E-downloads		BGS Kariyawasam RS Liyanarachchi	

2. Collection Management of the library	2.1 Editing and updating library catalogue 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 Service (SDI) 3.3 Indexing Services 3.4 Information Re-packaging 3.5 Exchange Service 3.6 Compilation of digital collection		BGS Kariyawasam RS Liyanarachchi BGS Kariyawasam BGS Kariyawasam RS Liyanarachchi -Do - BGS Kariyawasam	Monthl y Janu. – Dec
4. Publishing Journal & Publicity Service	4.1 Assisting for Publishing NARA journal vol. 40 4.2 Distribution of NARA publication 4.3 Publishing NARA Scientific Abstract 4.4 Sale of NARA Publications		BGS Kariyawasam BGS Kariyawasam RS Liyanarachchi BGS Kariyawasam RS Liyanarachchi	Janu. – Dec

Progress

Project 1.1 Acquisitions of Library Resources

Strengthened the Library resource by purchasing, donations, exchanges, and electronic downloads to Improve the scientists knowledge, as follows.

Collection Development

The following items were received by the Library.

1.1.1 Purchases:

Journal Titles:

1. ICES Journal of Marine Science
2. INFOFISH International
3. Journal of Aquatic Food Product Technology
4. National Geographic
5. Aquaculture
6. Asian Fisheries Science (Online)

Book Titles - 19 Nos.

Databases - 01 No. (AGORA)

1.1.2 Donations & Exchange :

Books – 69 nos., Reports – 24 n os. , Newsletters-34 nos., Travel Reports-25nos. CD-ROMs – 06 nos.

Progress (%)

Physical (100%)

Financial (75%)

Project 1.2 Resource Management

Library resource referral service was accessible to the scholars using Open Public Access Catalogue (OPAC). Journal Article Index (JAI) database were updated and NARA new arrivals were included to the NARA web.

Project 1.3 Information Retrieval

1.3.1 In order to retrieve from Journal articles, Postgraduate theses, Research Reports, Research articles and Newspaper clippings, were entered to 05 databases using Information Technology and were compiled indexes using WINISIS software. Summary of data entry for the year, given below.

Name of the Database	Quantity of Data
Journal Article Index (JAI)	4945
These Database	63
Research Reports Index	408
Research Article Index	329
Newspaper Article Index	779

1.3.2 Electronic Article database was compiled using GSDL software and entered 124 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 233nos.

1.3.4 Document Delivery Service - Library has joined for the British Council Membership program 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-coping during the year was Rs. 3123\=

Progress (%)	Physical (100%)	Financial (100%)
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Project 1.4 Library Management

As a preservation method the Ministry of Fisheries Administration Reports were scanned and added to the digital collection, 471 pages were added.

Progress (%)	Physical (75%)	Financial (- %)
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Project 1.5 Publications and Publicity Service

- 1.5.1 Sale of NARA publication were done by the library & the total amount received was Rs. 109,040.00/=
- 1.5.2 NARA journal Vol. 40 and NARA Scientific Abstracts were published & distributed.
- 1.5.3 Updated Library page providing the recent data in the institutional web page.

Project 1.6 Training Program, Workshops & Committee Meetings attended.

Local

- Workshop for Information Professionals organized by ITI
- 10th National Conference on Library & Information Science - Organized by SLLA
- Training Program on Total Quality Management and ISO 9001-2008 quality management systems for Libraries - Organized by SLSI
- National Institute of Library and Information Science Symposium 2013 - organized by NILIS
- NARA Annual Scientific Session 2013 – Presented a Poster “Blog on Fisheries and Aquatic Resources: application of social media to the NARA Library”

Progress (%)

Physical (75%)

Financial (75%)

5.11 EXTENSION DIVISION

Head of Division – L.K.G.T.Buddhika

Objectives of the extension service are

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

Project 6.2: Extension services

The unit carried out public awareness programs, providing auditorium facilities, NARA Media work, printing services for printing Posters, Leaflet report, forms etc. 18 Requests had been received from various institutions to take part their exhibitions. However, only 08 exhibitions could be attended due to financial constraints. 17 Educational visits (school, navy & government institution) consisting more than 1300 students & officers were noted during the year.

EDUCATION VISIT

Exhibitions

	Exhibition / School	Place	Period
1	Asoka college	Colombo	Jan 23 rd to 24 th , 2013
2	Deyatakirula	Ampara	March 24 th to 30 th , 2013
3	Ananda sastralaya	Matugama	April 03 rd to 07 th , 2013
4	Coast Conservation Department	Galle	June 05 th to 07 th , 2013
5	Yasodara Deevi College	Gampaha	June 06 th to 29 th , 2013
6	Future Mind – Nalandacollege	BMICH	June 21 st to 23 rd , 2013
7	Manner Exhibition for Cey-Nor	Manner	July 26 th to 29 th , 2013

8	Ministry of Minor Export Corp Promotion	Panadura	November 28 th to Dec 02 nd ,2013
9	S't Merys College	Matugama	Dec 26 th to 30 rd ,2013

Media Work

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

Staff Trainings

1. S.A.R.Rasanga – Certificate Course in Lalith Atulatmudali Vocational Training Center-Rathmalana from August 04th to December 04th, Course Fee 17750 LKR.
2. S.A.R.Rasanga – HRM, Training in CETRAC from March to April, Course Fee 5000 LKR.

Other Activities

1. NARA Scientific session was held on 28th November. Supported to Auditorium Facilities & Printing leaflets for the Session.
2. CHOGUM Summit Fisheries Exhibition was Held on 10th to 15th November. Supported to Extension work For the Exhibition.
3. Supported to Auditorium Facilities for workshops, Seminars in other Divisions.

Progress (%)

Physical (89%)

Financial (89%)

6. ANCILLARY SERVICES

6.1 PURCHASING & SUPPLY DIVISION

Head Of Division-Miss A.T.P.Kumari De Silva

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

Progress

1. According proper tender procedures Mainly purchase of ongoing projects,
 - Purchase of Lab Equipment & Chemical Items
 - 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 2013 & 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 imprest and maintain records.

For the year 2013,the division has maintained about 90 Tenders following the tender procedures.

2. 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.
3. 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.
4. Distribution of goods ordered by this Division to respective divisions after updating ledgers in the Main stores.
 - Maintain buffer stocks of consumables in the main stores for day to day requirements of divisions, issue of goods receipt notes, produce documents for payments, submit report to respective divisions when requested are also performed by this Division.
5. 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 C.H.T.Gamage (01.01.2013-28.02.2013)

Ms A.K.M.P Silva (01.03.2013-30.05.2013)

Mrs P.M.R Chandrasekara (01.06.2013-31.12.2013)

Over view of the Year

Service & Operation Division (S & O) is the supportive division of the institution .S & O division provide and maintain all the services and develop the infra-structure facilities in line with work programs of the institution.

Activities

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

1. Rehabilitation of NARA main building & other regional centers.
2. Maintenance & new installations of air conditioners & electronic appliances of the Institute.
3. Maintenance & new installations of electrical wiring of the institute.
4. Repair & maintenance of vehicles.

For the year 2013 below mentioned work has been completed and some activities are continuous.

01: Rehabilitation of main building & other regional research centers.

Some areas of the NARA main building were renovated.

1. Laid floor tiles for NHO Division
2. Laid floor tiles for Administration Division.
3. Partitioned the driver's rest room.
4. Cleaned the drainage lines of Administration & NHO divisions.
5. Repaired & maintained the labs.
6. Rehabilitated the NARA quarters.
7. Color washed the Front area of Main Building

Renovation works have been done for the other regional centers.

1. Rehabilitated the Panapitiya Aquatic Resources Center.
2. Repaired the circuit bungalow at Kalpitiya.

New Buildings

1. Ocen Observation & Tsunami Center at Beruwala

Infrastructure Facilities

1. Several activities was conducted to control Dendue Disease.

02: Maintenance & new installations of air conditioners & electronic appliances.

The identified ACs were repaired & some new ones were installed. The several electronic appliances belongs to the research divisions were repaired.

1. 3 Nos of ACs were repaired at Oceanography division.
2. New AC was installed for Server room.
3. Major AC was repaired at sea monitoring room.
4. 17-Ton AC of Auditorium was repaired.
5. New AC was installed for IPHT chemical lab.
6. 5/H.P submersible pump & blower were repaired.
7. Lab equipments of IPHT chemistry lab were repaired.
8. Biomedical freezer of P.C.R lab of IARAD was repaired & installed a power guard.
9. New TP bell line was installed for Rekawa R.R.C with fax & Internet.
10. Water pumps used for NARA were repaired.
11. New water pump was purchased for Kalpitiya R.R.C

03: Maintenance & new installation of electrical wirings.

1. The new power supplies were installed for the NARA main building.
2. 3PH power supply was installed for the canteen.
3. Driver's room was rewired & new electrical appliances were installed.
4. New power supply was installed for IPHT chemical lab.
5. 3PH power line was installed for IARAD lab.
6. New Electricity supply for Ocen Observation & Tsunami Center at Beruwala

The new power supplies installed for the other regional centers.

1. Power line was rehabilitated at Panapitiya R.R.C
2. New power line was installed for the fish market at Beruwala.

04: Rehabilitation of Vehicles (07 nos)

There are 26 vehicles & 14 Motor cycles in NARA fleet and 07 of them fleet taken for rehabilitation during the year. The vehicles under rehabilitation were.

Reg No. - PA-5935
32-7196
PA-5262
58-1012
PB-7365
251-0577
61-4803


Addition to above Rs.3,759,082.00 spent for services, running repairs, license and insurance of the fleet during the year. Out of 26 vehicles 04 vehicles identified for disposal due aged and uneconomical for further use. 22 vehicles & 14 Motor cycles effectively utilized for the running of 705,685 km during the year.



Cost for the Year Rs For NARA Fleet

a) Rehabilitation of vehicles (From Capital Budget)	3,277,830.24
b) Running repairs, Services cost Insurance & License fee (From recurrent Budget)	3,759,082.00
c) Vehicle Hiring charges	-
d) Fuel Cost	8,073,875.00
e) Total operated (km)	705,685.00

NATIONAL AQUATIC RESOURCES RESEARCH AND DEVELOPMENT AGENCY		
CONSOLIDATED CASH FLOW STATEMENT FOR THE YEAR ENDED 31 ST DECEMBER 2013		
	31.12.2013	31.12.2012
	RS.	Rs. cts.
CASH FLOWS FROM OPERATING ACTIVITIES		
SURPLUS (DEFICIT) FROM ORDINARY ACTIVITIES	-	(93,909,305.99)
ADJUSTMENT FOR:		
DEPRECIATION ON PROPERTY, PLANT AND EQUIPMENT	104,287,377.42	75,011,504.29
AMORTIZATION OF DEFERRED EXPENDITURE	(15,758,677.67)	(17,052,270.23)
PROVISION FOR RETIRING GRATUITY	12,809,645.26	10,323,286.37
INVESTMENT INCOME	-	(12,609,975.60)
OPERATING PROFIT/ (LOSS) BEFORE WORKING CAPITAL CHANGES	101,338,345.01	(38,236,761.16)
WORKING CAPITAL CHANGES		
(INCREASE)/DECREASE IN INVENTORIES	540,371.60	680,927.22
(INCREASE)/DECREASE IN TRADE & OTHER RECEIVABLE	9,125,095.31	12,273,041.31
(INCREASE)/DECREASE IN PREPAYMENTS	(2,119,133.22)	327,279.02
INCREASE/(DECREASE) IN ACCOUNTS PAYABLES	(12,629,673.37)	13,263,175.61
INCREASE/(DECREASE) IN ACCRUED EXPENSES	(17,312,230.18)	38,511,783.67
CASH GENERATED FROM/(USED IN) OPERATIONS	78,942,775.15	26,819,445.67
RETIRING GRATUITY PAID	(3,077,884.76)	(981,380.99)
INTEREST PAID		
NET CASH GENERATED FROM / (USED IN) OPERATING ACTIVITIES	180,281,120.16	25,838,064.68
CASH FLOWS FROM INVESTING ACTIVITIES		
PURCHASE OF PROPERTY PLANT AND EQUIPMENT	(10,030,559.52)	(26,089,372.24)
RESEARCH VESSEL	-	(251,924,648.99)
CAPITAL WORK IN PROGRESS	(11,936,732.81)	(18,400.00)
PROCEED FROM SALE OF PROPERTY PLANT & EQUIPMENTS	972,800.00	2,226,601.51
INTEREST ON TREASURY BILLS & FIXED DEPOSITS	1,281,626.32	10,383,374.09
		-
NET CASH GENERATED FROM/ (USED IN) INVESTING ACTIVITIES	(19,712,866.01)	(265,422,445.63)
CASH FLOWS FROM FINANCING ACTIVITIES		
CAPITAL GRANTS RECEIVED	120,818,966.00	70,818,774.40
NET CASH GENERATED FROM/ (USED IN) FINANCING ACTIVITIES	120,818,966.00	70,818,774.40
NET INCREASE / (DECREASE) IN CASH AND CASH EQUIVALENTS DURING THE YEAR	302,381,712.48	(168,765,606.55)
CASH AND CASH EQUIVALENTS AT THE BEGINNING OF THE YEAR	31,990,325.76	200,755,932.31

CASH AND CASH EQUIVALENTS AT THE END OF THE YEAR	15,215,485.01	31,990,325.76
ANALYSIS OF CASH & CASH EQUIVALENTS AT THE END OF THE YEAR		
CASH AT BANK	15,215,485.01	5,695,435.74
SHORT TEARM INVESTMENTS	-	26,294,890.02
	15,215,485.01	31,990,325.76
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 2013					
		31.12.2013		31.12.2012	
	Notes	Rs.	Cts.	Rs.	Cts.
ASSETS					
CURRENT ASSETS					
CASH AND CASH EQUIVALENTS	1	15,215,485.01		5,695,435.74	
SHORT TERM INVESTMENTS	2		-	26,294,890.02	
TRADE AND OTHER RECEIVABLES	3	26,132,204.10		35,257,299.41	
INVENTORIES	4	1,780,142.39		2,320,514.00	
PREPAYMENTS	5	2,411,644.61		292,511.39	
		45,539,476.11		69,860,650.56	
NON-CURRENT ASSETS					
INFRASTRUCTURE, PLANT AND EQUIPMENT	6	409,744,153.91		486,915,348.00	
LAND AND BUILDINGS	6	878,087,669.62		889,722,940.00	
CAPITAL WORK IN PROGRESS	7	16,736,347.08		6,121,975.25	
		1,304,568,170.61		1,382,760,263.25	
TOTAL ASSETS					
		1,350,107,646.72		1,452,620,913.81	
LIABILITIES					
CURRENT LIABILITIES					
ACCOUNTS PAYABLES	8	16,852,620.11		29,482,293.48	
ACCRUED EXPENSES	9	47,439,660.30		64,751,890.48	
		64,292,280.41		94,234,183.96	
NON-CURRENT LIABILITIES					
PROVISION FOR GRATUITY	10	77,499,035.38		67,767,274.88	
		77,499,035.38		67,767,274.88	
TOTAL LIABILITIES					
		141,791,315.79		162,001,458.84	
NET ASSET					
		1,208,316,330.93		1,290,619,454.97	
ACCUMULATED FUNDS					
RESERVES	11	1,107,955,623.78		1,243,899,857.33	
	12	100,360,707.15		46,719,597.64	
TOTAL EQUITY AND LIABILITIES					
		1,208,316,330.93		1,290,619,454.97	
THE SIGNIFICANT ACCOUNTING POLICIES AND NOTES ANNEXED FORM AN INTEGRAL PART OF THESE FINANCIAL STATEMENTS.					
					
(Mrs) G.W.N.Pavithra					
HEAD/FINANCE					

APPROVED AND SIGNED ON BEHALF OF THE BOARD.			
			
Dr.S.G Samarasundera		S. Suriyaarachchi	
CHAIRMAN		DIRECTOR GENERAL	
COLOMBO, 24TH March, 2014			

NATIONAL AQUATIC RESOURCES RESEARCH AND DEVELOPMENT AGENCY					
PERFORMANCE STATEMENT FOR THE YEAR ENDED 31 ST DECEMBER 2013					
		2013		2012	
	NOTE	Rs.	Cts.	Rs.	Cts.
REVENUE					
GOVERNMENT GRANT	13	236,135,855.13		203,514,261.60	
OTHER INCOME	14	10,095,388.81		20,952,869.28	
AMORTIZATION OF LOCL & FOREIGN GRNT	15	15,758,677.67		16,937,252.79	
TOTAL REVENUE		261,989,921.61		241,404,383.67	
EXPENSES					
PERSONNEL EMOLUMENTS	16	152,108,480.86		142,392,013.81	
TRAVELLING & SUBSISTENCE	17	1,602,089.68		1,364,526.32	
SUPPLIES & CONSUMABLES USED	18	2,492,276.58		2,629,602.45	
MAINTENANCE EXPENDITURE	19	15,783,412.83		23,380,740.81	
CONTRACTUAL SERVICES	20	29,158,332.49		28,464,677.75	
RESEARCH & DEVELOPMENT EXPENDITURE	21	69,241,855.13		54,053,593.60	
DEPRECIATION & AMORTIZATION EXPENSES	22	104,287,377.42		75,011,504.29	
OTHER OPERATING EXPENSES	23	7,377,917.02		8,017,030.63	
TOTAL EXPENSES		382,051,742.01		335,313,689.66	
SURPLUS (DEFICIT) FOR THE YEAR		(120,061,820.40)		(93,909,305.99)	
THE SIGNIFICANT ACCOUNTING POLICIES AND NOTES ANNEXED FORM AN INTEGRAL PART OF THESE FINANCIAL STATEMENTS.					



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கணக்காய்வாளர் தலைமை அபிபுதி திணைக்களம்
AUDITOR GENERAL'S DEPARTMENT

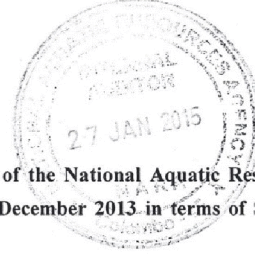


මගේ අංකය } LP/B/NARA/FAI/13/18
எனது இல. }
My No. }

ඔබේ අංකය }
உமது இல. }
Your No. }

දිනය } 06 November 2014
திகதி }

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 2013 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 2013 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 National Aquatic Research and Development Agency Act No 54 of 1981 and Section 25 (2) of the amendment 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 Agency on 14 June 2014.

1.2 Management's Responsibility for the Financial Statements

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, පොල්දො පාර, බත්තරමුල්ල, ශ්‍රී ලංකාව. - - இல. 306/72, பொல்துவ வீதி, பத்தரமுல்லை, இலங்கை. - No. 306/72, Polduwa Road, Battaramulla, Sri Lanka

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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 judgment, including the assessment of 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 the financial statements. Sub-sections (3) and (4) of the Section 13 of the Finance Act No. 38 of the 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 qualified audit opinion.

1.4 Basis for Qualified Opinion

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

2. Financial Statements

2.1 Qualified Opinion

In my opinion, except for the effects of the matters described in paragraph 2.2. of this report the financial statements give a true and fair view of the financial position of the National Aquatic Resources Research and Development Agency as at 31 December 2013 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 Accounting Deficiencies

An expenditure in revenue nature incurred on Boats and Vessels had been capitalized and the provisions for depreciation had been made in the previous year. Even though the capitalized amount had been corrected in the year under review, the over provisions of depreciation amounting to Rs.514,234 had not been rectified.

2.2.2 Accounts Receivable and Payable

The following observations are made

- (a) According to the age analysis of debtors presented to audit, the value of the debtor balances as at the end of the year under review amounted to Rs.26,132,204 and the value of balances older more than 03 years amounted to Rs.2,728,665.
- (b) According to the age analysis of creditors presented to audit, the value of loan balances payable as at the end of the year under review amounted to Rs.16,852,620 and the value of loan balances older than 01 year amounted to Rs.244,593.

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

The following non-compliances were observed.

Reference to Laws, Rules and Regulations etc	Non- compliance
(a) National Aquatic Resources Research and Development Agency Act, No. 32 of 1996 (amended)	Contrary to the objectives stated in the Act, a sum of Rs. 7,916,832 had been spent for the construction of a fish market.
(b) Financial Regulations of the Democratic Socialist Republic of Sri Lanka	
(i) Financial Regulation 371 (2)	An advance obtained should be settled immediately after the completion of the purpose for which it was granted. However, advances totalling Rs.213,243 obtained in 14 instances had not been settled even at the end of the year under review.



- | | |
|----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| (ii) Financial Regulations 454 and 751 | All inventory articles should be entered in an inventory register but such a register had not been maintained in the stores. |
| (c) Treasury Circular No. 842 dated 19 December 1978 | The Register of fixed Assets to record the value of fixed assets amounting to Rs.1,278 million had not been Updated. |
| (d) Circular No. 28 dated 10 April 2003 of the Department of Management Services | Without the approval of the Department of Management Services, a consultancy fee of Rs.650,000 had been paid. |
| (e) Paragraph 2 of the Treasury Circular No. 1A1/2002/02 dated 28 November 2002 | The Register relating to computers and Computer software valued Rs.7,013,457 had not been updated. |

3. Financial Review

3.1 Financial Results

According to the financial statements presented, the operation of the Agency for the year ended 31 December 2013 had resulted in a deficit of Rs.120,061,820 as compared with the deficit of Rs.93,909,305 for the preceding year. Accordingly, an increase of Rs.26,152,515 in the deficit for the year under review was shown. Increase in salaries, travelling expenses, contractual services, and research and development expenses had been the main reasons for this increase.

4. Operating Review

4.1 Performance

The total grants received for the research and development expenditure from 2009 to 2013 amounted to Rs.1,334 million and the expenditure incurred thereon totalled Rs.242 million. Accordingly, the expenditure incurred on research and development had represented 18 per cent of the grant received.



4.2 Management Inefficiencies

The following observations are made.

- (a) Out of the grants received for research and development activities as capital expenditure, a sum of Rs.20,027,819 had been spent for recurrent expenditure of the year under review, without being utilized for that purpose.
- (b) The vessel manufactured at a cost of Rs.15,685,633 enabling to use for research activities in the coastal areas had not been utilized for research activities up to now. A sum of Rs.4,427,117 had been paid as salaries, overtime and allowances of officers and security purposes.
- (c) Advances totalling Rs.333,891 had been paid as salaries, travelling, petty cash and special cash advances. Action had not been taken to settle them even by the end of the year under review.

4.3 Idle and Underutilized Assets

The following observations are made

- (a) Four motor vehicles, the assessed value of which was Rs.5,750,000 had remained idle without being utilized for more than 01 year.
- (b) A software had been purchased in the year 2009 by incurring an expenditure of Rs.272,160 but it had not been utilized up to now.
- (c) Although a sum of Rs.855,938 had been spent for the construction of a proposed canteen, it had been abandoned for more than 2 years.
- (d) Two boat engines (HP 200) valued at Rs.4,493,052 purchased without being properly evaluated, had remained unutilized for more than 2 years.



4.4 Commencement of Projects on Lands not Properly Acquired

Agreements had been entered into at a value of Rs.14,502,760 for the construction of a fish market and ocean observation and tsunami center in a land near Beruwala city. Even though a sum of Rs.6,532,047 had been spent thereon during the year under review, action had not been taken to acquire the land formally by the Agency.

4.5 Personnel Administration

Approved and actual cadre as at 31 December 2013 amounted to 443 and 308 respectively and the number of vacancies were 122.

4.6 Uneconomic Transactions

As two vessels built at a cost of Rs.3,329,908 to be used for research activities had been built without a proper standards, it could not be utilized and that value had been shown further under non- current assets as work in progress.

5. Accountability and Good Governance

5.1 Internal Audit

The following observations are made in respect of the establishment of internal audit division and the implementation

- (a) An adequate staff had not been attached to the internal audit functions. The Scheme of Recruitment including the audit assistants posts to carry out the audit functions at internal audit division of Head Office had not been approved.
- (b) It was unable to plan and implement the internal audit functions as required due to the shortage of staff.

5.2 Budgetary Control

Significant variances between the budget and the actual in the year under review were observed, thus indicating that the budget had not been made use of as an effective instrument of management control.



6. Systems and Controls

Deficiencies in systems and controls observed during the course of audit were brought to the notice of the Chairman of the Agency from time to time. Special attention is needed in respect of the following areas of control.

- (a) Budget
- (b) Financial Control
- (c) Human Resources Control
- (d) Assets Management
- (e) Accounting
- (f) Advances

W.P.C. Wickramaratne
Acting Auditor General

Actions taken by the Management on the Audit report issued by Auditor General's Department as per the section 14 (2) of the Monetary Act no 38 of 1971 regarding the financial statement for the year ended 31st December 2013

2.2 Comments on Financial Statements

2.2.1 Accounting deficiencies

Not Agreed

The amount received from the insurance policy of the Ship and the equipment attached were Rs.51, 42, 341.00. The deduction account to be done to the ship on the purchasing year 2012 was not deducted from the account. Therefore, this deduction was not occurred on the ship on the given year should be considered.

2.2.2 Receivable Balances.

(a) The details of last 3 years of receivables and their present situations are given below.

1. One hundred thousand rupees was deposited as a collateral to the saving account to purchase fuel for fishery activities.
2. To purchase computer accessories Rs.272,160.00 was given as a prepaid amount. Judicial action was initiated to take action on the computer accessories supplier to recover the given amount from them.
3. Rs.1050.00 was paid to G.N.G Perera as a Festival Advance with the approval from the governing council.
4. Distress Loan amount of Rs.27,576.00 was paid (J.G Maakammana) and advise him through the service.
5. Special Advance of Rs.23,576.30 was paid (J.G Maakammana) and advise was given through Labour Tribunal.
6. Rs.4, 341.95 as a salary advance of D.A Wickramasinghe was settled.
7. Rs.2,304,303.72 to HYUNDAI ENGINEERING & CONSRUCTION (amount taken) was settled on 2014.05. 02 with RE:NO 16979 and 16980.

b) Minimum value as per debit account, the balance amount to be given were Rs.16,414,369 also Rs.16,852,620.11; from this the balance amount for 3 years was Rs.1, 081, 618.42;

SIDA	Balance cash Project	192,816.96	Debited with the legal approval taken from the Governing council
SAREC Project	Saving account	51,776.46	Debited with the legal approval

	balance		taken from the Governing council
MADABOKKA MONITARING	Consultancy project	837,025.00	Now adecision was taken
		1,081,618.42	

2.3 Non-compliance with Laws, Rules, Regulations and Management decisions

- a)
 1. Up to now fixed advance pre-paid system was prepared.
 2. Fixed
- b) Fixed Asset
- c) Special legal action which was taken by the management and the advice given by the ministry the payment was done.
 3. Management of working capital

After the selection of the capital review report; the year of 2013 and the previous year Rs.26,152,515.00 amount of resources increase was appreciated. Because of that forced salary, transport expenses, agreement research and development projects also development projects expenses increases; the action was taken to increase the expenditure percentage and the amount increased was Rs.29,545,873.00. Therefore, resources increase was taken as a main reason for the increase of the expenditure and action was taken to increase the amount in 2013.

4. Operating review

4.1 Performance

To complete the research and development projects of the Agency on 2013 was Rs.285 million and research expenditure was 69 million. Instructions was given to the relevant officers to get rid of this situation in future and fix this situation.

4.2 Management Inefficiencies

- (a) Funds received from consultancy service work and external funded projects temporarily provided for the payments and after it was re-accounted.
- (b) Due to the opportunity given to implement machinery related research; in future the method of agreement signed to take action to give this machineries for rent to external bodies.
- (c) Now this amount is settled.

3.3 Idle and underutilized assets

a) Even though there were two actions taken to sell the motor vehicles; first opportunity was missed due to under values was bided. After the approval taken to publish it through the newspaper advertisement bid; only the Rs.38,000.00 was the amount was bided. So the approval from the secretary of the Fisheries and Aquatic Resources Development ministry; actions was taken to sell the vehicle through the paper advertisement bid.

(b) The legal action procedures are ongoing to take action against the computer software company to recover the advance payment done. But this software was not included on the capital account as a right information. Therefore, action is taken to purchase the software with the approval from the COPE board recommendation.

(c) Accepted that it will be settled down in 2014.

(d) Even though the investigations done through the bribery commission; through the COPE board recommendations can rent out for external bodies or any other suitable decision making.

4.4 Starting projects from Obtained lands for financial basis

The land provided for establishment of Fish marketing and oceanographic observation also Tsunami centers to be obtained for Agency.

3.4 Personnel Administration

The staff of NARA on 01.10.2014 was 456. After the approval obtained from the department of management services; balance carder will be filled in 2015. Also approved service staff amount was increased to 443 from 423.

4.6 Non economical transections

COPE board recommendations were given

4. Accountability and Good Governance

5.1 Internal Audit

Carders were filled with the approved procedure in 2014

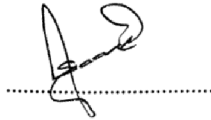
5.2. Budget chart project

Accepted to taken more consideration on the quantity which was stated as a recommended amount on the budget

The main reason for the consideration was to re settle the expenditure of the Agency to the account; the treasury not allocating the particular amount for the year. Also approved amount was not received fully were the expected reason for the failures to achieve the goal of the Agency.

6.0 Systems and Controls

Action has already been taken to pay special attention to the areas you have mentioned in the report (points 1 – 6).

A handwritten signature in black ink, appearing to be 'S. Sooriyaraachi', written over a horizontal dotted line.

S. Sooriyaraachi,
Director General- NARA