
INSTITUTIONAL REVIEW
of the
NATIONAL AQUATIC RESOURCES RESEARCH AND
DEVELOPMENT AGENCY (NARA)
(2013 - 2017)

A report prepared for the

SRI LANKA COUNCIL FOR AGRICULTURAL
RESEARCH POLICY (CARP)

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Sri Lanka Council for Agricultural Research Policy
Ministry of Agriculture

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CARP

Food Security Through Sustainable Agriculture

R/19/External Review/08/2018

03rd September 2018

Secretary,
Ministry of Fisheries & Aquatic Resources Development and Rural Economy,
Maligawatta New Secretariat,
Colombo 10



Institutional Review Report
of the
National Aquatic Resources Research and Development Agency (NARA)

One of the functions of the Sri Lanka Council for Agricultural Research Policy (Act No. 47 of 1987) shall be "(m) to review the performance of agricultural research projects, institutions and divisions from time to time." With regard to this function, SLCARP has completed a review of NARA recently. The review report was presented to the NARA Staff Members and SLCARP Council and finalized the report after incorporating comments given. Members of the Review Panel comprised of:

Dr. N. P. Wijayananda, Former Chairman/Director General, Geological Survey and Mines Bureau (*Chairman*)
Prof. J. M. P. K. Jayasinghe, Emeritus Professor, Wayamba University of SL
Dr. Jinadari de Zoysa, Former Director General, Department of Agriculture
Prof. D S Jayakody, Former Head, Department of Aquaculture and Fisheries, Faculty of Livestock, Fisheries and Nutrition, Wayamba University

Purpose of this above review is to ensure that NARA has performed its mandated functions effectively to the benefit of the sector and country. This review has been undertaken after 19 years. Recommendations made by the Review panel has indicated that even the 1999 recommendations are even valid for implementation. There are many valuable recommendations made which should be seriously taken up for discussion by NARA Governing Board and the Ministry for implementation.

Since The Treasury has financed this external review, Treasury expects SLCARP to follow up on the implementation of the recommendations. As such, I would kindly request you to ensure that the recommendations are implemented and this should be monitored by the NARA Governing Board. Ministry could request Ministry representative at the Governing Board to monitor the progress of implementation and report to the SLCARP.

Dr. S.D.G. Jayawardena
Chairman

cc: Prof. Daya Edirisinghe, Chairman, NARA
Director General, Department of National Budgets, Treasury
Secretary, SLCARP

Ms. Sandanali Basnayake, SLCARP Library
for Permanent Reference.

Abbreviations

MFARD	Ministry of Fisheries and Aquatic Resources Development
CARP	Sri Lanka Council for Agricultural Research Policy
UN	United Nations
NARA	National Aquatic Resources Research and Development Agency
BOM	Board of Management
MBRD	Marine Biological Resources Division
IARD	Inland Aquatic Resources and Aquaculture Division
SEMD	Socio-Economics & Market Research Division
FTD	Fishing Technology Division
ESD	Environmental Studies Division
IPHT	Institute of Post-Harvest Technology
NIOMS	National Institute of Oceanography & Marine Sciences
NHO	National Hydrographic Office
MED	Monitoring and Evaluation Division
RRC	Regional Research Center
COFI	Center for Ocean and Fisheries Information – Beruwala
AD	Administration Division
FD	Finance Division
SOD	Service & Operation Division
IA	Internal Audit
HOD	Head of the Division
DDG	Deputy Director General

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Acknowledgements

The review panel appreciates the confidence placed in them by CARP and acknowledges the guidance provided. The support provided by Dr. S.D.G. Jayawardane (Chairman) and Dr. Frank Niranjana (Coordinator – Ex. Review) is specially appreciated.

Prof. Daya Edirisinghe (Chairman, NARA), Mr. B.C.W. Iddamalgoda (Director General, NARA), Dr. Anil Premaratne (former Chairman, NARA) and all the staff of NARA co-operated with the panel completely, without reservation. We acknowledge their co-operation gratefully.

All the Heads of Divisions with their senior officers graciously agreed to meet the review panel and exchanged views and provided us insights which were valuable in arriving at our recommendations.

The efficient co-ordination of all review activities, by Dr. H.M.P. Kithsiri – Deputy Director General (Research and Development) and Mr. A.B.A.K. Gunaratne, - Director, Monitoring and Evaluation Division, NARA was indispensable in the successful completion of this review. The review panel acknowledges their contribution with gratitude.

Executive Summary

Sri Lanka Council for Agricultural Research Policy Act No. 47 of 1987 mandates Sri Lanka Council for Agricultural Research Policy (CARP) to review the performance of Agricultural research projects, institutions and divisions from time to time.

The National Aquatic Resources Research and Development Agency (NARA) is a State funded statutory institution which operates within the purview of the Ministry of Fisheries and Aquatic Resources Development. NARA, established in 1981, is the principal national institute charged with the responsibility of carrying out and coordinating research, development and management activities on the subject of aquatic resources in Sri Lanka.

An independent review panel consisting of four members was appointed by the CARP in consultation with the NARA to review NARA from 2013 to 2017. The review was conducted as per the Terms of Reference (TOR) given for the External Review of the Research Institutions in the National Agricultural Research System (NARS).

The review commenced with careful perusal of the brief report provided by NARA. The panel had several visits to the institution where the divisions were visited and separate discussions were conducted between the panel and staff of each division. The Panel also visited four regional research centers.

The Scientific and Technical Committee is the platform for harnessing of NARA's research with the national fisheries policy, industrial needs and those of academic interest. It was noted that although mandatory as per NARA Act., such a committee is not in existence. Development of a forward looking coherent scientific program for NARA has been an increasingly important and urgent national need and has to be addressed through a well formed Scientific and Technical Committee.

Disciplines covered by technical divisions of NARA are essential for the successful implementation of research projects and collaborative research among divisions will necessarily enhance the output of research. However, the panel observed that inter-divisional collaboration and collaborative team work culture is weak at NARA. An average rate of output of research publications (full research papers) by the scientists of certain divisions of NARA is below average. Few publications by senior scientists have appeared in peer reviewed international scientific journals during the last five year period and the majority of research findings have been presented/ published in local conferences/symposia in the form of abstracts.

Though the outcomes of the research findings of NARA has relevance to the development of the fisheries sector in the country, some research areas have not be in par with the policy goals of the MFARD.

Difficulty of retaining experienced researchers at NARA is a long standing issue and the panel members felt that it has to be addressed through a well formulated career development scheme.

Some of the technical divisions at the NARA headquarters possess sufficient infrastructure and facilities for its research and service functions. The number of scientific staff in some divisions are adequate but in others quite low. The level of expertise of scientists and supporting staff in some areas is inadequate. These limitations could be overcome by filling approved vacancies and providing training opportunities in important and inadequate areas of expertise.

Infrastructure and other facilities of regional centers are inadequate. Those should be upgraded to provide better service to the fisheries sector of respective regions.

1.0 Introduction

Overview of National Aquatic Resources Research and Development Agency (NARA)

History

NARA was incorporated in 1981 under the National Aquatic Resources Research and Development Agency Act No. 54 of 1981, amended in 1996 as amended NARA Act. No.32 of 1996 and is a State funded Statutory Institute.

Mandate of the NARA

As per the above NARA Act. and the amended Act.,NARA is mandated

- (a) to ensure the application and utilization of scientific and technological expertise for the implementation of the national development program on the subject of aquatic resources;
- (b) to promote and conduct research activities directed towards the identification, assessment, management and development of aquatic resources, and in particular in the following fields: -
 - (i) oceanography;
 - (ii) improvement and development of fishing craft, fishing gear and equipment, and fishing methods;
 - (iii) the social and economic aspects of the fishing industry, including the welfare of fishermen and their dependents;
 - (iv) the processing, preservation and marketing of fish and related products;
 - (v) the development and management of aquatic resources in the inland waters, coastal wetlands and off-shore areas;
- (c) to provide advisory and consultancy services on scientific, technological and legal matters relating to the exploitation, management and development of aquatic resources;
- (d) to co-ordinate the activities of institutions engaged in the exploitation, planning, research, development, control and management of aquatic resources;
- (e) to undertake the collection, dissemination and publication of information and data useful for the development of aquatic resources and the fishing industry of Sri Lanka;

- (ee) to undertake the collection processing and publication of hydrographic data and nautical information on the near shore and off shore areas and inland waters, and to have overall control of such activities in Sri Lanka;
- (f) to provide training for persons required to carry out or assist in the work of the Agency; and
- (g) to exercise, discharge and perform all the powers, functions and duties conferred or imposed on the Agency under this Act.

Vision of NARA

“To be the premier institution for Scientific Research in Conservation, Management and Development of Aquatic Resources in the Region.”

Mission of NARA

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

The Corporate Plan

NARA does not have a Corporate Plan as of today and the last plan was only till 2017.

Governing Ministry

NARA functions under the purview of the Ministry of Fisheries & Aquatic Resources Development.

Sources of Funding

NARA, being a Government statutory organization receives the annual capital and recurrent budgets from the Government Treasury. Funds are also generated internally mainly from the research grants and consultancy projects undertaken.

Organizational Structure

NARA is governed by the Chairman and the Board of Management (BOM). The BOM decides on the policies and the Director General is the chief executive officer responsible for coordinating the activities. NARA has total approved cadre for 499 employees and has total of 365 employees as at 31st May 2018.

The organization has eight Technical Divisions six Regional Research Centers and five supporting Divisions.

2.0 Procedure adopted for the review

An independent panel comprising four members appointed by CARP carried out the review. The Panel members were:

Dr. N.P. Wijayananda (Chairman) – former Chairman, Geological Survey and Mines Bureau

Dr. D.S. Jayakody – former Head, Department of Aquaculture and Fisheries, Faculty of Livestock, Fisheries and Nutrition, Wayamba University of Sri Lanka

Prof. J.M.P.K. Jayasinghe – Emeritus Professor of Aquaculture and Fisheries, Wayamba University of Sri Lanka.

Dr. Jinadari de Zoysa – former Director General, Department of Agriculture.

The Review Panel was formally informed about the review procedure at a meeting held on the 15th of March 2018 at CARP Head Office by Dr. S.D.G. Jayawardane, Chairman/CARP. The review was based on the Terms of Reference (TOR) given for the External Review of the Research Institutions in the National Agricultural Research System (NARS).

The Panel made several visits to NARA and also visited four Regional Research Centers in order to acquire information. Given below is the description of visits made by the Panel.

- 26th March 2018: First visit to NARA. The Review Panel had a meeting with Chairman and Director General of NARA and visited the Divisions.
- 03rd April 2018: Second visit to NARA. Meetings with Heads of the Divisions, Marine Biology, Hydrography, Oceanography and Fish Technology Divisions.
- 10th April 2018: Third visit to NARA. Meetings with Inland Aquatic Resources, Socio – Economic and Market Research and Environmental Studies Divisions.
- 18th April 2018: Fourth visit to NARA. Meetings with Institute of Post-Harvest Technology, Scientists Association of NARA, Monitoring and Evaluation and Finance Divisions.
- 24th April 2018: Fifth visit to NARA. Meetings with Administrative, Services and Operation Divisions and Trade Union Representatives.
- 02nd May 2018: Visited Rekawa and Kapparahota Regional Research Centers.
- 15th May 2018: Visited Kalpitiya and Negombo Regional Research Centers.
- 22nd May 2018: Sixth visit to NARA. Meeting with the new Chairman / NARA. Meetings with the Internal Auditor and Hydrographic Wing of Sri Lanka Navy.
- 30th May 2018: Seventh visit to NARA. Sought clarifications from Heads of the Divisions and finalized the report.
- 26th June 2018: Eighth visit to NARA. Meeting with NARA Chairman, Director General and HODs to discuss the draft report.

The panel perused number of documents made available by NARA and few more provided on request.

The Review Report was prepared in a participatory manner by all four members of the panel. Although different sections were written by different members, all collectively viewed the final document and there was complete consensus on all opinions and conclusions in the report. The panel takes collective responsibility for the contents of the report.

3.0 Assessment – Divisions of NARA

3.1. Marine Biological Resources Division (MBRD)

MBRD of NARA is vested with the responsibilities of conducting research towards management, development and conservation of marine living resources, and ecosystems for sustainable utilization.

This division has a principal scientist, four senior scientists and eleven scientists. Out of them four are holding doctor of philosophy degrees and three are reading for their doctoral degrees.

Monitoring of the commercial fisheries through collection of catch and effort data, species composition and biological information on some commercially important species such as large pelagics, small pelagics, demersal fishes, lobsters, prawns, crabs, sea cucumbers, manta rays and some mollusk species were under investigation during the last five years. Research on marine and estuarine sensitive habitats such as lagoons/ estuaries, coral reefs and sea grass beds were also investigated time to time during the last five years. Some attempts have been given for the research on protected animals such as turtles, dolphins and whales. Molecular biological studies on some commercially important species are also ongoing. In the year 2018, MBRD has taken steps to publish their research findings in a divisional publication named “Blue Ocean”. Research projects conducted by the MBRD during the last five years include,

- Management oriented research projects
- Development oriented research projects
- Research towards coastal zone management
- Conservation of coral reefs and threatened marine fauna
- Species identification and population studies using molecular techniques

The division has also contributed to the national development by taking part in projects such as “port city project” etc.

MBRD is also providing valuable information to the Indian Ocean Tuna Commission (IOTC) through their regular research programs. This information is used by the IOTC fisheries management purposes of the tuna stocks in the Indian Ocean.

During the last five year period division has published five full research papers, 40 abstracts and 24 documents in the proceedings of various workshops and symposia.

3.2 Inland Aquatic Resources and Aquaculture Division (IARD)

Inland Aquatic Resources and Aquaculture Division is vested with the responsibility of management and sustainable utilization of inland aquatic resources and the environmental assessment and management of inland aquatic habitats in the country.

The division conducts regular training programs on disease management in ornamental fish farming, fish nutrition, as well as in fresh water prawn culture and ornamental fish farming.

Extension materials in the form of leaflets and manuals have been prepared on mollusk culture, seaweed culture and on shrimp culture and diseases. Resource surveys and conservation programs for sensitive ecosystems such as mangroves, salt marshes and other wetlands are implemented. IARAD participates in preparation of EIAs, assessment of EIAs and in preparation of integrated management plans in coastal area.

Advisory services are available to farmers through the division in prevention and control of diseases in shrimp culture and fish culture systems, effluent treatment, and sediment management in shrimp culture and on water quality management.

Staff their qualification and fields of specialization

Scientific staff has two principal scientists, six senior scientists and eight scientists. There are five research assistants and twelve other support staff. Staff is highly qualified and includes 3 PhD, 3 MPhil, and 9 MSc qualified scientists. There is a scientist in the staff with 25 years of service without post graduate qualifications and another with a post graduate degree with over eighteen years of service working as a Development Officer. Administration is requested to look in to these matters. The Panel is of the opinion that such issues should be resolved in a transparent manner. The staff is specialized in diverse disciplines related to aquatic resources. Their specialization areas are, Wetland management, Aquaculture, Inland Fisheries and Freshwater Aquaculture, Fish diseases, Fish feed preparation, Ornamental fish culture, Fisheries management, fish nutrition, Marine Ecology, Aquatic animal health management and Bacteriology, Ecology and conservation biology, Brackish water aquaculture, shrimp and mollusc culture, Marine Eco-systems (coral reef) and Biotechnology, Ornamental fish breeding, Marine fish breeding and culture, Algae culture, tissue culture, Biotechnology, Molecular biology and Shrimp virology.

Researchable areas and development work addressed during the period of review

Large numbers of research programs have been completed during the period considered for the review. The notable areas covered are-

- Environmental assessment and management in aquaculture development, verification of culture technologies for shrimps, prawns, mollusc, brackish water fish, holothurians and artemia.
- Disease management, breeding of endemic ornamental fish species, crab fattening and reservoir fisheries management.
- Improvement of breeding and culture techniques for Sandfish (*Holothuria scabra*).
- Development of fish feed aquaculture, seaweed culture and Mollusc resource management program.
- Development of breeding and culture technology for high value endemic and exotic ornamental fishes, propagation techniques for aquatic plants.
- Monitoring of commercially level cultivation of seaweeds and site selection for expansion based on remote sensing and field sampling.
- Development of community based oyster and mussels culture.
- Surveillance and development of screening methods for disease conditions in Ornamental fish industry in three selected Districts.
- Fish feed development and ornamental fish production program at Panapitiya Regional Research Center, Use of Chitosan as an immune stimulant in tiger shrimp (*Peneus monodon*) feeds to resist viral diseases.
- Development of culture techniques in selected seaweed species and quality improved parent stock maintenance of commercially important seaweeds.
- Management of Viral Disease in Shrimp Industry in Sri Lanka Effect of water quality and climatic adaptations in shrimp farming other areas addressed by the division.

Research output and outcome

Research outcome is the end result of conducting research on a particular topic. In some of the projects outcome is not clearly indicated although several outputs are indicated. Periodical interim monitoring and end project monitoring procedures need improvement.

Division has 24 full papers and 82 abstracts published during the period of review. They have conducted several regular training programs and officers have participated in Ministerial committees.

Project evaluations are to be focused on the relevance, performance, efficiency, and impact of the project in relation to stated objectives. The main impact areas include economic, social, environmental, or sustainability. Outcome evaluations should also look into influence of research on technological development, innovation, or policy and practice changes in aquaculture and inland aquatic resources management. Most of the research

findings are yet to be transferred to end-users. Feed development work at Panapitiya RRC appears to be in a stage to proceed towards commercialization of feed production.

It is an appropriate time to review research findings during past few years and design a long term work program before committing for the next year research program.

The current burning issues in the shrimp culture include introduction of exotic shrimp species for Sri Lankan environment, disease management and sustainability and conversion of environmentally sensitive areas for shrimp culture. As the national research agency, NARA through IARD should be able to guide Ministry of Fisheries and Aquatic resources/ NAQDA in the proper direction in policy and development issues related to aquaculture, inland fisheries and coastal resource management. For that IARD should be armed with the necessary research backing and information.

Ongoing research projects and development program

There are 18 ongoing research projects of the division. Those include;

Introduction of feed for Tilapia culture, evaluation of formulated feeds developed for Asian sea bass through community based sea bass farming in lagoon, Improvement of feed development technology for ornamental fish production at Panapitiya RRC. Effects of brewer's yeast (*Saccharomyces cerevisiae*) and *Sargassum* sp. on growth of Sea cucumber (*Holothuria scabra*) juveniles., Use of Chitosan nano particles as an immune-stimulant in tiger shrimp (*Peneous monodon*) feeds to enhance cell activity and disease resistance to resist viral diseases-Chilaw, Development of marine fish breeding technology -Culture of seahorse in lagoon cages & Alteration of life span of fire shrimps , Introduction of endemic *Pethia melanomaculata* (Tic tac barb) to ornamental fish industry through proper technology development, Biofloc Technology as an Integral Approach to Enhance Production and Ecological Performance ornamental fish culture, Development of breeding techniques for selected fresh water ornamental fish using existing facilities at RRC Rekawa, Efficiency of hormones on spawning characteristics of selected exotic fish species in family Cyprinidae and maintenance of existing ornamental fish breeding facility, Biotechnological applications on aquatic plants and seaweed industries, study of the optimum conditions for grow out farming of Sea Cucumber, (*Holothuria scabra*), Establishment of gene bank for *Kappaphycus* & *Euchema* varieties suitable for culture and culture of other potential seaweeds – Dondra, Improving spat collection methods for commercial scale oyster farming and experimental reef restoration for enhance the spat availability, Study on the potential for commercial use of naturally abundant oyster (*Crassostrea* sp.) in Negombo estuary, Investigation of possible viruses infections in shrimps and strain variation studies of WSSV related to dissemination routes, Exploration on frequently recorded white spot disease outbreaks and survey on OIE listed viral infections in Sri Lanka, Study on the evaluation of effectiveness of the stockings in selected perennial reservoirs in Rathnapura, Kurunegala and Puttalam districts.

Research projects developed are in several areas and are of importance to inland aquatic resources development and management. One of the notable projects is "Biofloc Technology as an Integral Approach to Enhance Production and Ecological Performance ornamental fish culture".

However the process of identification of researchable and development issues need strengthening. Research prioritization is important before finalizing the program. In this process, IARD must closely collaborate with NAQDA and other stakeholders.

3.3 Fishing Technology Division (FTD)

This division has four researchers and of them one is in the "senior scientist" category and the other three are in the "scientist" category. Fishing technology related research is part and parcel of fisheries research and the latter cannot be considered without the former component. Fishing technology related research should be complementary more to the marine biological research programs. Poor coordination was noted between FTD and MBRD with regard to their research programs. Some of the activities involving minor technological inputs such as deploying Fish Aggregating Devices are being handled by the staff of the FTD. Considerable time of the staff members of this division is used for fact finding activities related to fisheries conflicts assigned to the division by the Department of Fisheries. It is difficult for the existing staff of the FTD to take up the additional workload of attending to fisheries conflicts. Research is underway to improve the quality of fishing gear to minimize the environmental and resource damage. Activities of the FTD during the last five years include,

- Modification of existing fishing gear
- Adaptation of new technology to suit local conditions
- Habitat enhancement

Deployment of FADs is given high priority by the division during the last several years. The ecological implication of FAD deployment is questionable. Is there real habitat enhancement takes place or merely fish aggregation is a question that persists. There is no evidence of cost- benefit analysis on the deployment of FADs.

During the last five years the division had no full paper publications. One abstract has been published in the proceedings of a national symposium and one abstract in the proceedings of NARA annual sessions.

3.4 Environmental Studies Division (ESD)

ESD was established in 1989, and is responsible for monitoring of water quality in coastal waters, estuaries, lagoons for pollution. The monitoring has to be done continuously in order to provide early warnings. The Division is also required to study the socio-economic implication of pollution for fishing communities.

ESD has nine scientists, one with Ph.D, four M.Sc.s and others with basic degree.

Ongoing Projects

- Preparation of lagoon environmental profiles for selected lagoons.
- Behavioral impact of toxic material and pollutant and development of possible methodologies and treatment technologies to improve inland water resources including river basins (Kelani River).
- Investigation of causes for emergency incidents such as oil spills, algal blooms and fish mortalities (emergency studies).

New Projects

- Assessment of current water pollution status and accumulation of heavy metals in selected edible fish species in Bolgoda Lake.
- Assessment of environmental impacts of extensive shrimp farming on Mundal Lake and its surroundings.
- Identification of the operational impacts of cooling water system of Norochcholai Coal Power Plant.
- Assessment of marine litter in the southern and north western coast of Sri Lanka.

Publications

During the last five years ESD published 35 Abstracts, 15 full paper publications.

3.5 National Institute of Oceanography and Marine Sciences (NIOMS)

NIOMS is vested with the responsibility of building up understanding and knowledge of the marine environment around the country. The institute has nine research officers, three of them with Ph.Ds. and 11 supporting staff.

The principal activities of NIOMS are

- Joint research expeditions conducted in the Indian Ocean with International Oceanographic Institutions to study the monsoon circulation and other oceanographic parameters within Sri Lanka's Exclusive Economic Zone,
- Monitoring sea level changes, measuring current, temperatures, waves, tides and salinity and location of ocean energy potentials around the country have been conducted. Investigations are also been done on the distribution and transportation of

nutrients, trace metals, organic matter and other biological assessments in oceanic and coastal waters.

- The Institute is planning to set up a National Oceanographic Data Centre (NODC) for the benefit of the public and investors in the field of Oceanography.

Ongoing Research

- Oceanographic observations around Sri Lanka
- Integrated oceanographic investigation of coastal upwelling in Southern Sri Lanka
- Improvement of fishing ground forecasting and information dissemination system
- Analyses of vessel monitoring system (VMS) data to investigate its possible applications
- Sea level observation and prediction of the short-term and long-term sea-level changes
- Modeling of Coastal Sediment Dynamics on the Western Coast of Sri Lanka.
- Database and Applications Development for Sea-level Observations
- Plastic and Polythene Debris in Land and Ocean around Sri Lanka
- Impact of temperature on coral reefs in east and west coast of Sri Lanka

Oceanography Division is keen to embark on

- Offshore oceanography
- Numerical modeling for ocean status prediction and forecast
- Marine Geology

However, as no specialized personal is available, the potential new recruits shall be B.Eng, B.Sc (Physics) and B.Sc (Geology) graduates. Due to the delay in recruitment procedure, unable to recruit good candidates.

Publications

During the last five years NIOMS had thirty full paper publications, two book chapters, 43 abstracts and 14 proceedings.

3.6 National Hydrographic Office (NHO)

NARA has been mandated under the NARA Act. "to undertake the collection processing and publication of hydrographic data and nautical information on the near shore and off shore areas and inland waters, and to have overall control of such activities in Sri Lanka". In order to fulfill this mandate NHO has been established in 1984 jointly with Sri Lanka Survey Department and Sri Lanka Navy and has been accredited with the International

Hydrographic Organization (IHO) as the focal point for Hydrography in Sri Lanka.

The principle task of NHO is to carry out hydrographic surveys through systematic data collection of inshore, near shore and offshore areas. This cover sea area up to the limits of 200 nautical miles Exclusive Economic Zone. In addition, hydrographic surveys of inland water bodies are being done. The immediate outputs of NHO are nautical charts, thematic maps on fisheries and other user oriented hydrographic maps involving digital and analogue hydrographic data.

Hydrographic data obtained from surveys are mainly used for port and harbor development, coastal zone management, delimitation of the limits of national maritime jurisdiction, control of marine pollution activities, data for coast conservation and coastal engineering projects and charts for navigation. NHO is capable of carrying out hydrographic surveys at water depths up to 5000 m, covers the continental margin of Sri Lanka.

NHO has total staff of 31 and is headed by the Chief Hydrographer, with 24 years of experience. The Office is reasonably equipped. Unavailability of the Research Vessel Samudrikahas disrupted the work program and charting in deep seas has not been possible.

NHO has completed Nautical Charts of four commercial harbors and their approaches and approaches to Norochcholai coal power plant. Charts of most of the fisheries harbors, lagoons and several inland water bodies have been completed. NHO has entered into a MoU with United Kingdom Hydrographic Office (UKHO) to undertake the production and distribution of electronic navigation charts around Sri Lanka.

3.7 Institute of Post-Harvest Technology (IPHT)

This Division conducts research to ascertain and improve post-harvest technology applicable to the aquatic resources. Main activities of the IPHT include, introduction of new food processing technologies for locally available under-utilized or non-utilized aquatic resources, introduction of improved hygienic processing techniques for traditional fish products, development of technology for extraction of fish oils from fish and fish wastes, analysis of detailed lipid profiles and formulation of feeds for aquaculture, investigations on post-harvest losses and measures to minimize the post-harvest losses, investigations on human health hazards due to contamination of fish and fishery products from chemical residue, antibiotics, biotoxins and resistant pathogens, utilization of small pelagic fatty fish and fish waste to extract oil, developing techniques for producing feeds for shrimps and prawns using locally available raw materials. Laboratory testing and consultancy services on microbiological assessment, chemical analysis, food preservation, processing and quality control are also undertaken by the division.

Staff, their qualification and fields of specialization.

The staff includes eight scientists, five research assistants, six lab attendants/laborers, project assistant, development officer and management assistant. There are two principle

scientists, two senior scientists and four scientists in the scientist's career. They are trained in diverse disciplines (food microbiology, food technology, product development, industrial and environmental chemistry, food science and technology) and capable of handling responsibilities vested with IPHT. There are two officers with PhD and rest are with masters.

Researchable areas and development work addressed during the period of review

The researchable areas and development work of the division during last five years include quality assessment of fish sold in retail markets, assessment the quality of fish based products in the local market, evaluation of the quality and value addition of edible seaweed species in Sri Lanka, assessment of nutritional quality of underutilized aquatic resources and food safety, assessment and monitoring of quality of fish and infrastructure facilities in main markets, extraction and characterization of Collagen from Sri Lankan fish waste. quality losses of fish products and upgrading the supply chain of fishery products, exploring aquatic resources for natural compounds ; sustainable production and industrial application, screening of toxic chemical residues in selected fish and fishery products, safety of oysters and clams available in Kalpitiya area, extraction and characterization of Collagen, quality depreciation of fish in existing and scientifically designed/modified multi-day boats, low cost technologies for dried fish with high biological value, keeping quality under different packaging conditions and production of smoked dried Tilapia (*Oreochromis mossambicus*).

Research/ development output and outcome.

Quality Control Laboratory of IPHT has been accredited for several chemical and microbiological parameters as per ISO/IEC 17025: 2005 Standards. Clients include fishery industry, fish exporting companies; Ministries, and academic institutions. Eleven leaflets and two booklets have been prepared. Manual for good sanitary practices for fish retailing shops also published.

Recommendations to reduce fish quality losses along supply chain, preparation of manual on designing of chill storage facilities in multiday boats with University of Moratuwa, Optimization of Bivalve depuration system located at Kalpitiya station to provide depuration facility for bivalve- farmers and collectors, Development of fish smoker with filter system to filter and remove toxic smoke residues are some of the commendable outputs by the division. Over 500 test reports have been produced. Technology for several value added products are available from the division, although they are not yet commercialized. IPHT staff has 14 full papers and 33 abstracts published during the period of review.

There is a considerable contribution and resource allocation for product development and value addition in the IPHT work program. Feasibility study on resource availability, potential markets, economics, environmental and other sustainability issues have to be looked in to before selecting/ implementing projects.

Efficient methods and strategies are to be selected to transfer the technologies developed, to end-users. Scaling up of products, marketing and collaborative product development with the industry are suggested.

There is a considerable amount of information on post-harvest losses available with scientists of IPHT. Practical applications/ instructions/ management interventions to reduce losses , improvements needed for boats, handling of fish, transportation along marketing chains are yet to be fully transferred to end-users including policy makers.

It is an appropriate time to review research findings during past few years and design a long term work program before committing for the next year research program.

Research outcome is the end result of conducting research on a particular topic. In some of the projects conducted by IPHT outcome is not clearly indicated although several outputs are indicated. Periodical interim monitoring and end project monitoring procedures need improvement.

Evaluations are to be focused on the relevance, performance, efficiency, and impact of the project in relation to stated objectives. The main impact areas include economic, social, environmental and sustainability for the most of the programs conducted by IPHT. Outcome evaluations should also look into influence of research on technological development, innovation, or policy and practice changes with respect to IPHT division.

Ongoing research projects and improvement of research/ development program

Assessment of quality of fish in newly built in multiday boats, Central Fish Market and selected retail outlets, Investigation of incidences of histamine forming bacteria in chilled Yellow fin – tuna (*Thunusalbacares*) in export fishery industry, Sanitary survey and assurance of safety of edible bivalve mollusks, Extraction of bio active protein and peptide from marine resources (Seaweeds, and fish processing waste), Value Added Aquatic Products, Evaluation of Bio-active Potential of Selected Sri Lankan Marine Algae are the main ongoing research areas.

These projects cover most of the important areas related to post harvest aspects. Feasibility study on resource availability, potential markets, economics, environmental and other sustainability issues have to be looked in to in selecting research /development projects in IPHT. Outputs and outcomes are to be clearly defined. Time schedule for deliverable should be made available for monitoring process.

The outcome of this division can be improved significantly by providing opportunities for undergoing international trainings/ participation at conferences/workshops in the area of fisheries post-harvest, providing required facilities for advanced chemical analysis and

other facilities for value addition and bio-prospecting research. Increased support to conduct extension work and providing adequate funds to purchase instruments which are prioritized by HOD and the staff to upgrade the laboratories are also recommended.

3.8 Socio – Economic and Market Research Division (SEMD)

This Division was established in 1997 to conduct socio-economic & marketing research on fishing industry, fishing community and aquatic resources of Sri Lanka with the goal of enhancing social and economic opportunities and improving quality of life of the stakeholders.

Functions of this Division at present are marketing and trade research, economic analysis of fishing operations, studies on social aspects and welfare of fishermen and their dependents, providing advisory and consultancy services on the above aspects and publishing 'Fisheries Industry Outlook' (instead of 'Sri Lanka Fisheries Year Book' which had been terminated publication recently) annually. This is available on NARA website <http://www.nara.ac.lk/page id=1334>.

Staff of the Division consists of one Principal Scientist/Head of the Division, 02 Senior Scientists, 05 Scientists (out of them 07 are having masters and the other bachelor degrees), 05 Research Assistants and 02 Helpers. Posts of an economist, a sociologist, a scientist & a field research assistant are vacant at present.

This Division has carried out following research, advisory and consultancy projects from 2013-2017.

Research projects-

- Study on market & its potential of seaweeds in Sri Lanka.
- A comparative study on ornamental fish industry in Sri Lanka.
- Women participation in Sri Lankan fisheries- North western province.
- Women participation in Sri Lankan fisheries- Southern province.
- Socio-economic & marketing aspects of lagoon fisheries in Sri Lanka.
- Cost of production & economic efficiency of marine fishery in Sri Lanka.
- Identification of formal & informal institutional barriers for the development of aquaculture industry in Sri Lanka.
- Socio-economic aspects of mechanized & non-mechanized beach seine fishery.
- Study on impacts of trawl fishery.
- Socio-economic impacts of banning spear fishing.
- Study on ICT knowledge of fishers.

Advisory projects

- Establishment of fisheries information service with a telephone hotline for providing advises & requested information.
- Skipper training.
- Livelihood development- '*Wewak SamagaGamak*' program in Rekawa, Puttlam, Panama and Kokkilai ;establishment of clam produces organization in Kalpitiya.
- Skill development in fisheries at Deduru-oya.
- Program to mark 'World Fisheries Day' in 2017
- National development projects- Exhibitions at BMICH on '*ThirasaraUdana*' & '*DiviyakaUdawa*'.

Consultancy projects- Following Consultancy projects have been undertaken and completed during past 05 years.

- Socio economic aspects of the Bay of Bengal Large Marine Eco-system (BOBLME) project
- Socio-economic impact of Port city project
- Petroleum resources development secretariat (PRDS) project-socio economic aspects

On-going research in 2018

- Value chain analysis and development of giant fresh water prawns, lobster, crab and clam fisheries in Sri Lanka.
- Application of indigenous knowledge for fisheries management.

Outcomes of the projects-

Outcomes have not been clearly indicated. However, the available research data could be used for planning future research of other divisions, policy planning and decision making in fisheries sector.

Observations of the Review Panel-

Review panel noted that there are 03 important vacancies (an economist, a sociologist & a scientist) to be filled. In addition, a field research assistant and an office aid are also vacant. An economist and a sociologist would be real assets to the Division in planning and implementation of a good research program for the Division. Therefore, those vacancies should be filled considering availability of resources.

Research programs of the Division in the past 05 years were not sufficient, especially from 2013-2016. Priority should be given to research program rather than advisory and development work.

This Division should play a leading role in finding out causal factors of socio- economic and marketing problems faced by fisheries sector, socio-economic barriers in transferring new technologies developed by NARA and recommend improvements for the research plans of the

other Divisions and technology transfer. This could be facilitated by making research data and other statistics available to relevant Divisions of NARA in planning future research and carry out collaborative studies as a team to cater the needs of the fisheries sector.

Findings of this Division are quite useful for policy and decision makers of the fisheries sector and relevant findings should be passed on to them forthwith.

Establishment of the telephone 'hot line' service to provide advices and information to fishermen, other stakeholders and general public when requested, is commendable but maintaining quality and proper management need trained officers to handle this service. This could be improved by studying process of the government departments which handle similar services very efficiently and train officers accordingly. Additionally, this service could be upgraded with provision of new technological facilities and combining the resources available at Extension unit of Monitoring and Evaluation Division. Such efficient service would update knowledge of stakeholders and facilitate technology transfer and enhance the image of NARA among fisheries sector immensely.

Publications of past five years - Only one full research paper publication which was in 2015 in a journal i.e. Journal of the National Aquatic Resources Research and Development Agency, had been published. Three papers on local symposia proceedings and 17 abstracts in symposia (16 held in Sri Lanka and 01 abroad) had also been presented. The research findings should be published before the data get outdated. The quality of research publications would be upgraded if those are published in refereed journals.

3.9 Monitoring and Evaluation Division (MED)

The Division is responsible for research project planning, monitoring and evaluation. Preparation of action plan, monthly progress monitoring and compilation of annual reports are responsibilities of the Division. Additionally, Information Technology (IT) unit, Library and Information unit, Extension unit and 06 Regional Research Centers are placed under this Division.

Staff comprises of Director (Monitoring & evaluation), 01 Assistant project monitoring officer (with Masters Degrees), 01 Development officer (attach to the ministry) and a Helper.

Research projects & activities –

- Demarcation of oyster beds in North Western coastal area using remote sensing technology & zonation of Puttlam lagoon for oyster culturing.
- Quantitative assessment of sensitive coastal habitat & zoning for aquaculture in Puttlam lagoon-GIS & remote sensing approach
- Application of satellite remote sensing method to detect coral reef distribution in Pigeon Island.
- Development of a coastal special database.

- Identification of potential areas for shrimp farming & salt industry in Puttlam District.
- Assessment & monitoring of research projects of NARA.
- Provision and maintenance of internet services and online information for scientific staff of NARA and stakeholders.
- Coordination of annual scientific sessions.

Outcomes of the projects-

- Completed baseline map layer and database on currently available oyster beds in Puttlam lagoon and disseminated data among stakeholders working in oyster industry. It had been found that total area of 81 ha was covered by oyster beds in Northern part of Puttlam lagoon.
- Detected extent of coral reef distribution in Pigeon Island and shared the data among key agencies involved in decision making for management of Pigeon Island National Park. It had been found that this coral reef was quite stable and survived around 50% unharmed during El Nino condition in 1998 and Tsunami in 2004.
- Developed a coastal spatial database for improved management of coastal ecosystem.
- Completed maps of current coverage of mangrove and sea grass beds in Puttlam lagoon. Report on analysis of change of mangrove coverage from 1956 to 2014.

3.9.1 IT unit-

The activities include provision of high quality technology-based services to research activities and technology support for audio-visual, multimedia, desktop and web based applications and services.

Staff comprises of 01Scientist(with a Master degree),01Assistant IT officer, 01Network/hardware technician, 01 Management Assistant and a Helper. Following posts are vacant at present -01Assistant Director (IT), 01Scientist, 01Assistant network administrator and a research assistant.

Research projects and activities -

- Use of geography information system (GIS) and remote sensing (RS) for resource planning and identification of suitable areas for aquaculture development and forecasting. It delivers spatial and attribute data to internal researchers.
- Storage of spatial data of marine and terrestrial areas. It intends to facilitate as a platform to pool data /information available in respect to aquaculture resources, environment and users which enable to develop environment friendly products and scientifically based management of aquatic resources/environment.
- Provides all aspects of IT and systems implementation for information gathering, processing, sharing and dissemination among stakeholders.
- Provides expertise in computing hardware and software support as well as local area network and wide area network connectivity to the staff and administrative support of computer networks.

- Maintains IT contacts and software licenses and coordinates procurement of IT related hardware and software.
- Provision and maintenance of internet services and online information for scientific staff of NARA and stakeholders.
- Coordination of annual scientific sessions.

Outcomes of the projects-

- Launched a new website for NARA using 'wordpress' and updated.
- Mail servers had been upgraded and problems of personal computers used by staff had been resolved whenever requested.
- Successfully coordinated annual scientific sessions.

3.9.2. Library & Information unit-

Library has a total collection of 5060 books, 2766 reports, 514 research papers, 500 electronic research papers, 266 journals, 03 online journal accesses, AGORA-3000 online database access.

Activities of this unit include assisting researchers for library search, provision of reference facilities and library facilities through internet, collection of research papers, lending of books to readers and exchange of books and have linkages with other libraries etc.

Published the Journal of National aquatic resources research and development agency, vol. 41, 42 & 43 and distributed among other Institutes.

Staff includes 01 Senior librarian, 01 Librarian (one with master degree and the other with a post-graduate Diploma), 01 Development officer (Project), and 02 Helpers. Two Management assistants (Librarian) and 01 Management assistant posts are vacant.

Outcomes-

- Improved library collection of reading material and provided access to scientific information according to requests of NARA scientists.

3.9.3. Extension Unit-

Activities of this Unit

- Organizing fisheries and public awareness workshops on research projects carried out by NARA
- Conducting educational exhibitions.

- Training of fisher community.
- Other technology transfer activities.

Staff of this unit consists of 01 Extension officer, 01 development officer (with Bachelor degrees), and 01 Photo technician, 01 Management assistant and 01 Helper. One Senior Extension officer, 01 Multimedia designer and 01 Video editor posts are vacant.

Outcomes-

Dissemination of research information had been carried out by publishing Journal of National Aquatic Resources Research and Development, NARA scientific sessions extended abstracts and NARA annual reports. Printing and dissemination of newsletters 'Blue Ocean', 'Sayuru Netha' and posters on scientific information, conducting exhibitions and training programs, contributing to newspaper articles and TV programs are other means of technology transfer. Additionally, fisher community and farmers had been trained on fisheries & aquaculture management.

Observations & recommendations of the Review Panel

Even though this Division is conducting monitoring and evaluation of research projects, performance appraisal of staff seemed to be not very effectively carried out. A committee comprising senior officers could work out a simple, fair and unbiased methodology for performance appraisal of all staff including lower levels. HODs could undertake formal performance appraisal accordingly, of individual staff members of their Divisions annually and suggest ways for them to improve in conducting research work, which would eventually upgrade overall performance of the Institute. Performance appraisal of HODs could be done by DDG.

This Division should be strengthened for efficient transfer of technologies developed by scientists of NARA and coordinate and support extension work carried out by the other Divisions. This could be carried out by implementing a regular procedure for collecting and summarizing technical information from different Divisions and disseminating those to the relevant stakeholders. Review team observed that many technologies developed by NARA had not reached the end users specially the products developed by Post-harvest technology Division. Therefore, it is necessary to review technology transfer process adopted by scientists in the past, to find out exact causes viz. marketing, economic, social factors and etc. which hinder transfer and thereby, develop strategies to overcome obstacles and implement effective transferring. Socio-economic and marketing Division could play an important role here.

Overnight rest room

Research staff working on projects off and on has activities that require overnight monitoring. Additionally, staff members going on long field visits may need to stay overnight and join the transport vehicles rather than picking them up by visiting their houses early morning. At present the drivers have this facility but not for the scientific staff. Such a facility was available some time

back by allocating rooms at "Wadiya" is now being used for some other purposes. Facilities should be provided by adding accessories such as telephone connection, minor cooking appliances, refrigerator and a water filter.

Fishing gear stores

Storage facilities for fishing gear is not available attached to Fishing Technology Division. There should be a place close to this division to store fishing gear and material issued by the stores for rigging purposes. As of today, division's space is used for this purpose. This pattern has to be changed by providing appropriate space to house, rig and display fishing gear.

Museum

A very good collection of marine and freshwater organisms were transferred to NARA at the inception from the Research Division of the Ministry of Fisheries. Several years back, a research assistant was assigned to look after those specimens but later on no qualified officer is regularly attending to the activities of the museum. Those items were kept unattended over a long period of time and are kept at a room named as the "Museum". Presently it is not looked after well and the items are not properly maintained by a qualified staff member trained for the purpose.

Exhibition hall on the ground floor

Large display items such as skeletons of marine mammals, models, mounted specimens etc. are now kept in a large display room on the ground floor of the main building very close to the main entrance. Above items are not properly maintained. Some items are covered with dust as regular cleaning is not done. This space has to be utilized properly as it gives an image of NARA to those who enter to the main building.

3.10 Services and Operation Division

This Division is responsible for infrastructure development, vehicle maintenance, electrical, mechanical and civil engineering work.

Staff of this Division comprises Director (Service & Operation), 03 Technical Officers (Electronic, Mechanical and Civil), 01 Landscaping Officer, 01 Transport Officer, 01 Management Assistant (Transport), 01 Technical Assistant (Civil), 01 Technical Assistant (Mechanical), 01 Draughtsman, 03 Management Assistants, 01 skilled labor, 03 Electricians (01 over cadre), 03 Welders (01 over cadre), 01 Carpenter, 01 Motor mechanic, 21 Drivers and 08 Helpers.

Following vacancies of staff are existing- 01 Assistant Director (Vessel operation & maintenance), 01 Assistant Director (Service & Operation), 01 Development officer (Project), 01 Technical Assistant (Electrical), 01 Plumber, 01 Carpenter, 02 Masons, 01 Motor mechanic and 05 Drivers. These vacancies should be filled with immediate effect to provide better service.

Vehicle fleet includes 21 motor vehicles (including 01 three- wheeler) and 15 motor cycles. Vessels and boat fleet include 01 vessel (RV Samudrika) which is of 25 m length with endurance

of 07 days having accommodation capacity of 07 Research staff. Boat fleet consists of 05 boats including 01 hydrographic survey boat (Taranga), 02 FRP boats (at RRC Kalpitiya) and 02 FRP teppan (one at RRC Kalpitiya and the other at Panapitiya).

Observations & recommendations of the Review Panel

The review team observed that services of maintaining the vessel with the existing staff are not up to the expectation. Vessel maintenance had not been carried out properly during the past 05 years, resulting in several breakdowns (worked only 345 sea days from September 2012 to October 2017) and finally immobility of the vessel for a long period (from October 2017 up to date) thereby, depriving of scientific staff to conduct important research work on hydrography, oceanography, environmental studies, marine biology and others. Furthermore, immobility of the vessel creates problems of wastage of vessel parts, in addition to burden of dockyard cost of Rs.6000 per day, cost of salaries of staff, insurance fee etc.

This pathetic situation should be considered seriously by the higher management and a workable solution should be developed and implemented without delay. If this Division is unable to maintain the vessel properly, an agreement should be signed to hand over that before it get deteriorate further, to an able body like Sri Lanka Navy or a reliable shipping company for maintaining and get their service for NARA research, instead.

Even though vehicle fleet available for use by scientific staff is adequate, scientists are unhappy about vehicle allocation procedure. A transparent method, agreeable to both parties should be drawn after discussing with transport officer and the Director, as this kind of minor matters also paralyze implementation of research program and create frustration among scientists.

Maintenance of the main building of NARA appeared not been undertaken regularly in the past and as a result most laboratories and office rooms are in need of renovation which is undertaken presently. Some corridors are getting wet during rain which should be prevented immediately to avoid major repairs in future. The habit of pilling up of cabinets in corridors to allow space inside office rooms create unpleasant environment and tarnish good image of NARA. Officers should be trained to computerize data and keep soft copies to avoid large paper files and save working space. Unwanted things should be disposed regularly to make the environment pleasant.

Infrastructure development, renovation and maintenance of buildings at RRC Rekawa, Kapparathota, Kalpitiya and Kadolkele where the review panel visited are quite slow. For minor constructions, procedures suitable to those regions should be implemented to speed up engineering work.

3.11 Administration of NARA

- **Governing Board**

This comprises of 16 members including 08 *ex-officio* members and 08 appointed members.

- **Chairman Office**

Staff comprises of Chairman (on contract basis), 01 Secretary to Governing Board/ Legal Officer, 01 Personal Assistant and 02 Helpers. A post of Book Binder is vacant.

Internal Audit Division comes under Chairman. Staff of this Division comprises of an Internal Auditor, 01 Internal Audit Officer, 01 Management Assistant and 01 Helper. One Development Officer (Project) post is vacant.

- **Director General Office**

Staff comprises of Director General (on contract basis), 01 Personal Assistant and 03 Helpers.

- **Deputy Director General Office (Recently implemented)**

Staff comprises of Deputy Director General, 01 Research Assistant and a Helper. A post of Development Officer is vacant.

Administrative Division (AD)

This Division was established to properly manage human resources (HR) and implement administrative matters efficiently and effectively.

Staff comprises of one Assistant Director (HR), 01 Administrative Officer, 03 Development Officers (Project), 06 Management Assistants (MAA), 01 Skilled Laborer, 01 Care Taker/Cook and 06 Helpers.

Observations of the Review Panel-

Review panel noted that two topmost posts viz. Director (Administration & HR) and Assistant Director (Administration) in addition to the posts of 03 Translators, 02 Management Assistants and 02 Care Taker/Cooks are vacant. Therefore, existing staff have to cover up the duties of the vacant positions which is not very satisfactory for smooth running of activities of the Division.

Total of 361 human resources (staff of all grades) are administered by this Division. Review panel observed that some important technical grade positions, viz. 03 Senior Scientists (SS), 01 Senior hydrographic surveyor, 31 scientists, 01 Sociologist, 01 Economist, 02 Hydrographic surveyors, 01 Senior cartographer, 01 Senior system analyst, 01 Data analyst, 01 Senior extension officer, 01 Cartographer Data analyst (Nautical), 01 Cartographer Data analyst (GIS), 01 System analyst, 01

Land surveyor, 01 Cartographer, 01 Diving officer, 03 Translators, 03 Development officers, 05 Field research assistants, 30 Research assistants, 02 Cartographic Draughtsman, 01 Head Driver /Marine, 01 Draughtsman, 03 Drivers, 01 Driver assistants, 01 Technical assistant (Electrical), 02 Management Assistants (Library), 01 Ocean observation technician, 01 Assistant skipper, 01 GIS Technician, 01 Radio officer are vacant,altogether 105 posts are vacant at present.

Rational distribution of staff should be carried out as some divisions are suffering from lack of staff. If some of the important vacancies are not filled immediately, efficiency of NARA would get affected especially the careers of scientist and research assistant. A newly recruited scientist should get at least five years of research experience in his or her field, to be productive. Therefore, filling of vacancies should be carried out on a regular basis which is a good investment for future of the Institute. Higher management should consider this seriously, as properly guided human resource is the major strength of an Institute.

Some trade unions claimed that staff of NARA was not satisfied with the procedure of recruitment where some staff members had been recruited outside the scheme of recruitment (SOR). NARA being a scientific research Institute, needs high quality well qualified staff to achieve its goals. Therefore, recruitment to higher grade technical and non-technical posts should be purely on merit basis. There should be a transparent procedure of recruitment for all staff positions with no political interferences.

Several problems of recently introduced scheme of promotion (SOP) had also been highlighted, where some staff members are deprived of promotions to upper grades due to cadre restrictions. e.g.: A Senior Scientist is promoted to Principal Scientist (PS) position only when a PS post is vacant (i.e. when an existing PS retires, dies or leaves the Institute) even though, the SS had fulfilled the necessary requirements for promotion to PS post. Similarly, a PS has to wait to be promoted to Head of the Division (HOD) until the present HOD retires or leaves the post. Removal of career restrictions and rotation of HOD position periodically are good solutions for this.

This is true with some other technical and non-technical staff grade positions as well. Additionally, some have to retire in the recruiting grade after long years of service due to various reasons. These were highlighted in our discussions with almost all staff grades and trade unions.

The higher management should take precautions to create a peaceful and satisfactory working environment by minimizing such promotional barriers for the staff members, especially for the scientists, to obtain higher productivity from them. SOP of universities is a better option to implement and that would solve much of the above problems and reduce dissatisfaction among officers who tend to leave the Institute in frustration, for universities or for better pastures.

Criteria for research allowance had been requested to change by some scientists, considering high quality research publications as well. A team of senior scientists could be appointed to work out an appreciable scheme.

Carrier development of the staff – Scientists are receiving foreign trainings to some extent but middle level technical and non-technical grades of staff are deprived of foreign trainings to certain

extent. As all staff should get opportunities to update their knowledge, they could be allowed to apply for such opportunities appearing on internet or other media to overcome this barrier.

Scientists claim that they have to get the approval of the management before applying for foreign training opportunities appearing on internet and delays in approval procedure may exceed closing dates resulting in depriving of them even to apply. To avoid this, they could be allowed to apply for foreign trainings and approval could be given afterwards considering relevance and other conditions. The budgetary allocation for staff training and opportunities for staff to travel abroad, both for conferences and for short and long term training, should be increased. Participation in such events would enhance updating knowledge, provide opportunities to discuss their scientific achievements with the colleges of other countries facilitate communication with international scientific community and finally improve job satisfaction of the staff. Still there is a scientist with 25 years of service without post graduate qualifications in IARD. Panel would bring the matter to the notice of NARA.

A senior management committee comprising chairman, DG, DDG and HODs should be established to address issues related to staff recruitment, promotion, training and other administrative matters.

Motivation of staff could be enhanced by felicitation of good work of all categories of staff by introducing a reward scheme. Three scientists have won President's award in 2017 which was a good achievement. The other scientists also could be encouraged to get similar achievements.

Scientists claim that present administrative procedures (necessity of recommendation by HOD as well as DDG) in releasing 'petty cash advances' would cause delay in timely operation of research program. This delay is inevitable as the DDG has to give recommendation for more than 80 officers and DG has to approve those.

To avoid this kind of delays, HOD could be given the sole responsibility of recommendation of petty cash advances requested by the scientists to overcome such difficulties. If a HOD is not taking the expected responsibility, he or she could be penalized. Approval could be given by the DDG. Recommendation of cash advances of HODs could be given by DDG and approval by DG.

Decentralization of management activities to certain extent would relieve the burden of work load of higher authorities and at the same time, that would enhance HODs to acquire hand on experiences to handle higher management positions in future as well as to enhance their moral. HOD positions should be strengthened and they be allowed to participate in management activities positively and also take responsibility of guiding scientists and other staff of the respective Divisions to work in team spirit to improve the productivity of their research work.

Officers who are appointed to work in management positions including HODs should be trained just after appointment to carry out management work efficiently.

3.12 Finance Division

Functions of this Division include utilization of public and other funds effectively and efficiently enhancing accountability and transparency to achieve the goals of NARA.

Staff of this Division consists of Director (Finance), Assistant Director (Finance), 01 Accounts Officer, 01 Development Officer (Project), 02 Accounts Clerks (these posts are not in the approved carder list), 01 Book Keeper, 03 Management Assistants, 01 Shroff, 02 Helpers. This is the only Division where all staff positions are filled.

This Division handles Rs. 588 m. budget (Rs. 263 of Capital + Rs. 325 Recurrent) of treasury funds in 2018. Budgets of consultancy projects, research grants (local & foreign) and earnings of the Institute which is Rs.16m in 2018 are also managed.

The financial management is carried out through procurement committee, audit & management committee and the governing board.

Observations & recommendations of the Review Panel-

The Director and the staff are supposed to provide good service, but the scientists are highly concerned about long delays in purchasing laboratory equipment and other items needed to carry out their research program, due to various financial procedures and barriers. An efficient and rapid procedure for purchasing requested scientific equipment and other items is necessary to avoid long delays. Divisional Heads, DG,

DDG, Director (Finance) and other relevant officials could get together and derive a feasible and efficient way to overcome such financial barriers and facilitate smooth running of the scientific program. Officers requested to revise subsistence allowance (Rs.1500) as they claim that this is inadequate at present. This and other financial allowances could be revised periodically to suit inflation rate if applicable.

Scientists should have peace of mind to conduct research work without hanging around to get services of supporting staff.

Budgetary allocation for staff training and provisions for staff to travel abroad for conferences and for short and long term trainings should be increased.

3.13 Regional Research Center – Kalpitiya

RRC Kalpitiya is the field station of NARA in the North-West Coast close to several important areas /habitats (Puttalam Lagoon, the Dutch Bay, the Portugal Bay, Wilpattu National park, Kala Oya and Appu Aru, and Bar Reef marine sanctuary).

The station is operational since 1984. The objectives of establishing this station was to decentralization of the research program of the agency and facilitation of field oriented research by providing facilities and instruments.

The present staff include two scientists, one research assistant, five laborers and two circuit bungalow keepers. Operation of a sea cucumber hatchery and community based culture trials on sea cucumber, processing and value addition of seaweed, improvement of spat collection methodologies and community based oyster culture are the main research/ development programmes conducted by the center. In addition, a depuration plant is maintained by the center and facilities are available to the community for a nominal fee which is commendable.

Considering the location, the center should coordinate research/ development programmes conducted by NARA relevant to North Western Province.

There are several issues / concerns about Bar reef sanctuary and Norchhole coal power plant, post-harvest losses and fisheries management issues in lagoons and coastal areas of Kalpitya/Puttlam and Chilaw and Kalpitiya,. Tourism and related activities are expanding rapidly in in the district. Impacts of these activities on sensitive ecosystems and improving sustainability of those activities need to be addressed. Puttlam district is the leading shrimp culture area in the Country. Health, environment issues and sustainability issues are other research/ development activities identified to be coordinated and implemented from RRC at Kalpitiya.

Non availability of a vehicle, basic laboratory facility for water quality analysis, microbial quality analysis, refrigerator and deep freezer deprive the officers from availability of basic facilities for research.

Establishment of at least basic facility for water quality monitoring, microbial quality monitoring, sample storage facility and transport facility are urgent requirement. A small pier to facilitate boat anchorage and refurbishment of the sea cucumber hatchery are other improvements identified.

The circuit bungalow is located in between the main building/ laboratory complex and the hatchery. This will affect the health management and operational issues of the hatchery. The hatchery has to be secluded from rest of the area and activities.

3.14 Regional Research Center – Kadolkale (Negombo)

Kadolkale research center is located adjoining the Negombo Lagoon in a well grown mangrove area of 14 ha in extent. Several objectives of this station have been identified since the inception of the station. Decentralization of the work programme of NARA and facilitating field oriented research, development of a national mangrove research and educational center, education, conservation of the mangrove area of 14 ha bordering the upper reaches of the Negombo lagoon, which is the remaining only largest single land ward patch of mangroves and promotion of Eco-Tourism based on the mangroves were the main objectives.

Broad development objectives of the station

Development of a coastal aquaculture advisory center, Conducting studies for the management of mangrove ecosystems and to development of mangrove park, regular monitoring of water

quality and pollution in Negombo lagoon, to provide educational training programmes on brackish water aquaculture are other objectives identified .

Staff

The present staff includes one scientific officer, two research assistants and three laboratory assistants.

Only one research project is conducted by the officers in the center. The research programme investigates the reasons for rapid increase in oyster *Crassostrea cucullata* population in Negombo lagoon and possible solution to control the rapid increase in population.

Center looks after a 14 ha of diverse mangrove area and has a collection of different mangrove species available in Sri Lanka. The center is open for visitors and researchers and conduct awareness programs on mangroves and lagoon environment. The center should promote greater community awareness, understanding and enjoyment of lagoon and mangrove environment, and to foster stewardship through educational programs and activities.

Kadolkale Regional research center is proposed to take lead role in coordinating and implementing programs addressing issues related to environment in Negombo lagoon, management of fishery resources in lagoon and coastal areas, post-harvest issues and issues related to mangrove environment with the collaboration of all relevant divisions.

Still the ownership of land is not properly vested with the NARA. This can be a threat to the station in future.

Constraints identified to affect the smooth functioning of the center include, unavailability of an allocated vehicle and transport facility, delay in attending to repairs and maintenance, inadequate facilities to conduct research and lack of adequate manpower.

Development of facility for basic water quality analysis and filling the carder vacancies in laboratory assistants and laborers will facilitate better functioning of the center.

3.15 Regional Research Center – Beruwala

Purpose of establishing this RRC is to provide oceanographic and fisheries related information to the fishers. As Beruwala has a well-developed fishery harbor, providing this information will be highly important to conduct well planned fishing operations for multiday fishers. This RRC is named as “Centre for Ocean and Fisheries Information” (COFI). This was established recently and a Scientist of the Oceanography Division is looking after the activities. Activities of this RRC need to be further strengthen.

3.16 Regional Research Center – Panapitiya

NARA has acquired this research station from NAQDA, and concentrates in ornamental fish culture, fresh water prawn culture, fresh water fish culture and fish feed preparation.

Two research officers are allocated to the center and the officer in charge operates from NARA head office. One scientist is stationed there. Five supporting staff are attached to the center. There are six ponds and three ponds are operational. Other three are under renovation. The center has a collection of brood stock.

Feed preparation and sales are two of the main functions in addition to maintenance of brood stock, breeding and rearing. Five different feed varieties are produced. Rearing, nursery and brood stock feed for the ornamental fish in general and specialized feed for gold fish and carps are available at station. There is a good demand for the feed produced at this center.

Considering the location and the available facility it is proposed to maintenance of a healthy brood stock, conduct research in genetic improvement of broodstock, development of techniques for breeding of endemic fresh water ornamental fish species and health management of ornamental fish.

Providing a feed drier, feed ingredient mixing machine, a machine to produce feed with smaller pellet sizes for larval feed will increase the efficiency, capacity and the quality of the feed produced in the center. Allocating a vehicle, improvement of capacities for water quality analysis and development of basic facility for disease diagnosis are suggested.

3.17 Regional Research Center – Rekawa

This research center was established in 2001. There are thirteen (13) staff members attached to the station (all categories) but only a single project is identified for the year 2018. There is no officer in charge of this station (OIC) and a scientist attached to Kapparatota Regional Research Center, is covering up duties on temporary basis. There are eight (or nine) acres of land but the land area is not properly utilized, maintained and protected. Most of the space of the research building is unutilized. Auditorium is used to store some fishing gear as a temporary arrangement. Laboratories are not properly attended for the last five years and equipment available are not up to the standard to conduct good quality research. The existing scientific program of the regional research center does not reveal the manner in which this center is making a significant contribution to the development and management of the fisheries resources of the Southern Province.

There are no senior staff officers (as at April 2018) and the senior officers who were at the center have been transferred to other stations and the existing staff is inadequate to carry out a meaningful scientific program of research. The only visible activity at the station is having some fish tanks used for breeding and selling ornamental fishes. Even within this activity, no research component was observed. This center does not have a coherent plan to address purpose of establishing the

center. In the absence of such a plan and proper guidance, officers are attending to ad hoc type of emerging priorities and the capacity of the center is underutilized.

3.18 Regional Research Center (RRC) – Kapparithota

Kapparithota RRC has been closed down sometime back but has restarted recently. Purpose of closing down was due to the unhealthy working environment of the area to conduct research peacefully. Originally the center was established using the “community hall” of the fishers of the area. As a result although it was given to NARA, fishers used to visit the premises frequently disturbing the activities of the center. With the establishment of the RRC at Rekawa in the year 2001, to cater the fisheries related needs of the southern province, a decision was taken to close down this center. Staff and the equipment of the center was transferred to Rekawa RRC. Several years later, with the change of management, steps have been taken to reestablish this center.

After visiting the center, the panel members felt that staff members at Kapparithota RRC are still struggling with the same problems they were facing few decades back. According to the staff members at Kapparithota RRC, they are devoting considerable time on land/property related issues than research. The review panel is of the opinion that the present site of Kapparithota RRC is not a suitable place to conduct research.

Recommendations on RRC Rekawa and Kapparithota

Quality of fisheries research depends on several important pillars,

- (1) The specificity of the subject matter/project/research
- (2) Clarity and appropriateness of the methodology used, design of the research project etc.
- (3) Qualifications and experience of the research staff
- (4) Equipment used
- (5) Supervision

None of the above was at a satisfactory level with regard to both these RRCs. As a result, staff members are attending to nonproductive day to day activities and data collection. One fully fledged research station is sufficient to cater the needs of the southern province than having understaffed, poorly funded, under equipped two RRC's. Rekawa RRC is situated at a much better location than Kapparithota to conduct research in a peaceful environment. A vehicle has to be provided to this station on permanent basis. OIC of this RRC has to be provided with a quarters inside the premises. At least one more quarters and a circuit bungalow are needed for another scientist and for the staff travelling from Colombo for overnight stay. Above (1) to (5) have to be attended as early as possible.

3.19 Research Vessel Samudrika

NARA presently possess a small research vessel (LOL 25meters), constructed nearly eight years ago.

As at today, this vessel is non-functional due to a major breakdown. Considering our experience in Sri Lanka and overseas, it may not be viable to own a research vessel even if it is a gift, because NARA does not have sufficient funds / trained personnel/ infrastructure facilities to maintain a research vessel. Manpower and financial factors are likely to become limiting factors for keeping the vessel at sea for a reasonable duration necessary to justify owning such a vessel. As regular maintenance is done by officers of NARA who are not well trained on handling research vessels, the treasury money used on frequent repairs also are not justifiable.

4.0. SWOT analysis

Strengths

- Only fisheries research institute in Sri Lanka
- Research arm of the MFARD
- Situated close to the sea and Kelani River outfall
- Having large area of land for future expansion
- Having RRCs to cater the regional needs
- Having a high number of research staff
- Certain laboratories are accredited
- Having a journal to publish own research findings
- Having a research vessel for the institute
- Possess a powerful Act.
- Having annual scientific sessions to present research findings
- Sabbatical leave system is in place at NARA for scientists

Weaknesses

- Lack of a long term work program
- Lack of guidance for the young staff to conduct research
- RRCs are poorly maintained
- Poor condition of the laboratories of RRCs
- Not having a Scientific and Technical committee to direct NARA on future research needs
- Not having a manual of procedure for the institute
- Vehicle fleet –considerably old (having frequent breakdowns)
- Poor career opportunities for the NARA staff
- Frequent changes in the top administration (Chairman and DG)
- Short of vehicles for the RRCs to conduct research on an organized manner
- No senior staff at the RRCs to guide young scientists
- Frequent breakdowns of the research vessel

Having limited number of experienced scientists to write good research proposals for external/ foreign funding

Action has not taken to fill certain key positions (e.g. Administrative Officer)

Poor interdivisional collaboration.

Long delays in equipment & chemical purchase

Regulations had not been formulated to the NARA Act.

Opportunities

Having a vast aquatic area for future research

Having frequent foreign visits for researchers to develop outside exposure

Opportunity for international and regional scientific collaboration

Having large land area in Rekawa and Kalpitiya RRCs for future expansion

Vast land and sea area available in North and East for research purpose after settlement of civil disturbances.

Threats

Scientists leaving NARA for better opportunities

Universities developing their capacities in aquatic research

Accredited laboratories are developing in the country for certification – aquatic export related areas

5.0. Conclusions

As a result of overstretching the scope of NARA's functions, specificity of its main role appears to be lost. Consequently, the specificity of the functions of the Director General, Governing Board and the Scientific and Technical Committee also has been lost. As a result, the qualifications of those appointed to these posts also could not be made sufficiently specific to indicate that research related to the "Fisheries and Aquatic Resources" sector is the primary role of this agency. Therefore, the responsibility of directing, guiding, and training, monitoring and evaluating the research being conducted has not been taken into consideration to a satisfactory level.

- NARA still does not have a cohesive "Aquatic Resources Management Development and Research Plan" prepared in keeping with paragraph 5k of NARA Act. No. 54 of 1981, which has also being highlighted in the 1999 review report. With a proper work program, long term- such as continuous monitoring; medium term- such as proposals by the scientists and short term- such as stake holders' requests, NARA should be able to make a positive impact to the national development.
- Very limited inter-divisional research has been done and the trend was to work in isolation. It is important that there should be a collective effort in planning and conducting research to get the best use of the effort.
- The lack of inclination shown in publishing scientific results (findings) may be due to inadequacy in research planning, research training, data analysis, statistical interpretation and in scientific writing.
- Review panel is of the view that the resources available at Kalpitiya, Negombo, Panapitiya and Rekawa RRCs are underutilized.
- Research Vessel Samudrika is not adequately utilized. Though the vessel has been newly bought, due to 'technical problems' she has been sailing only for around 75 days per year and has hampered the data collection.
- Career development of the staff –All staff should get opportunities to update their knowledge. Budgetary allocation for staff training and provisions for staff to travel abroad for conferences and for short and long term trainings should be increased.
- Motivation of staff could be enhanced by felicitation of good work of all categories of staff by introducing a reward scheme.
- As far as possible the University culture has to be introduced to technical divisions of NARA for administrative purposes.

6.0. Recommendations

The Review Panel observed that there is limited impact of NARA's scientific program on the national development. In order to strengthen and expand the scope of its activities and make NARA's contribution more productive the following recommendations are made.

Administrative

- In order to give wider authority to activities of NARA the regulations under the NARA Act. should be gazetted.
- Properly approved manual of procedures is recommended in order to streamline and facilitate the activities of NARA.
- NARA should take measures to provide relevant training opportunities to employees at all levels based on training needs assessment and ensure that such training opportunities are effectively utilized. Such opportunities are available openly and may encourage the scientists even to apply online.
- It is difficult to retain senior scientific officers at NARA with the present carder structure ('pyramid'). The Panel recommends that NARA should have carder structure similar to State Universities and a program of motivation should be established.
- NARA should consider raising funds through local (as National Science Foundation and National Science Council) and foreign funding agencies.
- Maintenance of the Research Vessel Samudrika should be done by a professional body who could keep her operational for most of the year.
- Steps need to be taken to equip and make the best use of all Regional Research Centers, Kalpitiya, Negombo, Panapitiya and Rekawa RRCs.
- The viability of the Kapparathota RRC has to be seriously looked into.
- The Beruwala RRC needs further strengthening on forecasting information useful for fishers.
- The panel recommends that the activities of NARA should be reviewed regularly, once in three years.
- NARA being a scientific research Institute, needs high quality well qualified staff to achieve its goals. Therefore, recruitment and promotion to higher grade technical and non-technical posts should be purely on merit basis. There should be a transparent procedure of recruitment and promotion for all staff positions with no political interferences.
- Filling of approved staff vacancies should be carried out on a regular basis which is a good investment for future of the Institute. Higher management should consider this seriously, together with implementation of an effective career development program, as properly guided human resource is a major strength of an Institute.
- A committee comprising senior officers should work out a simple, fair and unbiased methodology for performance appraisal of all staff including lower levels.
- Officers who are appointed to work in management positions including HODs should be trained just after appointment to carry out management work efficiently.
- A senior management committee comprising chairman, DG, DDG and HODs should be established to address issues related to staff recruitment, promotion, training and other administrative matters.

Scientific

- It is most important that the Science and Technical Committee as per para 17 of the NARA Act. No. 54 of 1981 be appointed in order to implement a more productive scientific work program and strengthen their role through regulations.
- Most of the conclusions and recommendations made in the 1999 external review report are still valid and recommend to give due consideration.
- Due to the lack of a proper mechanism to archive data, valuable information have been lost forever. A proper repository should be setup to preserve the data (raw and processed) and samples whenever possible. Such data should be archived as soon as they have been acquired and should make open filed after a reasonable time period not exceeding three years.
- Publication of the Journal of National Aquatic Resources Research and Development Agency should be streamlined.
- NARA web site has to be updated. A common format should be adopted in providing information of RRCs.
- At present several parameters tested at IPHT quality assurance laboratory is accredited as per ISO/IEC 17025: 2005 Standards. Laboratory of the Environmental Studies division also should maintain as accredited laboratory considering the latest quality control requirements.
- Regional research centers should coordinate/ implement programs on research and development issues specific to those regions.
- Conduct regular internal reviews/ assessment of the technical work program to evaluate the content, relevance and the quality of the research in addition to output and outcome by a committee.
- There is a considerable contribution and resource allocation for product development in the IPHT research program. When product development research is initiated feasibility also should be looked into.
- Barriers of social, economic, marketing and other problems in transferring new technologies developed by NARA should be studied in depth to derive and implement effective ways of technology transfer.
- Findings on socio-economic & market research are quite useful for policy and decision makers of the fisheries sector and relevant findings should be passed on to them forthwith.
- Research in North and East should be improved gradually in future.
- Research programs of FTD has to be revisited. As per the Act. of NARA, improvement and development of fishing craft, fishing gear and equipment and fishing methods have to be looked into.