

# **Annual Report and Accounts**

**1994**



**NATIONAL AQUATIC RESOURCES RESEARCH &  
DEVELOPMENT AGENCY  
Crow Island, Mattakkuliya  
Colombo 15**

# CONTENTS

MARINE BIOLOGICAL RESOURCES DIVISION .....	1
INLAND AQUATIC RESOURCES AND AQUACULTURE DIVISION .....	6
FISHING TECHNOLOGY DIVISION .....	11
NATIONAL HYDROGRAPHIC OFFICE .....	13
INSTITUTE OF POST HARVEST TECHNOLOGY .....	19
ENVIRONMENTAL STUDIES DIVISION .....	26
OCEANOGRAPHY DIVISION .....	30

# MARINE BIOLOGICAL RESOURCES DIVISION

## GENERAL

Seven Research Officers were engaged in the research program undertaken by this division during the year 1994. Two Research Officers were out of the Island following their Post Graduate Studies leading to Ph.D.

## RESEARCH PROGRAMME

Nine Research Projects were carried out under the research program of MBRD. 6 projects were funded by NARA and the other three projects were externally funded.

### 1. NARA Funded Projects

#### 1.1 Study of the shark catches in the Large Pelagics Fisheries in the south and west coast of Sri Lanka

During the year 1994, 27 shark species were recorded. 75% of the sharks landed were silky shark. This species is the major contributor to the shark catches landed at the Negombo and the Beruwala landing sites. The percentage number of the second larger contributor, the Oceanic whitetip shark was 5.04. Twenty six mounted jaws and seven specimens belonging to different shark species were collected. The shark catches have contributed to 10-50% of the total income of the multiday fishing boats during this year.

#### 1.2 Study of the Small Pelagic Fisheries on the west and south coast of Island.

The NARA/TCP Sampling program was used to collect the data on the small mesh gill net fishery from Negombo to Hambantota. This fishery at Chilaw was monitored by the NARA staff. The catch rate of small mesh gill net fishery by FRP boats ranged between 0.5 kg/boat to 403 kg/boat for January to December period. Fish catch consisted mainly of Hurulla, Sudaya, Salaya, Karalla and Jeelawa.

Several matured Hurulla with eggs were landed during April and May.

#### 1.3 Study of Bio-economics of Beach-seine and Small Mesh gillnet fisheries from Moratuwa to Beruwala.

The beach-seine fishery at Angulana and Tikkappola area were studied from January to December. The Beach-seine fishery was not operated during May to October 1994 (sout) of the National Aquatic Resources Agency (NARA) was established on 13th March 1994 jointly with the Sri Lanka Navy and the Survey Department. The NHO is managed by a Directorate of three, consisting of the Chairman/NARA, the Commander of the Navy or his nominee and the Surveyor General or his nominee.

The main objectives of the NHO are to carry out detailed hydrographic surveys of inland water bodies and inshore, nearshore and offshore national ocean space upto the outer limit of the Exclusive Economic centres (Chilaw and Welihena) were selected for data collection. Data collection was carried out at these sampling stations through out the year and the estimated average catch rates for the major craft/gear combinations engaged in the fishery (LR/TN and LR/SMGN) for the study period were 5.93 kg/boat/day and 12.76 kg/boat/day respectively.

### **1.5 A Bio-economics assessment of demersal fisheries in the southern and western coastal waters of Sri Lanka.**

Fortnight sampling visits were made to southern and western sampling centres. Bio-economic data on the fishing activities at the Patnangalle seasonal fishing was also recorded from logbooks maintained by fishermen for comparative purposes. Bottom longline and hand line were widely operated in both southern and western coastal areas. In the last quarter the number of boats operating bottom set longline and trammel nets in Negombo and Chilaw have increased.

### **1.6 Comparison of reproductive biology of the two most abundant commercial holothuroids (*Holothuria scabra* and *H. atra*) of the north-western coastal waters (Puttalam District).**

The plot of gonad indices against time in months showed two peaked reproductive activity in both species. However, the activity seems to be delayed in *H. atra* than in *H. scabra*. It appears that March to April and September to November is the peak spawning period for *H. scabra*, and that for *H. atra* is during April to May and October to December. Thus the most suitable period to start the culture methods of both three species would be March to May.

### **1.7 Bio-economic study of the Ring net fishery in the south**

Study of the ring net fishery was carried out throughout the year by monitoring the catches at Weligama, Mirissa, Dondra, Kudawella & Kottegoda. Catch rates fluctuated from day to day depending on the availability of the free swimming schools. Catch rates have varied from 0 - 600 kg/boat. Catches consisted mainly of frigate tuna. With the onset of southwest monsoon in early May, the catches of frigate tuna declined. Some ring nets operation were carried out with small meshed gillnets (1" - 1.75") targeting gar fish.

## **2 Externally Funded Projects**

### **2.1 Study of the Puttalam/Mundal Estuarine System under the coastal Ecosystem study programme funded by SAREC - (SAREC/19/CE-07)**

The collection of catch/effort data from the coral reef associated fisheries and the coastal fisheries from Udappuwa to Mampuri was continued upto September. Since then no field studies were made. Analysis of data and the preparation of the scientific reports were carried out. Some field visits were made to fill information gaps in the socio-economic component of the project. Analysis of socio-economic data were continued and the preparation of the final report was commenced.

## **2.2 Establishment of a monitoring system for catch of artisanal drift net and longline fishing. TCP/SRL/2251 (A) - funded by FAO.**

The collection of data on drift gill net longline fishing by the samplers were continued throughout the year and the data collected were entered into the computer database. The analysis of data collected during the previous year were carried out. This project was terminated in Dec. 1994 and NARA will continue the monitoring of these fisheries through the field based samplers. As stated in the project agreement the staff recruited to the above project will be absorbed into NARA permanent cadre to continue the work.

## **2.3 Resources surveys within the EEZ of Sri Lanka (funded by ADB)**

The consultants appointed to the Project has completed two reviews one on the past resources survey & the other in the longline fishery in the Indian Ocean. The preparation of the computer data base for the analysis of resources survey data is underway. International bids were called for the charter of two resource survey vessels. Log books were introduced into selected offshore fishing boats on an experimental basis for field testing.

## **2.4 Studies on the recruitment pattern of shrimp larvae in the Rekawa Lagoon**

During the first four months of this year, shrimp catch was very high and around 4.0 mt of shrimp was produced. With the onset of the south-west monsoon, shrimp production declined and in May it was at a very low level. June to Sept. period was the lean season when shrimp as well as fish production of the lagoon was poor. Lagoon mouth was cut open several times during this year and constant connection between sea and lagoon was observed during July. - Nov. period. Fish "Kraals" were constructed in the lagoon during Oct. 1994 and later most of them were removed due to poor shrimp production.

## **2.5 Survey of Coral Reefs**

### **Field activities in the Northwest**

The studies conducted in 1993 was continued in 1994 mainly to assess the overall changes to the health of the reef. Reef conditions were determined by assessing the extent of live coral cover, extent of damage to the reefs, causes of damage and the abundance of selected groups of fishes and other organisms as well as sedimentation etc. To assess the above, Intercept Line Transect studies were conducted at the Bar Reef Marine Sanctuary, Kandakuliya and at Mampuri.

One of the important findings is that the greatest impact on the reefs have changed from human impact in 1992 to a population explosion of *Acanthaster planci* in 1994.

### **Field activities in the South and Southeast**

A preliminary reef survey was carried out at the Great Basses reef off Kirinda. This initial survey gathered information on species diversity of corals, fish and other reef organisms as well fisheries activities in the area.

## 2.6 Special Area Management Plan for the Hikkaduwa Marine Sanctuary

The Coastal Resources Management Project supported by USAID is carrying out a Special Area Management Programme at Hikkaduwa and Rekawa with the aim of preparing management plans. Previous surveys conducted by NARA in 1985 and 1992 indicated that the health of the reef is rapidly being degraded due to various anthropogenic activities. Permanent transects established during these studies were lost due to human interference, as a result new permanent transects had to be installed for the study conducted in 1994.

### Research Papers Published/Presented

**The following research papers were presented at the 2nd NARA Annual Session held on 2nd Dec. 1994.**

*Dayaratne, P. & K.P. Sivakumaran; BioSocio-Economic Assessment of the Purse-seine Fishery in The South-West Coast of Sri Lanka.*

*Sivakumaran, K.P. & P. Dayaratne; Bio-Socio Economic Assessment of the beach seine fishery in the southwest coast of Sri Lanka.*

*Jayakody, D.S. & S.S.C. Pieris; Trials with fish aggregation devices (FADs) off west and south-west coasts of Sri Lanka.*

*Rajasuriya, A. & Kavish Rathnapriya; The Abundance of the Crows-of-thorns starfish **Acanthaster planci** (Linne, 1758) in the bar reef and Kandakuliya areas, and implications for management.*

*Moiyadeen, N.M. ; Comparison of re-productive biology of the two most abundant commercial holothuroids.*

*Jayawardane , P.A.A.T. & P. Dayaratne; Preliminary analysis of the flying fish fishery in Kandakuliya on the north western coastal waters of Sri Lanka.*

*Maldeniya, R. ; Bottom long line fishery in Negombo - a decade after its introduction.*

*Amarusooriya, D. & P. Dayaratne ; Seven records of sharks from the large pelagic catches landed in the west and the south west coasts of Sri Lanka.*

*Dayaratne, P. & R. Maldeniya ; Exploratory fishing for large pelagics by the modified aAbu Dhabi boat NW-35- an outcome.*

*Rajasuriya A.; Three genera and twelve species of stony corals new to Sri Lanka.*

**The following research papers were presented at the 49th Annual Session of Sri Lanka Association for the Advancement of Science.**

*Maldeniya, R. & T.A. Rajapakse ; Taxonomic study of snappers (Family: Lutjanidae) in demersal fish catches from southern and western coasts of Sri Lanka.*

*Dayaratne, P. & K.P. Sivakumaran; Bio-socio-economic assessment of the ring net fishery in the south-west coast of Sri Lanka.*

**The following research papers were presented at the Sri Lanka/FAO National workshop on Development of Community-based Fisheries Management System.**

*Dayaratne, P. Information made for strategic planning of Fishery Management.*

*Jayakody, D.S. Traditional Lagoon Fishery in Negombo.*

### **Training/Workshop**

One officer underwent training on Coastal Resources Management organised by the Coast Conservation Department and CRMP.

Two officers of the Division participated as a resource person at the Master Teacher Trainers Workshop organized by the Coast Conservation Department. The workshop was held at Hikkaduwa from 21st to 25th June 1994.

One officer participated as a resource person in the one day seminar for the staff of hotels at Hikkaduwa. The seminar was organized by the CRMP and held at the Coral Gardens Hotels on 17th July 1994.

One officer participated as a resource person at the ornamental fish rearing workshop held at NARA on 14th July 1994.

Two officers attended the meeting of the Coastal Ecology Advisory Committee at NARESA on 7th July 1994.

Two officers attended the workshop on Developing National Strategies to Conserve Bio-diversity held on 30th July 1994. This workshop was organized by the Ministry of Environment/NAREP/RG.

One officer participated as a resource person at a seminar on Tourism and Coastal Resources Management held at Dickwella Relais Hotel from 18th 22nd September 1994.

Five officers attended the International Workshop on Community Based Fishery Management held from 3rd to 5th October at the Ceylon Inter-continental Hotel.

# INLAND AQUATIC RESOURCES AND AQUACULTURE DIVISION

## PROJECTS

### **1. Monitoring of effluents in shrimp farms (SAREC project):**

Under SAREC programme, continued monitoring of water quality in the main water sources for shrimp farming. Sampling was carried out for effluent quality at selected farm sites. Experiments to explore the possibility of utilizing molluscs to improve the water quality was conducted. Survival and growth of several bivalves and gastropods in effluent canals were studied. Water quality in main water sources were found at sub optimal levels with respect to total suspended solids, and metabolic toxicants during a considerable period of the year.

### **2. Study on fattening *Scylla serrata* (lagoon crab)**

Initial culture experiments were started. Crabs were fed at 5 - 8 % of the body weight and growth rates were monitored in fiber glass aquaria. A literature survey was conducted and compilation of available data on crab fattening was done.

### **3. *Artemia* culture in Kalpitiya**

Repaired ponds in Kalpitiya regional station with improvements to water supply and power supply. A culture experiment was conducted introducing 500 milk fish fry. A poly - culture trial was conducted using 500 milk fish and 1500 shrimps. Organic fertilizer was used to enhance the productivity and rice bran was used as a feed.

### **4. A sociological study of inland fishing community. A case study in Kandalama.**

Preliminary analysis of data collected from Kandalama was completed and started a survey on preliminary survey of the people residing in three villages around Kandalama reservoir.

Based on the preliminary survey, selected 15 fishermen for monthly observations and continued.

### **5. Studies on sociological constraints environmental considerations, land use changes, user conflicts in areas developed for shrimp culture.**

Collected information on new shrimp farm sites on their location, soil quality and water quality. Collected information on user conflicts. Previous land use pattern and trends in changes in land use pattern in the shrimp culture area were studied.

### **6. A study on the present exploitation level and distribution pattern of bivalves and trace metal levels in bivalves.**

This study included (1) Collection of information on the distribution pattern of edible bivalves in Negombo lagoon. (II) collection of information on environmental parameters affecting the distribution of bivalves. The study was conducted at six sampling sites.



Samples for sediment texture organic matter were also collected. These samples will be utilized to analyse select heavy metals.

The results were presented at SLAAS sessions 94.

### **7. Mussel culture programme ( Southern Provincial Council)**

A project proposal submitted to Southern Province council was accepted and a grant of Rs. 150,000 was made available.

Three floating rafts (8 x 5 m ) were constructed in the Rumassala bay and about 25000 of spat of brown mussel, *Perna perna* were stocked in each raft using plastic baskets. Spat were collected from the Rakawa reef and transported to the culture site. Three fishing families were employed for this purpose. Cleaning of baskets was continued weekly intervals. Socio-economic survey has been started to determine the consumer demand of these mussel species among the local people and tourists.

### **8. Investigations on disease out-breaks in shrimp culture systems as on problem soils.**

Continued collection of information on problem soil distribution at potential shrimp culture sites around coastal areas of Chilaw lagoon, Dutch canal , Mundal lagoon and Mi-oia estuarine area of the Puttalam lagoon.

Farm sites were surveyed for common symptoms and pathological signs.

### **9. Shrimp culture sustainability and the environment.**

A regional study co-ordinated by Network of Aquaculture Centers in Asia-Pacific was initiated during the year 1994. The survey will provide information necessary to policy makers and farmers for planning and managing shrimp culture in a sustainable manner. Three enumerator training programmes were conducted.

Using a questionnaire, 170 farm sites were surveyed.

Using 12 enumerator and 2 supervisors.

### **10. Feasibility of commercial contract growing of sturgeon the fish in Sri Lanka.**

A collaborative programme with Ministry of Fisheries, Russia, Volgograd, Sturgeon plant was initiated. The objectives were,

- \* To determine the possibility of transportation of Yolk-sac stage larvae from Volgograd to breeding stations in Sri Lanka.
- \* Feasibility of developing Yolk-sac stage larvae to fingerling stage under controlled environmental conditions.
- \* To study the growth of fingerlings under high temperature conditions to marketable size.

The transportation of yolk sac stage larvae was found successful with very high survival rates. Very high mortalities were observed in out-door tanks. Survival upto 60% was observed in glass aquaria under temperature control condition where temperatures were maintained at 22 °C.

Fish gained a total weight of 130 g in growth experiments over a culture period of 7 months.

## Research papers prepared and presented

- Kithsiri H.M.P., *Influence of sea grass coverage on the abundance of three commercially important bivalve sps. in Puttalam lagoon. SLAAS 94.*
- Kithsiri H.M.P., *Studies on clams and cockles fishery in Puttalam lagoon. SLAAS 1994.*
- Kuruppu, M.M.; *"Nutritional quality and size considerations of Sri lankan Artemia for use in commercial hatcheries" - presented at NARA Annual Scientific sessions 1994.*
- Kuruppu, M.M.; *"Life cycle of Artemia parthenogenetica Sri Lanka" for publication in the Journal of South Asian Natural History.*
- Jayasinghe, J.M.P.K., *Site assessment for shrimp culture systems in North Western Province: Survey on soil quality. SLAAS 94.*
- Corea, A.S.L.E., Ekaratna, S.U.K and Jayasinghe, J.M.P.K, *Water quality in Dutch canal, the main water source for shrimp farming industry in Sri Lanka. SLAAS 94.*
- Corea, A.S.L.E., Ekaratna, S.U.K and Jayasinghe, J.M.P.K, *Effluent quality of shrimp farming systems in the North Western Province. SLAAS 94.*
- Wijesekara, R.G.S, Jayasinghe, J.M.P.K. and Edirisinghe, U. *Effect of water exchange rate on benthos, plankton and soil quality in giant tiger prawn cultured in earthen ponds. SLAAS 94.*
- Edirisinghe, U., Wannigama, J.P. and Jayasinghe, J.M.P.K. *Effects of water exchange rate on growth of Penaeus monodon and water quality in earthen ponds. SLAAS 94.*
- Gunawardena, I.M.P.K., Edirisinghe, U. and Jayasinghe, J.M.P.K., *Use of locally available raw materials for formulation of shrimp feeds. SLAAS 94.*
- Jayasinghe, J.M.P.K., Sunil, W. and Edirisinghe, U. *Economics and performance of shrimp hatcheries. SLAAS 94.*
- Wanninayake, W.M.T.B. and Brand, A.R. 1994. *A study of Spawning Cycles of Aequipecten opercularis and Pecten maximus in the Irish Sea, United Kingdom. Annual Scientific Sessions, national aquatic Resources Agency.*
- Siriwardena, P.P.G.S.N., Rana, K.J. and Baird, D.J. (1994). *A method for partitioning cadmium body burden in small aquatic organisms. Environ. Toxicol. Chem Vol. 9.*
- Siriwardena, P.P.G.S.N., Rana, K.J. and Baird, D.J. (1994). *Variation in stress tolerance of tilapia yolk sac-fry to metal stress: Implications on extrapolating laboratory toxicity test results to field. Presented at the Annual Scientific Sessions of the National aquatic Resources Agency, 15 Dec. 1994.*
- Siriwardena, P.P.G.S.N. (1994). *Ultrastructural changes in tilapia yolk sac-fry gills to cadmium stress: Is it an accumulated damage response or a compensatory response? A poster presentation at the Annual Scientific Sessions of the National aquatic Resources Agency, 15. Dec. 1994.*

## Reports

- Prepared written material (04 chapters) for the National Institute of Education on the following topics of ornamental fishery :
  - a. Importance of the industry
  - b. Fish identification
  - c. Ornamental fish breeding
  - d. Nutrition.
- "Fundamentals of ornamental fish culture" - for teachers.
- 5 yr Fisheries plan - sub-sector Aquaculture Export of live fish.
- Book-let on Ornamental fish disease prepared for the National Institute of Education.(P.K.M. Wijegoonawardena).
- Course material prepared (on fish disease) for the ornamental fish farming course conducted by NARA.
- Preparation of syllabus for year 10 - 11 on fish diseases for National Institute of Education.
- Final report on the *Artemia* project for the funding Agency, CARP.
- Report on Export of live fish.
- Briefing paper on shrimp farming.

## Consultancy services

Forty six, shrimp farm sites were assessed.

Total earning, Rs. 512875.00.

## Other involvements

### Ornamental Fish Culture

- Conducted a one month course for 40 participants at NARA. With the help of resource personnel from NARA, Industry and Universities.
- Conducted one day introductory courses
  - 05 programmes at Yakkala
  - 01 Programme at Kandy.
  - 01 Programme at Unawatuna.

### Shrimp Culture

- Conducted seminars on shrimp culture. at Chilaw, Baticola and Colombo.
- Participated in Scoping committee meeting EIA assessment meetings.

## Post graduate studies

Several members of the staff continued their postgraduate studies.

One officer completed her Ph.D. degree.

### A. In Sri Lanka

Degrè	No of officers
M. Phil	02
M.Sc	01
M.A	01

### B. Abroad

Ph.D	01
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## **Fishing Technology Division (1994)**

### **Staff:**

D.S. Jayakody	-	Acting Director
S.S.C. Pieris	-	Research Assistant
W.G. Sirisena	-	Research Assistant
P.M. Darmasena	-	Research Assistant
Danton Silva	-	Laboratory Attendant
P.W. Gunasekara	-	Boat Operator

### **General Comments:**

During this year three major activities were undertaken by the division. Lack of research officer to this division hampered most of the project activities. Requests were made to NARA authorities to provide two staff grade officers - one fishing technologist and one boat builder to develop the activities of the division. The service of on fishing technology advisor was provided to the division under the ADB project.

### **Projects**

#### **Fish Aggregation Devices (FADs) - Funded by CARP**

Three FADs were deployed during January - April period of this year. The results were encouraging. Several requests have been received from various parts of the country asking for FADs.

It was planned to construct and deploy five FADs during this year. Although construction was initiated, it was not possible to complete and deploy the remaining two FADs due to unfavourable weather conditions.

Project Target- 100%

Achieved - 80%

#### **CASITA Project - funded by the Southern Provincial Council**

Twenty one CASITAs have been constructed and deployed during January - April period. With the onset of the South-West monsoon, CASITA deployment stopped due to rough weather conditions. CASITA construction was also affected heavily by the unfavourable weather conditions prevailed during the period July - October. Hundred new CASITAs have been constructed during this period and are ready for deployment.

Project Target - 100%

Achieved - 60%

### **NW - 35 Operations**

This boat owned to NARA was operated during the s-w monsoon period with the financial support of a private person to generate funds and also to keep the boat in running condition. By the time it was planned to collect information on fish catches. Five cruises have been completed. The first trip generated a profit to the division. All other trips were failures. A NARA officers has been participated at each cruise and they were given a training through this exercise.

### **Trainings**

Mr. S.S.C. Pieris and W.G. Sirisena were sent for a short term training at Tangalle Training School during October - November period of this year. This training was funded by the ADB project. The training was on the construction of fishing gear types.

# NATIONAL HYDROGRAPHIC OFFICE

1.0 The National Hydrographic Office (NHO) of the National Aquatic Resources Agency (NARA) was established on 13th March 1994 jointly with the Sri Lanka Navy and the Survey Department. The NHO is managed by a Directorate of three, consisting of the Chairman/NARA, the Commander of the Navy or his nominee and the Surveyor General or his nominee.

The main objectives of the NHO are to carry out detailed hydrographic surveys of inland water bodies and inshore, nearshore and offshore national ocean space upto the outer limit of the Exclusive Economic Zone of Sri Lanka and the production of navigation charts and other documents embodying the results of these surveys.

The present main activities of the NHO are to produce the following :

- (a) Navigation Charts of Sri Lanka waters from the territorial baseline to the outer limit of the Exclusive Economic Zone.
- (b) Tide Tables of National Waters.
- (c) Co-tidal Charts of National Waters.
- (d) Preparation and issue of notices to mariners.
- (e) Continuous updating of the above documents.

## 2.0 PERSONNEL

The staff of the National Hydrographic Office in 1994 was as follows :

- (1) Director/NHO - Mr. R.de S.S. Ameresekere ,B.Sc (Ceylon), M.Eng. (Fred/Canada)
- (2) Chief Land Surveyor - Mr. Wimal Kumarasinghe, Professional Exam in Advanced Surveying (Cambridge Univ./UK)
- (3) Senior Hydrographic Surveyor - Mr. B.H.B. Nihal Silva, Diploma in Surveying & Levelling
- (4) Actg.Senior Hydro. Surveyor - Mr. M.A. Ariyawansa, B.Sc., Post Graduate Diploma in Statistics
- (5) Land survryors - Mr. P.N. Kodikara,Dip. in Surveying & Levelling (Adv. Level) - on secondment from Survey Dept.  
Mr. A.W. Gunasekara, Dip. in Surveying & Levelling (Adv. Level) - on secondment from Survey Dept.
- (6) Survey Recorders - Mr. P.A.D. Sunil , on secondment from Sri Lanka Navy  
Mr. E.B.P. Samankumara, on secondment from Sri Lanka Navy
- (7) Draughtsmen - Mr. W.A. Wilfred, Surveyor General's Licence for Authorized Draughtsmen.  
Mr. P.B Ratnapala, Surveyor General's Licence for Authorized Draughtsmen.
- (8) Cartographic Draughtsmen - Mr. S.R.T.P. Sinhabahu, National Certificate in Draughtsmanship & National Certificate of Technology.  
Mrs. G.D.T.D. Nandadasa, Diploma in Cartography

(9) Chief Cartographer	-	Mr. G.N. Perera, Dip. in Map Production, City & Guilds of London Institute
(10) Consultant Cartographer Institute.	-	Mr. Walter Gunaratne, Dip. in Cartography -City & Guilds of London Institute.
(11) Project Personnel & Team	-	Mr. Michael Gruber, M.Sc. Dip. Ing (Geodesy), Consultant Hydrographer Leader.
(12) Mr. Herman Nuffer	-	Dip. in Marine Engineering (Dip.Ing.), Short Term Expert, from 03.01.93 to 18.07.93.
(13) Mechanical Engineer	-	Mr. D.A. Karunasena, C.E.I. Part II, I.E.S.L Part II
(14) Mechanic	-	Mr. R.M.N. Gamini
(15) Electronics Engineer -		Mr. G.D. Nanayakkara, Full Technological Certificate, City & Guilds of London Institute, Associate Member, Institute of Electronics and Radio Engineers London. Incorporated Engineer, Engineering Council, London.
(16) Electronics Assistant -		Mr. W.K. Seneviratne, Cert. in Electronics Engineering, National Apprenticeship Board.
(17) Electronics Trainee	-	Mr. M.A.S. Prasad, Dip. in Electronics Engineering, Apprentice Training Institute.
(18) Trainee Hydrographic Surveyors	-	Mr. A.N.D. Perera, B.Sc. General Mr. S.N.S Amarasinghe, B.Sc. General
(19) Chief Systems Analyst	-	Mr. A.L. Lokuge, B.Sc. General, Dip. in Systems Designs.
(20) Systems Analyst	-	Mr. H.G.B. Vidyasiri, Post Graduate Diploma in Computer Technology
(21) Analyst/Programmer	-	Mr. S.W.S. Weerasinghe, B.Sc.Dip. in Programming, ACS Parts I, II, III
(22) Data Entry Operator	-	Mr. W.K.M. Mahindapala
(23) Hydrographic Officer	-	Mr. D.L.P. Hewage
(24) Hydrographic Assistant	-	Mr. L.S.C. Siriwardena
(25) Accountant	-	Miss. T.D.L.R. Perera, Dip.in Accountancy, B.Com.
(26) Store Keeper	-	Mr. W.M.A. Dayasena
(27) Clerk	-	Miss K. Premi
(28) Typists	-	Mrs. M.D.C. Jayanthi, Certificate of Word Processing, International Business System (IBS)  Mrs. A.A.N. de Alwis

### 3.0 TRAINING CLASSES CONDUCTED

Computer classes in Personal Computer Management, Corel Draw, Word Perfect were conducted for the NHO Staff by the Sri Lanka-Germany Aid Project.



#### **4.0 WORKSHOPS, SEMINARS, LECTURES ATTENDED**

- (a) A seminar on "Revised Plan of Operation" Third Phase, Strengthening of the National Hydrographic Office" was held from 10th to 12th June 1994 at the Pegasus Reef Hotel, Wattala.
- (b) Mr. R. de S.S. Ameresekere, Director/NHO, participated in a Seminar on "IOMAC" Ad Hoc Consultation Meeting of the Technical Co-operation Group (TCG) Meeting of the Association of Shipping & Ports Authorities.

#### **5.0 MEETINGS OF THE BOARD OF DIRECTORS OF NHO**

During the period under review 12 meetings of the Board of Directors of NHO were held.

The following comprised the Board :

Mr. M.R.P. Molligoda, Chairman/NARA and Chairman/Board of Directors/NHO (upto 25.08.1994)

Mr. M.H. Gunawardena, Chairman/NARA and Chairman/Board of Directors/NHO (from 03.11.1994)

Mr. N.C. Seneviratne, Surveyor General, Member

Comdre. H.R.Amaraweera, Member (upto 25.08.1994)

Comdre D.W. Sandagiri, Member (from 03.11.1994)

Mr. M.P. Salgado, Addl. Surveyor General, deputised for Surveyor General at 3 meetings.

#### **6.0 NATIONAL CHARTING PROGRAMME UNDER THE NARA/GTZ PROJECT**

The first two Fair Sheets Nos. 9101 and 9105, on the scale of 1:25,000, taken up under the above programme were partly completed from data acquired during 1994. These two sheets are expected to be completed in 1995. Hydrographic Surveying in sheets Nos. 9013, 9109, 9110, 9202, 9114 were commenced during the year. This work was affected due to equipment repairs and bad weather conditions.

#### **7.0 HYDROGRAPHIC AND LAND SURVEYS UNDERTAKEN**

##### **(a) Survey of Kankesanthurai Harbour**

On a request from the Sri Lanka Ports Authority a hydrographic survey was carried out in the Kandesanthurai Inner Harbour during the period 6th to 11th January 1994. The plan on the scale of 1:2000 and 8 cross section drawings of the jetty and main breakwater were completed on 7th January 1994 and an advance copy handed over to Sri Lanka Ports Authority.

##### **(b) Coastal Investigations - Colombo North for the CCD/GTZ Project**

A shoreline survey to pick up the fluctuations of the shoreline between groyne close to the Modera Kovil and the Kelani River Mouth, was carried out during the period 29th December 1993 to 17th January 1994 and the plans handed over to the Project Manager, CCD/GTZ Project.

**(c) Coastal Engineering Investigations - Payagala for Coast Conservation Department**

The contract for Coastal Engineering Investigations in the Payagala Coastal Stretch, 7.5 km in length, extending from Maggona to the Kaluganga River Mouth, was awarded to the National Hydrographic Office by the Coast Conservation Department.

The following tasks were carried out during the period 3rd March to 8th April 1994.

- (i) Established Shore Control Stations and picked up shore front details.
- (ii) Carried out shore profiles at a spacing of 250m and as extension of all sounding lines.
- (iii) Carried out the bathymetric survey with line spacing of 250m upto a depth of -7.0m
- (iv) Plans were drawn.

**(d) Land Survey at Uda Walawe**

Planwork of the detailed survey of an area approximately 18 acres at the Inland Fisheries Station at Udawalawe, which was surveyed in December 1993, was completed during the period 14th December to 17th January 1994.

**(e) Mirissa Fishery Harbour Survey for the Ministry of Fisheries & Aquatic Resources - ADB Project**

Regarding the dredging work, the following tasks were done, and plans were handed over.

- (i) Independent check of survey carried out in January 1994 jointly by Ceylon Fisheries Harbour Corporation and the contractor.
- (ii) Checking of fixed points/bench marks as shown in drawing.
- (iii) Checking of contractor's monthly progress of survey.

**(f) Coastal Engineering Investigations - Payagala for the Coastal Conservation Department**

The bathymetric survey, post-processing and planwork were completed.

**(g) Hikkaduwa Marine Sanctuary Survey**

Shore control survey, bathymetric survey, Post-processing and planwork completed.

**(h) Beruwala Fishery Harbour for the Ministry of Fisheries & Aquatic Resources Development**

Hydrographic Survey, Land Survey and Plan work were completed.

**(i) Puranawella Fishery Harbour Survey 1994 for the Ministry of Fisheries and Aquatic Resources Development**

Field work and Plan work were completed.

**(j) Weligama Bay Survey for the Oceanography Division, NARA**

Field work and Plan work of the survey were completed.

**8.0 MISCELLANEOUS WORK**

**(a) Tide Gauge at Trincomalee**

A Tide Gauge was installed in Trincomalee.

**(b) Training of Draughtsmen**

Training of two Draughtsmen in draughtsmanship was undertaken by NHO, on request from two technical colleges, as part of their practical training. The training commenced on 1st December 1993 and was scheduled to be continued for six months. However, the training programme concluded on 13th January 1994 as both secured employment elsewhere.

**9.0 MISCELLANEOUS DRAFTING WORK**

**(a) Fisheries Map - Sri Lanka and the Indian Ocean Region**

The draft map is completed and awaiting instructions from the Ministry of Fisheries & Aquatic Resources Development to proceed with the printing of the map by the Survey Department.

**(b) Preparation of Sea Floor Morphology Maps for Oceanography Division, NARA**

About 70% of the above work was completed during the year.

**(c) The following maps, plans & diagrams have been prepared.**

- (i) Map of Kalpitiya Marine Sanctuary for Coral Unit, NARA.
- (ii) Map showing Fishing Areas between Panadura to Chilaw, for Marine Biological Resources Division, NARA.
- (iii) Map of Kalametiya Lagoon for Environmental Survey Unit, NARA.
- (iv) Location Diagram of NHO water tank and NHO premises.
- (v) Environmental Plan of Lunawa Lagoon for Environmental Survey Unit, NARA.
- (vi) Plan of the reproduction room for the Cartography Section.
- (vii) Electronics & Mechanical Engineering Sections along with Stores Section of NHO maintained the Electronic Equipment, Survey Equipment, Boats, and other Land equipment.

## 10.0 RECRUITMENT OF STAFF

The following staff were recruited during the period under review :

1. Chief Systems Analyst
2. Analyst/Programmer
3. Data Entry Operator
4. Trainee Hydrographic Surveyor
5. Accountant
6. Mechanical Engineer
7. Mechanic

# INSTITUTE OF POST HARVEST TECHNOLOGY

## 1. Staff

Research Officers (Permanent)	05
Project Officers (Temporary)	02
Research Assistants	05
Laboratory Attendants	02
Labourers	06
Typist	01

## 2. Recruitment

Two Project Officers, Ms. Chamila Liyanage and Mr. Ranjith Edirisinghe were recruited for the STD 3 Project.

## 3. Resignations

Ms. Damayanthi Amarasinghe resigned from the post of Research Officer in December.

## 4. Leave of absence

Ms. W.M.K. Perera continues with her post graduate studies in the U.K.

## 5. Transfers

One labourer, Mr. Kapila Jayasena was transferred from another division to IPHT

## 6. Post Graduate Studies

Ms. W.M.K. Perera continues with her post graduate studies in the U.K. Mr. R. Edirisinghe (Project Officer) has registered for an M. Sc. degree at the University of Sri Jayawardenapura.

## 7. Promotions

Interviews for promotion were held for two Research Assistants in the division.

## **8. Training, Seminars and Workshops attended**

1. Dr. T.S.G. Fonseka, Dr. V. Jayaweera and Mrs. Pradeepa Jayasinghe participated at the 9th session of the IPFC working party meeting on fish technology and marketing held in Cochin, India from 7 -11th March 1994. a total of 5 research papers were presented by the participants.
2. Dr. V. Jayaweera participated in the Strategy for International Fisheries Research workshop on priorities in post harvest fisheries research. A country paper based on research priorities was presented by Dr. Jayaweera.
3. Dr. V. Jayaweera (Scientist- in -charge, STD 3 Project) received training (3 weeks) on lipid analysis at the Technological Laboratory, Ministry of Fisheries, Denmark, as part of the STD 3 Project on Fish Lipids.
4. Dr. V. Jayaweera and Mr. Ranjith Edirisinghe participated at the Scientific Meeting of the STD 3 project which was held at the Prince of Songkla University, Hat Yai, Thailand from the 21st - 25th November 1994.

## **9.0 Progress of the Projects**

**Project 1** Utilization of low value fish species - Miss B.D.Y. Amarasinghe

**Project 2** Hazard Analysis Critical Control Point (HACCP) investigations in farm shrimp processing - Dr. T.S.G. Fonseka

**Project 3** Studies related to quality aspects in the marine export industry - Dr. V. Jayaweera

**Project 4** Utilization of low value fish and fish waste to extract oil for food and feed purpose (STD 3 Project) - Dr. V. Jayaweera, Mrs. C. Liyanage and Mr. R. Edirisinghe

**Project 5** Histamine Survey - Dr. T.S.G. Fonseka and Mrs. P. Jayasinghe

### **9.1 Utilization of low value fish species - B.D.Y. Amarasinghe**

Quantitative studies on the fish mince revealed that the gel strength of Lagga and Kusapotta was greater than Mundali and Venganawa. The bacteriological quality of the ingredients used in the preparation of fish fingers was found to be TVC  $10^5$ - $10^7$ /g(pepper) and  $<10^3$ /g(wheat flour). Mould counts were  $<10^4$ /g in all the samples analyzed.

The storage characteristics of Ambul Thiyal in polystyrene containers was investigated in detail and the results were presented at the IPFC working party (9th session) meeting at Cochin, India, in March 1994. The possibility of using goraka as a bio-preservative in fish preservations was discussed at this meeting.

Several studies on the preservative effect of Goraka on bacteria and fungi were carried out. The first studies were with laboratory media incorporated with Goraka extract, Goraka extract + potassium sorbate and Tartaric acid. These results were presented at the SLAAS annual session, 1994.

As the combination of Goraka and sorbate had a positive preservative effect on bacteria and fungus, several combinations of goraka extract and sorbate were tried out as a dip on fish. A 2% sorbate dip with pH adjusted to 5.7 using goraka extract was found to be effective in reducing the surface count on the skin of Hurulla. This treatment was also tested on a semi-commercial scale, in collaboration with a fish exporter, processing vacuum packed chilled sword fish. The treatment was tried as a dip and a spray and compared with the treatment already used by the exporter. The

experiment was repeated and the results of both experiments indicated that the spray was more effective than the dip. The treatment was effective in controlling the growth of hydrogen sulphide producing bacteria (spoilage bacteria). The results of this study was presented at the NARA annual sessions, 1994.

As a result of this work with Goraka which was presented at the IPFC working party meeting in Cochin, Prof. H.H. Huss, an expert in Fish microbiology inquired of the possibility of exchange students from Denmark (STD 3 Project) to work with our scientists on this work. They arrived in November and are working on the presence of lactic acid bacteria on fish and fishery products, in order to find out whether they can be used as bio-preservatives.

## **9.2 Hazard Analysis Critical Control Point (HACCP) investigations in farm shrimp processing - T.S.G. Fonseka**

Samples of shrimp, ice and water were collected from the processing plant and condition of the factory and various processes. The samples are being analyzed for total bacterial counts, coliforms, *Escherichia coli* and *Salmonella*. Insufficient washing prior to chilling and delays in freezing trays appear to cause some concern in the processing lines observed. This project will be continued in 1995 as earlier planned.

## **9.3 Studies related to quality aspects in the marine export industry - V. Jayaweera**

A total of 04 factories was investigated. Each factory was sampled on two occasions. Swab samples from tables, baskets, trays, gloves, balance etc. that came in contact with the shrimp/fish; water and ice samples; shrimp/fish samples were collected on each occasion of sampling and analyzed for total viable bacterial count, hydrogen sulphide producers, coliforms, faecal coliforms, *Escherichia coli* and *Staphylococcus aureus*.

The results showed heavy contamination of utensils such as trays, gloves, baskets and on one occasion the balance was contaminated with *Staphylococcus aureus*. The ice used in some of the factories was contaminated with faecal coliforms. High counts on tables, trays, gloves etc. sampled prior to being used indicate that the washing procedure is not effective in removing the bacterial load.

This study was effective in identifying certain weak areas in the control of hygiene in shrimp/fish processing establishments.

Two reports have been issued to a processor at his request.

A preliminary investigation on the possibility of using pH as a quality parameter in shrimp processing was carried out. The experiment which began at the site and time of harvesting was carried out over a 87 hour period. An increase in pH was observed after 32 hours ice storage. The pH increased from an initial 6.5 to 7.4 after 87 hours of ice storage. This experiment has to be repeated in order to establish its use as a quality index.

#### 9.4 Utilization of low value fish and fish waste to extract oil for food and feed purposes (STD 3 project) - V. Jayaweera, C.V. Liyanage and R. Edirisinghe

##### Shark liver (C.V. Liyanage)

Three landing sites namely Negombo, Beruwala and Mirissa were selected for the study. A total of 100 liver samples of different species were collected and analyzed for lipid content. Based on the lipid content and the landings of the different shark varieties, three species, Silky shark (*Carcharhinus falciformis*), Hammerhead shark (*Sphyrna lewini*) and Oceanic white tip shark (*C. longimanus*) (highest production and high oil yield) were selected for further studies on the seasonal variation of lipid content and quality.

The quality of livers was determined using TVN and pH as parameters. High TVN and pH values are indicative of low quality. The quality of the oil was measured using free fatty acid value, peroxide and thiobarbituric acid values.

The effect of storage in ice and freezing, on the quality and yield of lipids was investigated. One ice storage study was carried out and the Free fatty acid and peroxide values were observed to increase indicating the deterioration of the quality of lipids. Lipid oxidation rate of oil contained in the liver muscle was investigated and was found to increase during the storage in ice. The lipid oxidation work was done using the Oxygen meter and the technique introduced by Dr. Susan Brough. Dr. Brough was sent by NRI, U.K., on an exchange programme under the STD 3 project, to work on the oxidation rate of lipids in fish muscle. She worked at IPHT, NARA for two months (October-November, 1994).

Several methods of oil extraction too have been carried out for selection of a suitable method for commercial extraction. The studies on this are still continuing.

A status report has been submitted to the Co-ordinator of the STD 3 project, Prof. H.H. Huss, Denmark.

##### Small pelagics - R. Edirisinghe

The selected landing sites were Negombo and Chilaw. Forty seven varieties of fish have been analyzed for lipid content. The quality of the fish was measured by TVN content. The quality of the extracted lipids were determined by peroxide, free fatty acid and thiobarbituric acid values. Based on the abundance, high lipid content and low value, **eight** species of pelagics were selected for further studies. These are **Lagga** (*Thryssa* sp.), **Sudaya** (*Sardinella albella*), **Linna** (*Decapterus russelli*), **Karalla** (*Secutor ruconius*), **Keeliya** (*Terapon jaruba*), **Hurulla** (*Amblygaster sirm*), **Orawa** (*Signaus jarus*) and **Angaya** (*Fusiliers* sp.). Studies on the seasonal variation of oil content and its quality of the above species was commenced and will be continued in 1995.

Preliminary studies on methods for the extraction of lipids from the fish muscle have been carried out. The work will be continued in 1995.

The effect of ice storage and storage at ambient on the content and quality of lipids was investigated on Salaya. The study indicated that the storage in ice was able to preserve the quality of the oil in comparison to that stored at room temperature.

A status report has been submitted to the Co-ordinator of the STD 3 project, Prof. H.H. Huss, Denmark.



## 9.5 Histamine Survey - T.S.G. Fonseka and P. Jayasinghe

A total of nine samplings of dried fish (5) from producing (Kalpitiya - Chilaw) areas and (4) from consumer (Kandy - Kurunegala) areas were analyzed during this period. Total of 120 samples were collected of these 77 samples were from Kandy -Kurunegala - Kuliyaipitiya, while the rest were from Chilaw and Kalpitiya. All these samples were and examined for histamine. Further some of the histamine decarboxylase producing organisms isolated and were subjected to biochemical studies. There is a wide variation in the level of histamine in dried fish. Sixteen samples had histamine <6mg/100g of which 13 samples were from producer areas. In general the level of histamine is low in samples taken from producing areas. However the highest level of histamine was also obtained from a balaya sample (2086mg/100g) taken from Kalpitiya. In general there is a wide variation of histamine in dried fish from inland markets. About 30% of the samples (23/77) had histamine level above 100mg/100g. The results indicate that over 90% of the isolates were Gram negative motile rods catalase positive and oxidase positive or negative belonging to *Proteus* and Enterobacteriaceae groups.

The work on dried fish would be reported after one more sampling of inland areas. This would be done in Jan 1995 and report preparation would finish in March 1995.

## 10.0 Extension work, Test Services and Dissemination of Information

- 1 21 samples of fish and 5 samples of shrimp were analyzed for total viable count, total coliform count, faecal coliform count, *Escherichia coli* and *Staphylococcus aureus*.
- 2 6 samples tuna, 1 sample sword fish and 1 maldivian fish sample were analyzed for histamine content.
- 3 Mercury content of 6 fish samples were analyzed and the reports submitted to the clients.
- 4 Ten samples of fish, 6 samples shrimp and 1 sample lobster were analyzed for total viable count, total coliform count, faecal coliform count, *E. coli*, *Staph. aureus*, *V. cholera*, *V. parahaemolyticus* and *Salmonella*
- 5 One sample of fish was analyzed for *V. cholera*.
- 6 Two reports on the preparation of salted dried fish and maldivian fish were submitted to a client.
- 7 Two quality studies on the unit operations of a fish processing plant were carried out at the request of a client and the reports submitted.
- 8 Two samples of shrimp and one sample of lobster were analyzed for total viable count, total coliform count, faecal coliform count, *E. coli*, *Staph. aureus*, *V. cholera*, *V. parahaemolyticus* and *Salmonella*.
- 9 Four samples of water and 2 of ice were analyzed for bacteriological quality. The parameters determined were coliforms, faecal coliforms, faecal coliforms and *E. coli*.
- 10 Two samples of algae were analyzed for proximate composition and the report submitted to the client.
- 11 Two samples of fish examined for sensory quality and the report submitted to the client.
- 12 Dr. T.S.G. Fonseka served as an examiner for Affiliated University college, Kuliyaipitiya, final year students in assessment of their dissertations.
- 13 Consultancy work for Asia Pacific Aquasystems on live lobster exports.
- 14 Dr. V. Jayaweera delivered a course of lectures, on fish technology, for the final year Zoology Special students of the University of Kelaniya.

- 15 Three samples of dried seaweed were handed over for analysis (Cartis Ltd.). Agar from one of the seaweed samples did not gel. Extraction of agar out of three seaweed samples, gel strength, gel composition and chemical composition were carried out. The samples were also analyzed for *Escherichia coli* and *Salmonella*. The report was submitted to the client.
- 16 Dr. T.S.G. Fonseka commenced consultancy work for Asia Pacific Aquasystems on live lobster exports and a report was prepared.
- 17 Sample of fish sausages were analyzed for total viable count, faecal coliforms, *Escherichia coli*, *Salmonella* and *Staphylococcus aureus*.
- 18 Dr. V. Jayaweera attended a meeting on 19th September (Poya day), at the request of Dr. U. Tissa Vitarana, Advisor to the Ministry of Science, Technology and Human Resources Development, to study and report on the issues involving a shipment of canned fish.
- 19 A sample of prawn feed was analyzed for proximate composition and the report prepared.
- 20 One Worm sample was analyzed for bacteriological quality.
- 21 Dr. V. Jayaweera conducted a lecture to personnel at the Sri Lanka Standards Institution on "**Hazard Analysis of Critical Control Points**" with special reference to the shrimp processing industry.
- 22 Dr. V. Jayaweera commenced a series of lectures on food microbiology to students following the M.Sc. course in Food Science at the University of Sri Jayawardenapura.
- 23 Dr. V. Jayaweera participated at the workshop aimed at preparing text books (for teachers) on marine and inland fish technology (as a resource person) held in the Training Institute, Mattakkuliya.

## 11. Reports and Publications

- 1 *T.S.G. Fonseka and R. Vithanage - Storage life of farm shrimp (Penaeus monodon) in ice and at ambient temperature. Paper presented at the 9th session of the IPFC working party meeting held in Cochin, March 1994*
- 2 *T.S.G. Fonseka - Molecular typing of Salmonella isolated from farm shrimp in Sri Lanka. Paper presented at the 9th session of the IPFC working party meeting held in Cochin, India, March 1994*
- 3 *T.S.G. Fonseka, I.V. Ranjini and K.S. Seetha - Level of histamine in tuna fish (Katsuwonus pelamis) caught in a multi-day boat and stored in ice. Paper presented at the NARA annual sessions, 1994*
- 4 *T.S.G. Fonseka and R. Vithanage - Histamine in tuna fish during ice storage. Paper presented at the SLAAS Annual Sessions, 1994*
- 5 *L.S. Kumarasinghe, T.S.G. Fonseka and U. Edirisinghe - Some microbiological characteristics of farm shrimp (Penaeus monodon) at harvest and processing. Paper presented at the SLAAS Annual Sessions, 1994*
- 6 *B.D.Y. Amarasinghe and V. Jayaweera - Extension of the shelf life of Ambul Thiyal. Paper presented at the 9th session of the IPFC working party meeting held in Cochin, India, March 1994*
- 7 *B.D.Y. Amarasinghe, V. Jayaweera and S. Kapuduwa - The preservative effect of Goraka in fish processing. Paper presented at the NARA annual sessions, 1994*
- 8 *B.D.Y. Amarasinghe and V. Jayaweera - Preliminary investigations on the effect of Goraka (Garcinia cambogia) on the growth of bacteria. Paper presented at the SLAAS Annual Sessions, 1994*
- 9 *N.H. Dassanayaka and B.D.Y. Amarasinghe - The present status of the Negombo Fishery Harbour with special reference to pollution of harbour environment. Report submitted to BOBP, Madras and the Ministry of Fisheries, Sri Lanka*
- 10 *P. Jayasinghe, C.V. Liyanage and C. Jayasinghe - Extraction of Agar from Seaweed. Paper presented at the 9th session of the IPFC working party meeting held in Cochin, India, March 1994*

11. *P.S. Jayasinghe and C. Jayasinghe - Preliminary studies of Chitosan for removal of mercury from water. Paper presented at the NARA annual sessions, 1994*
12. *P.S. Jayasinghe, C.V. Liyanage, C. Jayasinghe and R. Samaradivakara - Utilization of waste products in the shellfish industry. Paper presented at the SLAAS Annual Sessions, 1994*
13. *V. Jayaweera and R. Brown - Histamine in fish of Sri Lanka. Paper presented at the 9th session of the IPFC working party meeting held in Cochin, India, March 1994*
14. *V. Jayaweera - SIFR Post Harvest Fisheries Workshop, Background Country Statement of Sri Lanka. Report presented at the Strategy for International Fisheries Research workshop, Cochin, India, March 1994*
15. *V. Jayaweera - Quality assessment at certain stages in the fish processing plant I and II. 02 reports submitted to the Managing Director of the Factory.*
16. *V. Jayaweera, K. Hettiarachchi and B.D.Y. Amarasinghe - The incidence, survival and proliferation of pathogenic bacteria on raw and cooked fish IPHT, NARA, Internal Report.*
17. *C.V. Liyanage - Utilization of fish waste to extract oil for food and feed purpose - I shark liver. Report submitted at the Scientific Meeting of the STD 3 Project held at the Prince of Songkla University, Hat-Yai, Thailand, November 1994*
18. *E.M.R.K.B. Edirisinghe - Utilization of fish waste to extract oil for food and feed purpose - II small pelagics. Report presented and submitted at the Scientific Meeting of the STD 3 Project held at the Prince of Songkla University, Hat-Yai, Thailand, November 1994*

## 12 Supervision of Projects

Dr. T.S.G. Fonseka is the internal supervisor of Research Officer, Mrs. P. Jayasinghe, in her M. Phil project work on fermented fish. He also commenced the supervision of an under graduate student from the University of Peradeniya. The project is based on bacterial disease in farm shrimp (*Penaeus monodon*).

Dr. Jayaweera is the internal supervisor of Project Officers, Ms. C.v. Liyanage and Mr. R. Edirisinghe in their project work on fish lipids under the STD 3 project. She also commenced supervision of a student from the University of Peradeniya, on a project to investigate the suitability of pH as a measurement of quality in shrimp processing.

## 13 Constrains

Supply of media and chemicals has been a constraint for many of the projects.

## **Environmental studies Division**

### **1. NARA/BOI Environmental Monitoring Programme**

Regular weekly monitoring of industrial effluents from the sewage treatment plants at Katunayaka and Biyagama Export Processing Zones were carried out. A total of one hundred and twenty one samples were analysed for 15 physico-chemical parameters. Of this 97 samples were from the Katunayake EPZ, 23 from Biyagama EPZ and one sample from the effluent of Ansell Lanka Ltd; were studied for the BOI. Analytical reports indicating necessary recommendations were submitted to the Board Of Investment (BOI). Some of the effluent samples collected from the KEPZ failed to conform to the stipulated guidelines for waste water discharged into inland surface waters and such occasions were brought to the attention of the BOI for necessary follow up action.

In addition to the above Export Processing Zones, a rubber glove factory at Katana (Bo Saeng Ltd) and a rubber factory were visited to inspect the effluent treatment plants and also to collect samples. In both cases, the effluent samples analysed did not conform to BOI guidelines and the management of the factories were informed for necessary action.

### **2. NARA/SAREC Marine Research Programme**

#### **Study of two important river systems in Sri Lanka with respect to pollutant transportation to the coastal system (Kelani and Kalu Ganga).**

Quality of water at selected locations along the Kelani and Kalu ganga was studied for the purpose of determining the levels of pollutants and their distribution. A total of eight sampling visits including the catchment of the two rivers were made. Samples were analysed for physico-chemical as well as micro-biological parameters.

Fish samples were collected from the Kelani and Kalu Ganga for the purpose of determining the levels of organo-Chlorine Pesticide residues in the fish tissues. The samples were sent for analysis in Sweden. Analytical work is complete and the report on this is being prepared. However during the latter part of this period, the non-availability of vehicle due to repairs affected the sampling programme to a great extent.

### **3. Environmental Monitoring Programmes**

Study of the impact of agricultural development on the water quality of reservoirs and canals of the Mahaweli 'H' system.

Sampling was carried out from the irrigational canals and reservoirs of the system. Water quality analysis was done for samples collected during eight field trips with 18 samples being collected per visit. and the report is being compiled. Data from this report was provided to the Wetland Steering Committee for the formulation of a Wetland Report for the Nachchaduwa Reservoir area.

Studies on eutrophication of Kotmale reservoir also was conducted on a regular basis during the year and data was presented at the SLAAS Annual Scientific Sessions.

#### **4. Introduction of bio monitoring to get early warning on the occurrence of Pollution.**

Though initial experiments including the species to be used for the above were identified, the project is hampered due to the lack of necessary equipment.

#### **5. Study of the Water Quality and Pollution Levels of the Hikkaduwa Marine Sanctuary**

This study was completed and the final report submitted to the Coastal Resources Management Project (CRMP) in May 1994. The study was initiated for the purpose of establishing baseline data on the present water quality and for the purpose of identifying sources of pollution to the Marine Sanctuary. The data, conclusions and recommendations were incorporated in the Environmental Profile Report for Hikkaduwa published by the CRMP.

1. NARA/BOI Environmental Monitoring Programme
2. NARA/SAREC Marine Research Programme
3. Environmental Monitoring Programmes
4. Introduction of bio monitoring to get early warning on the occurrence of Pollution.
5. Study of the Water Quality and Pollution Levels of the Hikkaduwa Marine Sanctuary

#### **5. Miscellaneous Projects**

##### **5.1 Study of the present condition of the Lunawa Lagoon.**

This study was conducted during this period for the purpose of ascertaining the present conditions in relation to fisheries and pollution aspects. It was noted that the lagoon receives a large amount of untreated effluents from industrial establishments in this area. A paper on this work was presented at the annual sessions of NARA.

##### **5.2. Relocation of Tanneries - Study of the Water Quality of Kalametiya Lagoon.**

On the request made by the Ministry of Industries, a water quality study of the lagoon was carried out for the purpose of contributing towards the EIA report of the above project. The data analysis is in progress.

##### **5.3. Study of Economic, Social and Environmental Impact of Coastal Aqua culture in the Puttalam District.**

A project proposal was submitted to the Central Environmental Authority on the above project. Dr. Padmini de Alwis attended the project evaluation meeting on the above as well.

##### **5.4. Kerawalapitiya Land Reclamation Project**

Dr. Padmini de Alwis and Mr. S.A.M.Azmy participated in the Technical review committee meetings and inspection of the sand fill site. Miss.M.H.S.Ariyaratna participated in the visit to the burrow site. Dr. Padmini de Alwis attended meetings on the evaluation of the EIA.

## 5.5 Cleaner Fishery Harbours Project - Negombo Fish Landing Site

The short term study regarding the environmental and post harvest handling aspects of the Negombo Fish Landing Site was completed and the report was submitted to the National Fisheries Training Institute of the Ministry of Fisheries & Aquatic Resources and to the Bay of Bengal Programme (BOBP).

## 5.6 Coast Conservation Exhibition at Galle.

Preparations were made and participated at the inauguration organised by CCD.

## 6. Other Activities

6.1 Dr. Padmini de Alwis attended the meetings of the National Experts Committee on Biological Diversity.

6.2. Technical Review Committee of the National Wetland Steering Committee. Dr. Padmini de Alwis participated in the meetings on the above held at the CEA and made contributions on the Nachchaduwa Reservoir Study.

6.3. A brief project proposal to conduct a water quality monitoring study to comply with the conservation action plan of the National Conservation Strategy was prepared and forwarded to the representative of a donor agency as requested by the Ministry of Environment.

6.4. Mr. S.A.M.Azmy attended the seminar on Environmental Information Systems 'Infoterra' organised by UNEP/Ministry of Environment.

6.5. SLAAS annual Scientific Sessions(50th Anniversary)

A paper based on Eutrophication problems in the Kotmale reservoir was presented by Dr. Padmini de Alwis and Mr. S.A.M.Azmy.

6.6. NARA Annual Scientific Sessions 1994.

Two Oral presentations and a poster presentation were made by this division. Another paper was presented jointly with the Oceanography Division.

6.7. Feasibility study for establishing a joint waste treatment plant for Industrial Establishments in Ekala-Ja-Ela.

Dr. Padmini de Alwis attended the above meeting held at BOI.

6.8. NAREPP steering committee meetings

Dr. Padmini de Alwis & Mr. N.H.Dassanayaka attended meetings held at Ministry of Environment & Parliamentary Affairs.

6.9. Coastal Resources Management Project (CRMP) Committee meetings

Dr. Padmini de Alwis attended the above meetings held at the Hikkaduwa Divisional Secretariat and made a presentation on the Pollution aspects in the area

6.10. Discussion on the Fishery Harbour Development in Morawala (Negombo).

6.11 CEA/NAREPP meeting on baseline data on water quality. CEA. Dr. Padmini de Alwis attended.

6.11 Site Inspection - Coal Fired Power Plant. - Mr. S.A.M.Azmy participated in the inspection visit made to the proposed site at Talawila.

6.12 Technical Committee meeting for evaluation of environmental Impact Assessment (EIA) Report of Suvic Hotel Project. Dr. Padmini de Alwis attended.

## **7.0 Workshops & Seminars**

- 7.1 Updating Sri Lanka Environmental Action Plan. MEPA at BMICH. - Dr. Padmini de Alwis attended.
- 7.2 Guidelines and Strengthening of Industrial Pollution Management. MEIP.- Dr. Padmini de Alwis attended
- 7.3 Wetland Conservation. CEA. - Dr. Padmini de Alwis attended.
- 7.4 Nuclear Power & Energy Planning. Atomic Energy Authority. - Dr. Padmini de Alwis attended.
- 7.5 Community based Fishery Management. Dr. Padmini de Alwis participated in this workshop and a paper on ' Environmental Pollution and it's impact on Fishery Management- Lunawa Lagoon.' was submitted as a reference paper at this workshop.
- 7.6 Dr. Padmini de Alwis participated in the seminar organized by the Ministry of Transport, Highways, Environment and Women's Affairs for discussing the current position with regards to the bio-diversity of Sri Lanka.
- 7.7 EIA Techniques. Centre for Environmental Studies, Peradeniya. Mr. S.A.M.Azmy attended.
- 7.8 Mr. S.A.M.Azmy attended the seminar on tracer techniques organised by the Atomic Energy Authority.
- 7.9 Workshop on Puttalam Lagoon Studies. Dr. Padmini de Alwis made a presentation.
- 7.10 Economic Evaluation of Environmental services of Bolgoda Lake. MEIP. - Dr. Padmini de Alwis attended.

# OCEANOGRAPHY DIVISION

## 1.0 STAFF

### 1.1 Oceanography Division (NARA)

Research Officer	07	(01 on Study Leave )
Research Assistants	04	
Sampler	04	
Typist	01	
Peon	01	
Draughtsman	01	(contract)

### 1.2 SAREC Project Staff

Research Assistants	02	(contract)
Technical Assistant	02	(contract)

Oceanography lab attendant was transferred to Eng/Tech Division

## 2.0 RESEARCH WORK

2.1 To continue the systematic Geological/Geophysical mapping survey off Great Basses/Pottuvil (under UNDP Project)

2.2 Physical Oceanographic studies on the continental shelf of Sri Lanka (UNDP/FRG Project)

Both projects were not commenced due to the non availability of funds from UNDP/FRG.

The testing of New UNDP Equipments got delayed due to the continued cyclone repair work of P.V. Samudra Maru and the nonavailability of berthing facilities at the Colombo Harbour.

After completion the cyclone repair work at CDL, the Research vessel R.V. Samudra Maru was transferred to Trincomalee harbour on 7th June 1994 in order to check the performance of the installed equipments, and also to install and commission new UNDP equipments . Three one day sea cruises were conducted in the month of July at outer harbour off Mutur Trincomalee. On Board repairing and service work were carried out by Expert Engineer from the "Oceanics" along with NARA scientists for more than 5 days.



Ten instruments were tested for their working condition while one Metron-6 Deep water Echo sounder was sent to Singapore for replacement of spare parts at the 'Oceanics' work shop. Fixing of transducers, installation of capacitor banks were successfully carried out by the Expert Engineer with the help of S & O division and Oceanography Staff.

During the last day of testing ships generator (40KV) broke down. Quotations have been received for the repairs of the generator and after the technical evaluation the repairs were offered to St. Josephs Eng. Negombo in the month of September 1994.

Since the lab air conditioner is poorly functioning most of the equipments were transferred to the Head officer laboratory for maintenance. Some of the necessary items for the maintenance of the equipments were purchased. arrangements are on the way to purchase a AC/DC transformer for the PTR and 6 way intercom for the lab.

Metron-6 echo-sounder was repaired in the "Oceanics" Laboratory in Singapore and returned back. It needs testing at deep sea. Arrangement are made to purchase a transformer for the PTR and 6 way intercom for the lab. Maintenance and operation of the vessel was transferred the Oceanography Division from the D (S & O) division from December 1994.

Training on Board the vessel for the Oceanography staff with the installed equipments could not be carried out due to the break down of the generator. Qualified Scientific, technical, navigational staff needed to be recruited to conduct Oceanographic Surveys.

### **2.3 NARA/NARESA/SAREC PROJECT**

#### **Physical Oceanography Survey Puttalam/Mundal Lagoon By Mr. Rajapaksha Mr. Jayasiri, Mr. E.M.S. Wijeratne and Mr. K. Arulananthan**

During the study period, sea level, temperature and salinity data were analysed to obtain the knowledge of the entire eco-system including water exchange with other water bodies. Mean salinities of the study area indicated wide variation such as 38 psu in the puttalam basin, 24psu in the Mundal lake, 31psu in the dutch canal (north) and 18psu in the dutch canal (south). During the dry periods, salinity in the Mundal exceeds the ocean salinity. During the rainy season Mundal lake salinity goes down up to 2psu. Water level data shows that maximum tidal range in the Puttalam basin goes up to 35 cm and in the Mundal lake, less than 5 cm. There is no relationship between tidal ranges and phase lags of the Puttalam lagoon with the Mundal lake. The water exchange between Mundal lake and Puttalam lagoon through dutch canal mainly depends on precipitation and evaporation.

During the rainy season the outward volume flux varied from 10-28 cubic m/s and during the dry season the inward volume flux is about 4 cubic m/s. The average residence time in the Mundal Lake varies between 14 to 50 days and is closely related to the intensity of rainfall. The highest retention time coincides with the low precipitation. Draft final technical report on influence of Mundal lake/dutch canal system on the water exchange in the Puttalam lagoon is under preparation.

## **2.4 Physical Oceanography Survey Negombo Lagoon By Mr. Rajapaksha, Mr. Jayasiri, Mr. E.M.S.**

**Wijeratne and Mr. K. Arulanathan**

Analysis of sea level, temperature, salinity and current measurements were done and draft report was submitted to Dr. Lars Redburg for his corrections.

Analysis of results show that the salinities and water exchange within the lagoon is highly dependent with the monsoonal periods. During the dry period from January to March and in August the salinities were high as 30psu and the residence time was long up to 2 weeks. During the rainy periods (May, October to December) when the fresh water supply exceeds 100 cubic meter per second the residence time was lower as 2 to 5 days and the salinities were lower as 5psu. The lagoon never exceeded the ocean salinity during the study period. But it may occur when the evaporation exceeds the fresh water supply, therefore it can be concluded that the river discharge always greater than 1.5 cubic meter per second. There is a tendency for stronger vertical stratification during high fresh water supply. Studies carried out indicates that the salt water intrusion into the rivers (Dadugam Oya and Je-Ela) reaches as far as 15 to 18 km from the head of the lagoon. During wet periods salt intrusion is minimal.

## **2.5 INVESTIGATION OF HYDROLOGICAL PROCESSES IN THE WELIGAMA BAY NARESA**

**Project by Mr. K. Arulanathan**

The data collected from during the year 1993 were analyzed and the annual report was submitted to NARESA during the early part of 1994. during the period studies following oceanographic studies were carried out :

- 1) Water exchange of the Polwatte Ganga with Weligama Bay
- 2) Salt water intrusion into the Polwatte Ganga
- 3) Water Circulation in the Weligama Bay

Using the knudson formulae water exchange of the Weligama Bay was calculated. The estimated water exchanges are 4.5 days and 14 days respectively during the rainy and dry seasons. Digital salinometer was calibrated using the Autosal and used for the analysis. The salt water intrusion into the Polwatte Ganga is upto 8 km. upstream. In order to evaluate the consequences of future possible modifications of the Polwatte Ganga, a systematic investigation has been carried out on mathematical modelling and calculating the salt wedge movement. It was found that the minimum residual flow which could be allowed to flow is 4 cubic meter per second. Further deficiency of the residual flow on the stream would cause further intrusion of sea water into the Polwatte Ganga to a great length in its upstream.

No typical current velocity is observed in the Polwatte Ganga. Surface current velocity varied widely from 10 cm/sec. to 110 cm/sec. The average annual current velocity observed in the Weligama bay is 22 cm/sec.

Sediment budget studies were started during the first half of the year 1994 and the progress report of the half year was submitted to NARESA. Sediment samples were collected, sieved and analyzed for statistical parameters. All the relevant coastal profiles and sample location maps were plotted. The amount of erosion and accumulation of the sand along the coast were calculated and the map indicating erosion and accumulation were drawn.

## **2.6 INVESTIGATIONS TO SELECT SUITABLE AREAS FOR THE WAVE ENERGY PLANT IN THE SOUTH WEST COAST OF SRI LANKA - NARESA PROJECT by Dr. K. Tennakoon.**

The project commenced on 01.01.1994 and continued until 31.05.1995. Allocated amount from NARESA was Rs. 102,000.00. The project mainly concentrated to select suitable areas for the wave energy power plant in the southern coastal belt of Sri Lanka and to experiment on a model study. The main objective was to gather and collect available data and form a strong data base on the selected sites. The data can be used whenever necessary and to select the type of plant and location.

Results for the survey shows that places like Palatupana, Bundala and Unawatuna are most promising sites along the southern coast. Among all the sites for a power plant Unawatuna is the best site considering the location in the Rumassala hill range closer to the temple. The Creek is 7m long and 4m width. Wave data has been collected throughout the year in different seasons at all three locations.

- (1) Palatupana, Bundala sites show a annual prominence of wave energy through out the year due to the effect of both monsoons.
- (2) Mainly the Unawatuna wave data will be used for the physical model study.

Physical model is under preparation parameters are tested in the model. It is expected to have the optimal wave characteristics for the Unawatuna and other sites.

Results of the survey shows that during the months of October-November 1994 wave heights at Palatupana and Bundala sites varies from 1.12 - 3.0m and wave periods ranged in between 5.9 - 12.4(sec). At Unawatuna wave heights were measured and observed in the range of 1.13 - 2.8m and the periods were at 6.45 - 11.92 (sec).

## **2.7 SEA LEVEL ANALYSIS AND TIDE PREDICTION AROUND SRI LANKA NARA PROJECT By Mr. E.M.S. Wijeratne**

According to the above project three tide gauges has to be installed by NHO around Sri Lanka at Trincomalee, Galle and Bundala. At the beginning of the project (early 1994) all the tide gauges were tested and was in working condition. One tide gauge was installed at Trincomalee NAVY pier in July 1994. The Galle tide house was completed in October 1994. But unfortunately, after a year it was realized that all three tide gauges are not functioning due to internal battery failure. Totalling Rs. 45,000 was released to the NHO in order to repair the instruments but still the power system has not been repaired completely.

## **2.8 BIO MONITORING OF TRACE METAL IN THE NEGOMBO LAGOON Miss M. Selladurai**

The project "Bio monitoring of trace metals in the Negombo Lagoon" was satisfactorily completed. The accumulation of iron was the highest in various species of fishes ranging from 40-83.4ug/g drywet. Similarly Fe was observed in high concentration in the sediments 14-36mg/g) as well as in surrounding water (0.0015-0.0035ppm). The maximum value of concentration factor between water sediment and water/fish was seen for iron with the order of 10 and 10 respectively. The present levels of the five elements in this aquatic system was found to be within the safe range.

The study revealed that there was not much considerable variation in levels of trace metal among various species of fishes. The regression analysis was conducted to justify the corresponding co-efficient and it shows that no two fish species were identical in terms of trace metal interrelation, which critically depends on the habit, habitant and geographical origin of the individual species. High concentration factor was observed for Fe, reveals that a high affinity for the metal for sediment as well as fish species. However, additional data based on long term monitoring is necessary for the development of viable strategy and work on this subject.

### **3. PROJECT PROPOSALS**

#### **3.1 NARA PROJECTS**

- 3.1.1 A study on Physical, biological process and Nutrient distribution in the Chilaw lagoon/NARA by Mrs. M. Selladurai, Mr. T. Dharmaratne and Mr. K. Arulanathan
- 3.1.2 A project proposal titled "Sea Level Analysis and Tide Prediction around Sri Lanka" continuation of 1994 by Mr. E.M.S. Wijeratne was submitted to NARA for the year 1995.
- 3.1.3 Project proposal on "The study of plankton for the purpose of training the oceanographic staff is submitted to the Actg. Director Oceanography by Miss. Manimegala.
- 3.1.4 Study of Oceanographic parameters in the Bologoda estuarine was submitted by Mr. K. Arulanathan for the NARA funding 1995.

#### **3.2 NARESA PROJECTS**

- 3.2.1 Study of siltation rate and sediment budget within the Hikkaduwa Marine Sanctuary by Mr. E.M.S. Wijeratne and Mr. R. Rajasuriya
- 3.2.2 Dynamics of physical processes and flux of organic carbon through the Kelaniya estuary by Mrs. M. Selladurai and Mr. E.M.S. Wijeratne.
- 3.2.3 Three proposals were submitted on Wave Energy, Solar pond and Muthurajawela Sea Sand filling by Dr. Tennakoon.
- 3.2.4 Salt water intrusion into major rivers of the different climatic zones by Mr. K. Arulanathan.

#### **3.3 FOR SAREC FUNDING**

A proposal was submitted to SAREC "Research on the natural resources management and Oceanographic studies on the coastal environment (Malala lagoon system) of Sri Lanka by Dr. Ranatunga, Mr. K. Arulanathan, Mrs. Selladurai and Mr. E.M.S. Wijeratne.

### **3.4 FOR FOREIGN FUNDING**

- 3.4.1 Project proposal titled "Can oceanography fulfilled the human needs in Sri Lanka" was submitted to the Japanese Technical/Cooperation through the Ministry by RO's of the Oceanography Division.
- 3.4.2 Prepared a preliminary research proposal to University of Southampton, UK on Chemical Perturbation affecting the conservation status of tropical mangrove estuary based on nutrient cycles and sediment water interactions by Mr. T. Dharmaratne.
- 3.4.3. Project proposal on the "Guide lines for a biological study around Sri Lanka using satellite remote sensing" was submitted to Arthur C. Clark center through Dr. Jayakody By : Miss. Manimegala & Dr. N.G. Ranatunge.
- 3.4.4 A brief proposal was made on the 2nd Gen. Oceanographic vessel by Dr. G. Ranatunge to be submitted for the JICA funding.

### **3.5. FOR OTHER FUNDING**

- 3.5.1 Proposal submitted to the Energy Conservation Fund "Wave Energy Assessment along the Southern and South-Eastern coastal belt of Sri Lanka by Dr. K. Tennakoon.

### **3.6 PROPOSALS FOR CONSULTANCY WORK**

- 3.6.1 A proposal was prepared to the Ministry of Fisheries to conduct soil investigations at the Kudawella fishery harbour by Dr. g. Ranatunge and Mr. T. Dharmaratne.
- 3.6.2 A proposal was submitted to ADB/project Leader regarding the Biological Oceanographic survey to be conducted by the Oceanographic Division within the "Fisheries Resources Survey" by Dr. G. Ranatunge and Mr. K. Arulananthan.

### **4.0 OVERSEAS TRAINING**

#### **4.1 Overseas Training**

##### **(Long term and Short term)**

- 4.1.1 Mr. K.S. Guruge is following a M.Sc course in Geological Oceanography in the University of Kochin-Japan and not reported for duty since March 1994.
- 4.1.2 Mr. T. Dharmaratne returned after two years of training in Southampton University England after following a M.Sc in Oceanography.
- 4.1.3 Dr. K. Tennakoon returned after a 10 weeks training course in "Coastal zone management" conducted by IOI Institution, Madras

- 4.1.4 Dr. G. Ranatunge participated in two short term training course in “Marine Radio Activity” in Australia (12 days) organized by IAEA and “Marine Geology and Geophysics” organized by IOC (8 days) in Karachi at the Institution of oceanography.
- 4.1.5 Mr. E.M.S. Wijeratne and Mr. K. Arulananthan participated in a workshop at the Institute of Marine Science, Zanzibar, Tanzania from 9th to 14th December, 1994. Two papers were presented on “Tidal Oscillation and friction in the Puttlam Lagoon” by Mr. E.M.S. Wijeratne and “Comparison of studies on the pan free surface evaporation in the Puttalam Lagoon” by Mr. K. Arulananthan.

## **4.2 SPECIAL TRAINING**

Pre planned “SONNE” International Geological/Geophysical cruise on in the Eastern Indian ocean (Sonne 93) funded by F. Republic of Germany commenced form 8th January to 22nd January 1994. Dr. R.A.D.N.G. Ranatunge, Dr. K. Tennakoon, Mr.W.A.S. Fernando participated in the above cruise to gain the first hand experience and knowledge on sediments and there movements in the eastern Indian Ocean particularly the Bay of Bengal Sediments. Chief scientist was Dr. H. Kudraz from the B.G.R.

The data and samples obtained were shared during the cruise such as uncalibrated CTD measurements, bathymetric maps, core samples of Negombo in the continental slope, black/white parasound pprofiles, will be analysed within a period of 3 years. Draft half yearly report was submitted to NARA by B.G.R.

## **4.3 LOCAL TRAINING**

- 4.3.1 Mr. Wijeratne is undergone a diving course which was organized by the CAMP project.
- 4.3.2 Dr. N.G. Ranatunge participated two days Seminar organized by the Atomic Energy Authority on usage offshore tracer technics.
- 4.3.3 Dr. K. Tennakoon participated in a 5 days training course in “Training for Trainers in Coast Conservation” organized by C.C.D.

## **5.0 PRESENTATIONS AT THE ANNUAL SESSIONS NARA**

### **5.1 Paper Presentations**

- 5.1.1 Bio Accumulation of trace metals in the Negombo lagoon by Mrs. M.Selladurai and Mr. S.A.M. Azmy.
- 5.1.2 Influence of Mundal Lake and Dutch canal on the Puttalam Lagoon by Mr. H.B. Jayasiri and Mr.J.K. Rajapaksha.
- 5.1.3 Heat Exchange in Puttalam/Mundal estuarine system and solar radiation presented by Mr. J.K. Rajapaksha (prepared by Mr. E.M.S. Wijeratne).
- 5.1.4 Comparison of studies on Pan Free surface evaporation of Puttalam Lagoon by Mr. K. Arulananthan.

## **5.2 POSTER PRESENTATIONS AT NARA ANNUAL SESSIONS**

- 5.2.1 "Possibilities for OTEC plant in Trincomalee canyon" by Dr. T.K.D. Tennakoon.
- 5.2.2 "Axial salinity distribution in the Negombo lagoon by Mr.J.K. Rajapaksha and Mr. H.B. Jayasiri.

## **5.3. OTHER PRESENTATION**

- 5.3.1 Titled "Investigation of Hydrological Processes in the Weligama Bay" was presented at the NARESA auditorium by Mr. K. Arulananthan.

## **6.0 TECHNICAL REPORTS (DRAFT)**

- 6.1 The following were prepared for the SAREC final report on "Water exchange in Mundal Lake/Dutch Canal System in relation to the Puttalam Lagoon" by Mr. H.B. Jayasiri.
- 6.2 "River influences salinity variation and water balance in Negombo Lagoon" by Mr. J.K. Rajapaksha.

## **7.0 EXTENSION WORK**

Dr. g. Ranatunge was fully engaged until October 1994.

- 7.1 In the evaluation of Tenders submitted to select the consultants for the "Construction, Supervision designing of Harbours and Anchorages in coastal Eng. Studies, Negombo and Chilaw under the CHFC/ADB project. One of the tenders was finalized and the others are in the process of finalizing.
- 7.2 In the evaluation of field investigations conducted by LHI regarding the "Puranawella Fishery Harbour" comments were given to the Tech. Evaluating discussed. The report was still in the process of evaluating
- 7.3 Engaged in preparation of the general specifications for the charter of vessels and the comments were submitted to the Team Leader Mr. Leslie Joseph ADB Project - Team Leader.
- 7.4 A News Letters with the title of "Ocean Wave Energy Potential around Sri Lanka" was prepared for the Department of Civil Engineering, Hydraulic and Maritime Research Laboratory Cork Ireland.
- 7.5 Article for the NARA news letter were prepared and submitted on "Ocean is the Major CO2 source" by Mr.E.M.S. Wijeratne.
- 7.6 A poster on physical Oceanography Survey-Mundal Lake was prepared by Mr. J.K. Rajapaksha and Mr. B. Jayasiri.

## 8.0 ACTIVITIES

### **Dr. G. Ranatunge**

- 8.1 Dr. g. Ranatunge submitted comments to Dr.P. de Alwis for the evaluation of the EIA report prepared by E.C.L. (Pvt) Ltd on the Kerawalapitiya (Muthurajawella) Reclamation Project.
- 8.2 Dr. Ranatunge was fully engaged in the administrative matters of the Kalpitiya RRC and Samudra Maru.

### **Miss. M. Selladurai**

- 8.3 Engaged in the inventerizing and allocation of UNDP instruments within the division.
- 8.4 Engaged in the preparation of a list of chemicals which are necessary for the Samudra Maru and for other NARA projects.
- 8.5 Reference/Litratures were collected for the Samudra Maru Biological Oceanographic survey.
- 8.6 Engaged in the operation of carbon coulometer with the agents "Analytica" in the Oceanography lab.

### **Mr. T. Dharmarathne**

- 8.7 Prepared a poster on "Nutrient distributin in the Central Indian Ocean" for the second south Asia Geological congress.

### **Mr. K. Arulanandan**

- 8.8 Prepared revised budget for the SAREC project (Physical Oceanography survey).
- 8.9 Engaged in preparing a physical oceanographic project proposal to be submitted to National Institute of Oceanography.
- 8.10 Engaged in preparing project proosal titles "Study of Oceanographic parameters in Bolgoda Lake" to be submitted to NARA.
- 8.11 Participated in the discussion organized by Dr. Ranjith de Silva on the Management plan of Puttalam Lagoon presented a paper.

### **Dr. K. Tennakoon**

- 8.12 Dr. K. Tennakoon was engaged throughout in the repairs of Trincomalee Cod Bay sit (05 visits were done).

### **Mr. Nishantha de Silva (R.A.)**

- 8.13 Has prepared a list of literature available within the division for organizing the Oceanography Division Library.



## 9 CONSTRAINTS

Lack of office, laboratory facilities, support staff, vehicles, non availability of the vessel support group (Electronic Eng., Technician, Navigator, etc) greatly retarded the progress of the offshore scientific researchwork during the year 1994.

# **FINAL ACCOUNTS**

**1994**

**NATIONAL AQUATIC RESOURCES RESEARCH &  
DEVELOPMENT AGENCY**

**Crow Island, Mattakkuliya**

**Colombo 15**

**NATIONAL AQUATIC RESOURCES RESEARCH & DEVELOPMENT AGENCY**  
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Income & Expenditure Account For The Year Ended 1994

1993				1994	
	<u>RECEIPTS</u>				
22,500,000	Government Contribution	(Sches 01)		23,000,000.00	
1,383,420	Sundry Income	(Sches 02)		2,822,807.12	
579,782	Other Contribution	(Sches 03)		6,161,994.12	
14,505,143	Grant Received	(Sches 04)		18,710,166.49	
781,414	Profit on Sale of Assets			<u>12,714.45</u>	
<u>40,250,760</u>					50,707,682.18
	<u>EXPENDITURE</u>				
	<u>ADMINISTRATIVE EXPENSES</u>	(Sches 05)			
13,910,218	Salaries, Wages & Allowances	(Sches 06)	14,894,143.24		
782,246	Provision for Gratuity		712,002.20		
1,957,808	Es.P.F.s & Es.T.F.s	(Sches 07)	2,191,795.26		
1,672,241	Overtime		1,336,487.61		
1,054,155	Travelling		709,221.73		
589,650	Security Charges		705,147.74		
	Professional Expenses		77,746.00		
136,250	Fees-Board Meeting & Others		151,484.39		
1,145,076	Fuel		860,233.70		
344,953	Advertising Charges		184,890.00		
589,974	Stationery	(Sches 08)	573,305.92		
52,405	Postage		113,478.97		
87,717	Entertainment		97,074.30		
42,219	Welfare		29,117.43		
297,920	Telephone		180,908.12		
284,145	Foreign Travelling		115,983.75		
184,578	Sundries		143,931.17		
431,946	Insurance		43,855.68		
2,955,973	Maintenance of Motor Vehicles, Buildings, Vessels, Boats & Equipment etc.	(Sches 09)	3,763,603.31		
55,000	Audit Fees		55,000.00		
27,362	Bank Charges		27,763.06		
75,122	Chemical & Consumables	(Sches 10)	14,740.50		
44,450	Painting		93,430.00		
	Bad Debtors		<u>184,066.25</u> ?		
613,678	Development & Extension		-		
979,782	Special Project Expenses	(Sches 03)	6,161,994.12		
92,874	Sundry Items		-		
<u>28,407,747</u>					34,221,412.45
	<u>ESTABLISHMENT EXPENSES</u>				
1,944,017	Electricity Charges		2,025,800.39		
29,820	Gas		-		
673,675	Rates & Taxes		672,000.00		
19,601,808	Provision for Depreciation	(Sches 11)	<u>25,063,476.78</u>		
<u>22,247,320</u>					28,361,337.17
110,406,301	Excess of Expenditure Over Income				11,875,068.44
<u>11,565,559</u>	Previous Year Adjustment				<u>708,717.16</u>
<u>111,971,860</u>	Balance Carried Forward				<u>11,166,351.28</u>

*M. H. Samudralene*  
M. H. Samudralene  
CHAIRMAN

15th August, 1995.

*Dr. M. U. Jayasekera*  
Dr. M. U. Jayasekera  
DIRECTOR GENERAL

15th August, 1995.

*Urasapala Samudralene*  
Urasapala Samudralene  
ACCOMPTANT

15th August, 1995.

**NATIONAL AQUATIC RESOURCES RESEARCH & DEVELOPMENT AGENCY**  
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Balance Sheet as at 31-12-1994

1993				1994
	<u>CAPITAL EMPLOYED</u>			
86,721,658	Balance Brought Forward			78,160,404.31
10,505,000	Grant for the year	(Sche. 11)		14,470,000.00
6,595,315	Foreign grant for the year	(Sche. 12)		4,450,682.24
3,023	Local grant for the year	(Sche. 13)		2,522,687.00
<u>(11,971,860)</u>	Excess of expenditure over income			<u>(11,166,351.28)</u>
<u>91,853,136</u>				<u>88,437,424.30</u>
	<u>FIXED ASSETS</u>			
3,873,159	Buildings	(Sche. 14)		8,159,053.90
1,463,824	Machinery			1,102,150.86
4,832,976	Equipment			9,365,197.33
607,053	Vehicles			357,404.47
10,863	Bicycles			198,071.00
1,282,489	Furniture & Fittings			1,636,380.60
348,376	Auditorium			285,219.86
149,957	Main Pond			129,122.97
814,107	Library Books			1,147,146.50
-	Admiralty Charts			5,788.00
5,565,397	Research & Development (Local)			7,978,230.92
64,517,490	Research & Development (Foreign)			48,512,062.92
<u>85,496,122</u>	Sumudramaru			<u>17,162,276.71</u>
<u>98,961,813</u>				96,038,106.03
	<u>CURRENT ASSETS</u>			
563,014	Stock as at 31-12-1994	(Sche. 15)	764,137.08	
2,703,565	Debtors & Prepayment	(Sche. 16)	773,169.13	
242,215	Deposits	(Sche. 17)	166,715.00	
1,152,272	Advances	(Sche. 18)	45,737.76	
1,838,062	Debtors - Employees	(Sche. 19)	1,917,027.67	
<u>5,363,425</u>	Cash in hand & at Bank	(Sche. 20)	<u>4,744,234.79</u>	
<u>11,862,553</u>				8,411,021.43
	<u>CURRENT LIABILITIES</u>			
7,568,743	Creditors & Accrued Expenses	(Sche. 21)	11,373,873.24	
5,748,328	Project Creditors	(Sche. 22)	419,085.72	
3,788,222	Provision for Bad Debtors	(Sche. 23)	254,600.00	
<u>1,865,937</u>	Consultancy Project		-	
<u>18,971,230</u>				<u>12,047,538.96</u>
17,108,671	Net Current Assets			(3,636,537.53)
-	Deferred Liabilities			(3,964,144.20)
<u>91,853,136</u>				<u>88,437,424.30</u>

*M. H. Gurusawardene*  
M. H. Gurusawardene  
CHAIRMAN

15th August, 1995.

*M. U. Jayasekara*  
M. U. Jayasekara  
DIRECTOR GENERAL

15th August, 1995.

*Yasapala Somaratne*  
Yasapala Somaratne  
ACCOUNTANT

15th August, 1995.

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உமது இல.  
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නිදහස් වතුරගා, කොළඹ 7, ශ්‍රී ලංකාව  
கணக்காய்வாளர் தலைமை அபிவிதி திணைக்களம்  
சுதந்திர சதுக்கம், கொழும்பு 7, இலங்கை  
AUDITOR-GENERAL'S DEPARTMENT  
INDEPENDENCE SQUARE, COLOMBO 7, SRI LANKA

දිනය/திகதி/Date : ... 07 August 1996.

The Chairman,  
National Aquatic Resources, Research and  
Development Agency.

Report of the Auditor General on the Accounts of the  
National Aquatic Resources Research and Development  
Agency for the year ended 31 December 1994 in terms  
of Section 14(2)(c) of the Finance Act No. 38 of  
1971.

The audit of accounts of the National Aquatic Resources Research and Development Agency (NARA) for the year ended 31 December 1994 was carried out under my direction in pursuance of provisions in Article 154(1) of the Constitution of the Democratic Socialist Republic of Sri Lanka read in conjunction with Section 13(1) of the Finance Act No. 38 of 1971. In carrying out this audit, I was assisted by a firm of accountants in public practice. My observations which I consider should be published with the annual report of the Agency in terms of Section 14(2)(c) of the Finance Act appear in this report. A detailed report in terms of Section 13(7)(a) of the Finance Act was forwarded to the Chairman of the Agency on 27 December 1995.

1:2 Scope of Audit

Audit opinion, comments and findings in this report are based on a review of the financial statements presented to audit and substantive tests of samples of transactions. The scope and extent of such review and tests were such as to enable as wide an audit coverage as possible within the limitations of staff, other resources and time available to me. Sub-sections (3) and (4) of Section 13 of the Finance Act give discretionary powers to the Auditor General to determine the scope and extent of the audit.

2. Accounts

2:1 Opinion

In view of my observations appearing in this report, I am unable to express an opinion on the accounts presented. Major deficiencies observed in this connection are tabulated below.

<u>Deficiency</u>	<u>Reference to paragraph in the report</u>
(a) Accounting Policies	2:5:1
(b) Inappropriate disclosures in the Accounts	2:5:2
(c) Omissions in the Accounts	2:5:3
(d) Overstatements and Understatements in the Accounts	2:5:4
(e) Accounts Receivable and Payable	2:5:5
(f) Lack of Evidence for Audit	2:5:6
(g) Non-compliance with Laws, Rules, Regulations, Management Decisions etc.	2:5:7
(h) Transactions not Supported by Adequate Authorities	2:5:8
(i) Unreliability of Financial Results and Financial Position	3:1
(j) Weaknesses in Systems and Controls	4.

2:2 Financial Results

According to the accounts presented, the working of the Agency during the year under review had resulted in a deficit of Rs. 11,875,069 as compared with the deficit of Rs. 10,406,301 for the preceding year. The following statement gives a summary of the financial results for the year under review and the preceding year.

	<u>Year ended 31 December</u>			
	<u>1994</u>		<u>1993</u>	
	Rs.	Rs.	Rs.	Rs.
<u>Income</u>				
Government Contribution	23,000,000		22,500,000	
Sundry Income	2,822,807		1,383,421	
Grant Received (Amortization)	18,710,166		14,606,143	
Profit on Sale of Assets	<u>12,714</u>	44,545,687	<u>781,414</u>	39,270,978
<u>Expenditure</u>				
Administration	34,221,413		28,407,741	
Establishment	3,297,860		2,647,512	
Depreciation	<u>25,063,477</u>		<u>19,601,808</u>	
	62,582,750		50,657,061	
<u>Less :</u>				
Amount recovered from Projects	<u>6,161,994</u>	<u>56,420,756</u>	<u>979,782</u>	<u>49,677,279</u>
Deficit for the year		(11,875,069)		(10,406,301)
Accumulated Deficit Brought forward	(92,615,655)		(65,914,604)	
Prior Period Items	<u>(12,984,015)</u>	<u>(105,599,670)</u>	<u>(16,294,750)</u>	<u>(82,209,354)</u>
Accumulated deficit carried forward		<u>(117,474,739)</u>		<u>(92,615,655)</u>

2:3 Financial Structure

According to the accounts presented, the financial structure of the Agency as at 31 December 1994 compared with that as at 31 December 1993 is given below.

	<u>As at 31 December</u>			
	<u>1994</u>		<u>1993</u>	
	Rs.	Rs.	Rs.	Rs.
<u>Resources</u>				
Government Contribution		95,813,380		81,343,380
Foreign Aid	100,547,427		96,096,746	
Adjustments for Special Dollar Account Balance	( 8,853,775)	91,693,652	(8,853,775)	87,242,971
Other Contributions		18,405,129		15,882,440
		205,912,161		184,468,791
Accumulated Deficit		(117,474,739)		( 92,615,655)
		88,437,422		91,853,136
		=====		=====
<u>Utilisation</u>				
Fixed Assets at written down value		22,385,535		13,382,804
Vessel ' Samudra Maru'		17,162,276		15,496,122
Foreign Aid Projects (Net)		48,512,063		64,517,490
Other Projects (Net)		7,978,231		5,565,397
Net Current Liabilities		( 7,600,683)		( 7,108,677)
		88,437,422		91,853,136
		=====		=====

92,615,655  
11,875,000



2:4 Source and Application of Funds

The following statement shows the source and application of funds of the Agency during the year under review and the preceding year.

	Year ended 31 December	
	<u>1994</u>	<u>1993</u>
Source	Rs.	Rs.
Other Sources		
Government Contribution	14,470,000	10,505,000
Foreign Aid	4,450,681	6,595,315
Other Capital Contribution	2,522,689	3,023
Proceeds from Disposal of Fixed Assets	25,774	875,489
		<u>17,978,827</u>
Application		
Deficit for the year	(11,875,069)	(10,406,301)
Adjustments for items not involving movement of funds		
Gratuity provided for the year	712,002	782,245
Depreciation - Fixed Assets	5,883,803	4,748,331
- Project Expenditure	19,179,674	14,853,477
Profit on Sale of Fixed Assets	( 12,714)	(781,414)
	<u>13,887,696</u>	<u>9,196,338</u>
Prior Period Items	(12,984,015)	(16,294,750)

Adjustment for items not involving movement  
of Funds

Adjustments for Fixed Assets	146,501	1,080,000
	<u>1,050,182</u>	<u>(6,018,412)</u>
Gratuity Payments	( 187,421)	( 127,401)
Additions to Fixed Assets	(14,815,166)	(6,827,140)
Adjustments made for Fixed Assets	251,128	1,850
Increase in Expenditure on Foreign Aid Project	( 3,735,834)	(9,800,866)
Increase in Expenditure on other Projects	( 3,999,458)	(1,023,994)
	<u>(21,436,569)</u>	<u>(23,795,963)</u>
Decrease in Working Capital as analysed below	<u>32,575</u>	<u>( 5,817,136)</u>

Effect on Working Capital

Increase / (Decrease )

	1994	1993
	Rs.	Rs.
Provision for bad debts	94,059	-
Stocks	201,123	(114,124)
Debtors	(1,930,396)	1,017,615
Advances	(1,106,535)	(483,664)
Staff Loans Receivable	78,966	141,165
Cash and Bank Balances	(619,191)	(3,807,717)
Creditors and Accrued Expenses	(3,805,130)	(108,778)
Consultancy Projects	1,865,937	7,924
Project Creditors	5,329,242	(2,469,557)
Deposits	( 75,500)	-
	<u>32,575</u>	<u>(5,817,136)</u>

2:5 Comments on Accounts

2:5:1 Accounting Policies

Following observations are made.

- (a) The value of fixed assets and stocks in the balance sheet amounting Rs.96,038,106 and Rs.764,137 respectively are represented book balances.
- (b) The sum of Rs. 18,710,166 shown as an income for the year represents a book entry which is made up by writing back the capital portion of grant received equivalent to amortization provided for the previous years on foreign funded projects (Rs. 17,510,166) and the depreciation on Vessel " Samudra Maru" (Rs. 1,200,000). Grant received in previous year does not represent an income for the current year.
- (c) Work in progress on long term contracts had not been valued as at 31 December 1994. The cost incurred has been set off against receipts from the customers and the Surplus/Deficit shown under Creditors/Debtors.
- (d) The Project expenditure totalling Rs. 56,490,294 as at the end of the year under review had been shown as fixed assets viz. Rs. 48,512,063 under Foreign Aid Projects and Rs. 7,978,231 under other Capital Projects. The Project expenses were made up of both tangible assets and intangible expenses. The Project expenditure had been amortized on a straight line method at 20 % on cost irrespective of tangible components. The amortisation so provided amounted to Rs. 19,179,674.
- (e) Depreciation had been provided on computers on a straight line method at 10 %<sup>on</sup>/cost. This rate was not in agreement with the generally accepted rate.

- (f) The basis adopted to calculate the provision for gratuity had not been in compliance with SLAS - 16.

2:5:2 Inappropriate Disclosures in the Accounts

Following observations are made.

- (a) Stocks amounting to Rs. 764,137 included revenue items and advances receivable. Thus the stocks had not been valued in accordance with SLAS - 5.
- (b) Receivables amounting to Rs. 2,902,650 had not represented any realizable value.
- (c) Annual subscription of Rs. 4,200 made for a magazine had been capitalised although the magazine had not been received during the year.
- (d) A sum of Rs. 50,000 advanced to the Welfare Society had not been shown as amount receivable in the accounts.

2:5:3 Omissions in the Accounts

Following omissions were observed.

- (a) The assets transferred from the former Fish Technology Division of the Ministry of Fisheries to the Agency when the latter was established in 1981 had not been valued and brought to account after getting them vested in terms of the Act.
- (b) Rates payable to the Colombo Municipal Council amounting to Rs. 4,927,830 were outstanding upto 31 December 1994 and a provision had not been made for payment of penalty amounting to Rs. 2,463,915.
- (c) Although there were considerable delays in remitting EPF and ETF contributions, provision for penalty had not been made.
- (d) A small boat, procured locally by Project Co-ordinator in March 1993 had not been valued and incorporated in the accounts.
- (e) Value of 75 nos. <sup>of</sup> books received as donations in 1994 had not been valued and brought to account.
- (f) A sum of Rs. 30,000 held in deposit by an Institution and which was confirmed by the party concerned had not been brought to account.

- (g) Trading results of the welfare society " Supunsala " which is run with money advanced by the Agency for the year under review had not been incorporated in the accounts.
- (h) Provision had not been made in the accounts in respect of video cassettes valued at Rs. 266,700 which had become obsolete.
- (i) Adjustment had not been made in respect of 357 library books lost from the library during the year.

2:5:4 Overstatements and Understatements in the Accounts.

Following overstatements and understatements were observed.

- (a) Value of fixed assets as at 1 January 1994 had been understated by Rs. 349,650.
- (b) Accumulated depreciation balance as at 1 January 1994 had been overstated by Rs. 34,965.
- (c) Depreciation on Research and Development ( Foreign Funded Project ) had been overstated by Rs. 9,999.
- (d) Current account balance of National Hydrographic Office had been overstated by Rs. 219,991.
- (e) Prior year adjustment account balance of National Hydrographic Office had been overstated by Rs. 91,016.

2:5:5 Accounts Receivable and Payable

Following observations are made.

- (a) Salary advances and travelling advances outstanding as at the end of the year under review amounted to Rs. 76,842 including Rs. 33,277 outstanding for periods ranging from one to four years.
- (b) None of the debtors, deposits and advances balances totalling Rs. 773,169 Rs. 153,415 and Rs. 45,738 respectively had been confirmed.
- (c) Confirmations of balances amounting to Rs. 1,516,099 had not been received in respect of two bank accounts.
- (d) Confirmations of balances had not been received in respect of any of the 157 creditors whose balances aggregated Rs. 11,792,959.
- (e) Petty cash advances given to the staff during the period 1991 to 1994 totalling Rs. 133,777 had not been settled upto the end of the year 1994.
- (f) Out of debtors, deposits and advances, balances totalling Rs. 322,491 and Rs. 103,965 were outstanding for periods ranging from one to five years and over five years respectively.
- (g) Out of the creditors balances, Rs. 11,614,099 and Rs. 6,887,091 were outstanding for periods ranging from one to five years and over five years respectively.
- (h) The provision of Rs. 254,600 made for bad debts was not considered adequate in view of the magnitude of the long outstanding debts.

2:5:6 Lack of Evidence for Audit.

The following items in the accounts could not be satisfactorily vouched or accepted in audit due to lack of evidence indicated against each item.

<u>Item</u>	<u>Value</u> Rs.	<u>Evidence not made available.</u>
(a) Fixed Assets (Other than Research and Development )	39,547,812	(i) Fixed Assets Register (ii) Board of Survey Reports
(b) Research and Development Expenses	56,490,294	(i) Fixed Assets Register (ii) Project Expenditure Register. (iii) Verification Reports.
(c) Stocks of Consumables	764,137	Verification Reports.
(d) Petty cash advances to Staff	133,777	Register of Petty Cash Advances
(e) Debtors	579,239	) ) Direct Confirmations.
(f) Creditors	11,792,959	
(g) Foreign Aid - Grant	2,910,000	Fixed Assets Register
(h) Other Capital Projects	12,210,554	Detailed Schedules
(i) Travelling Advances	57,980	- do -
(j) Payments	86,311	Eight Payment vouchers
(k) Deposits	166,715	Direct confirmations
(l) Bank balances	1,516,099	Confirmations
(m) Provision for Bad Debts	254,600	Basis of Computation

(n) Purchases	342,927	Goods Received Notes
(o) Purchase advances	45,738	Confirmations
(p) E.P.F. Liability	1,191,647	Detailed Schedules
(q) Provision for Gratuity	3,964,144	Details of Computation.

2:5:7 Non-compliance with Laws, Rules, Regulations, Management Decisions etc.

Instances of non-compliance observed in audit are given below.

Reference to Laws, Rules, Regulations,  
Management Decisions etc.

Particulars

(a) Finance Act :

(i) Section 12

Approval of the relevant Ministers had not been obtained for the form and contents of the annual accounts.

(ii) Section 13(5)(b)

Report on stocks, stores, debtors and creditors had not been furnished to the Auditor General along with the accounts.

(iii) Section 13(5)(d)

An internal audit programme had not been settled in agreement with the Auditor General and half yearly internal audit reports for the year 1994 had not been submitted as prescribed

(iv) Section 13(6)

Report on accounts as specified by the Auditor General had not been furnished along with the accounts.

(v) Section 14(1)

A copy of the draft annual report had not been submitted within 4 months after the end of the financial year.

(vi) Section 14(3)

Annual report on accounts for the years 1991, 1992 and 1993 had not been tabled in Parliament upto 30 June 1995



(b) National Aquatic Resources Research and Development Agency Act No. 54 of 1981.

(i) Section 32(2)

Proper books of accounts had not been kept in respect of assets, liabilities, income and expenditure.

(ii) Section 10(1)

The Governing Board shall meet at least once a month. But, there were no meetings held from 23 August, 1994 upto 30 June 1995.

(c) Manual of Procedure.

(i) Paragraph 5

The following functions had not been identified and delegated in respect of disbursements.

- Authorisation
- Approval
- Certification
- Payment.

(ii) Paragraph 7

Deposit ledger and Votes Ledger had not been kept as specified.

(iii) Paragraph 13

Board of survey had not been carried out.

(d) Financial Regulation

No: 1646

Daily Running Charts and Monthly Performance Summaries of vehicles to be submitted to the Auditor General on or before the 15th day of the following month had not been submitted upto 31 January 1996 in respect of the year under review.

(e) Treasury Circular.

No: 842 of 19 December 1978

Fixed assets registers had not been maintained.

(f) Public Administration Circular

No : 264 of 15 August 1984

The Accountant of the Agency had used Agency's vehicles for private purposes without obtaining the approval of the Cabinet.

2:5:8 Transactions not Supported by Adequate Authorities.

Following instances were observed .

- (a) Although seven signatures are required to complete a payment voucher, only the signatures of the officer who prepares the voucher and the Accountant appeared on vouchers.
- (b) Three computers, three printers and a printer cable had been purchased during the year at a cost of Rs. 279,189 although the tender board appointed for this purchase had approved only one computer and a printer. It was also observed that tender board was appointed only on 12 January 1994 after opening the tender on 29 December 1993.

3. Financial and Operating Review.

3:1 Financial Results

The working of the Agency during the year ended 31 December 1994 had resulted in a deficit of Rs. 11,875,069 compared with the deficit of Rs. 10,406,301 for the preceding year.

In view of the material uncertainty reflected in the financial statements as described above, any attempt to analyse this variance is not likely to lead to any meaningful results.

The financial results disclosed in the annual financial statements of the Agency had been adjusted by the Agency for accounting errors omissions etc. observed in the subsequent years as a regular feature. For instance, the deficit of Rs. 10,406,301 shown in the accounts for the previous year had been adjusted during the year under review by Rs. 12,984,015. Similar adjustments made during the previous five years are given below

Year	Financial results	Adjustments made in subsequent years
	Rs.	Rs.
1988	( 6,335,458 )	( 1,058,134 )
1989	( 6,129,108 )	475,250
1990	( 8,715,370 )	( 1,724,142 )
1991	( 7,733,944 )	(12,317,717 )
1992	( 8,163,129 )	(16,294,750 )

In this context, the possibility of similar adjustments of the financial results and the financial position for the year under review in subsequent years cannot be ruled out. Therefore, no reliance can be placed on the financial results and the financial position reflected in the accounts.

### 3:2 Application of Specific Funds.

According to the accounts presented, the total receipts and expenditure under Federal Republic of Germany ( FRG ) Project during the year under review are given below.

	<u>Receipts</u>	<u>Expenditure</u>
	Rs.	Rs.
Treasury Grant	14,470,000	14,470,000
Foreign Aid	4,450,682	4,627,832
	<u>18,920,682</u>	<u>19,097,832</u>

The objectives of the Project are to provide assistance to the hydrographic service with a view to raising the contribution made by Hydrography in the management of aquatic resources and maritime shipping. A copy of the agreement dated 18 October 1973 had not been made available for audit though called for.

### 3:3 Physical Performance.

Neither the Project Performance Evaluation Reports had been prepared, nor adequate records had been maintained for the year under review. The progress of the Projects and the Agency could not therefore be ascertained.

### 3:4 Apparent Management Inefficiencies.

The following inefficiencies were observed.

- (a) A loss of cash in safe amounting to Rs. 60,280 had been reported on 29 March 1993. However, cash in safe and in transit had not been insured against risk upto now.
- (b) A sum of Rs. 12,460 belonging to the Agency had been lying at the Modera Police Station since 29 March 1993. No action had been taken to settle the matter.

3:5 Repairs and Maintenance of Research Vessel " Samudra Maru ".

The research vessel " Samudra Maru " handed over by the Ministry of Fisheries in February 1985, remained inoperative until 31 December 1994 with a crew of ten.

Following observations are made.

- (a) A total sum of Rs. 11,655,788 had been incurred on repairs and maintenance during the 8 years ended 31 December 1993.
- (b) A sum of Rs. 1,806,529 had been spent for repairs and maintenance during the year.
- (c) The cost of spare parts purchased by UNDP amounted to Rs. 20,310,000.
- (d) The annual cost of salaries of the crew of the vessel amounted to Rs. 485,125.

3:6 Funding Arrangement for Provision for Gratuity.

A sum of Rs. 3,964,144 had been provided for gratuity as at 31 December 1994. However, in this regard a fund to settle the liabilities in future had not been created by the Agency.

3:7 Idle Resources.

Certain parts of the land, sports room, fish tank, " Supunsala " and some building space remained idle during the year under review. Suitable action had not been taken by the Agency to utilise these resources or to take appropriate alternative course of action. These resources were idling for periods ranging from one to nine years.

3:8 Uneconomic Transactions.

Following observations are made.

- (a) Certain vehicles belonging to the Agency had been used by the Ministry of Fisheries. The running and maintenance expenses of three vehicles had not been recovered from the Ministry.
- (b) Although a total sum of Rs. 4,927,830 had been provided for rates payable to the Municipal Council since 1979, no action had been taken to settle the outstanding balance. Penalty accrued so far for the delay in payment amounted to Rs. 2,463,915.

- (c) A sum of Rs. 32,985 had been paid as salaries to some employees out of NARA funds who had been released to work at the Ministry of Fisheries.
- (d) Services of a Firm of Chartered Accountants had been obtained for the preparation of a Fixed Assets Register by paying a sum of Rs. 21,246. However, it was observed that the Fixed Assets Register had not been maintained properly by the Agency.
- (e) Petty cash imprest of the Shreff had been increased from Rs. 25,000 to Rs. 35,000 without any justifiable reason and this had enabled the Shreff to have excess cash with him.
- (f) No recoveries had been made in respect of electricity and water supplied by the Agency to the outside projects.  
 Eg : TUNA Project  
 ADB Project

3:9 Identified Losses

Following observations are made.

- (a) Loan balances totalling Rs. 75,680 due from employees had become irrecoverable as the employees concerned are no longer in service of the Agency.
- (b) Four tyres purchased from a private firm in April 1994 at a cost of Rs. 9,200 had not been received by NARA.
- (c) A sum of Rs. 984,066 due on account of advances given to outsiders, and petty cash advances paid to staff had been written off during the year as irrecoverable.

3.10 Cost of Personnel

A comparative statement of average cost of personnel for the year 1993 and 1994 analysed under each category is given below.

Category	No. of employees		Average Cost per Employee.	
	1994	1993	1994	1993
			Rs.	Rs.
Executives	60	74	105,361	62,220
Non-Executives	219	190	54,978	57,780
Total	279	264	65,813	58,361
	=====	=====		

3:11 Vehicle Utilisation

The Agency had a fleet of 26 vehicles as at the end of the year under review. Cost of running and maintenance of this fleet during the year under review could not be ascertained in the absence of proper accounting records showing these expenses under separate headings. The total cost of fuel of this fleet during the year under review was Rs. 1,047,675 compared with Rs. 1,145,076 during the previous year. It was also observed that the running charts and log books had not been properly maintained for individual vehicles indicating the distance travelled, fuel consumed, repair cost etc. Hence, it was not possible to determine the cost of fuel consumed by each vehicle, the average performance per litre and the cost of repairs per vehicle.

3:12 Budgetary Control

Significant variations were observed between the budget and the actual income and expenditure during the year under review thus indicating that the budget had not been made use of as an effective instrument of management control.

4. Systems and Controls

Deficiencies observed during the course of audit were brought to the notice of the Chairman of the Agency in my detailed report furnished in terms of Section 13(7)(a) of the Finance Act.

Special attention is needed in respect of the following areas of control.

- (a) Delegation and segregation of duties.
- (b) Fixed Assets
- (c) Advances for Purchases
- (d) Debtors and Creditors
- (e) Petty Cash
- (f) Control Accounts
- (g) Review of operations and records by the internal audit.
- (h) Vehicles
- (i) Budget
- (j) Maintenance of books and records.
- (k) Foreign telephone calls

(S.C. Mayadunne)  
Acting Auditor General.

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(S.C. Mayadunne)  
Acting Auditor General.

**National Digitization Project**

***National Science Foundation***

Institute : National Aquatic Resources Research and Development Agency(NARA)

1. Place of Scanning : Crow Island, Colombo 15

2. Date Scanned : 2017/04/27.....

3. Name of Digitizing Company : Sanje (Private) Ltd, No 435/16, Kottawa Rd,  
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4. Scanning Officer

Name : P.L.D. Sajintha.....

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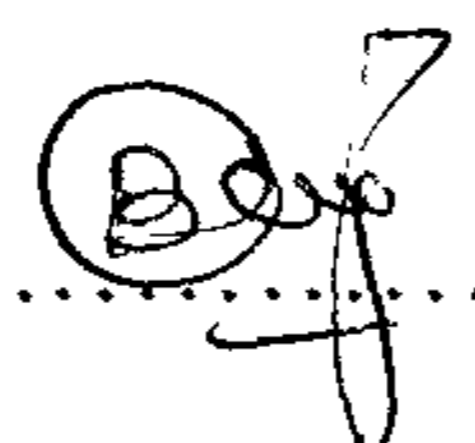
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