INVESTIGATION REPORT ON ESTABLISHMENT OF AQUACULTURE COURSE IN SRI LANKA FISHERIES TRAINING INSTITUTE

JAPAN INTERNATIONAL COOPERATION AGENCY

Contents

Preface

In response to the request of the Government of Sri Lanka for a survey on the establishment of an aquaculture in the Sri Lanka Fisheries Training Institute, the Japan International Cooperation Agency dispatched a four-members investigation team from January 25 to February 10, 1977, under the leadership of Dr. Masaru Fujiya, Chief of Water Quality & Fish Pathology Research Division, Freshwater Fisheries Research Laboratory, Fishery Agency.

As one of the links of the policy of promoting fisheries, Sri Lanka has plans to develop aquaculture, on which much effort has not thus far been concentrated, and develop it into an inquiry. Against this background, Sri Lanka asked Japan, an advanced country in aquaculture, to carry out an investigation on the possibility of developing aquaculture, including the training of technical personnels. Japan, a seagirt country like Sri Lanka, decided to render positive cooperation. In fiscal 1974, Japan sent two specialists, Dr. H. Uno and Dr. R. Yuki, there to perform the first survey, and this group was followed by the latest four-members investigation team.

The latest investigation team was sent there to conduct a follow-up on the results of the previous investigation. It encompassed not only the technical aspect but the administrative aspect as well. In this context, it is expected that the results on the latest investigation may provide data for broad judgement in conjunction with future aquaculture development programs in Sri Lanka.

Availing myself of this opportunity, I wish to tender the most sincere appreciation to the Ministry of Fisheries and the Sri Lanka Fisheries Training Institute.

July 1977

Michio Takeda
Director
Experts Assignment Department
Japan International Cooperation Agency

Epitome of Sri Lanka

Following Britain's protracted colonial rule, Sri Lanka declared independence and became an autonomous country of the British Commonwealth in 1948. Adopting a republican form of government in 1972, this country changed its name from Ceylon to Sri Lanka.

Situated in lat. 5∿10° and long. 78∿82°, Sri Lanka measures 65,610 square kilometers and has a population of 13,030,000 (1974). Topographically, Sri Lanka is a flatland with the exception of its central region where a mountain range exists. The north seacoast features a relatively large number of inlets, whereas the south coast is monotonous.

In general the climate of Sri Lanka is tropical. The north region is a dry zone, whereas the south is a wet zone being suitable for agriculture. The temperature stands in the neighborhood of 29°C all the year. But the temperature in the mountain range of the central region is fairly low throughout the year, standing at about 20∿21°C, dropping sometimes to below 10°C at night.

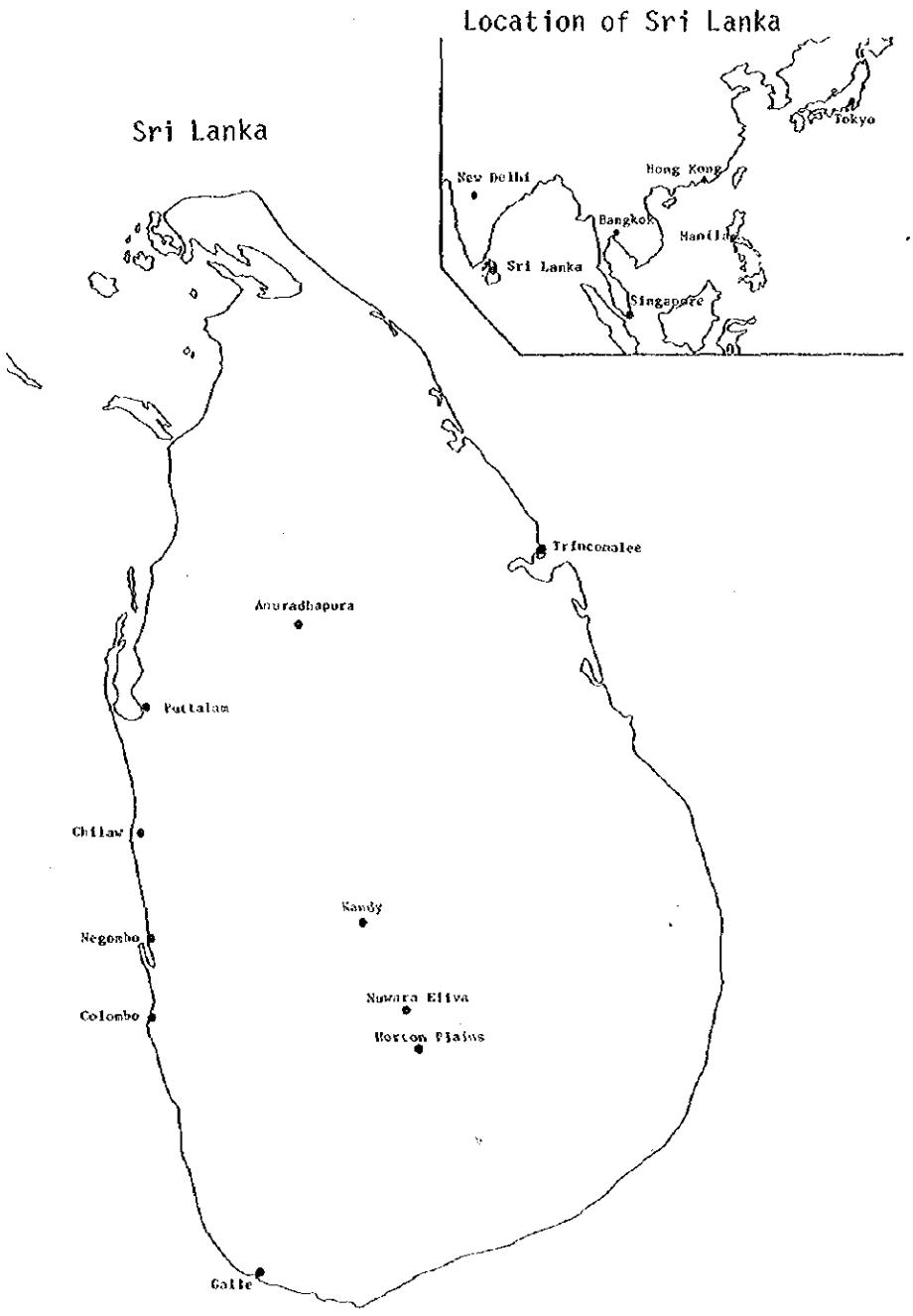
Racially, Sinhalese account for 68%, Tamirs 23%, and Moors and others consist of the rest. In respect of religion, about 80% of the national population, centering around the Sinhalese, believe in Hinayana Buddhism, which is followed by Hinduism with about 7%, Christianity with about 4% and Islamism with about 3%.

Agriculture is generally concentrated in the south region and evolves around rice cultivation.

The littoral areas feature coconut plantation, whereas the plantation what is generally known as Ceylonese tea is being performed in the mountainous central region. Almost all the road and railway networks are legacies of the British colonial rule but fully developed.

Buses are put on frequent use as a means of transport. Bus services are well developed not only in the urban areas but in the countryside as well. The railway services, however, are relatively few in number, and emphasis is on freight transport.

Incidentally, English is used as the official language between races. Sinhalese was designated as the national language in 1956.


Location of Sri Lanka
Tokyo
New Delhi
Hong Kong
Bangkok
Manila
Sri Lanka
Singapore
Sri Lanka
Trincomalee
Anuradhapura
Puttalam
Chilaw
Kandy
Negombo
Nuwara Eliya
Colombo
Horeon Plains
Galle

I. INTRODUCTION

1. Outline of Past Developments and Investigation Policy

In the past several year, Sri Lanka has been striving to develop the fishery industry, but there still are many underdeveloped areas, such as coastal shallowsea estuaries, bays and lagoons, and inland waters in the mountainous central region, including lakes, dam tanks and rivers.

In respect of the development of aquaculture in these areas, Japan was already asked to render cooperation. In March 1974, a investigation team including Dr. H. Uno and Dr. R. Yuki was sent to Sri Lanka to perform a survey on the feasibility of farming fishery and published its report.

Sri Lanka called for Japan's cooperation in the concrete future development of aquaculture. One of the requests was for cooperation from Japan for the establishment of an aquaculture course in the Sri Lanka Fisheries Training Institute, which was established with the cooperation of Japan in April 1975.

There was also a call for cooperation from Japan in the troutculture in the mountainous central region.
Consequently, the main purpose of the latest Japanese investigation team was to check up on the significance of the aquaculture course to be established in the Sri Lanka Fisheries Training Institute and also on the aquaculture of trout in the mountainous central region.

In order to examine the significance of the aquaculture course in the Sri Lanka Fisheries Training Institute, it is necessary for a deeper understanding about the role of aquaculture in the fisheries of Sri Lanka and also about its future prospects. With this in mind, it was decided to study these two aspects on the basis of the findings of a fact-finding survey to be conducted on the inlets and lagoons of main coastal estuaries.

In respect of the aquaculture of trouts, a similar fact-finding survey was conducted in principal areas of the mountainous central region.

On the basis of the findings of these investigations, preparation for the acceptance of students in the aquaculture course to be established in the Fisheries Training Institute and also views of the Ministry of Fisheries, it was decided to study the significance of the aquaculture course to be established in the Institute.

2. Organization of the Investigation Team

Head: Dr. Masaru Fujiya, Chief, Water Quality & Fish Pathology Research Division, Fresh Water Fisheries Research Laboratory, Fishery Agency

Dr. Hisashi Kanno, Chief, Mariculture Division, Tohoku Regional Fisheries Research Laboratory, Fishery Agency

Dr. Yoshimasa Enomoto, Aquaculture Specialist, FAO

Mr. Kaichiro Shimizu, Japan International Cooperation Agency

3. Investigation Schedule

Jan. 25 (Tues) Left Tokyo and arrived in Colombo

Jan. 26 (Wed.) Discussed the schedule and paid courtesy visits to Mr. S.D.R. Jayaratne, Minister of Fisheries; Mr. E.G. Goonewardena, Permanent Secretary of Fisheries; Mr. Akira Yoshioka, Japanese Ambassador; Mr. P.A. De Mel, Principal, Sri Lanka Fisheries Training Institute; and Japanese Specialists.

Jan. 27 (Thurs.) Met Mr. E.G. Goonewardena, Permanent Secretary of Fisheries

Jan. 28 (Fri.) Visited fish market and Called at the Fishery Cooperative Association in Negombo

Jan. 29 (Sat.) Investigated Chilaw Lagoon and visited the local fish market and Pitipana Experimental Station.

Investigated Puttalam Lagoon and met local extension officers of the Ministry of Fisheries.

Jan. 30 (Sun.) Moved to Annuradapura from Colombo.

Jan. 31 (Mon.) Investigated Alampil and Kokkilai Lagoons and met local extension officers of the Ministry of Fisheries. Observed shrimp fishing.

Met migrant fishermen.

Feb. 1 (Tues.) Moved to Nuwaraeliya from Anuradapura.

Feb. 2 (Wed.) Investigated the rainbow trout hatcheries and ponds of the local fresh water fishery station.

Tours the Horton Plain River (to which rainbow trouts are released.)

Feb. 3 (Thurs.) Moved to Colombo from Nuwaraeliya. Toured the local fresh water fishery station (under construction).

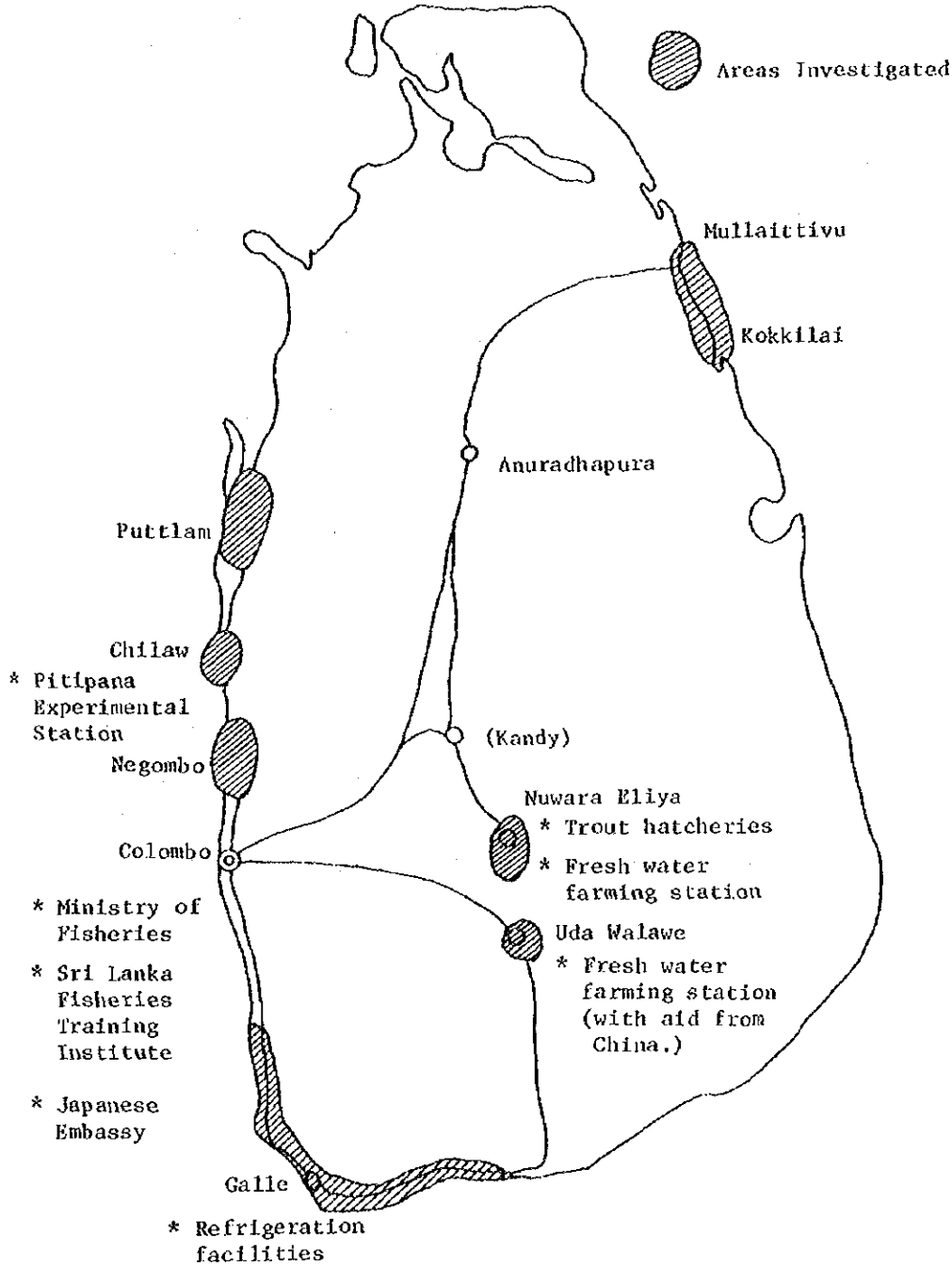
Feb. 4 (Fri.) Exchanged views with specialists of the Sri Lanka Fisheries Training Institute, met Mr. E.G. Goonewardena, Permanent Secretary of Fisheries, and reported to Mr. Akira Yoshioka, Japanese Ambassador.

Feb. 5 (Sat.) Toured the Uda Walawe fresh water fishery station developed with Chinese technology and interchanged with Chinese technicians.

Inspected the conditions of fisheries in the south littoral area (lagoons and refrigeration facilities in Galle).

Feb. 6 (Sun.)	Sorting of the collected data.
Feb. 7 (Mon.)	Met the parties concerned of the Ministry of Fisheries and collected data.
Feb. 8 (Tues.)	Met the parties concerned of the Ministry of Fisheries and collected data.
Feb. 9 (Wed.)	Left Colombo and arrived in Bangkok.
Feb. 10 (Thurs.)	Left Bangkok and arrived in Tokyo.

4. Investigation Points and Main Places of Visit



II. SUBSTANCE AND FINDINGS OF THE INVESTIGATION

1. Present Status of Aquaculture and Aquacultural Research in Sri Lanka

i) Present Status of Aquaculture

The role played by the fisheries in Sri Lanka is exceedingly great. On the animal proteins required for the nation, 70% must be depended on marine products. At present, marine products are supplied to the tune of about 50% of the required amount, and dried marine products are imported to make up for the shortage.

The output of fresh fish in 1975 reached about 130,000 tons, up about 18,000 tons or about 16.7% from the previous year. The output of the pelagic fisheries industry has been on the downturn, but the decrease is offset by an increase in the output of the coastal and inland-water fisheries. In particular, the increase in the output of the inland-water fisheries is extremely remarkable, as it stands at about 47%.

About 85% of the fish catch are made available on the market as fresh fish, about 13% consumed as cured or dried products, and the rest as canned products.

Table 1. The Trend of Production since 1970

(thousand tons)

Sector	1970	1971	1972	1973	1974	1975
Deep sea fisheries	3.2	2.5	2.5	2.3	2.2	0.9
Coastal fisheries	85.2	73.4	89.3	81.9	99.2	113.1
Inland fisheries	8.2	8.0	8.3	6.9	7.5	13.1
	96.6	83.9	100.1	99.1	108.9	127.1
Percent to 1970 production	100.0	86.9	103.6	102.6	112.7	131.6

Table 2. Disposition of Catch

Method	Estimated Quantity (tons)	Percent
Marketing (fresh)	108,880	85.7
Freezing	912	0.7
Curing	16,402	12.9
Canning	300	0.2
Reduction	612	0.5
Total	127,106	100.0

In fiscal 1975, the producer prices of fish rose by 8.6% on the average from the previous year with the retail prices registering an average rise of 7.5%.

On the other hand, Sri Lanka imported marine products primarily from Pakistan, the Maldiv Islands, Ethiopia, India and Malaysia. In 1975, the imports ran up to a total of about 15,000 tons. Sri Lanka's fish exports evolved around prawns, spiny lobsters and sea cucumbers, diverted mainly to the United States, Singapore, Japan and Britain.

The fish consumption per capita in 1975 stood at about 11 kg (26 lb) in 1975, registering a slight increase from the previous year.

Sri Lanka's coastline measures roughly 1,800 km, and there are 120,000 ha of lagoons along the seacoast. Besides, the areas fitted for aquaculture in the estuaries are estimated at 41,000 ha (Ling, 1972). At present, practically no aquaculture is conducted.

In the inland waters, on the other hand, rivers, water reservoirs, irrigation ponds and lakes are stocked with fish primarily for their multiplication. But practically every aquaculture project is placed on an experimental basis, and few on a commercial basis.

The main species of fish with which inland waters are stocked at present include carp, tilapia, glammie and trouts.

In the farming of carp, technical assistance is given by China. The demonstrational experiment of raising

and the distribution of roes and fries is performed primarily by the Uda Walawe inland water breeding experiment station. A few Chinese specialists give guidance and successfully perform experiments.

Of the species of fish with inland waters are stocked, tilapia turns out to the most propagated one. Sixty-six inland waters throughout the nation are stocked with about 600,000 fingerlings.

Lakes and rivers in the mountainous central region -- primarily, those in Nuwara Eliya -- are stocked with rainbow trouts, but their stocking remains on an experimental stage, their number ranging from 20,000 to 30,000.

The trout hatcheries in Nuwara Eliya were established in 1882. In the early years, they were engaged in stocking trouts for a sort of Englishmen's fishing club but placed under the jurisdiction of the Ministry of Fisheries in 1974. Consequently, the scale is small and the techniques developed at the time of their establishment are still inherited. In order to put them to industrial use, the improvement of the facilities and techniques is necessary.

In 1975, Sri Lanka imported 20,000 trout eggs each from England and New Zealand for hatching, stocking and distribution to trout growers, but in small scale.

Thus, the production of the fishery industry in Sri Lanka still remains insufficient, although the industry is of exceedingly great importance. High hopes, therefore, are pinned on its future development. In this context, the development of aquaculture should be a major task in the future.

ii) Present Status of Surveys and Research of Aquaculture

The research of fisheries in Sri Lanka is performed mainly by research workers of the Ministry of Fisheries and the University of Sri Lanka.

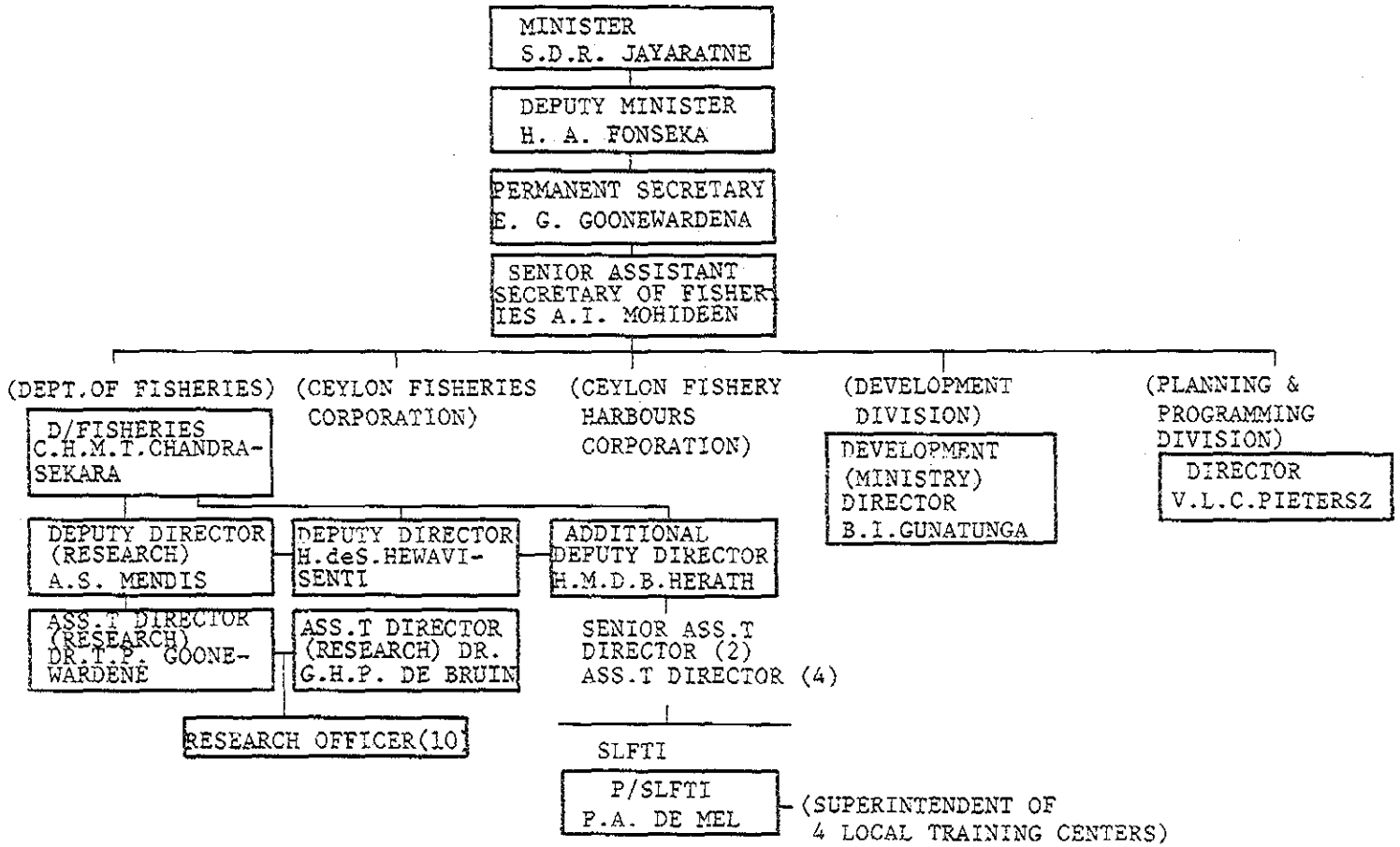
The Ministry of Fisheries consists of one bureau, two departments and two public corporations (Fig. 1), and the research division belongs to the Department of Fisheries. The Research Institute has the head offices in the building of the Ministry of Fisheries but will make its appearance as a Central Fisheries Experiment Station in the immediate vicinity of the Sri Lanka Fisheries Training Institute in the near future.

The Research Institute is performing a number of studies in aquatic biology, fishing gear and methods, preservation, use and processing and other fields. Above all, the studies related to aquaculture are as follows:

a) Survey of Lagoons

The survey of lagoons was begun in 1974. A few lagoons have been chosen and their configuration, water depth, bottom quality, water quality and other physical characteristics are surveyed. On the basis of the findings of these surveys, their productivity is under study and a survey is conducted on their interrelationship with important aquatic organisms --- particularly, the production of shrimps, mussels, crabs and fish.

Fig. 1 ORGANIZATION CHART OF MINISTRY OF FISHERIES (AS OF 1977)



On Kokilai, the representative lagoon along the east coast, and Puttalam, the representative lagoon along the West coast, monthly surveys are performed for a comparative study. The main survey items are as follows:

(1) Salinity, dissolved oxygen, phosphate, nitrate and silicate.

(2) Bottom conditions.

(3) Zoo- and phyto- plaktons.

(4) Survey on organisms for catches, hauls of fishes and shellfishes, dimensions of fishes and shellfishes, fishing gear and fishing methods.

In respect of the lagoon of Nanthikadal, a survey is carried out primarily on shellfishes. In this survey, 13 species of shellfishes have been already observed and classified. A basic study is also under way on oyster culture.

b) Survey on Milkfish Fingerlings

In April 1975, a survey was started on milkfish fingerlings in the Mannar area. That year, 60,000 fingerlings were collected. In the same way, 33,000 fingerlings were also collected in the Kalptiya area.

Most of the fingerlings were distributed to commercial breeding ponds for breeding experiments, and some to the ponds of the Research Institute for breeding experiments. In addition, similar surveys are also performed on mullets, rabbit-fish, shrimps and crabs.

c) Experiments on Fish Breeding

In the Pitipana experimental station, experiments on the breeding of milkfish, mullets and shrimps are under way.

In this station, the mortality, growth rate, conditions for fertilization, breeding density, the water quality, configuration of the ponds and breeding results are surveyed, and these are important basis studies for aquaculture.

d) Survey on Pearl Oysters and Oysters

Along the west coast in the south, a dredge survey is conducted along the depths of 8~40 fathoms west to Colombo and also off Madi Parai and Negombo.

Along the coast in the north, a similar survey is carried out off Chilaw, off Puttalum and in Manner Bay. This survey, however, has thus far failed to discover pearl oyster and oyster resources, although the existence of prawn and sea cucumber resources has been ascertained.

e) Surveys and Research of Inland Waters

The surveys and research of inland waters in Sri Lanka is in the process of development. Experiments on the hatching, intermediate breeding and growth of common carp, grass carp are carried out in the Uclawarawe experimental station with Chinese assistance according to an elaborate plan, and high hopes are pinned on its outcome.

In the Polonnaruwa experimental station, experiments are performed on the egg and fry production, transplantation and stocking of carp and tilapia. The experiment on the transplantation is extensive in scale and favorable results have been secured.

The Ginigathena and Nuwara Eliya experimental stations are either newly completed or under construction. Particularly in the Nuwara Eliya experimental station, plans are afoot for making studies on carp and also on trout, as a cold water species.

In the University of Sri Lanka, on the other hand, fish breeding experiments are carried out in part, to say the least of marine biological studies, to collect basic data.

In particular, the studies on the compound raising of mullet and milkfish will become a basis for the development of aquaculture in the future.

In this manner, aquaculture is not observed in terms of industry in Sri Lanka, but there exists a full enthusiasm for its development, insofar as the existing experiments and studies and the future programs are concerned.

The development of aquaculture and its studies still entails problems in spite of the conspicuous enthusiasm. Above all, the lack of technical personnels accumulating deep knowledge about aquaculture constitutes an extremely grave factor.

In the research sector, the efforts of the leadership of the Research Institute and assistance from advanced countries make it possible to carry out plans. In the sector of actual experiments and studies, including demonstrational experiments, however, the shortage of technical personnels may become a major barrier.

In respect of guidance and propagation, practically no persons with knowledge about aquaculture are observed among local extension officers of the Ministry of Fisheries and other individuals concerned. Therefore, it is an urgent task to train personnels for the development of experiments and studies and the development and propagation of projects -- particularly, to train cadre officers in the studies and staff personnel for the development of propagation and the guidance.

2. Future Prospects of Aquaculture in Sri Lanka

There are many areas suitable for aquaculture in the coastal and inland water districts of Sri Lanka. Geographically, the future prospects are bright. In particular, the utilization of lagoons, development of shallow waters and estuaries and utilization of inland waters centering around those in the mountainous central region will constitute the core of future development.

In order to develop aquaculture, a wide variety of factors are required. Above all, development of technique organization of growers and financial support to them are essential matters (Fig. 2).

When the present situation of developed countries is viewed in terms of aquaculture, one tends to arrive at the conclusion that only the upgrading and development of techniques is the most responsible factor, but it is inadvisable to think lightly of their well balanced social background.

For the development of techniques, it is important that a full research system and projects for its propagation should be established both in the basic and practical sectors. At the same time, it is also necessary to train personnels to be assigned to these projects.

In respect of studies and extension projects, Sri Lanka already is experienced in general fisheries other than aquaculture. In this sense, much can be expected of the establishment of a system required for the development of aquaculture in the future. In order to propagate the results of scientific studies and make projects out of them, there would be a need to train personnel specifically for this phase of studies.

In respect of basic and practical studies, the availability of research workers equipped with special skills is not necessarily required. For the on-the-spot experiments and studies, however, there will be a need for personnel experienced in aquaculture or given specialist training in aquaculture. Insofar as this is concerned, however, the present situation in Sri Lanka is not always adequate.

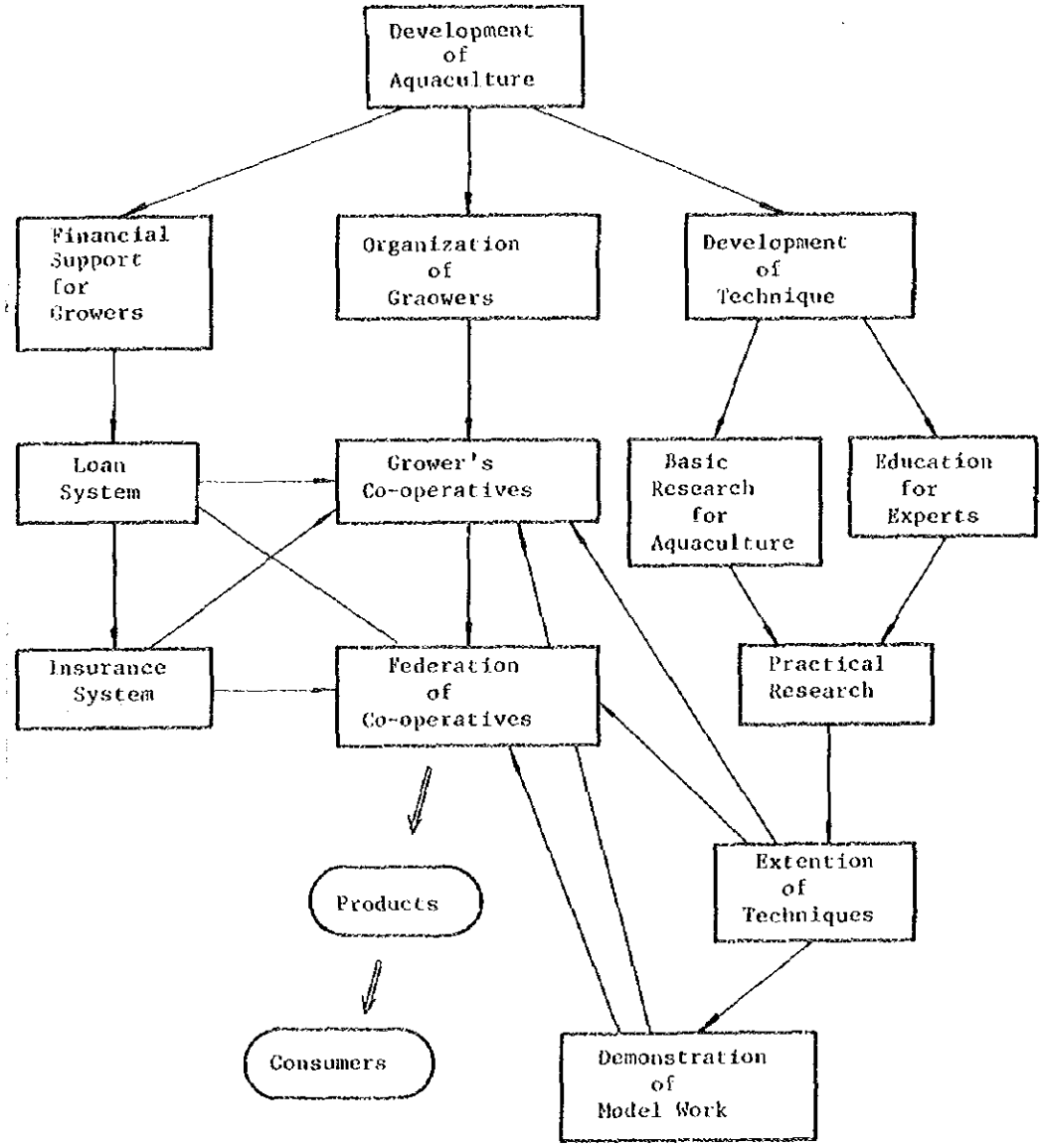


Fig. 2. Fundamental Idea of Aquaculture Development

In regard to organization of fishermen and the systematization of financial aid to fishermen, Sri Lanka is experienced with fishery cooperative associations and fishery corporations in respect of general fisheries, so that there will presumably not arise any major difficulty in the development of aquaculture.

Farming fisheries will presumably become the core of aquacultural techniques in the future. It is worthwhile to develop aquaculture in Sri Lanka primarily according to the concepts of farming fisheries.

The fundamental process of fish farming is shown in Fig. 3. In other words, seeds are produced under artificially controlled conditions, the fingerlings raised with an attempt for their adaptation to the realm of nature are released into the realm of nature, and those grown with the utilization of the productivity of nature are harvested.

For the production of seeds, although in some cases natural adult fish are used; in the perfect seed production, artificially matured fish should be used.

For acclimatization with the realm of nature, it is necessary to prepare special facilities, perform fertilization for the upgrading of the productivity of nature, and take special steps for the maturation of adult fish, but these techniques are practically completed.

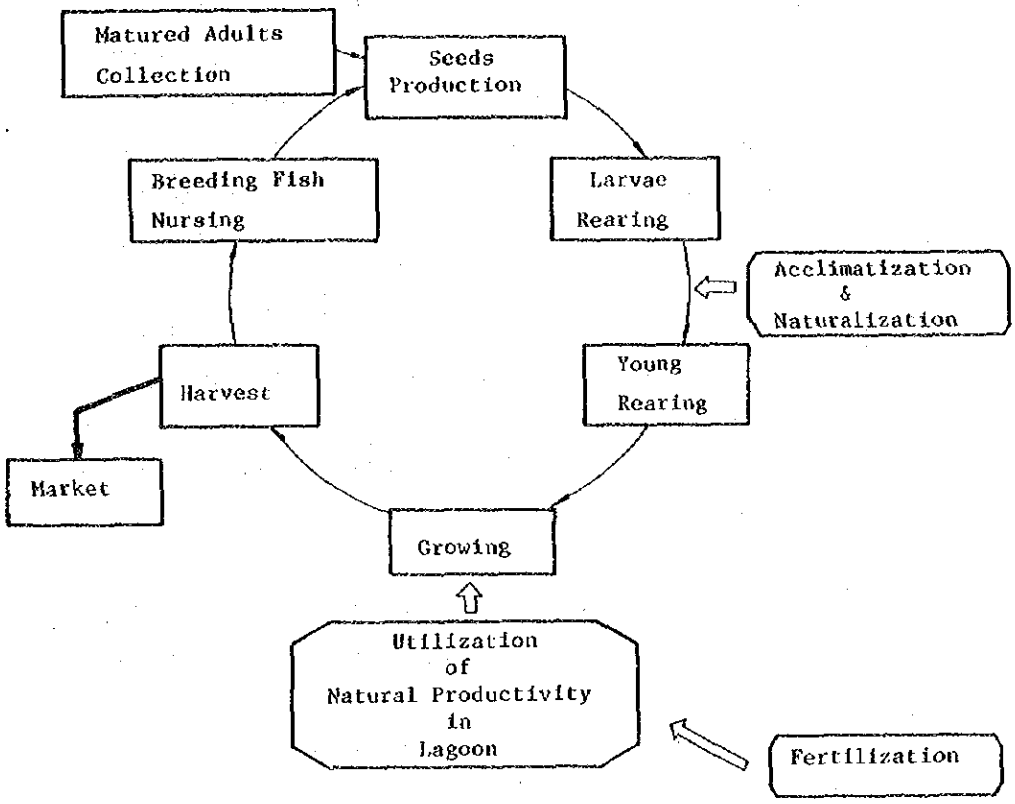


Fig. 3. Fundamental Process of Fish Farming

In all this process, the production of seeds and their nursing, which are carried out at present, are illustrated in Fig. 4. In other words, this figure represents a method in which natural fingerlings, are collected and used as seeds and, wherever necessary, nursing is done; and another method in which artificially spawned eggs are hatched to nurse fingerlings and use them as seeds. The difference lies in whether eggs are artificially collected and hatched. At first sight, the difference seems little, but there exists a big difference in terms of technology.

The nursing in which fingerlings are grown is followed by a process of growing, for which there is a need to establish such secondary technologies as water condition control, fertilization to water, predator control and disease control.

Most of the grown organisms must be harvested and taken out. Some are used as parent fish for artificial spawning. The parent fish for artificial spawning are not necessarily those which have been artificially bred; some are natural ones.

Some seeds could be used in fish farming of the feeding type, but most should be used in the stock recruitment type. (Fig. 5)

Here, hopes are laid not only on the growing of stocked seeds with the productivity of nature and their recapture but also on their settlement and the reproduction of resources in the stocked area and its vicinity.

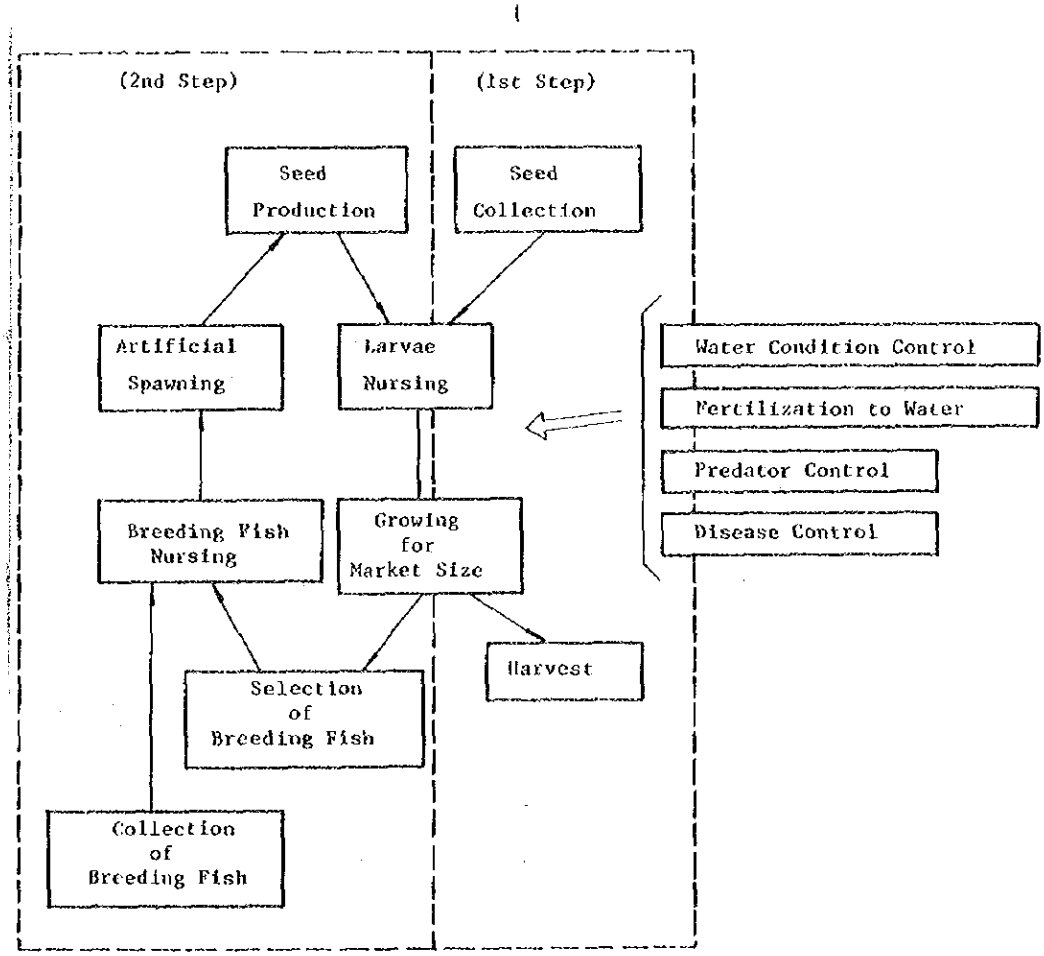


Fig. 4. Principle of Seed Production and Nursing

In recent years, there have been criticisms about fish harming of the feeding type in shortage of feeds, and this type is not so appropriate in Sri Lanka in terms of feed supply. In the areas suitable for aquaculture in Sri Lanka, whether they be situated in the littoral or inland-water areas, fish farming of the stock recruitment type is advisable for a future concept.

At present, the aquaculture industry does not exist in Sri Lanka, and no technologies have been accumulated in this sector. For the development of aquaculture, therefore, it is advisable to start with the learning of primary technology.

For this purpose, it seems worthwhile to pursue technological development in three steps, into which the series of developments leading to the stock recruitment type, as mentioned earlier, is divided.

In the first step, there will be a need for the acquisition of technology for nursing for which natural seeds are used and growing to market sizes, as illustrated in Fig. 4, and it is an urgent task to embark upon research for this. During the course of research and technical development in this step, there is a need to establish technology for collateral necessary factors, such as water condition control, fertilization to water, predator control and disease control.

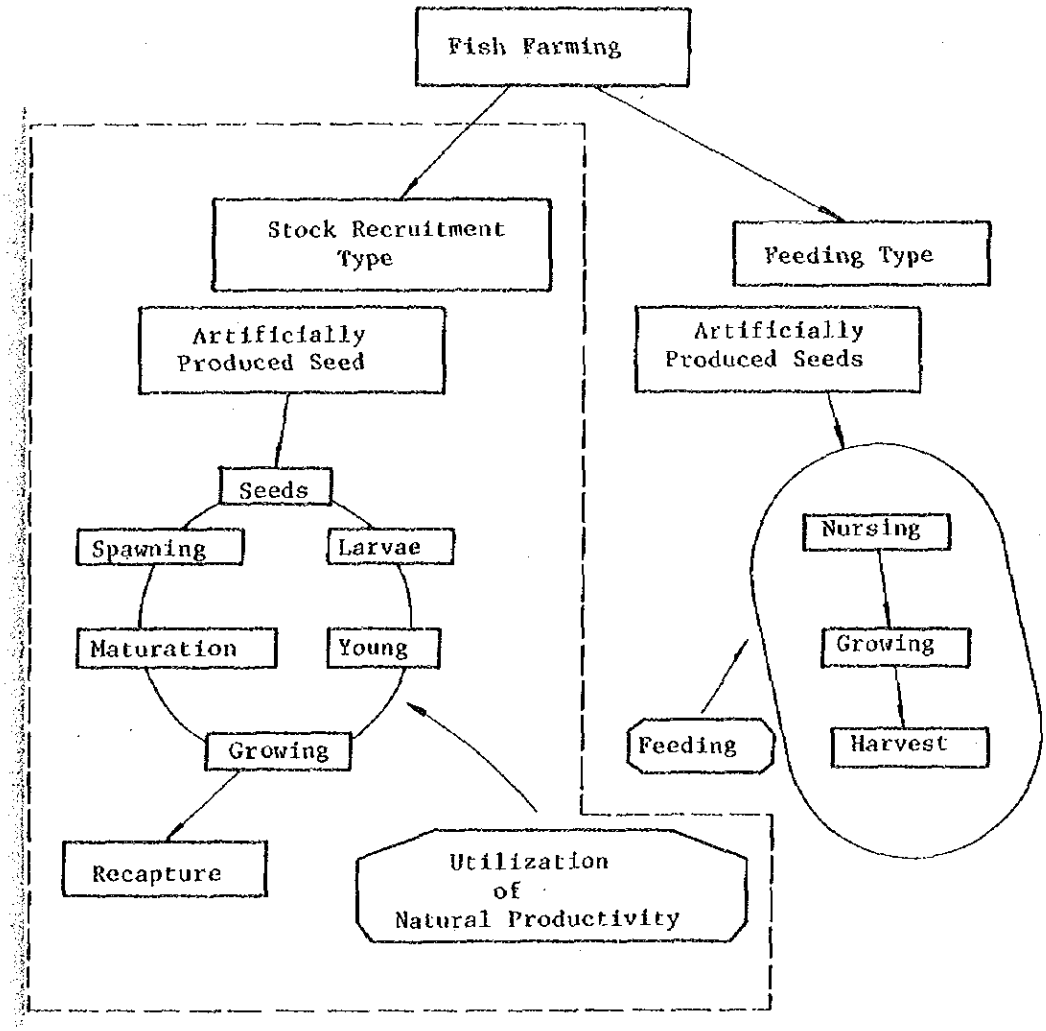


Fig. 5. Principle of Fish Farming

In the second step, it is desirable to master technology for the artificial production of seeds, as shown in Fig. 4. The establishment of this technology forms a basis for the development of lagoons in the future, so that the research and technical development to be done in this phase will turn to be a key to the development of aquaculture in the future.

The third step marks a shift to stock farming of the modern type. (Fig. 5) The outcomes of the research and technical development scheduled for this step will determine the future of aquaculture. The scope of application of this technology is broad, such as the development of estuaries and lagoons along the seacoast, and the utilization of lakes, rivers, dam tanks and irrigation tanks in respect of inland waters.

One way of promoting these research and technical development programs would be the schedule shown in Fig. 6.
In Sri Lanka, there is neither aquaculture nor accumulated technologies, so it is necessary for a team including cadre research officials of the Ministry of Fisheries to deepen their understanding about the present situation of modern techniques, thoughts about aquaculture and future strategical concepts. With these individuals serving as the core, it will subsequently be necessary to formulate an aquaculture development program and a research project.
For the time being, there is a need to set up the first through third projects as a research and technical development program. It might be a good idea to incorporate the technical development of the aforementioned first step in the first research project and that of the second and

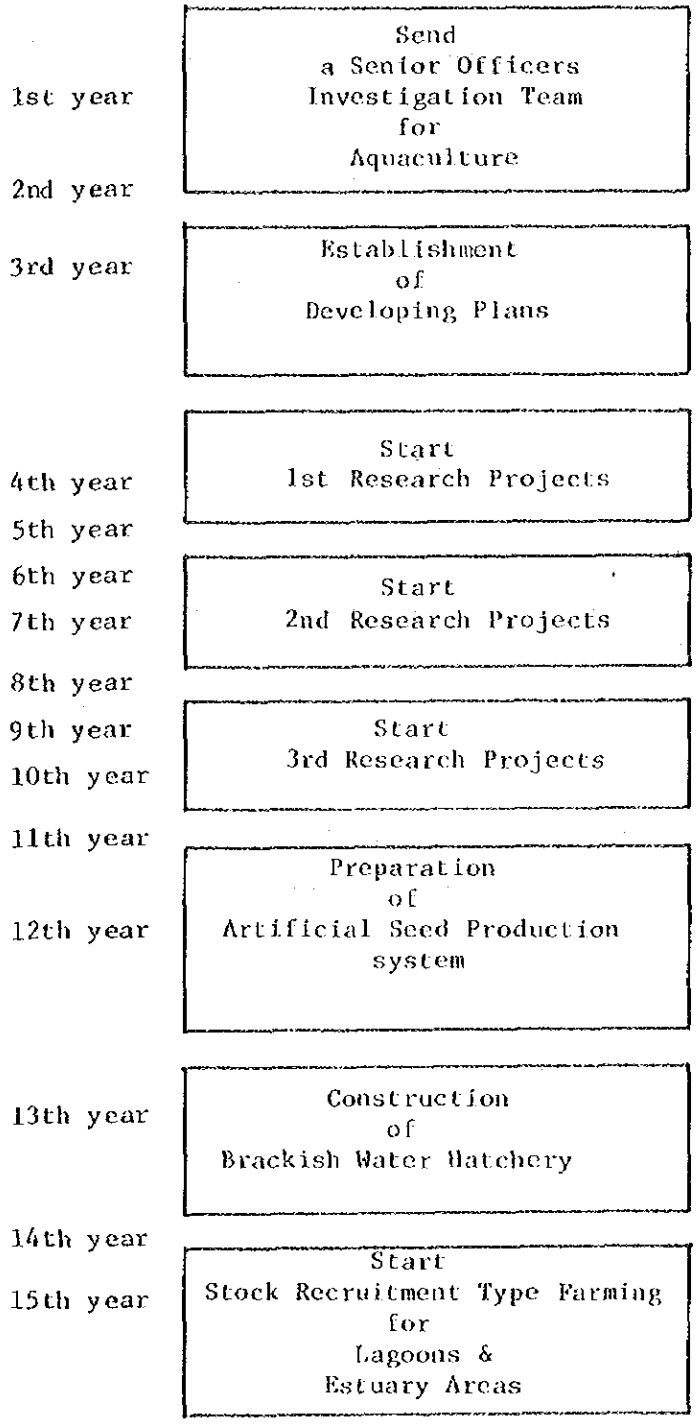


Fig. 6. Coastal Aquaculture Schedule

third steps in the second and third research projects, respectively.

The development of aquacultural technology based on stock farming does not necessarily make progress at an easy step, because it involves complicated factors. Therefore, it is necessary to carry out these projects at a steady pace step by step.

In all types of stock farming, the situation is different in that of trouts. In the developed countries, considerably standardized technologies have been established in respect of the hatching and growing of trouts, so that it is possible to accomplish achievements over shorter periods than in the case of brackish water fish farming.

The existing technologies for the hatching and stocking of trouts in Sri Lanka are inherited from those developed for a sort of fishing club established for Englishmen in 1882. These techniques might be fitted for the kind of stocking for a fishing club on a small scale but is unsuitable for any designs on an industrial scale. Therefore, there is a need to work for a drastic modernization of the facilities and techniques.

Trout has thus far been considered to be the kind of fish which should be raised in stock farming of the feeding type. In recent years, however, the prices of feed have been on the rise, and the supplies affected by overproduction, so that the prospects for stock farming of the feeding type are not bright.

As the direction toward new development against this background, the farming formula with hatching and stocking projects seems more suitable. For this purpose, it is necessary to step up studies, including the selection of the right species. In Sri Lanka, a new inland water fishery experimental station is under construction at Nuwara Eliya, and this station will become the center for studies on trout in the future.

An idea of trout farming schedule is shown in Fig. 7.

At present, Sri Lanka has no experience in the stock farming of trout. In this case, too, there will be a need for a survey team of the cadre class to be dispatched to developed countries in order to survey the basic concepts, the position of trout farming as an industry, and modern techniques and facilities, and draft the master plan for the development of a trout farming industry. According to these programs, trainees of the technician's status should be sent to developed countries for the learning of hatching and stocking techniques, trout farming specialists should be received, and modern facilities should be introduced to step up the programs.

It is expected that hatching and stocking techniques may be developed to a considerable degree in several years.

There are many waters in Sri Lanka which may be put to effective use, such as coastal estuaries, lagoons and inland waters. If the development of aquaculture, including the training of personnel is properly carried out,

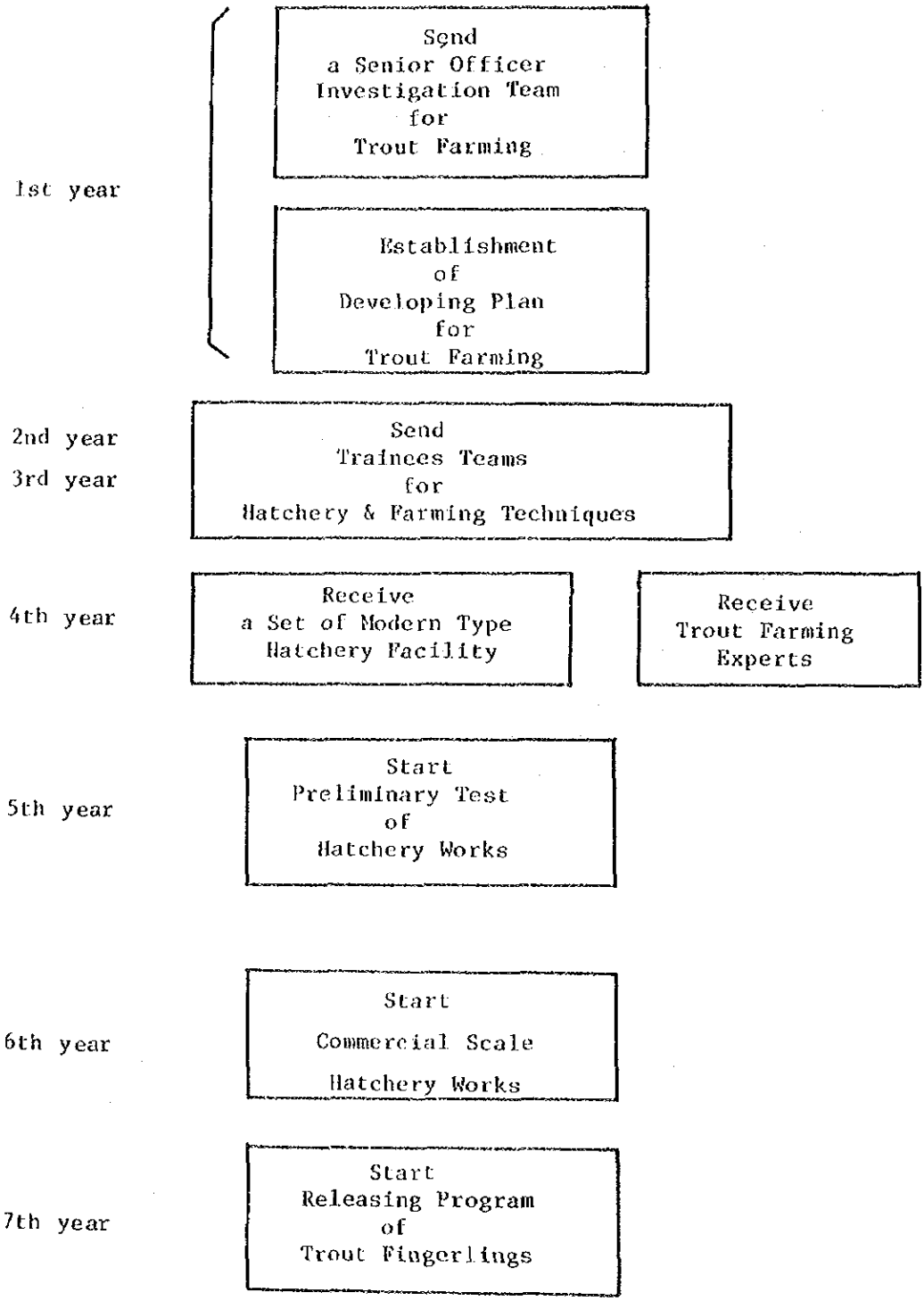


Fig. 7. Trout Farming Schedule

there will be bright prospects for its future. However the development will require a time before its completion. For example, it would require 15~20 years before it become possible to develop a lagoon with large-scale civil engineering projects, as suggested in the survey report prepared by Dr. H. Uno and Dr. R. Yuki.

3. Outline of Sri Lanka Fisheries Training Institute and Conditions for Establishment of Aquaculture Course

The Sri Lanka Fisheries Training Institute was established under an agreement between the Governments of Japan and Sri Lanka as one of the links of the development of offshore and pelagic fisheries in Sri Lanka. This Institute belongs to the Ministry of Fisheries and is managed with the cooperation of Japanese advisors.

A survey team was dispatched from February 25 through March 18, 1972, in respect of educational facilities for the development of deep-sea fisheries in Sri Lanka. On the basis of its survey report, an agreement was concluded and exchanged on the establishment of a new fisheries training institute.

The Sri Lanka Fisheries Training Institute was opened in April 1975 and the teaching began in June of the same year albeit somewhat belatedly as against the initial schedule.

Under this agreement, the Japanese side offered a training vessel and equipment necessary for lessons and drills, dispatched nine advisors and provided training for the staff personnel of the Institute, whereas the Government of Sri

Lanka offered a plot of land and buildings for the Institute, which was established on Crow Island as it is today.

At present, two-year fisheries and engineer courses are established as regular courses at the Institute. Plans are afoot for the establishment of one-year post-graduate courses.

One of the features of the courses at this Institute is that emphasis is put on practical education with the ratio of lectures to drills standing at 40:60, and this system is extremely suitable for accomplishing the purpose of training cadre technical personnels, who will shoulder the burdens of offshore and deep-sea fisheries in the future.

This educational policy and the curriculum are rated as being extremely suitable for, and significant to, the development of the fisheries of Sri Lanka. Therefore, it is extremely significant and worthwhile to newly establish an aquaculture course at the Institute at the same level as the fisheries and engineer courses under the same policy.

Aquaculture is basically different from general fisheries. In general fisheries, the purpose is to catch marketable organisms produced in the realm of nature. In aquaculture, the fingerlings of organisms, which are known as artificially produced seeds, are raised or stocked, and the productivity of nature is utilized for their growing before they are hauled.

General fisheries and aquacalture are basically symmetrical, as the former is known as "hunting" fisheries and the latter as "farming" fisheries.

The sector of basic sciences associated with aquaculture is extremely broad in scope. It includes individual biology, such as embryology and physiology; biochemistry, such as nutritional physiology and sciences on feed; physics and chemistry, such as environmental control; and ecology. It should be considered for the preparation of the curriculum and teaching schedule that the aquaculture is a typical practical science.
In establishing a curriculum, counsel should be sought from the teaching staffs of universities and high schools experienced in the education of aquaculture.

For the establishment of aquaculture course, it would be advisable to establish an additional classroom and laboratory on the location of the present Institute for lectures and simple practical trainings. For the practical outdoor trainings, such as experiments on the breeding of fishes and shellfishes, oceanographic surveys, environmental surveys and ecological surveys on organisms, it would be necessary to establish a new marine laboratory and provide it with necessary equipments. For the laboratory, it would not be necessary to have sophisticated analyzers, but equipment for biological and oceanographic surveys would be of necessity.

When the practical trainings on sophisticated analyzing techniques are required, they should be prepared at the Institute of the Ministry of Fisheries under the guidance

of its researchers. For this purpose, the preparation of some equipments is desirable at the Research Institute of the Ministry of Fisheries.

At present, it is difficult to produce and procure such teaching materials and equipment in Sri Lanka, and it would be better to procure them in Japan.

As already mentioned, the curriculum of the aquaculture course is extremely multifarious. But it can be possible to find talents in Sri Lanka to teach basic subjects. Fortunately at the University of Sri Lanka, talents are available in the basic sector, such as biology, physics and chemistry, and also in the sector of practical science, such as marine biology, and it is desirable to see cooperation from them. The Research Institute of the Ministry of Fisheries also has researchers experienced in studies associated with aquaculture, and their cooperation will also be required.

In the specialized sector of aquaculture, it is difficult to look for qualified persons in Sri Lanka at present. In this respect, there will be a need for the dispatch of specialists from Japan. These specialists should not only teach lessons at the Institute but extend cooperation as advisors in respect of the development of aquaculture done by the Ministry of Fisheries.

The role which is to be played by the aquaculture course of the Institute should, as a matter of course, be limited to the educational purpose of training personnel. Consequently, the purpose of the marine laboratory should also

be limited to training, and no commitment should be made in the sector of industrial responses, such as demonstrational experiments.

The demonstrational experiments on aquaculture are complicated in content, and a considerably large scale and concept is required, so that it would be difficult to carry them out with staff officials and trainees of the Institute, and different plans should be prepared.

Aquaculture techniques are making steady progress. New research findings give birth to new techniques, which stimulates production. Therefore, the curriculum of the aquaculture course should always be based on new knowledge. For this purpose, it should be considered to provide new knowledges to the teaching staff.

Fortunately, Japan is the most advanced country in the field of aquaculture, so that cooperation from Japan may be expected in respect of the training of lectures for the regular aquaculture course and the observation of new techniques.

As has thus far been pointed out, the raison d'etre of the Sri Lanka Fisheries Training Institute and the role it has played since its establishment lie in the teaching of technology of the intermediate level. In this context, the role the fisheries and engineer courses have thus far played is of significance.

The establishment of an aquaculture course under such a guideline will also be extremely significant as a means to solve the shortage of technical personnels in aquaculture, which constitutes one of the issues with which Sri Lanka is confronted at present. It is expected, as already mentioned, that the execution of the program with attention paid to some conditions will bring about great achievements in this sector in the future.

4. Development of Aquaculture in Sri Lanka in Immediate Future and Role of Aquaculture Course

The establishment of an aquaculture course in the Sri Lanka Fisheries Training Institute should be considered in close association with the concept for the development of aquaculture in Sri Lanka.

The development of aquaculture in Sri Lanka, as already mentioned, will start with the observation of aquaculture in developed countries by cadre officials of the Ministry of Fisheries and the Research Institute, which will be followed by the drafting of a development program and the execution of a survey and research project on necessary study matters.

If the development concept which has been presented as one idea is put into practice, the immediate studies may be conducted in the form of a series of three projects. Of course, anything found universally usable from among the achievements made during the course of the studies should be formed into a project one after another.

The best way of carrying out the three projects would probably be to organize a project team for their execution.

In this case, it would be desirable to organize the team with researchers of the Ministry of Fisheries, staff members of the Sri Lanka Fisheries Training Institute and researchers of the University of Sri Lanka and strive to step up effective studies.

The concept for the development of aquaculture and its relationship with the establishment of an aquaculture course in the Sri Lanka Fisheries Training Institute are shown in Fig. 8 as an idea.

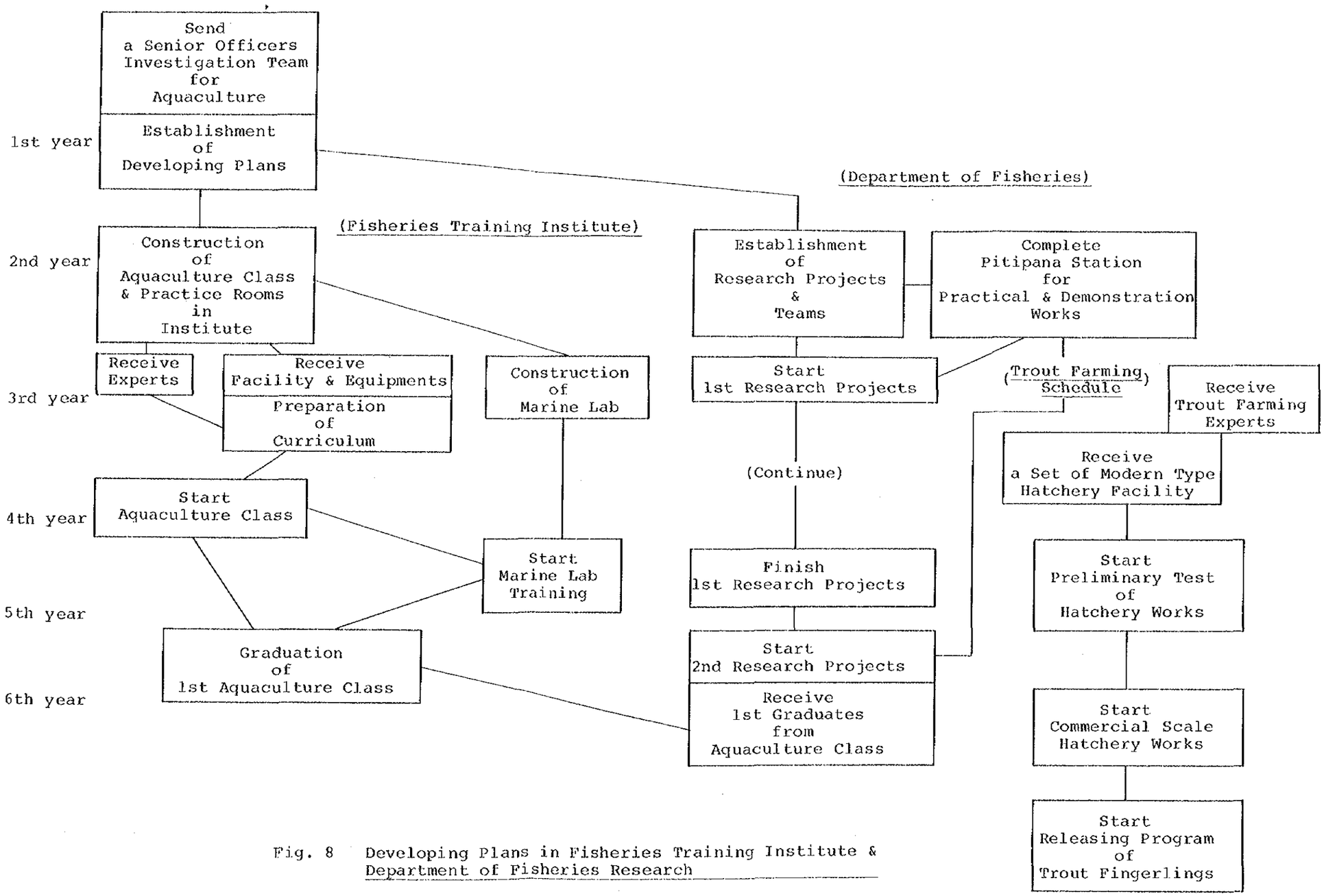


Fig. 8 Developing Plans in Fisheries Training Institute & Department of Fisheries Research

In accordance with the aquaculture development plan drafted after the return of a fact-finding team of officials of middle standing from developed countries, it would be feasible to draft a study project and organize a project team in the first year. In the meantime, there will be a need to redevelop the Pitipana Brackish Water Fisheries Experimental Station for use in applications and demonstrational experiments.

In the second year after this preparatory phase, it would be become feasible to embark upon the first three-year project, which will be taken over by the second study project in the fourth year with some achievements.

In the meantime, a trout aquaculture development program would start with the investigation and survey of officials of middle standing, which would be followed by the drafting and execution of a development program, and the training of several officials in developed countries would be completed. Therefore, it would become feasible to modernize hatcheries in the third year. It would be possible to put the hatchery facilities into preliminary operation in the fourth year and put them into full operation on a commercial basis in the fifth year. Their application in stocking projects would also become feasible in the year following.

It might be better to establish an aquaculture course at the Sri Lanka Fisheries Training Institute in line with such a development program.

In accordance with the program, it is necessary to additionally build classrooms and laboratories in the Institute on Crow Island in the first year.

In the second year, it would be necessary to receive specialists from developed countries and procure necessary facilities and equipment. At the same time, there would be a need to construct a marine laboratory. In the third year after these preparations, it would be possible to open the aquaculture course.

There is no way of knowing about the details of the curriculum at this juncture, but practical exercises will be given in the second year at the marine laboratory, so that the station will have to be completed before that time. In the fourth year, the first group of students will graduate from the course. In the research sector, the graduation coincides with the start of the second research project and also with the start of the full operation of hatcheries on a commercial basis under the trout aquaculture development program. The graduates may be immediately given assignments under these programs.

In respect of the development of aquaculture along the coast of Sri Lanka and trout aquaculture in the mountainous central region, there is a conspicuous lack of knowledge about suitable locality surveys and the socioeconomical background. Of these surveys, scientific surveys are performed by the Research Institute of the Ministry of Fisheries and socioeconomic ones primarily by local extension officers.

For the improvement of future development programs, it is desirable to assign to regional offices extension officers with knowledge about aquaculture. For this purpose, too, it is desirable to assign graduates from the aquaculture course.

In organizing the fishermen engaged in aquaculture, there will be a need for the availability of persons knowledgeable about aquaculture in cooperative association or loan projects. As it is necessary to assign such personnel to main districts, it will be desirable to make use of graduates from the aquaculture course.

The achievements of experiments and studies must, as a matter of course, be promptly applied to industrial development of aquaculture.

The most important thing between study and industry is a demonstration. The demonstration of research achievements developed under a project formula will presumably be performed at the Pitipana Brackish Water Fisheries Experimental Station. In addition, it will be necessary to conduct demonstrations and extension at other major districts throughout the nation. On these occasions, too, high hopes are pinned on the activity of graduates.

III. RECOMMENDATIONS

According to the information obtained through this investigation, the following recommendations are suggested:

1. The development of aquaculture in Sri Lanka is worthwhile. It is advisable to carry it out, as it will greatly contribute to the upgrading of the national life.

2. Any aquaculture development should be discussed and drafted after the preparatory phase which will include the visit to developed countries by cadre officials of the Ministry of Fisheries and senior officials of the Research Institute as well as the training of technical personnels in modern aquacultural techniques.

3. Prior to an attempt to embark upon aquaculture as a project, it is necessary to survey and study some essential matters. For this, a project formula will be of much use. In organizing a project team, it will be necessary to include research officials of the Ministry of Fisheries, staff officials of the Sri Lanka Fisheries Training Institute and staffs of the University of Sri Lanka, and they should collaborate with one another in solving the problems.

4. On places suitable for aquaculture along the coast and in lagoons and rivers, long-term surveys should be carried out on a routine basis in an attempt to develop the techniques and expand the suitable areas.

5. The development of aquaculture along the coast and in lagoons and trout aquaculture in lakes and rivers should, in principle, be carried out according to a formula of farming of the stock recruitment type. For this purpose, the existing Sri Lanka Fisheries Training Institute, when viewed from its raison d'etre and educational purposes, is presumably suitable for the training of technical personnels. Therefore, it is appropriate to establish an aquaculture course at this Institute, and the establishment will have to be valuable for the future development.

6. The purpose of establishing an aquaculture course is exclusively educational. In responses to industry, therefore, the teaching staff for this course should not take part in any activities unless they do so as members of a project team.

7. For the establishment of an aquaculture course, it is necessary to prepare classrooms and laboratory for practical exercises in the Institute.

   For the establishment of these facilities as well as the preparation of a curriculum, the counsel should be sought from experts in each field.

8. The teaching staffs for the aquaculture course should consist mainly of scientists and technicians in Sri Lanka with specialists from developed countries as advisors.

9. For a visit to a developed country, dispatch of trainees and procurement of specialized equipments, Japan may probably be the best country in terms of achievements made by various countries of the world at present.

10. To research and development projects, extension projects and investigation projects, graduates from the aquaculture course should be properly assigned to work for a rational utilization of personnel.

11. If the development of aquaculture is carried out in an attempt to put it on commercial basis at a steady pace, it will take about 10 years to achieve the production of artificial seeds for marine aquaculture on commercial basis, and about 20 years to develop the coastal and lagoon areas with full-scale civil engineering works. However, a trout hatching and stocking project may be accomplished in a considerably earlier phase.

APPENDIXES

Main Interviewees:

Ministry of Fisheries, Sri Lanka

Mr. S.D.R. Jayaratne, Minister of Fisheries

Mr. E.G. Goonewardena, Permanent Secretary of Fisheries

Mr. A.I. Mohideen, Senior Assistant Secretary of Fisheries

Mr. C.H.M.T. Chandrasekara, Director, Department of Fisheries

Mr. V.I..C. Pietersz, Director, Planning and Programming Division

Mr. A.S. Mendis, Deputy Director (Research), Department of Fisheries

Mr. H.M.D.B. Herath, Additional Deputy Director, Department of Fisheries

Dr. T.P. Goonewardene, Assistant Director (Research), Department of Fisheries

Miss. Y. Raphael, Researcher

Mr. C. Grelo, Researcher

Sri Lanka Fisheries Training Institute (SLFTI)

Mr. P.A. De Mel, Principal

Mr. Zennosuke Takagi, Senior Advisor

Mr. Shiro Horibe, Specialist

Mr. Naoki Suzuki, Specialist

Mr. Mikinao Sekioka, Specialist

Mr. Hiroshi Matsunaga, Specialist

Mr. Shyoichi Kobayashi, Specialist

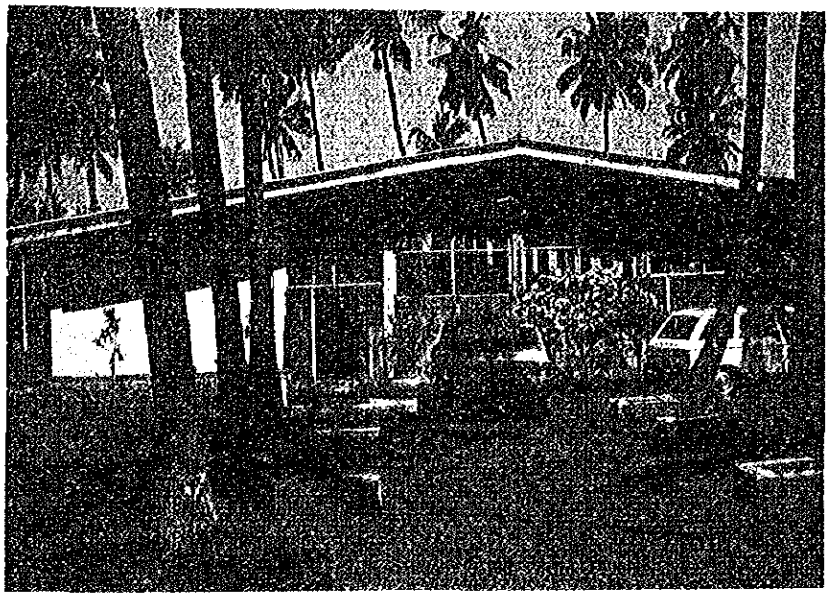
Mr. Yoshiya Ikeda, Coordinator

Japanese Embassy, Sri Lanka

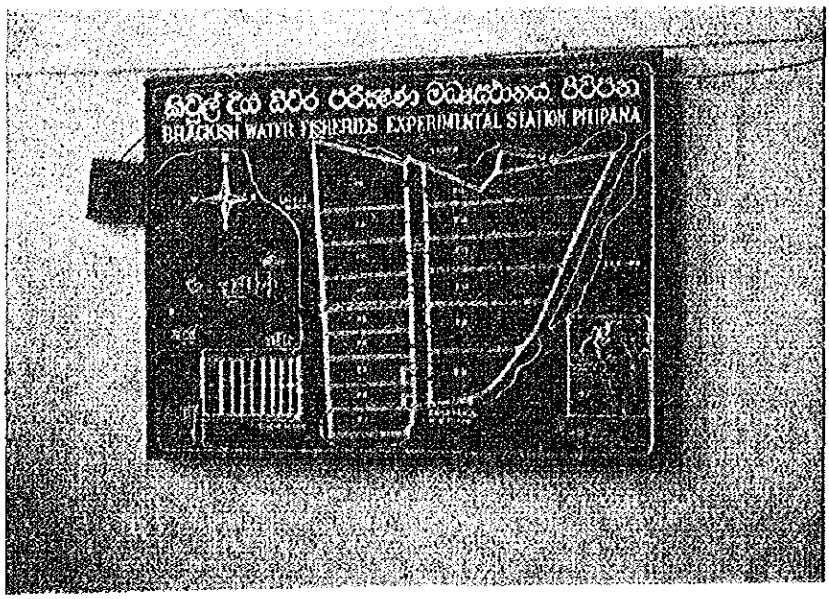
Mr. Akira Yoshioka, Ambassador

Mr. Ken Sasaguchi, First Secretary

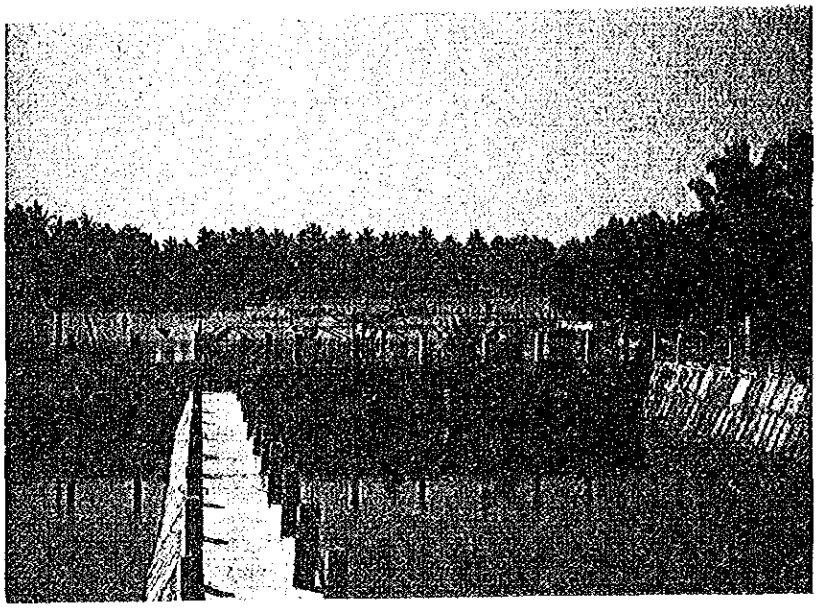
Mr. Kouichi Aoyama, Second Secretary



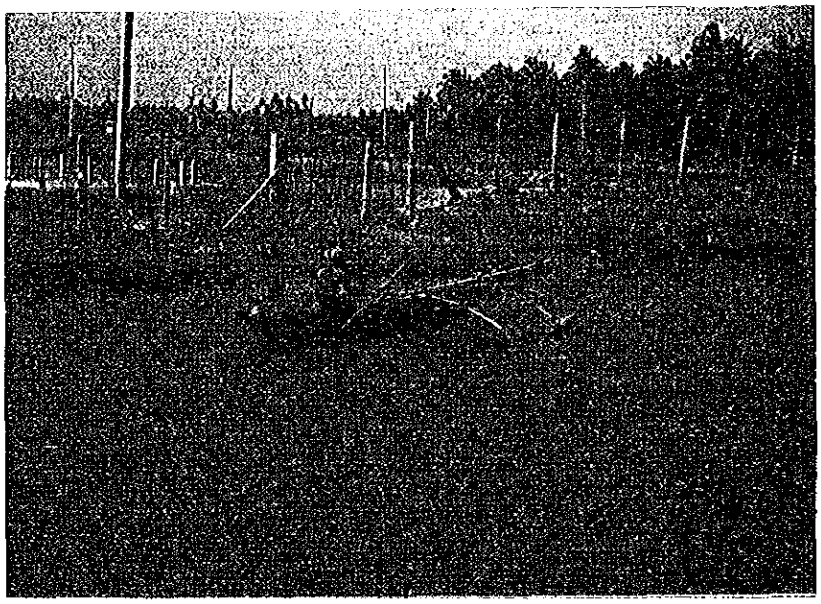
1. Pitipana Brackish Water Fisheries Experimenatl Station .



2. Plan of Pitipane Brackish Water Fisheries Experimental Station



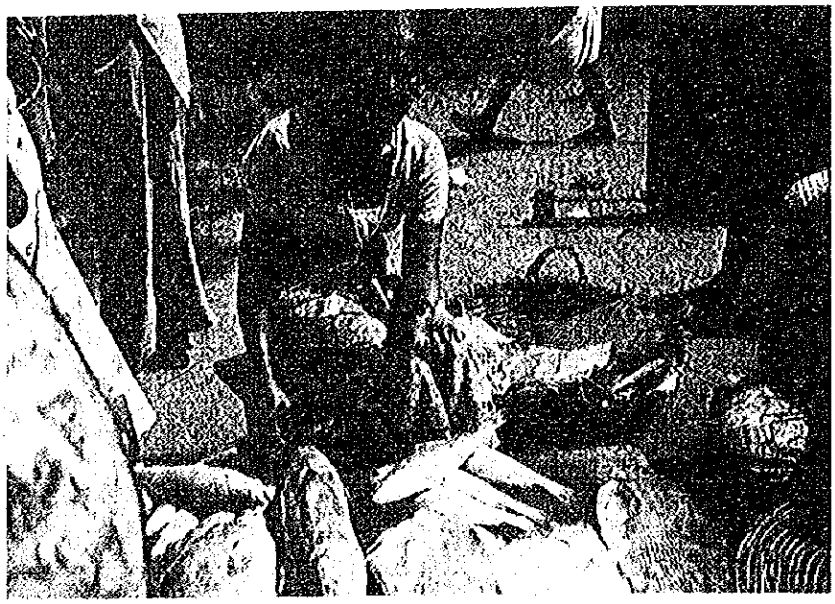
3. Experimental ponds at Pitipana Brackish Water Fisheries Experimental Station



4. Experimental ponds and canal of Pitipana Brackish Water Fisheries Experimental Station

5. Fishing vessels operating off Pitipana

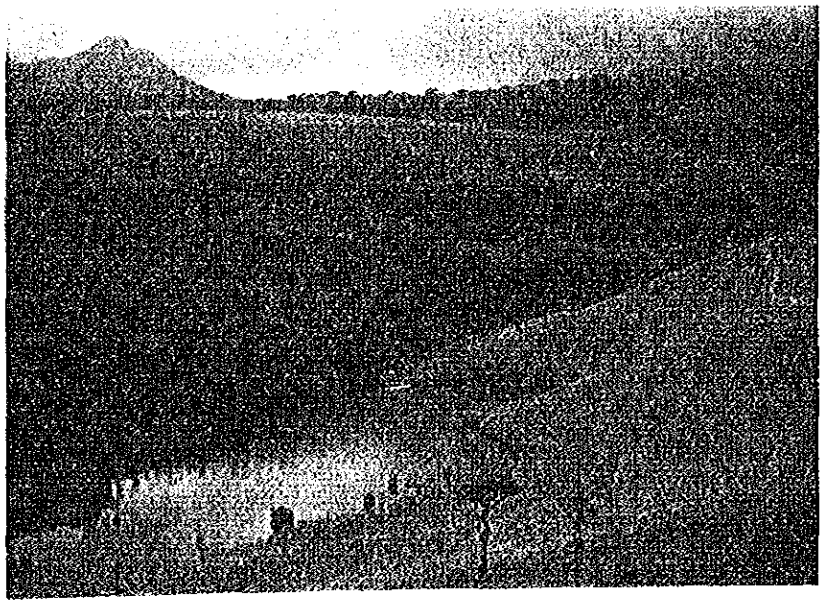
6. Fishing village near Chilaw



7. Fish market in the open air

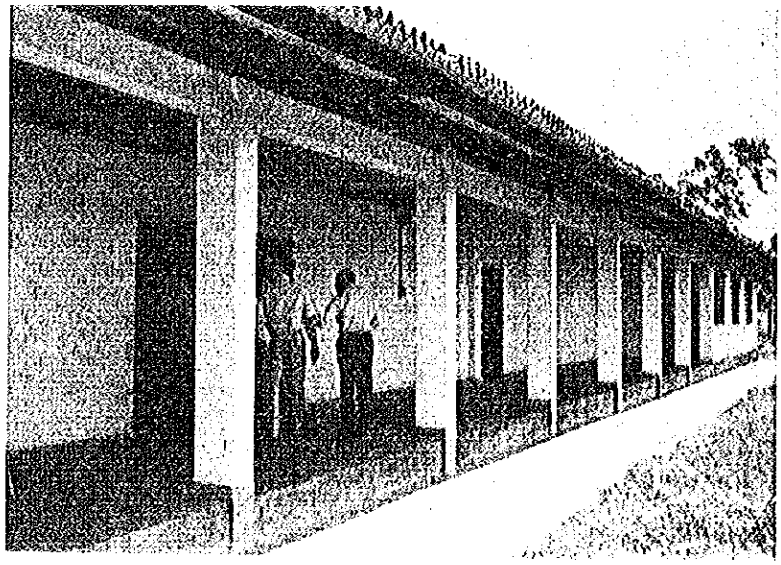
8. Surrounded by tea plantations, a Fresh Water Fisheries Experimental Station under construction on the outskirts of Nuwara Eliya

9. Administrative building of a Fresh Water Fisheries Experimental Station under construction

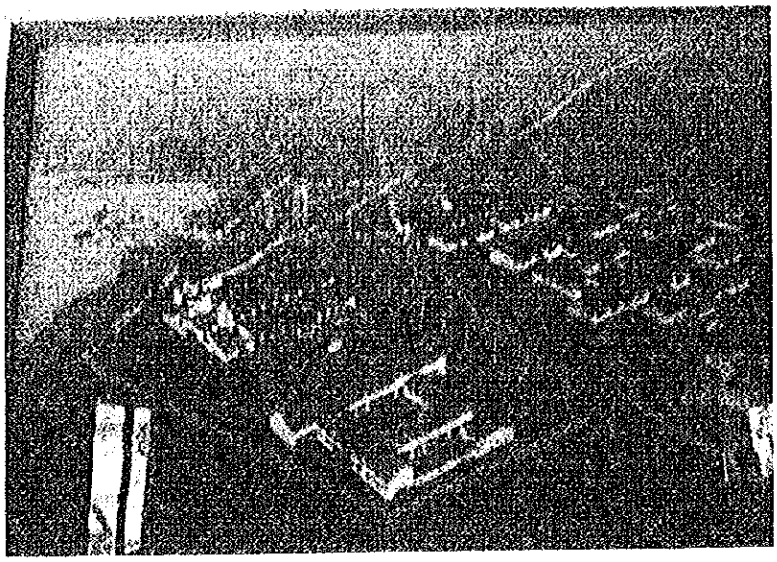


10. Rainbow trout-stocked Horton Plain River

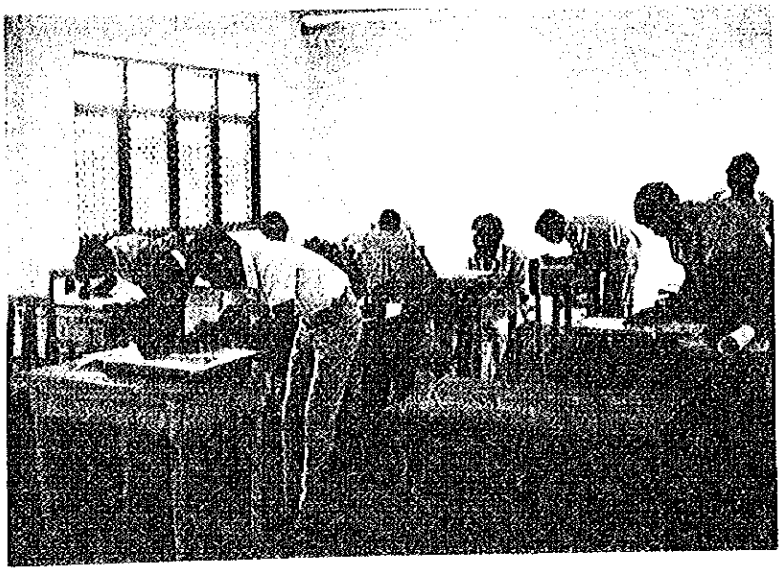
11. Wooden ships under construction at Chilaw shipbuilding yard



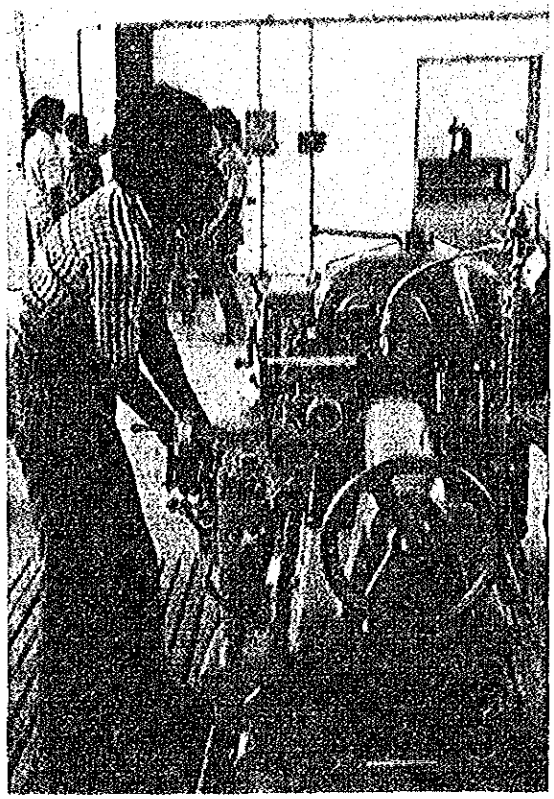
12. Sri Lanka Fisheries Training Institute



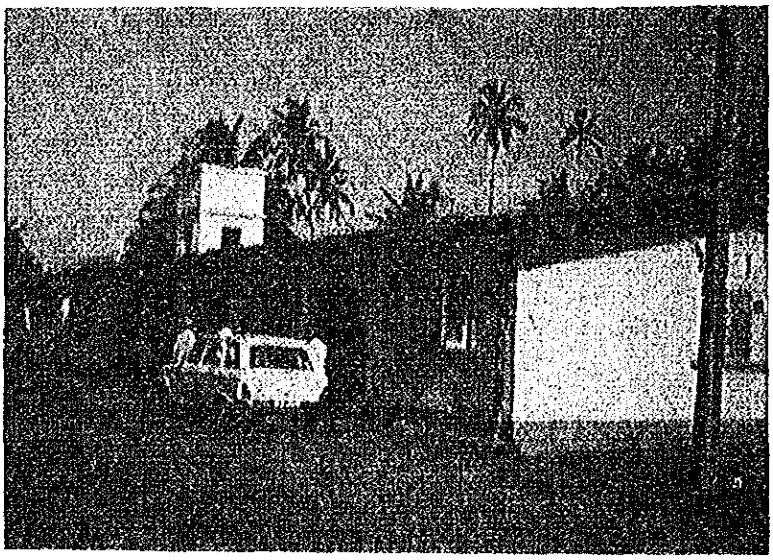
13. Plan of Sri Lanka Fisheries Training Institute



14. Trainees engaged in practical exercise at the Sri Lanka Fisheries Training Institute

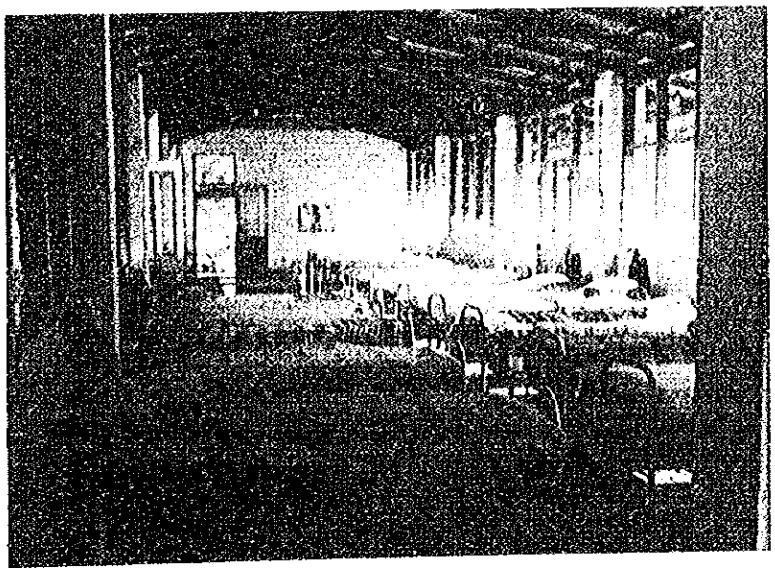


15. Trainees engaged in learning machine operation at Sri Lanka Fisheries Training Institute



16. Local center operated by the Ministry of Fisheries

17. Demonstration room at local center



18. Billet attached to local center

4 – b) List of Principal Researchers

Mr. A.S. Mendis,

Deputy Director (Research)

In charge of the Research Division of the Department of Fisheries.

Dr. T.P. Goonewardene,

Assistant Director (Research)

Presently in charge of Inland Fisheries and Fish Technology Section of the Research Division.

Dr. G.H.P. De Bruin,

Assistant Director (Research)

Presently in charge of Marine Fisheries Section of the Research Division.

Dr. K. Sivasubramaniam,

Research Officer

Presently working in the U.N.D.P. Project on Ocean Fishery Resources.

Mr. K. Satchithananthan,

Research Officer

Presently working on dried salted fish and beche-de-mer processing

Miss. Y.I. Raphael,

Research Officer

Presently in charge of the Brackishwater Fisheries Station, Pitipana, Negombo

Mr. T.S.S. Peiris,

Research Officer

Presently working on Fish handling and processing-use of ice, refrigeration and fish products.

Mr. B.D.L. Joseph,

Research Officer

Presently in charge of the Freshwater Fisheries Station, Polonnaruwa.

Also working on marine fishery resources and bait supplies in the U.N.D.P. Project on Ocean Fishery Resources.

Mr. Samarasinghe,

Research Officer for Physical Oceanography
Presently under training and receiving instruction at the University of North wales, U.K.

Mr. Weerasooriya,

Research Officer for Gear Technology

Presently working in the U.N.D.P. Project on Ocean fishery Resources

Mr. M.S.M. Siddeek,

Research Officer for Biometrics

Presently working on prawn population dynamics

Miss. N. Perera,

Research Officer

Presently working on squid resources in the U.N.D.P. Project on Ocean Fishery resources.

Miss. D. Fernando,

Research Officer

Presently working on bivalve (Oysters, mussels, clams) resources in the coastal region (marine bays and estuarine-lagoon waters)

Exports

Comparison of the Exports (1974 ∿ 1975)

	1974			1975		
	Q'ty (tons)	F.O.B value Rs.M.	Unit value per ton (Rs.)	Q'ty (tons)	F.O.B value Rs.M.	Unit value per ton (Rs.)
Prawns	673.1	13.7	20,370	523.2	11.1	21,144
Lobsters	233.4	4.7	20,298	76.0	2.9	38,437
Other fish		3.0		215.0	3.5	
Shark fins and fish maws	61.2	2.0	32,258	53.8	1.3	24,530
Beche-de-mer	183.9	3.3	18,108	120.0	3.2	26,631
Others		0.1			0.2	
Total		26.8			22.2	

Source: Customs Department

Main Importing Countries from Sri Lanka

Country	Total value of import (Rs.M)	Percent	Major items imported
U.S.A.	10.3	46.6	Frozen, prawns, lobsters and fish
Japan	4.0	18.1	Frozen, prawns, lobsters and fish
United Kingdom	1.9	8.6	Frozen prawns and live fish
Singapore	5.8	26.2	Shark fins, fish maws and lobsters
Others	0.2	0.5	
Total	22.2	100.0	

Imports

Variety	1974			1975		
	Q'ty (tons)	C.I.F. value Rs.M	Unit value per ton Rs.	Q'ty (tons)	C.I.F value Rs.M	Unit value per ton Rs.
Maldive fish	3,349.8	19.0	5,708	1,710.8	10.2	5,945
Dried fish	13,206.3	30.1	2,279	13,334.5	33.5	2,519
Others		0.9			0.3	
Total	16,556.1	50.1	3,021	15,045.3	44.0	2,924

Source: Customs Department

Main Exporting Countries to Sri Lanka

	Total value of imports Rs.M
Pakistan	23.6
Maldive Isalnds	9.9
Ethiopia	3.4
India	2.4
Aden	2.3
Malaysia	3.4
Others	0.7
Total	44.0

Imports and Exports of Fish, Fish Products
Fishing Nets and Nettings during the years

(1974 and 1975)

	1974		1975	
	Quantity (Cwt)	Value Rs.	Quantity (Cwt)	Value Rs.
A - Imports				
1. Fish and Fish Products				
Maldive Fish	66,696	19,033,680	34,215	10,172,756
Sprats-dried not salted	4,768	585,973	13,341	1,689,342
Fish dried, not salted	6,978	808,317	27,776	3,596,461
Fish dried, salted	252,381	8,704,652	225,572	28,231,054
Prawns	-	128	1	1,486
Prepared and preserved fish	-	9,648	41	31,694
Codliver Oil	-	4,585	129	248,373
Fish (Live or Dead) (Chilled or Frozen)	3,198	870,808	6	27,855
Other				
Total		50,017,791		43,999,021
2. Fishing Nets and Netting	-	8,448,145		2,670,015
Total Imports		58,465,936		46,669,036

	1974		1975	
	Quantity (Cwt)	Value Rs.	Quantity (Cwt)	Value Rs.
B - Exports				
Fish (Live and Dead) (Chilled or Frozen)				
Prawns	13,462	13,711,020	10,463	11,061,312
Lobsters	4,668	4,737,488	1,519	2,919,272
Other including live fish		3,009,228	4,300	3,460,008
Shark fins and fish maws	1,225	1,975,778	1,076	3,220,228
Beche-de-mer	3,677	3,329,089	2,409	3,207,671
Shells	-	33,829	408	84,499
Others	-	-	-	131,972
Total Exports		26,796,432		22,184,962

Average prices of fresh sea fish

(Rs. Per lb)

Variety	Producers' price		Retail price	
	1974	1975	1974	1975
Sear	2.39	2.77	3.38	3.74
Paraw	1.75	2.02	2.32	2.65
Blood fish	1.44	1.72	2.17	2.51
Shark and skates	0.97	1.18	1.61	1.82
Rook fish	1.07	1.29	1.51	1.82
Shore seine	0.90	0.99	1.30	1.41
Others	3.54	3.12	4.60	4.02
All varieties	1.39	1.51	2.00	2.15

Source: Compiled form average weekly prices by Fisheries Inspectors in respect of their divisions.

Fresh Fish Prices-Whole Sale Market Pettah

Variety			(Rs. per lb)	
			1974	1975
Seer	..	..	3.37	4.32
Paraw	..	..	2.73	3.38
Blood Fish				
Kelewalla	..	..	2.19	2.98
Balaya	..	..	1.85	2.50
Atawella	..	..	1.88	2.35
Thalapatha	..	..	2.79	3.38
Rock Fish				
Meeraliya	..	..	1.72	1.91
Red-mullet	..	..	1.92	1.92
Shark	..	..	1.83	2.18

Registration of Fishing Crafts-1975

Table 8

	Oru, Kulla, Thony		Theppam		Kattumaram		Vallam		D.F s boats	Private & Plastic boats		Paru, Pathai Karawalai Padu		Odam	Thundal	Kanoe	Total
	M	O	M	O	M	O	M	O	M	M	O	M	O	O	O	O	
Total No. of Crafts registered up to 31.12.74	263	13103	1204	8439	1256	5059	400	4551	2163	1230	796	18	1250	122	2	153	40009
Total No. of registered cancelled during 1.1.75 to 31.12.75	-	-	-	18	-	-	-	1	-	-	-	-	-	2	-	-	21
Balance	263	13103	1204	8421	1256	5059	400	4550	2163	1230	796	18	1350	120	2	153	39988
Total No. of Fishing crafts registered 1.1.75 to 31.12.75	15	933	7	507	2	197	19	254	116	110	289	54	-	-	-	-	2503
Renewal of Craft			Mechanized				Non-mechanized			Total				M = Mechanized O = Ordinary			
Total No. of Fishing crafts registered up to 31.1275	278	14036	2704 1211	8928	1258	5256	8892 419	4804	2279	11596 1340	1085	72	1250	120	2	153	42491
Renewal of Craft			Mechanized				Non-mechanized			Total				M = Mechanized O = Ordinary			
No. of Craft renewed up to 31.12.75			2704				8892			11596							

Per Capita Annual Consumption of Fish

Table 7

1. Total local production of fresh fish	Tons				99,116	108,952	127,106
2. Exports converted to fresh form	Tons	505	518	610	1,269	1,784	1,398
3. Total local supply available for consumption	Tons	96,103	83,379	99,500	97,847	107,168	125,708
4. Imports converted to fresh form	Tons	80,663	78,704	85,480	45,919	36,629	31,820
5. Total fish supply							
6. Local supply as percentage of local comsumption		12,516	12,699	12,951	13,180	13,393	13,603
7. Mid year population	Thousands	12,516	12,699	12,951	13,180	13,393	13,603
8. Per Capita annual consumption of Fish	lbs.	31.64	28.59	31.99	24.43	24.05	25.94

Estimated Dried Fish Production by Varieties-1975-Coastal Fisheries (CWT)

D.F.E.O's Division	Seer	Paraw	Blood fish	Shark & Skate	Rock Fish	Share Seine I	Share Seine II	Others	Total
Negombo	-	-	-	-	-	-	-	-	-
Colombo	-	-	-	-	-	-	-	-	-
Kalutara	-	-	-	-	-	-	-	-	-
Galle	-	-	-	-	-	-	-	-	-
Matara	-	-	105	-	-	-	10	-	115
Hambantota	-	-	-	-	-	-	-	-	-
Jaffna	23	6,613	34	10,310	4,546	6,610	36,327	-	64,463
Mannar	77	2,093	741	3,920	2,277	946	10,794	154	21,002
Mullativu	32	126	-	362	89	284	1,996	91	2,980
Trincomalee	-	1,401	-	-	910	114	10,146	15	12,586
Batticaloa	-	-	-	2		74	1,908	12	1,996
Kalmurai	-	-	-	-	-	19	6,496	557	7,072
Puttalam	-	202	-	975	998	590	9,739	-	15,504
Total:	132	10,435	880	15,569	8,820	8,637	77,416	829	122,718

Estimated Dried Fish Production by Months 1975-Coastal Fisheries (Tons)

D.F.E.O's Division	January	February	March	April	May	June	July	August	September	October	November	December	Total
Negombo	-	-	-	-	-	-	-	-	-	-	-	-	-
Colombo	-	-	-	-	-	-	-	-	-	-	-	-	-
Kalutara	-	-	-	-	-	-	-	-	-	-	-	-	-
Galla	-	-	-	-	-	-	-	-	-	-	-	-	-
Matara	-	-	-	-	-	-	-	35	25	30	25	-	-
Hambantota	-	-	-	-	-	-	-	-	-	-	-	-	-
Jaffra	612	2,439	3,594	10,964	10,541	2,989	6,147	9,021	7,075	7,075	4,579	3,332	64,463
Mannar	5,404	2,544	3,597	2,609	1,959	335	446	408	240	696	1,327	1,437	21,002
Mullativu	249	-	206	733	550	301	246	251	261	183	-	-	2,980
Trinconalee	61	24	150	147	2,066	514	167	3,830	2,895	327	2,405	-	12,586
Batticaloa	-	-	146	41	82	10	50	264	361	850	192	-	1,996
Kalmurai	326	328	669	430	-	283	699	1,314	1,098	130	1,825	-	7,072
Puttalam	1,390	2,239	1,516	1,280	504	356	143	710	166	88	1,732	2,410	12,504
Total:	8,042	7,574	9,878	16,204	15,702	4,758	7,898	15,833	12,121	6,853	10,838	7,017	122,718

Estimated Fresh Fish Production during 1975 by Varieties-Constal Fisheries

D.F.E.O's Division	Seer	Paraw	Blood fish	Sharks & Skates	Rock Fish	Group One	+ Group Two	Other Varieties	Total
Negombo	338	114	5,996	4,023	566	144	6,062	1,201	18,384
Colombo	27	350	95	121	190	206	1,322	611	2,922
Kalutara	139	85	3,086	481	155	335	924	73	5,278
Galle	281	364	2,299	94	386	60	253	236	3,973
Matara	75	162	3,862	660	656	333	515	165	6,428
Hambantota	300	164	2,467	343	454	220	1,006	117	5,071
Jaffna	748	1,534	4,110	3,209	5,150	574	4,532	2,228	22,085
Mannar	218	862	89	1,490	1,324	1,767	4,874	416	11,040
Mullativu	370	591	741	241	166	2,205	2,595	483	7,312
Trincomalee	288	818	1,573	390	1,949	633		299	7,219
Batticaloa	244	206	1,296	446	308				5,472
Kalmurai	109	113	455	308	305		1,076		
Puttalam	283	656	3,662	842	986	1,116	6,238	1,395	5,178
Total:	3,420	6,019	29,731	12,648	12,535	7,868	32,022		113,054
Parcentage:	3.0	5.3	26.3	11.2	11.1	7.0	28.3	7.8	100.0

Table 2

Estimated Fresh Fish Production during 1975 by Months-Coastal Fisheries

D.F.E.O's Division	January February	March	April	May	June	July	August September	October November	December	Total
Negombo	1290	1026	1369	1088	1309	1843	1641	2084	2130	1867	1181	1554	18384
Colombo	148	132	166	147	68	106	98	143	188	481	953	292	2922
Kalutara	269	167	281	290	356	350	354	365	344	549	789	1064	5278
Galle	249	212	183	206	105	149	332	344	478	538	579	1698	3973
Natara	326	328	341	598	714	611	465	1204	674	369	334		6428
Hambantota	299	243	262	233	215	301	567	1107	383	395	507	559	5071
Jaffna	1397	1552	1796	1890	2349	1969	1806	2007	2155	1881	1488	1795	22085
Mannar	1111	1121	1088	349	225	472	668	992	1047	1549	1388	1030	11040
Mullativu	35	315	299	918	1144	1048	1065	862	946	680	-	-	7312
Trincomalee	574	553	684	621	635	804	605	622	681	617	444	379	7219
Batticaloa	187	276	261	528	583	497	593	611	851	488	371	226	5472
Kalmunai	234	206	333	127	186	251	237	250	270	216	242	140	2692
Puttalam	839	788	704	1353	1046	958	1069	1101	1456	1951	2038	1875	15178
Total:	6960	7019	7767	8348	8935		9400	11692	11603	11581	10314	10076	113054

Total landings of fresh fish during the years 1974 and 1975

	1974	1975	Percent increase+ decrease-
Landings by the Sri Lanka Fisheries Corporation trawlers, 11 ton boats and tuna boats	2195	941	-57.1
Landings by deep sea vessels owned by Private companies	-	14	+100.0
Estimated Landings in the coastal fisheries			
(a) By 3-1/2 ton mechanized boats	47712	42346	-11.2
(b) By non-mechanized crafts and other mechanized crafts and by other methods	51506	70708	+37.3
Estimated total fresh water fish landings	7539	13097	+37.7
Total:	108952	127106	+16.67

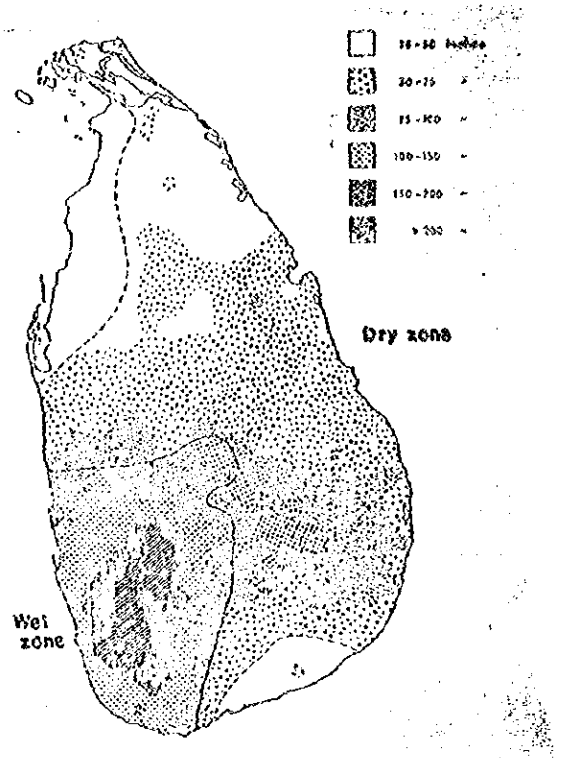


Fig — Annual rainfall in Ceylon, according to Rainfall May 1955 of Survey Department, Ceylon Thick line encloses the wet zone. Broken lines enclose the very dry areas in northwest and southeast. (after Brinck 1971)

TEMPERATURE CHART

		Jan.-Apr.	May-Aug.	Sept.-Dec.
Colombo	Minimum	23.0C	25.1C	23.5C
	Maximum	30.8C	29.7C	29.6C
Kandy		19.1C	21.2C	19.5C
		29.8C	28.1C	28.0C
Nuwara Eliya		8.5C	12.6C	10.9C
		21.1C	19.3C	19.7C
Anuradhapura		21.7C	24.4C	22.5C
		31.4C	32.6C	30.8C
Trincomalee		24.6C	25.7C	24.3C
		29.2C	33.6C	30.2C