

VOCATIONAL CURRICULUM IN MARINE FISHERIES FOR VIII, IX AND X CLASSES IN LAKSHADWEEP

VOCATIONAL EDUCATION AND
MANPOWER DEVELOPMENT
PROJECT OF
DEPARTMENT OF OCEAN DEVELOPMENT
GOVERNMENT OF INDIA

JUNE 1988



EDUCATIONAL CONSULTANTS INDIA LIMITED
(A Govt. of India Enterprise)
A-1/111, Safdarjang Enclave
New Delhi-110029



Sub. National Systems Unit.
National Institute of Educational
Planning and Administration
17-B, S. A. B. to Marg, New Delhi-110016
DOC. No.....
Date.....

Printed by INSDOC, Hillside Road, New Delhi-110012.

C O N T E N T S

	PAGE
LETTER OF TRANSMITTAL	i
PREFACE	v
THE ASSIGNMENT	vii
THE SUMMARY OF THE REPORT	xiii
CHAPTER I : INTRODUCTION	1
1.1 GEOGRAPHICAL SETTING	1
1.2 DEMOGRAPHY AND SOCIO-ECONOMY SETTING	1
1.3 OCCUPATION	4
1.4 INDUSTRY	8
CHAPTER II : VOCATIONAL SCHEME FOR LAKSHADWEEP	10
2.1 GENERAL	10
2.2 IDENTIFICATION OF VOCATIONAL COURSES	10
2.3 VOCATIONAL COURSE IN MARINE FISHERIES	13
2.4 FISHERIES COURSES RUN IN OTHER STATES	14
CHAPTER III : STRUCTURE OF THE PROPOSED SCHEME	15
3.1 GENERAL	15
3.2 EDUCATIONAL SYSTEM	16
3.3 TEACHING SCHEME	17
3.4 OBJECTIVES OF TEACHING DIFFERENT SUBJECT AREAS IN MARINE FISHERIES	20
3.5 TEACHING METHODOLOGY	23
3.6 REASONS FOR ELABORATING THE CURRICULUM	28

	PAGE
3.7	DETAILS REGARDING UNIT OF CLASS 28
3.8	IMPLEMENTATION OF THE SCHEME 29
CHAPTER IV :	EVALUATION PATTERN 31
4.1	GENERAL 31
4.2	PROPOSED PATTERN 32
CHAPTER V :	STAFF STRUCTURE 37
5.1	GENERAL 37
5.2	COMMON STAFF FOR BOTH MODULES 37
5.3	MODULE A (WHEN FISHING BOATS ARE HIRED) 38
5.4	MODULE B (WHEN THE ADMINIS- TRATION PURCHASES 3 FISHING BOATS) 39
5.5	MANAGEMENT STRUCTURE 39
CHAPTER VI :	SPACE AND EQUIPMENT REQUIREMENT AND COST ESTIMATES 41
6.1	GENERAL 41
6.2	SPACE REQUIREMENT 42
6.3	EQUIPMENT REQUIREMENT 42
6.4	COST ESTIMATES 43
ANNEXURE 1 :	SYLLABUS - COURSE: MARINE FISHERIES 47
	STANDARD VIII 47
	STANDARD IX 54
	STANDARD X 61
ANNEXURE 2 :	BIBLIOGRAPHY, REFERENCE MATERIAL FOR TEACHERS 68
ANNEXURE 3 :	LIST OF EQUIPMENT 75
ANNEXURE 4 :	LIST OF CHAPES 84
ANNEXURE 5 :	LIST OF PERSONS CONSULTED 88

एजुकेशनल कन्सल्टेंट्स इण्डिया लिमिटेड

(भारत सरकार का उद्यम)



Educational Consultants India Ltd.

(A GOVERNMENT OF INDIA ENTERPRISE)

डा० विश्व नाथ वशिष्ठ
प्रबन्ध निदेशक

Dr. V. N. Vashist

M. Sc., Ph.D., I.I.C., F.I.S. 1966.
MANAGING DIRECTOR

LETTER OF TRANSMITTAL

TD-3(58)/87

June 10, 1988

Dear Dr. Dwivedi,

Educational Consultants India Limited (Ed.CIL) have the privilege of submitting to you the Detailed Project Report (DPR) on Vocational Curriculum in Marine Fisheries for VIII, IX and X Classes in Lakshadweep. The Island Development Authority has taken numerous steps for an all round development of various Islands including Lakshadweep. The Department of Ocean Development (DOD), Govt. of India, has been entrusted with the task of developing vocational education fisheries in the Schools of Lakshadweep. The DOD assigned the task of preparing the DPR to Ed.CIL vide their Letter No. DOD/56/IDA/7/87 dated March 1, 1988. An Expert Committee comprising of the following members was constituted:

1. Dr. V.N. Vashist, Chairman
Managing Director,
Ed.CIL.
2. Shri Y. Srikrishna, Co-Chairman
Director,
Central Institute of Fisheries
Education,
Bombay.
3. Shri M.D. Zingade, Member
Asstt. Director,
National Institute of Oceanography,
Bombay.
4. Shri A.G. Kalawar, Member
Former Director of
Fisheries,
Govt. of Maharashtra,
Bombay.

- | | | |
|----|--|------------------|
| 5. | Shri M.P. Bansal,
Director (Education),
Lakshadweep Administration,
Karavati,
Lakshadweep. | Member |
| 6. | Shri V. Ravindraniathan,
Scientist,
Central Marine Fisheries Research
Institute,
Cochin. | Member |
| 7. | Representative of Department of
Ocean Development,
Govt. of India,
New Delhi. | Member |
| 8. | Shri B.L. Mathur,
Consultants, Ed.CIL,
New Delhi. | Member Secretary |

The Committee was helped by the Central Institute of Fisheries Education, Bombay in preparing the detailed syllabus of various subject areas in Marine Fisheries for teaching to VIII, IX and X classes in the schools of Lakshadweep. The project report reflects the collective and cumulative wisdom, experience and expertise of the distinguished members of the expert group as well as various specialists in different areas who had been associated in the preparation of this detailed project report.

We would like to place on record our appreciation for the whole hearted cooperation of the expert group and particularly of Dr. S.N. Dwivedi, Additional Secretary, Department of Ocean Development, who constantly advised the expert group on various aspects of the objectives of the scheme as well as the course content and also the need to develop a practice oriented syllabus so as to generate self-employment among the students of Lakshadweep.

We would also like to express our gratitude to the Director and other officials of the Central Institute of Fisheries Education, for their valuable contributions and cooperation in preparing the syllabus as well as the teaching aids. Our special thanks are also due to Shri P.M. Sayeed, Member of Parliament from Lakshadweep whose pragmatic comments and advice has helped the expert group in formulating the project report in the right perspective. We also acknowledge the contribution of

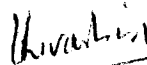
Mr. M.P. Bansal, Director (Education), Lakshadweep for the advice on the objectivity of the scheme and for highlighting salient features of the prevalent situation in the Islands. We would also like to register our thanks to Dr. Y. Kamaal, Assistant Director General (Fisheries), I.C.A.R., New Delhi who had been kind enough to go through the manuscript and suggest changes.

On behalf of Management of Ed.CIL, my colleagues and on my own behalf, I take this opportunity to express our sincere gratefulness to the Department of Ocean Development, Government of India and the Administration of the Union Territory of Lakshadweep for giving us this opportunity for preparing this report.

We sincerely hope that this report will meet the expectations of the Department of Ocean Development as well as the Lakshadweep Administration. We would also like to request the DOD to give us the opportunity to implement the project report and would like to assure that Ed.CIL will be able to implement the same on a turnkey basis and within the agreed time frame.

With kind regards,

Yours sincerely,



(V.N. VASHIST)

Dr. S.N. Dwivedi,
Additional Secretary,
Department of Ocean Development,
CGO Complex, Block 12,
Mahasagar Bhawan,
New Delhi.

PREFACE

In the recent past the islands have been receiving greater attention under the Island Development Authority which has been constituted under the Chairmanship of the Prime Minister himself. One of the widespread problems is of the educated unemployed. It is well known fact that after the High School and after other educational degrees the youngmen are looking forward towards the Government for white collar jobs. With the development of the islands they have alienated themselves from the traditional sector and the naturally available resources of the oceans. Their ancestors navigated extensively and provided dried fish to traders. After extensive deliberations, the IDA has decided to introduce vocational education at High School level in the schools of Lakshadweep. This is a new and challenging task in which efforts have to be made that the students are reoriented and develop confidence that on completion of this course they can be gainfully employed for management of the marine living resources and fisheries. Therefore, Marine Fisheries Syllabus has been designed for classes VIII, IX and X. While designing these courses the Department of Ocean Development has consulted various experts and have undertaken formulation of the syllabus through the Educational Consultants India Limited.

The present syllabus apart from giving greater importance to practical work also introduces the concept of "Earn while you Learn". The students are provided facilities for marine fishing. Whatever catches they get, would be shared among themselves so that they develop

a confidence that fisheries is a paying proposition and they would be able to earn more than what they get in white collar jobs. Suitable linkages with the Government Departments and the Fisheries Corporations should be provided so that on completion of the course students are able to obtain finance for fishing boats either for a small group of 4 to 5 students or on cooperative basis. This will ensure that students after completion of the course are self employed in fishing, in post harvest technology, product development and marketing so that they can earn more than Rs. 20 thousand per annum.

Around the island fish is a permanent renewable resource and their optimum management without affecting the environment would go a long way in providing additional jobs. It is hoped if this programme becomes successful then, similar programmes can also be introduced in other islands and coastal states of India.

I take this opportunity to compliment Ed.CII, the Central Institute of Fisheries Education, Bombay (ICAR), Educational and Technical experts from Lakshadweep and others who have worked hard for successful completion of the project. Our grateful thanks to IDA who have given this opportunity to develop vocational courses in Fisheries - which open up new sector for self employment and makes education more meaningful to harness natural renewable resources.

S.N. DWIVEDI
Member IDA
Department of Ocean Development
Govt. of India
New Delhi

THE ASSIGNMENT

Educational Consultants India Limited (Ed.CIL) has been entrusted the task of preparation of a detailed project report on the designing of a vocational curriculum for Classes VIII, IX and X in Lakshadweep by the Department of Ocean Development, Govt. of India vide their Letter No. DOD/56/DA/7/87 dated March 1, 1988. The project report was to be prepared under the guidance of an Advisory Committee which was constituted for the purpose. The following is the Advisory Committee:

- | | |
|--|-------------|
| 1. Dr. V.N. Vashist,
Managing Director,
Ed.CIL. | Chairman |
| 2. Shri Y. Srikrishna,
Director,
Central Institute of Fisheries
Education,
Bombay. | Co-Chairman |
| 3. Shri M.D. Zingade,
Asstt. Director,
National Institute of Oceanography,
Bombay. | Member |
| 4. Shri A.G. Kalawar,
Former Director of
Fisheries,
Govt. of Maharashtra,
Bombay. | Member |
| 5. Shri M.P. Bansal,
Director (Education),
Lakshadweep Administration,
Karavati. | Member |
| 6. Shri V. Ravindranathan,
Scientist,
Central Marine Fisheries Research
Institute,
Cochin. | Member |

- | | | |
|----|---|------------------|
| 7. | Representative of Department of Ocean Development, Govt. of India, New Delhi. | Member |
| 8. | Shri B.L. Mathur, Consultants, IEdi.(II), New Delhi. | Member Secretary |

The Advisory Committee was to be assisted by several course committees which were constituted and headed by senior members. The following were the course committees constituted for the purpose:

A. Fishing Technology

1. Mrs. Lata Shetty,
CIFE,
Bombay.
2. Shri Haridas,
CIFE,
Bombay.

B. Post-Harvest Technology

1. Dr. D.R. Rao,
CIFE,
Bombay.
2. Shri Ramaachandran,
CIFE,
Bombay.
3. Miss U.V. Gadre,
CIFE,
Bombay.

C. Fisheries Biology

1. Dr. M. Devraj,
CIFE,
Bombay.
2. Shri P. Acharya,
CIFE,
Bombay.

3. Shri D. Gulati,
CIFE,
Bombay.

D. Economics and Co-operation

1. Shri P.V.S. Rao,
CIFE,
Bombay.
2. Mrs. R. Tiwari,
CIFE,
Bombay.

E. Fishery Oceanography

1. Dr. P. Govindan,
National Institute of Oceanography,
Bombay.

In addition to the above, Prof. K.K. Ghosh, CIFE, Bombay and Prof. Raju, Regional College of Education, Mysore made valuable contributions in preparation of the course. The various departments of Central Institute of Fisheries Education were involved in preparation of the course curriculum and teaching aids.

Ed.CIL constituted the following team for undertaking the project at its end:

- | | |
|---|------------------|
| 1. Dr. V.N. Vashist,
Managing Director,
Ed.CIL. | Project Director |
| 2. Shri M. Visweswar,
General Manager (Projects),
Ed.CIL. | Project Leader |

3. Shri B.L. Mathur, Project Consultant
Consultant,
Ed.CIL.
4. Shri J.J. Nandi, Project Coordinator
Asstt. Manager (Projects),
Ed.CIL

Dr. S.N. Dwivedi, Additional Secretary, Department of Ocean Development, Govt. of India addressed the Advisory Committee regarding the objectives of these vocational courses. The major objective is that content and quality of the course should be such that students should develop confidence, capability and desire to take to fishing as self-employment, rather than looking for white collar jobs. During the practical course, incentives for fishing should be so designed that students develop a keen desire to undertake fishing and develop confidence that it is a remunerative career.

The Department of Ocean Development, Govt. of India and the Department of Education, Govt. of Lakshadweep had given the following guidelines in preparation of the curriculum for marine fisheries:

1. The course structure prepared should fit into the existing structure of teaching in Classes VIII, IX and X.
2. The weightage for practical training in fishing should be maximum so that the students can seek employment/self-employment once they pass out from the secondary school.

Considering all the issues involved, the expert group decided that the proposed curriculum should be given equivalent weightage in terms of time allocations as given to science subjects. It was also desired that the project reports should detail out the equipment list, the teaching aids, cost structure, the staffing pattern and other details required

for introducing this curriculum in the schools in the coming academic year. All these parameters have been taken into consideration and have been taken into consideration and have been detailed out in the project report.

To prepare the project report, Ed.CIL had consultations with a large number of officials and social workers prominent among which is the local Member of Parliament, Mr. P.M. Sayeed from Lakshadweep. Ed.CIL organised a number of meetings in Bombay and Delhi to thrash out issues related to the course structure and curriculum details of marine fisheries. A large volume of books were consulted and the on-going programmes in marine fisheries in schools of Maharashtra and Kerala were studied in preparing the report.

The present report incorporates a draft syllabus, which would be modified after it is put across to various experts and their views obtained. The chapterisation scheme gives details of all facets of the implementation of the proposed scheme.

Ed.CIL is greatly indebted for the valuable contributions made by Dr. S.N. Dwivedi, Additional Secretary, Deptt. of Ocean Development, Govt. of India, Mr. P.M. Sayeed, M.P., Lakshadweep. Dr. Subramaniam, P.S.O., Deptt. of Ocean Development, Lakshadweep and the members of Islands Development Authority. It appreciates the help extended by the all members of the Technical Division, the Finance Division, Administration Division of Ed.CIL in completing the project report in time.

THE SUMMARY OF THE REPORT

Educational Consultants India Limited have prepared this Detailed Project Report for introducing vocational curriculum in classes VIII, IX and X in the schools of Lakshadweep Islands. As an input to the preparation of the Report, sufficient number of documents pertaining to education, job prospects, socio-economic aspects and manpower requirement of the region have been studied. Detailed discussion have been held with large section of people concerned with administration and development of education of the Islands. The Report lays down the complete setting in which a vocational curriculum in Marine Fisheries has to fit in the present scheme of Class VIII, IX and X without disturbing the pattern of training followed in the schools at present.

The curriculum designed is practical oriented with sufficient incentives to the students. It aims at imparting training right at the school level for self employment by giving emphasis on development of cooperatives and marketing. This will bring about all round development in the form of a self-sustaining economy in Lakshadweep.

The salient features of the Report are summarised below:

1. The first chapter brings out the geographical, demographic and socio-economic setting of the Union Territory. The population, literacy, occupation, educational development and industrial setting is discussed. It has been indicated that nature has given abundant Marine Resources around the Islands and the same are required to be exploited for improving the economy.

2. The next chapter deals with socio-economic perspective and identification of vocational courses based on the available natural resources. The data of fish landing from 1975 to 1985 has been given and the same has been compared with the exploitable Marine Resources. The wide gap between the two clearly indicates that sufficient trained manpower is needed to exploit the same and hence a vocational course in Marine Fisheries has been proposed.
3. In Chapter III a complete structure of the proposed scheme has been given. The whole course of Marine Fisheries has been divided into 5 subject areas viz. Fishing Technology, Post Harvest Technology, Fisheries Biology, Cooperation and Marketing and Fishery Oceanography. Out of the total time available, only 25% time has been allocated for Theoretical Instructions in class rooms. The remaining 75% of time will be devoted for Practical Work. The practical work has further been divided into 2 papers viz. Indoor Practical work to be done in Laboratories and Workshops, and out door Practical Work in the form of actual fishing in a boat. Nearly 50% time has been allocated for actual fishing trips where the students will learn all aspects of Marine Fisheries. In order to give incentive, it has been proposed that most of the fish catch may be taken by the students. In the same chapter objectives of subject areas and the Teaching Methodology has been discussed. It has been proposed that a class consists of 36

students for theoretical instruction. For imparting instruction in the laboratory, the unit has to be divided into 2 batches of 18 students each. For fishing trips 3 batches of 12 students each have been treated as an unit.

4. The fourth chapter gives complete evaluation pattern with emphasis on the continuous assessment for Practical Work. A skill evaluation card has been designed so that the teacher is able to keep record of continuous assessment of each student on scientific basis. Terminal assessment will continue as usual because this course is to fit in the existing scheme.
5. Chapter V deals with staff structure. In this chapter two modules have been suggested. In one module when the administration purchases the boats for fishing, it has been suggested that the services of crew members recruited can be utilised for conducting Practicals during off-season period viz. when the sea is rough and fishing is not being done. The second module suggests that fishing boats are hired alongwith the crew on a contract basis and staff for conducting practical classes is recruited separately.
6. The last chapter deals with the requirement of space for class room, laboratories and workshops. Different types of equipment, glassware and consumable items required have been detailed and finally the cost structure has been worked out under different heads spreading over a period of 2 financial years till the end of the current plan period.

7. In the end 5 Annexure have been given. These are as follows:

- i) Curriculum Details for Class VIII, IX and X.
- ii) Bibliography, Reference Material for Teachers.
- iii) List of Equipment.
- iv) List of Charts.
- v) List of Persons who were Consulted.

CHAPTER I

INTRODUCTION

1.1 GEOGRAPHICAL SETTING

Lakshadweep is a group of Coral Islands in the Arabian Sea. These are scattered about 280 to 480 Kms. off the Kerala Coast. There are a total of 36 Islands comprising an area of 32 sq. kms. and only 10 of the islands are inhabited. Fig. 1.1 gives the map of these Islands. The map indicates that these islands lie between 8° and $12^{\circ}-30'$ north latitude and 71° and 74° east longitude.

Lakshadweep became an Union Territory in 1956 and since then the Govt. of India is taking keen interest in the development of these islands. Although the total land area of these islands is very small, but considering the Lagoons, submerged banks and reefs, its total area works out to 4200 sq.kms. Apart from this, the territorial waters spread over an area of 20,000 sq.km. and the economic zone area is 4,00,000 sq.km.

1.2 DEMOGRAPHY AND SOCIO-ECONOMY SETTING

According to 1981 census, the total population of this Union Territory is 40,249. Table 1.1 shows the population, area and literacy rates of 10 inhabited islands. Kavaratti, Amini and Minicoy islands have urban population which form 46.2% of the total population. Another important feature of these islands is that the progress in education was rapid after they became an union territory. The literacy rate rose from 23.57% in 1960-61 to 55.07% in 1983-84. The rate of progress shows that it may be possible to universalise education up to the age of 14 by 1995.

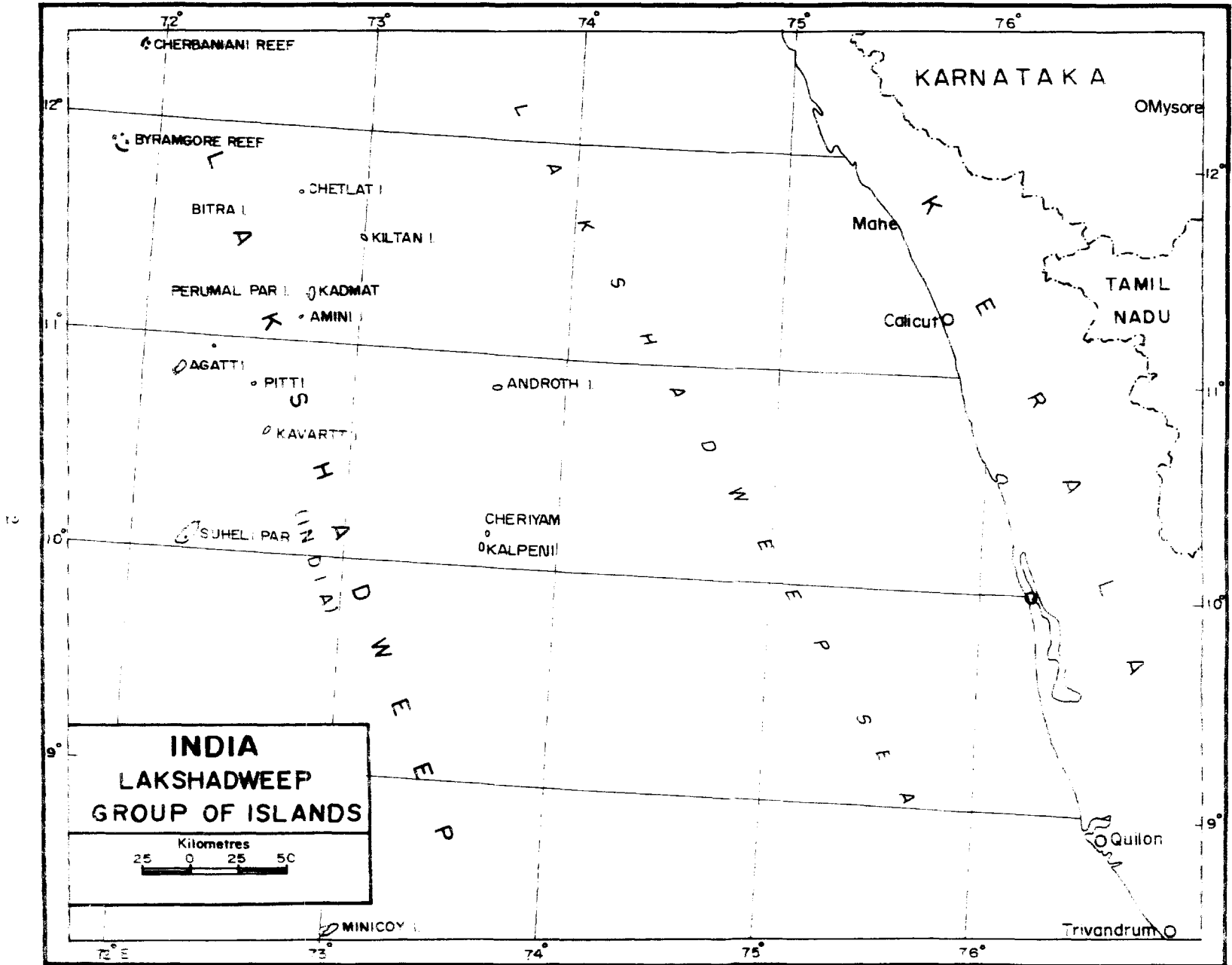


Fig. 1-1

TABLE 1.1

LAKSHADWEEP AREA AND POPULATION 1981 CENSUS

	Kavaratti Tahsil		Amini Tahsil					Andrott Tahsil		Minicoy Tahsil	Grand Total
	Kavaratti (Urban)	Agatti	Amini (Urban)	Kadmat	Kiltan	Cheliat	Bitra	Andrott	Kalpeni	Minicoy (Urban)	
1. Population Persons	6604	4111	5367	3114	2375	1486	181	6812	3543	6658	40249
Males	3623	2136	2776	1578	1189	734	101	3311	1838	3091	20377
Females	2981	1975	2591	1536	1186	750	80	3501	1705	3567	19872
2. Area of Sq. Kms.	3.63	2.7	2.59	3.1	1.6	1.0	0.1	4.8	2.3	4.4	32.0
3. Population per Sq.Kms.	1819	1523	2072	1005	1484	1484	1810	1419	1540	1524	1258
4. Percentage Decadal Variation	49.41	30.30	18.16	28.89	16.08	23.67	61.61	25.57	12.40	24.63	26.53
5. No. of Females per 1000 males	823	925	933	973	997	1022	792	1057	928	1154	975
6. Percentage of Schedule Caste	84.57	96.52	95.83	97.21	95.92	95.55	99.45	96.51	97.15	92.29	93.82
7. Literacy Rates:											
Persons	60.22	54.76	48.48	56.07	46.86	49.93	46.96	48.78	55.88	65.29	55.07
Males	70.74	64.10	62.90	64.01	56.01	54.90	52.48	61.58	67.19	71.40	65.24
Female	47.43	44.56	33.04	47.92	37.69	45.07	40.00	36.68	43.70	59.99	44.65

The inhabitants of this Island Territory are Muslims, and have been classified as Scheduled Tribes. The majority of the people belong to the Shafi School of Sunni Sect. The language of the islanders is a dialect of Malayalam with local variation, except at Minicoy where the language is Mahl which has its own script known as "Diwehi Tana".

An interesting social feature is the matrilineal family system, because of which the women folk enjoy a high status. The customs of the people of the islands except in Minicoy are in other respects somewhat similar to those of their counterparts in the Malabar area of Kerala State. The people of Minicoy dress like Maldivians.

1.3 OCCUPATION

The traditional occupation of the people is Fishing and coconut growing, but the spread of education has resulted in the virtual breaking down of the traditional society. The educated people from the lower caste are not going for the caste based jobs. They are satisfied with even low paid Government jobs in preference to traditional jobs which kept them in bondage. It is at times, even difficult to get enough people to climb trees for plucking coconut. There is "Educated Unemployed Association" in almost all islands. White collar jobs cannot be found for all the educated people. The 1981 census shows that there were 300 graduates and 270 technical diploma holders available in the islands for employment. About 100 students are sent every year to the mainland with scholarships for higher education. By the year 2000, the islands may have about 1400 highly qualified persons. In addition, there are school leavers who are not familiar with traditional skills and are not sufficiently qualified for any Government job. Thus it is concluded

that although the literacy rate of these islands is much higher than the national average, the linkage between education and economy is very weak. It is possible to improve the economy only when the young generation is put on socially useful productive work along with formal education right at the school level. The ultimate answer for all this is to introduce the vocational scheme at the school level.

Table 1.2 shows the educational development in Lakshadweep from 1960-61 to 1983-84 and Table 1.3 shows the expenditure on education for each plan starting from the II Five Year Plan to the VII Five Year Plan.

TABLE 1.2

EDUCATIONAL DEVELOPMENT

Year	No. of Institutions	Enrolment	Teacher Strength	Literacy Percentage
1960-61	10	3450	83	23.57
1965-65	31	4980	260	-
1971-72	41	7050	345	43.66
1973-74	42	7660	359	-
1979-80	39	11160	472	51.08
1983-84	42	13550	615	55.07

Source: VII Plan Lakshadweep.

TABLE 1.3

EXPENDITURE ON EDUCATION

(Rs. in Lakhs)			
Plan	Period	Allotment	Expenditure
Second	1956-60	12.04	11.98
Third	1960-65	18.83	35.98
Fourth	1960-74	36.29	42.89
Fifth	1974-78	72.71	77.82
	1978-80	138.31	42.48
Sixth	1980-85	150.00	288.80
Seventh	1985-90	827.21	

Source: VII Plan Lakshadweep (Projected).

By the end to the VII Plan, the enrolment of students is expected to increase to 16,700. The UNICEF is helping in meaningful implementation of Socially Useful Productive Work (SUPW) in schools. There are 2045 students in High School at present and the number may increase by another 1000 at the end of the plan.

Table 1.4 shows year wise break up of outlay in Education in different Sectors.

TABLE 1.4

SEVENTH PLAN OUTLAY IN EDUCATION

(Rs. in Lakhs)

Sl. No.	Sectors	Proposed Outlay	Year-wise Outlay				
			1985-86	1986-87	1987-88	1988-89	1989-90
1.	Primary Education	141.71	20.63	26.21	25.94	33.65	35.28
2.	Secondary Education	211.87	30.86	39.89	41.71	46.12	52.30
3.	Higher Education	130.07	12.19	28.35	28.37	22.90	38.49
4.	Sports and Youth Welfare	300.99	51.20	55.29	62.88	62.01	68.92
5.	Administration	40.84	7.40	7.99	8.10	8.75	8.86
6.	Adult Education	2.50	0.50	0.50	0.50	0.50	0.50
Total		827.21	122.61	158.22	167.50	174.53	204.35

Lakshadweep has fixed the following priorities for the VII Plan in Education.

1. Qualitative improvement of Education System.
2. Facilities for improving Pre-primary Education.
3. Vocationalisation of Education in Secondary stage.
4. Improvement of Administrative Efficiency.
5. Eradiction of illiteracy and Spreading of Universalisation of Elementary Education.

6. Additional facilities for higher education.
7. Consolidation of Achievements.
8. The entire children of school going age to be brought to school.

1.4 INDUSTRY

Any industrial venture in the Island should take into account the delicate ecological balance existing in the island. Transplanting mainland technology to the islands may be dangerous. Dry processes are to be preferred as compared to wet processes while some industries are identified. Moreover, shortage of land is a major constraint for construction of a factory. Farming out industrial process to household, collecting, testing, quality control and marketing may be better approach. Careful thought is to be given for establishing industry in the area of fishing and coconut products keeping in view the above mentioned points.

The estimated value of the calcareous sand, available in abundance in the islands and which is one of the essential raw material for the manufacture of white cement, is about Rs. 5000 crores. The annual exploitable quantity of Tuna fish alone is estimated to be about 1,00,000 tonnes. Other varieties of fish add up to another 1,00,000 tonnes. Coconut fibre is another industrial raw material. The industries based on these raw materials is a possibility, but land availability without disturbing the ecology is very limited and starting factories in the conventional sense may be difficult.

Keeping the ecological and environmental factors and the potential of the rich natural resources in view, it is advisable to promote the traditional and natural resources based industry in the islands. The population of the islands have a rich traditional heritage. The younger generation, though literate, have to be educated and made aware of the economic viability and profitability of the traditional trades and industry. To bring about such a change, it is necessary to start at the basic level by introducing vocational education in traditional trades at the secondary level. This is to be supported by schemes for self-employment, development of co-operatives and marketing agencies to bring about all round development in the form of a self-sustaining economy.

CHAPTER II

VOCATIONAL SCHEME FOR LAKSHADWEEP

2.1 GENERAL

For overcoming the problem of 'Educated Unemployment' Vocationalisation of Education is the answer. The vocational education will be a distinct stream to prepare students for identified occupation spanning several areas of activity. In general, vocational courses based on agriculture, marketing, social service, entrepreneurship and self-employment are to be designed, and the same will vary from place to place. The graduates from vocational course need not fear that they will not get opportunity for vertical movement in their life. On the contrary deserving candidates will get chance under predetermined condition for professional growth and career improvement. While ITIs and Polytechnics would cater to the needs of the organised sector, the thrust in the school programme would be on the section not covered by them and on the potentially very larger service sector. The school system would give greater attention to the areas of Agriculture , Agro-industries, Home services, and para-medical vocations. The choice of starting vocational courses at school level at Lakshadweep islands is based on the recommendation of the Educational Policy and the needs of Island.

2.2 IDENTIFICATION OF VOCATIONAL COURSES

A number of vocational courses were identified in following areas for Lakshadweep islands:

1. Fisheries based courses.
2. Agriculture based courses.
3. Industries based courses.
4. Health related courses.
5. Coconut and Coir based courses.

Out of 5 broad based courses mentioned above, greater emphasis has been given for starting a vocational course in Marine Fisheries, as it is a traditional trade of the island people and has a great potential for ensuring economic development of the Islands.

The traditional method of fishing is the hunting technique. This can be improved by introducing a vocational course in modern fishing techniques, viz., use of fish detector, modern methods of navigation, knowledge of oceanography, post harvest technology, boat repairing, engine maintenance etc.

In addition to fishing technology, there is scope for fish farming as most of the islands have lagoons attached to them and are ideally suited for adopting the farming techniques.

TABLE 2.1

COMPOSITION OF MARINE FISH LANDINGS (IN TONNES) IN LAKSHADWEEP DURING 1975 TO 1984

Sl.No.	Name of Fish	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1.	Elasmobranchs	325	354	296	198	364	284	211	240	332	287
2.	Halfbeaks & Full Beaks	29	33	58	144	101	99	113	87	103	62
3.	Flying Fishes	30	41	30	33	16	29	16	25	25	15
4.	Percnes	186	193	211	163	203	376	315	230	252	205
5.	Goatfishes	34	58	29	27	27	27	25	27	32	24
6.	Other Carangids	61	94	65	60	58	80	105	214	147	45
7.	Seer Fishes	66	87	41	41	24	21	50	99	59	59
8.	Tunnas	1932	1291	1166	1875	2694	1760	2236	2966	3303	4313
9.	Bill Fishes	-	-	-	-	-	-	-	42	13	42
10.	Barracudas	17	20	15	18	11	14	12	10	19	14
11.	Cephalopods	19	40	23	20	15	13	14	22	16	14
12.	Miscellaneous	232	361	381	201	233	206	203	239	221	251
Total		2931	2572	2315	2780	3846	2909	3300	4201	4542	5331

2.3 VOCATIONAL COURSE IN MARINE FISHERIES

Fisheries is the biggest possible source of employment for the islands. The annual possible harvest of Tuna is estimated to be about 1,00,000 tonnes. A similar quantity of Sharks could also be harvested without depleting the stocks. The actual catch per year is less than 5000 tonnes. Table 2.1 shows the composition of marine fish landings (in tonnes) in Lakshadweep from 1975-85. From the table it is clear that major contribution to the total landing has been accounted for by tunas forming about 68% on the average every year of the total catch. Major species that contribute to tuna Fisheries of this area is the oceanic species of tunas. The dominant species among them are skipjack and yellowfin tuna.

Tuna is a migratory fish, and these fish travel thousands of miles in a year enroute Lakshadweep. What is not caught in the islands is harvested by Japan and other countries and thus it is a great national loss in economic terms. This hidden treasure of nature needs to be exploited in a big way.

The technique adopted by the Islanders is that they go in search of shoals of Tunas with live baits in boats. After detecting the shoals of Tuna, live bait is put on the sea and artificially creating a situation in the sea to make an impression that big shoal of bait is moving. This attracts the Tuna to the side of the boat, and with the help of the hooks, Tuna is caught.

Thus a vocational programme in Marine Fisheries at the school level will enable the students to apply scientific methodology and acquire skills by which the fish shoals can be guided to predetermined location. Modern fishing technology will thus be very useful for catching a large number of fish and any number of people can be employed in this area.

This area can further be extended to fish farming, fish preservation and all other activities connected with the fishing industry.

About 350-400 students attend the 8th standard every year. The objective is to provide career opportunities for this number every year. About 20-25% of these students may go for higher education. The remaining 75% have to be diverted through the vocational stream to provide them gainful employment and self employment opportunities.

2.4 Fisheries Courses run in other States

At present no where in the country, a course in Marine Fisheries is being run starting from Class VIII. The Maharashtra Government runs a general courses in Fisheries at Classes IX and X level. In addition the Maharashtra Government also runs vocational courses in Fisheries at the plus two level. While the courses developed at class IX and X gives an exposure to the students regarding fisheries in general, the courses at the level of class XI and XII give a complete insight in different aspects of all types of Fisheries and is more practical oriented. Although, the experts committees have taken help from the contents of these syllabi, but the course content in Marine Fisheries has been developed on scientific lines taking into consideration the local conditions and environment of Lakshadweep. All efforts have been made to make the syllabi as realistic as possible, but the teachers and instructors need to be given an orientation course to orient them towards the modern teaching methodology and upgrade their knowledge in Marine Fisheries. Text books are to be developed as early as possible, to facilitate proper teaching of the subject.

CHAPTER III

STRUCTURE OF THE PROPOSED SCHEME

3.1 GENERAL

Before the detailed syllabi can be prepared for a scheme, its structure is to be developed on the following lines:

- a. Time available.
- b. Division of Time for Theory and Practicals.
- c. Areas in which the course is divided and time devoted for each area.
- d. Number of students per unit in Theory and Practicals together with justification.

Once the items at a,b,c and d have been decided, the next step is to devise a system of evaluation. The system of evaluation proposed should be in consonance with the existing system. This has been detailed in a separate chapter.

To implement the scheme, the requirement of physical and infrastructure facilities such as class-rooms, laboratories, workshops etc. are to be assessed. In addition the equipment required for implementing the course is to be listed. The staff requirement, their educational qualifications have to be worked out. All these aspects have been dealt with in separate chapters.

3.2 EDUCATIONAL SYSTEM

The educational system of Lakshadweep Island is linked with the educational system of Kerala, and any major structural change will take time. Therefore, the programme of vocational training is to fit in the existing teaching scheme. The Lakshadweep administration would like that the proficiency level in science, languages and social sciences of the students in vocational stream to be more or less the same as that of the other students of regular system. Table 3.1 below shows the present and proposed allocation of the time for various subjects in each class.

TABLE 3.1
PRESENT & PROPOSED ALLOCATION OF PERIODS IN A
WEEK FOR DIFFERENT SUBJECTS IN CLASS VIII, IX AND X

Subjects	Present Weekly Allocation of Time			Proposed Weekly Allocation of Time		
	VIII	IX	X	VIII	IX	X
Malayalam	6	6	6	5	5	5
English	6	6	6	6	5	5
Hindi	3	3	3	2	2	2
Social Studies	4	6	6	4	4	4
Physics, Chemistry, Biology	6	9	9	6	8	8
Maths	6	6	6	6	6	6
Physical Education	4	2	2	3	2	2
Craft	5	2	2	0	0	0
Vocational Course	-	-	-	8	8	8
Total	40	40	40	40	40	40

From the table it is clear that the proposed vocational course envisages the allotment of 8 periods per week of 40 minutes duration in all the three classes viz. class VIII, IX and X. It is proposed that the vocational stream would be introduced at class VIII level from the current academic session i.e. from 1988-89.

At present 40 periods are held per week (for 5 days a week) for each class, out of this, only 8 periods per week are proposed to be devoted for vocational course in each class. There are 35 weeks in an academic session, therefore, the total time available for this course will be $35 \times 8 = 280$, periods in each class. Since the objective of the vocational stream is to produce a skilled worker, it is proposed that about 25% of the total time is devoted for Theoretical Instructions in the class room, 25% of the total time for Indoor Practical work in a laboratory and 50% of the total time for actual fishing operation in a boat for each class.

The academic year starts in the 1st week of June every year, and from June to the end of October, the sea is very rough. During this period of about 19 weeks, it has been decided that lectures and laboratory type practical work may be held. For the remaining 16 weeks of the session viz., from November to February, actual fishing trips are to be conducted.

3.3 TEACHING SCHEME

Keeping the above mentioned facts in view, the whole course has been distributed into 5 subject areas of Marine Fisheries. Details of curriculum has been worked out in each area on the basis of time allotted for each as given in Table 3.2 below. This table gives the

teaching scheme of the course for classes VIII, IX and X together with the time to be devoted for training in each area of Marine Fisheries.

TABLE 3.2

DISTRIBUTION OF PERIODS ALLOTTED TO DIFFERENT TOPICS
IN MARINE FISHERY COURSE

Subject Areas	Theory			Lab. Practical			Fishing Trips
	No. of Periods			No. of Periods			
	VIII	IX	X	VIII	IX	X	
Fishing Technology	26	25	24	36	38	34	} 128 } Periods } from } November } to } February
Post Harvest Technology	12	15	17	20	22	26	
Fishery Biology	17	17	9	16	12	12	
Cooperation and Marketing	6	9	10	-	-	-	
Fishery Oceanography	11	11	12	8	8	8	
Total	72	72	72	80	80	80	

- Note: 1. The Emphasis is on Practical Training and Fishing which covers 75% of the Total Allocation of Time for the Course.
2. During fair weather between November to February each year. One day per week has been assigned for Fishing activity.
3. Education will be linked up with the self employment scheme and Cooperative Development.
4. In addition to the above (the distribution of the periods have been considered for a 5 day week), the 6th day can be utilised entirely for fishing which gives an additional allocation of 128 periods for Fishing.

Here it may be mentioned that Lab Practicals will be of 80 minutes duration i.e. 2 periods together. Therefore one unit for Indoor Practical work has been taken to be of 2 periods. In the detailed syllabus, number of units have been mentioned and not the periods. Fishing trips totalling 128 periods are spread over 16 weeks with 8 periods in a day. For fishing trips, time is no bar. It can even be for more than 8 periods

Since fishing operation takes a full day, this may be arranged on any one day in the week. It is therefore suggested that the time table may be formulated in such a way that the students of class VIII, IX and X are free from academic class work on different days in a week so that the same 3 boats can be utilised for all classes. If there are 2 sections of 36 students in each class the same boats can be utilised for the other section as well for the remaining 3 days of the week. If the school has only one section of class VIII, IX and X, then it may be possible to utilise the boats by the other schools also. Since boats are the costliest item, its utilisation has to be maximum during fair weather conditions. During fishing trips students will get benefits by sharing major portion from the total fish catch. This will serve two purposes. Firstly this will help the introduction of the concept "Earn while you Learn". Secondly the income may also motivate the students to put in more efforts in actual fishing making the course more effective and attractive. This could also be a source of some revenue for the Institutions. It is suggested that in each class specified number of fishing trips must be held. If the fishing trips are shortened due to some reason during the normal working days, additional time must be devoted for fishing on holidays to compensate the shortage.

In addition to 16 weeks of fishing trips, it has also been decided to take the students to main land for Educational Tour during vacation for a period of 2 to 3 weeks every year. Some of the institutes which the students should visit are CMERI, CIET, CIFNET and MPEDA at Cochin. The students will be exposed to the new fishing methods fishing industry and other associated areas connected with Marine Fisheries during the Education tour.

As the development of skills in fishing require a student to undertake as many fishing trips as possible. It is therefore, suggested that the sixth day of the week is also utilised for fishing trips during fair weather. However, this is left at the discretion of the teacher/instructor.

3.4 OBJECTIVES OF TEACHING DIFFERENT SUBJECT AREAS IN MARINE FISHERIES

A. FISHING TECHNOLOGY

Nearly 41% of the total time available will be devoted for teaching this subject. The broad objectives of teaching this subject are.

1. To acquaint the students with the indigenous craft and gear and the conventional fishing methods of Lakshadweep. The students will learn the constructional aspects of twines and ropes. They will be able to make different types of knots and webbing with the help of the same.
2. The students will be introduced to the elementary knowledge of engines and navigation. They will learn about the construction of wooden boats and fishing craft gear. They will be able to make simple gill nets pole and line, and identify different types of fishing material.

3. After learning the technologies as mentioned above, the student should be able to acquire all types of skills pertaining to fishing and thus become a skilled fisherman.

B. POST HARVEST TECHNOLOGY

1. After acquiring the basic knowledge of fishing technology, the students must know the scientific method of handling fish for processing, preservation and distribution. The knowledge of application of preservatives to fish for storage as well as operations of cold storage systems with particular reference to preservation of fish is to be taught.
2. Another objective is that the students must have sufficient practice of dressing of fish. They should be acquainted with sundrying, handling of simple equipment like Thermometers, hydrometer, hygrometer, barometer and brinometer must be known to the students.
3. Finally the students must be acquainted with different preservation techniques like freezing and smoking. They should be exposed to fish processing industry.

C. FISHERY BIOLOGY

The objectives of teaching this subject are to acquaint the students with:

1. (i) General body organisation of bony and cartilaginous fish, (ii) gross physical features, (iii) process of intake of food, (iv) vertical and lateral distribution of fish, (v) broad

adaptations to life in aquatic environment, (vi) recognising fish of commercial importance, and (vii) breeding time and size/age at breeding of commercial important fish.

2. Economic and Biological significance of various fisheries resources in their immediate sea areas. The students will also learn about the scientific basis for utilisation of marine fish.
3. Assessment regarding the potentialities and their importance and the impact of fishing on the environment. Thus they will be motivated to explore new areas of development and rational utilisation of resources through capture and culture fishery practices.

D. SOCIO-ECONOMIC COOPERATION AND MARKETING

In this subject, the students will learn:

1. Socio-economic conditions of the people of Lakshadweep.
2. To analyse the importance of group action like cooperatives in tackling problems.
3. Regarding functioning of cooperatives working at Lakshadweep.
4. Marketing aspects through the cooperatives.

E. FISHERY OCEANOGRAPHY

This is another important subject in Marine Fisheries. In this subject the students will:

1. Learn about the ocean as friend of mankind as supplier of salt, fish and other materials. They will be learning that sea is a transport medium and also controls the climate.

2. Be introduced with principal oceans of the world and their geographical features.
3. Learn about physico-chemical variables like temperature, pressure, wind, humidity, pH, salinity, depth currents, dissolved oxygen and gases.
4. Learn about interrelationship of meteorological variable of the ocean.
5. Be made familiar with the role of ocean in fish migration and growth etc.

3.5 TEACHING METHODOLOGY

The course in Marine Fisheries has been divided into 5 subject areas and their objectives have been defined. The time allocated for each subject area has also been given in the table of teaching scheme.




The detail syllabus in each subject area for all classes has been given in Annexure I. Since Marine Fisheries is only one subject in each class divided into 5 different areas, the teacher is likely to face difficulties in the beginning. The first difficulty will be "From which subject area the teaching is to begin". The second difficulty will be "The order in which teaching is to continue". In this connection, of course, the teacher is the best decision maker, but the most important guiding factor is that the order be chosen in such a manner that the different subjects remain interwoven and the students feel the importance of each subject area. Another important guiding factor is that fundamental portions be dealt first so that the more difficult portion be understood by students at a later stage. In other words, knowledge of pre-requisite for learning a subject is to be taught first.

It is therefore, suggested that the teacher may begin the subject of Marine Fisheries by taking the topics in the area of Fisheries Biology first, followed by Fishery Oceanography. The reason is that these are basic subjects for learning Fishery Technology. Therefore, Fishing Technology may be dealt at third stage and Post Harvest Technology may be dealt at fourth stage. Finally, when the students have learnt the fundamentals and technology of the subject, they may be taught about the principles of Socio-economics, cooperatives and marketing, but it is important that a continuity be maintained in the subject matter and topics be correlated. While teaching, due weightage of time allocated for each areas should be given. It is suggested that the total time should be in the ratio of 5:3:2:1:1 in the areas of Fishing Technology, Post Harvest Technology, Fisheries Biology, cooperation and Marketing and Oceanography, but the priorities in teaching of different topics from each area are to be fixed on scientific basis. It should be done in a manner that the subject remains interesting and the students are able to grasp and acquire knowledge in a graded manner. This sort of teaching will enable the students to develop the quality of comprehension and analysis during learning process.

SUGGESTED TEACHING SCHEDULE IN MARINE FISHERIES IN CLASS - VIII

S No		W E E K S																																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	
1	FISHERY BIOLOGY	Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical	
2	FISHERY OCEANOGRAPHY	Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical	
3	FISHING TECHNOLOGY	Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical	
4	POST HARVEST TECHNOLOGY	Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical	
5	COOPERATIVES & MARKETING	Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical		Theory		Practical	
6	FISHING TRIPS																					Fishing Trips															

LEGEND

 Theory
 Practical
 Fishing Trips

SUGGESTED TEACHING SCHEDULE IN MARINE FISHERIES IN CLASS - IX

26

S. No.		W E E K S																																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	
1	FISHERY BIOLOGY	Theory												Theory																							
		Theory						Theory						Theory																							
		Theory						Theory						Theory																							
2	FISHERY OCEANOGRAPHY	Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory	
		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory	
		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory		Theory	
3	FISHING TECHNOLOGY	Theory												Theory																							
		Theory												Theory																							
		Theory												Theory																							
		Theory												Theory																							
4	POST HARVEST TECHNOLOGY	Theory												Theory																							
		Theory												Theory																							
		Theory												Theory																							
		Theory												Theory																							
5	COOPERATIVES & MARKETING	Theory									Theory																										
		Theory									Theory																										
		Theory									Theory																										
		Theory									Theory																										
6	FISHING TRIPS																				Fishing Trips																
																					Fishing Trips																
																					Fishing Trips																
																					Fishing Trips																

LEGEND

- Theory
- Practical
- Fishing Trips

SUGGESTED TEACHING SCHEDULE IN MARINE FISHERIES IN CLASS - X

S No		W E E K S																																		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1	FISHERY BIOLOGY	Theory						Practical																												
2	FISHERY OCEANOGRAPHY	Theory						Practical																												
3	FISHING TECHNOLOGY	Theory						Practical																												
4	POST HARVEST TECHNOLOGY	Theory						Practical																												
5	COOPERATIVES & MARKETING									Theory																										
6	FISHING TRIPS																				Fishing Trips															

LEGEND

- Theory
- Practical
- Fishing Trips

Another important suggestion is that right in the beginning of session the teacher may prepare the break up of teaching plan of the whole subject matter according to syllabus giving priorities of each topic. This is to be juxtaposed with the probable time in which the teacher is able to finish a particular topic. The teacher should also keep a record of actual teaching done, and compare it at the end of the session with the records of planned teaching and the actual teaching. With each year of teaching experience, the gap between the planned teaching and actual teaching should be reducing. Moreover, this will enable the teacher to provide feed back information to the planners for further improvement of the curriculum.

3.6 REASONS FOR ELABORATING THE CURRICULUM

The objective of elaborating the syllabi and other associated matter in a big way is not only to define the salient topics, but also to serve as a guide line to the teacher particularly at this juncture, when even suitable text books and other related materials are not available. Thus the detailed syllabi together with supporting material will not only help in preparing the text books in future, but also help the teachers to commence teaching. In addition to the detailed syllabus, list of reference books for use of the teacher has also been given at Annexure 2.

3.7 DETAILS REGARDING UNIT OF CLASS

Since this is a vocational course, and it involves lot of practical work, the number of students in a batch are to be limited for effective training. It is, therefore, recommended that viable unit of 36 students be kept for class room teaching i.e. the lecture class will consist of

36 students. As regards practical work, these students will be divided in 2 batches for Laboratory work, and 3 batches for fishing trips. Keeping this in view, construction of 2 Laboratories and purchase or hiring of 3 fishing boats has been suggested for each unit of 36 students.

The reason why a batch of 36 students is suggested is that for fishing purposes, not more than 12 students can be accommodated in a boat of size 30/30 ft. along with 5 crew members. Since a minimum of two boats are to be sent together at a time for fishing trips due to safety reasons, an ideal batch would have been of 24 students. Keeping the present enrolment of students in class VIII in view, which is quite large; it was decided to limit the class strength to an unit of 36 students. A larger group would be difficult to manage in terms of imparting effective training. Even the number of 18 students suggested for working in a Laboratory at a time is slightly on the higher side. Usually 15 students under the supervision of 1 teacher can work satisfactorily in a Laboratory, and 18 students would be the maximum limit. For fishing trips not more than 12 students can be accommodated in a boat, therefore, the Committee thought of having 36 students in a batch.

3.8 IMPLEMENTATION OF THE SCHEME

Since the Island Development Authority of India has recommended that this course be introduced expeditiously in Lakshadweep in Secondary schools for the students of class VIII this year and subsequently in classes IX and X in a phased manner, a complete module has been developed consisting of detailed syllabi, the examination scheme

together with the list of equipment, space requirement and staff structure. It is, therefore, recommended that the norms laid down in the module be accepted as the standard and the recognition be granted by Kerala Secondary Board of Examination (which at present controls the secondary education at Lakshadweep) or by any other appropriate authority controlling the Secondary School Certification. It is proposed to introduce the subject from the academic session starting from June 1988 in selected schools of Lakshadweep. It is, therefore, essential that recognition be obtained immediately so that there may not be any difficulty in implementing the proposed vocational scheme.

It may be mentioned here that efforts have been made to fit in the proposed teaching schedule in the overall teaching scheme of the Kerala Board of Secondary Education. However, the evaluation pattern for this course has been suggested keeping in view the unique nature of the course. The reason is, that for a vocational course, more emphasis has to be given to Practical Training. Therefore, for purpose of evaluation, continuous assessment has been given significant weightage alongwith the terminal assessment for the practical work done by the students during the training period. This has been discussed in a separate chapter.

CHAPTER IV

EVALUATION PATTERN

4.1 GENERAL

The review committee gave serious thought to the evaluation pattern recognising the emerging trends of awarding the grades in Vocational Education. Keeping in mind the fact that this vocational course in Marine Fisheries is being identified for the first time in the country, it is too early to predict whether this course would be lucrative and attractive to the students in future. However full efforts have been made while designing the course, so that it becomes popular in future. For the present, there is need to stress more on serious education and training, and therefore, it is proposed that the examination is held on the same pattern as those of the other subjects. Moreover, for effective evaluation through a grading system, the teachers also need to undergo orientation course before the new system can be adopted in due course of time. Since other subjects of all the classes are being assessed by usual absolute marking system both in theory as well as in practical, it is desirable that this subject is also be assessed in conformity with other subjects. The only deviation will be that the marks for continuous assessment for Practical work will be awarded by the concerned teachers and will be sent to the Board for class X and to the Education Officer (Fisheries) for class VIII and IX duly supported by the relevant record.

4.2 PROPOSED PATTERN

The evaluation pattern will, therefore, consist of one theory paper of maximum marks of 60 and Two Practicals, viz.

- (i) Laboratory type Practical carrying maximum marks of 60 and
- (ii) Field Practical carrying maximum marks of 80.

Thus the total maximum marks for this course would be 200 in each class. The table below gives the examination scheme at a glance:

EXAMINATION SCHEME

		Max. Marks
Theory	Terminal	60
Indoor Practicals	i. Term Work	30
	ii. Terminal Exam.	30
Fisheries Trips	i. Term Work	40
	ii. Terminal Exam.	40

For theory papers, while setting the question paper, it is recommended that due weightage be given to each subject area. The recommended weightage may be in the ratio of 5:3:2:1:1 in the areas of Fishing Technology, Post Harvest Technology, Fishery Biology, Cooperation and Social Studies, and Fishery Oceanography respectively.

For Lab Practicals, consisting of 60 marks, it is suggested that 30 marks be awarded by the teacher on the basis of continuous assessment viz. day to day work done by each student in the Lab. For this purpose the teacher is required to maintain proper record and thus marks be

awarded on the basis of record book, taking into account the student's performance in practical and his attendance record. Further, a practical Examination be conducted at the end of the year and the marks be awarded out of 30. For classes VIII & IX, examinations will be conducted by the concerned teacher and the Education Officer (Fisheries) and for class X. The Board will appoint the external examiner.

For fishing trips, the Teacher/Instructor will maintain a skill evaluation card for each student and will allot marks out of 40 for continuous assessment. The teacher will assess the skills attained by the students during the field trips. Encl 4.1 gives the specimen of the skill evaluation card and identification of the possible skills to be attained by each student. At the end of each year a Practical Examination will be conducted in the same manner as for the lab. Practicals, and the marks be awarded out of 40.

SKILL EVALUATION SHEET
FOR
FISHING TRIPS

Name of the Student Class Roll No.
Academic Session

Sl. No.	Date	Time of Starting	Time of Return	Objective of the Trip	Skills attained	Marks out of 10	Remarks regarding general behaviour	Initials of Teacher
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								
11.								
12.								
13.								
14.								
15.								
16.								

34

Max. Marks (No. of Trips x 10), Total marks obtained

Actual Max Marks 40 Marks Calculated out of 40

Report on overall performance of the candidate to be given by the teacher at the end of the session

Signature of Head Master

Signature of Teacher

The following are some of the skills identified by the reviewing committee. However, the teacher is free to add more number of skills.

1. Sorting, grading, handling and storage of fish.
2. Location of Fishing areas, Fishing ground.
3. Collection of Bait Fishes.
4. Prevention of mortality in Bait Fish.
5. Fishing Operations.
6. Maintenance and Mending of nets.
7. Assemblage of fishing gears.
8. Engine Operation and Maintenance.
9. Trouble shooting of an engine.
10. Seamanship and Navigation.
 - (a) Manning ships routine.
 - (b) Rope work.
 - (c) Use of compass and steering.
 - (d) Buoyancy.
 - (e) Communication.
 - (f) Chart work i.e. finding the position of the shipping vessel and setting the course.
11. Berthing mooring and handling of fishing boat.
12. Operation and maintenance of life saving and fire fighting equipment.
13. Swimming, Handling emergencies and accidents (presence of mind).
14. Cleaning maintenance of Fishing Boats.

Sub-National Systems Unit,
National Institute of Educational
Planning and Administration
17 B, Safdar Road Marg, New Delhi-110016
LIC No.
Date:

15. Collection of samples of water, plankton and specimen for laboratory studies.
16. Use of First Aid.
17. Seaworthiness (Capacity to withstand the sea conditions).
18. Observation of oceanography condition-weather forecasting performance level.
19. Cooperation, coordination Courtesy during field trips.
20. Comparison of keeping quality of fish using different containers.

CHAPTER V

STAFF STRUCTURE

5.1 GENERAL

The requirement of staff depends on whether the Administration purchases the fishing boats or hires the same. Hence two modules of Staff Structure have been proposed, namely, one where 3 boats are hired alongwith the crew and the other where 3 boats are purchased for a batch of 36 students. For the two systems suggested, some staff will be such which will be common for both the modules. Therefore, the job description for the common staff is given first.

5.2 COMMON STAFF FOR BOTH MODULES

1. Education Officer (Fisheries) - 1

Functions: He will coordinate and effectively implement the scheme in different schools. He will be functioning from the Directorate of Education, Lakshadweep.

Qualifications

The candidate must be a post-graduate in Fisheries Science or be a graduate in Fisheries Science and P.G. Diploma in Fisheries Science from CIFE, Bombay or be M.Sc. (Fisheries Management) from CIFE, Bombay or M.Sc. (Zoology) with specialisation in Fisheries.

2. Fisheries Teacher - 1 (for each batch of 36 students)

Duties: To impart Theoretical instruction in all areas of Marine Fisheries and also to conduct indoor practicals. He will also accompany with one of the groups for fishing trips. He will be required to keep record of continuous assessment of the students both for indoor and outdoor practicals.

Qualifications:

The candidate should be a graduate in Fisheries Science. If such a candidate is not available, then a candidate with B.Sc. degree having Zoology and Chemistry as main subjects can also be recruited, but he is to be sponsored to undergo a re-orientation course in Fisheries Education at CIFE Bombay.

3. Lab Attendent - 1

(To be recruited through local employment exchange under class IV cadre).

5.3 MODULE A (WHEN FISHING BOATS ARE HIRED)

1. Mechanical Instructor - 1

The candidate must have passed SSIC Examination, and thereafter, have undergone training course in Engine Driver at CIFNET or the candidate must have passed SSIC Examination, and thereafter a certificate course of NCVT in diesel Mechanic from an I.T.I. Such a candidate must have an experience of 3 years of handling and maintenance of Marine Engines upto 80 H.P.

2. Fisheries Instructor - 1

The candidate must have passed SSLC Examination and thereafter he must have undergone training as Fishing Mate at CIFNET.

Here it may be added that such trained candidates are likely to be available at Lakshadweep Islands.

5.4 MODULE B (WHEN THE ADMINISTRATION PURCHASES 3 FISHING BOATS)

1. Tindal (Master Fisherman) - 3

The candidate must have 5 years experience of operating a mechanised fishing boat as Tindal independently for fishing operation. (One for each boat).

2. Engine Driver - 3

The candidate must have 5 years experience of operating a marine diesel engine. (one for each boat).

3. Deckhands - 9

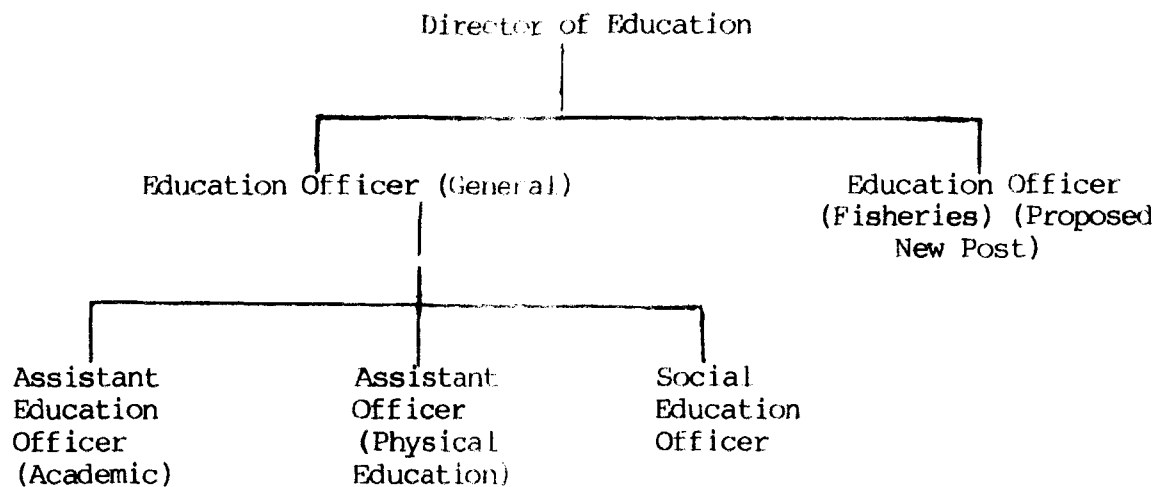
The candidate must have 5 years experience in marine fishing on mechanised boat as deckhands (3 for each boat).

5.5 MANAGEMENT STRUCTURE

In the above paragraphs staff needed has been worked out for a unit of 36 students undergoing a vocational course in Marine Fisheries. Since this scheme has been designed taking into consideration that Marine Fisheries is one of the subject, therefore no separate Management is

needed for this scheme. In the administrative set up of Directorate of Education, a new post of Education Officer (Fisheries) has therefore, been proposed in the cadre of Inspector of schools. His duty will be to see that the proposed scheme is implemented in the letter and spirit in all such schools where vocational course in Marine Fisheries is to be run. The person has to assess all aspects of the scheme carefully at different stages of implementation and monitor the scheme. In case practical difficulties are encountered, feed back information should always be sent to appropriate authority.

The administrative set up of Directorate of Education under the administrator of Lakshadweep is as follows:



CHAPTER VI

SPACE AND EQUIPMENT REQUIREMENT AND COST ESTIMATES

6.1 GENERAL

It has been suggested that a unit of 36 students will be divided into 2 batches for Indoor Practicals. Therefore, 2 laboratories will be needed in addition to a class room. These labs will be utilised for 4 periods a week for each class i.e. 12 periods per week for Class VIII, IX and X. In a school, therefore, even if there are 3 sections, each section having 36 students, 2 laboratories will be sufficient, but with increase in the number of sections, the staff strength will have to be increased and the fishing boats will also have to be increased to some extent. By suitable adjustment of the time table, it is possible to stagger the fishing trips so that the boats are utilised the maximum. In addition to the above, the quantity of raw material and glass ware consumed will also increase with the increase in the student strength, i.e. recurring expenditure of training will increase, but there will not be an increase in non-recurring expenditure which can be phased out in two financial years i.e. by March, 1990. By this time the laboratories can be fully equipped.

6.2. SPACE REQUIREMENT

1. Class Room 1 - 60 sq.m. for 36 students.

Since this vocational programme is a part of the regular course, it is not desirable that a separate class room be specially constructed. Theory classes can be held in the class rooms already existing in the school.

2. Laboratories for Indoor Practical - 2

For each Laboratory, working space of about 100 sq.m. will be required. One laboratory will be a Museum cum Biology Lab having facility for projection of transparencies and slides. The other one will be a technology laboratory. This laboratory will have equipment for fishing technology, post harvest technology and oceanography.

In addition to the laboratories, a small shed having an area of 15 sq.m. is to be constructed to house the diesel engine and a small repair workshop.

6.3 EQUIPMENT REQUIREMENT

The consolidated list of equipment/glassware/consumable materials has been given in annexure 3. This annexure consists of 3 lists.

1. The first list gives Dead Stock Items i.e. such items which are permanent in nature and require replacement after a sufficiently long time. Equipment such as Microscope, Diesel Engine, Thermometers, Pressure gauge etc. have been listed

here. To purchase these items, non-recurring grant is initially required.

2. Glasswares: These items are semi-permanent in nature. Some items in this list normally last for comparatively longer periods like jars for keeping fish, pipettes, reagent bottles, etc. There are some items which are consumed very often like test tubes, beakers, watch glass etc. Thus these can further be divided into 2 parts i.e. consumables and non-consumables.
3. Consumables: These items are consumed during the training period viz. chemicals, diesel oil, lubricants etc. For these items recurring grants will be required.

The rate of consumption of these items will depend upon the strength of the students. In a technical institution like ITI, raw material grant for consumable items varies from Rs. 50/-- per candidate per annum to Rs. 500/-- per candidate per annum depending upon the trade/trades. Therefore, a realistic yard stick is to be laid for this purpose. This figure can be found out only after running the course for one full cycle. Initially a L.S. grant may be provided by the administration.

6.4 COST ESTIMATES

While working out the cost estimates the following assumptions have been made:

1. The costs have been calculated for introduction of vocational curriculum in marine fisheries in one school.
2. The school would cater to a batch of 36 students in each class i.e. class VIII, IX and X respectively.

3. Basic infrastructure such as class rooms office space etc. are already available.
4. The land for building laboratories, workshops, sheds for storing boats etc. would be made available by the Lakshadweep Administration to the schools free of cost.
5. The furniture, space for library facilities are already existing and have not been accounted for in arriving at the cost estimates.
6. The salaries and remuneration of teachers and Laboratory staff have not been calculated as it is assumed that this would be paid from the existing Budget.
7. The rate for building construction has been assumed Rs. 1500/- per sq.m. and for sheds Rs. 1000/- per sq.m.

NON-RECURRING

Item	Amount
	(Rs. in Lakhs)
1. <u>Building</u>	
i. Laboratories - 2	
100 sq.m. each	3.00
ii. Workshop/Shed - 1	
15 sq.m.	0.15

2. Equipment

i.	Boats - 3	
	@ Rs. 4 lakhs per boat	12.00
ii.	Laboratory Equipment	2.00
iii.	Laboratory Furniture	0.50
iv.	Books	0.50
	Total	<u>18.15</u>

Recurring Expenditure
(Per Annum)

i.	Equipment (Consumables)	0.20
ii.	Books/Journals	0.05
iii.	Mainteiance	0.25
	Total	<u>0.50</u>

PROPOSED BREAK-UP OF EXPENDITURE

(Rs. in lakhs)

Items	Years	
	1988-89	1989-90
I. <u>Non-Recurring Expenditure</u>		
A. <u>Buildings</u>		
1. Laboratories	1.50	1.50
2. Workshop	0.15	--
B. <u>Equipment</u>		
1. Boats	4.00	8.00
2. Laboratory Equipment	1.00	1.00
3. Laboratory Furniture	0.25	0.25
4. Books	0.25	0.25
II. Recurring	0.50	0.50
	7.65	11.50

ANNEXURE 1

SYLLABUS

COURSE : MARINE FISHERIES

Standard VIII

Teaching Scheme	Examination Scheme
(Period per week)	Theory : 60 Marks
Theory : 4 periods	Indoor Practical :
Indoor Practicals : 4 periods	Term Work : 30 marks
Fishing Trips : 8 periods (1 day)	Terminal : 30 marks
	Fishing Trips
	Term Work : 40 marks
	Terminal : 40 marks

1. FISHING TECHNOLOGY

(a) Theory (26 periods of 40 minutes each)	No. of Periods
i. Indigenous fishing gears - wounding gear, lines, cast net, seine net, set gill net including live bait fishing net; (Describing differences with the help of chart/models emphasising more on the popular gear).	5
ii. Indigenous fishing boats - tuna boats - non-mechanised (Masodi) and mechanised; raft and canoe; (describing different craft with the help of models/charts with greater emphasis on differences in mechanised and non-mechanised tuna boats)	3
iii. Gear materials - natural fibres - usefulness of these fibres in fishing; common floats, sinkers and anchors and their uses in different nets.	3

iv.	Construction of twines and ropes - differences between twine and rope, twisting operation 'S' and 'Z' twist, folded yarn, cabled yarn, braided rope, construction of twines and ropes.	3
v.	Yarn numbering system - importance of Yarn numbering Denier and British.	2
vi.	Common fishing methods - pole and line, long lining, trolling, gill netting, shore seining, falling gear (cast net) (The method and area of operation to be explained in a simplified manner).	4
vii.	Terminology of fishing boats - over all length, breadth, depth, draft freeboard, fore part, midship part, aft part, port side, starboard side with sketches; (To be explained with charts/sketches)	2
viii.	Deck layout - deck layout of Masodi and Mechanised tuna fishing boats; (To be explained with charts/sketches).	2
ix.	Treatment and preservation of fishing gear - conventional preservative methods - sunlight disinfection, tannin preservation, coal tar preservation; storage of nets.	2
(b)	Indoor Practicals (18 units of 80 minutes of 2 periods each)	No. of Units
i.	Identification of twines and construction aspects - different types of natural and synthetic twines, twisted and braided twines, untwisting of cabled yarn to show 'S' and 'Z' twist, folded yarn and fibres.	1
ii.	Making of a gauge and needle using bamboo by each student.	1
iii.	Making of four types of knots - clove hitch, rolling hitch, sheet bends and reef knot, method of making knots (students have to make the knots themselves).	2
iv.	Loading of the needle and making foundation loop - Loading the needle and explaining the importance of foundation loop; making of the above by the students with the help of rolling hitch and clove hitch. (Minimum 30 loops to be made by each student).	1

v.	Making of a webbing with single sheet bend - making of webbing 10 meshes in 'T' direction and 6 meshes in 'N' direction; (Making the above webbing by the students themselves).	3
vi.	Making of a webbing with double sheet bend - making of a webbing with double sheet bend having 10 meshes in 'T' direction and 6 meshes in 'N' direction. (Students have to make the above webbing themselves).	2
vii.	Making of a webbing with reef knot - making of a webbing with reef knot having 10 meshes in 'T' direction and 6 meshes in 'N' direction (Making above webbing by students themselves).	3
viii.	Types of boats - dug out, raft, built up canoe, tuna fishing boats (Sketching and labelling of mechanised and non-mechanised tuna fishing boat).	2
ix.	Terminology of a fishing boat - (Explaining the terminology of a fishing boat with the help of a chart. Drawing of the above to be made by the students).	1
x.	Deck layout of a fishing boat - sketching the deck layout of a mechanised tuna fishing boat with the help of a chart.	1
xi.	Type of hooks, identifying the parts and sizes and sketching them with the help of models/charts.	1

2. POST HARVEST TECHNOLOGY

(a) Theory (12 periods of 40 minutes each)	No. of Periods
i. Fish - edible parts of fish, percentage of edible portion, main components of fish (water, fat, protein, minerals)	2
ii. Identification of spoiled fish and fresh fish - general appearance, flesh including belly and flaps, odour, texture	1
iii. Changes of Fish after catching - rigor mortis, autolysis, bacterial infection, temperature effect in relation to fish spoilage.	3

iv.	Methods of handling and storage - sanitation of deck, fishroom and equipments.	2
v.	Maintenance of quality at landing centre - grading, washing of fish in potable water, study of containers (materials, shape, capacity) - traditional (cane baskets, wooden boxes) and modern containers (Plastic and aluminium containers), merits and demerits of traditional and modern containers.	2
vi.	Ideal display table/mobile stalls/retail sale.	1
vii.	Temperature of fish during distribution - methods of controlling temperature.	1
(b)	Indoor Practicals (10 units of 80 minutes or two periods each)	No. of Units
i.	Handling of spring and beam balances	1
ii.	Edible portion of fish (Tuna or skipjack) - weight of whole fish, loss after gutting loss after beheading of edible part	2
iii.	Identification of spoiled and fresh fish - (eyes, gills, colour), odour, texture, study of rigor mortis, autolysis in dead fish, common areas of bacterial infection	1
iv.	Use of detergents and disinfectants/sanitizers - Importance of uniform, showing students scarf, apron, gloves, gum boots.	1
v.	Display of different types of containers, chopping boards, knives and dressing table - conventional and modern containers, cleaning and sanitizing containers, board, knives and dressing table.	1
vi.	Handling of mercury and alcohol thermometer - recording temperature of air, water, fish, ice.	1
vii.	Effect of cooling on the keeping quality of fish - ideal use of ice (in different containers), covering fish with wet cloth. (Demonstration and individual practice)	2
viii.	Containers used in the transport of fish. (Demonstration and individual practice)	1

3. FISHERIES BIOLOGY

(a) Theory (17 periods of 40 minutes each)	No. of Periods
i. English and local names of most common food fishes and baitfishes in the Lakshadweep.	1
ii. External features of a common and useful bony and cartilaginous fish, a mollusc and a crustacean.	3
iii. Body adaptations in fishes to its habits and habitats. Bottom and surface living fishes. Breeding time/size/habits of commercially important fish.	3
iv. Alimentary canal in relation to food and feeding habits. Predators, plankton feeders and browsers; food of fish - plankton, benthos and nekton; feeding habits.	3
v. Local distribution and economic importance of 5 most common commercial fishes and 3 common marine mammals in the Lakshadweep.	3
vi. Phytoplankton as primary producers; Phytoplankton, zooplankton, crustaceans and fish in food chain; corals, coral reefs and lagoons and their ecological and economic importance to Lakshadweep.	4

(b) Practicals (8 units of 80 minutes or 2 periods each)

Note: (Where necessary the items should be dissected, demonstrated, explained and described by the Instructor. The students should maintain complete records of all practicals with labelled diagrams and elementary description).

	No. of Units
i. External morphology of a typical bony fish and a cartilaginous fish.	1
ii. Diagram of five species of commercially important Indian Ocean tunas from actual specimens.	1
iii. Diagram of 5 commercially important fishes (other than tunas from actual specimens).	1
iv. Study of body forms of bony fishes, cartilaginous fishes and shell fishes (squids, cuttlefishes, octopus and lobsters).	2

- v. Alimentary canal of a typical teleost. Relationship between alimentary canal and feeding habits. 1
- vi. Male and female gonads and major maturity stages of any common teleost. 1
- vii. A study of morphological adaptations of pelagic, demersal, neritic and offshore fishes 1

4. SOCIO ECONOMICS AND COOPERATION

- (a) Theory (6 periods of 40 minutes each) No. of Periods
- i. Fishing as a profession - present status and scope for development 1
 - ii. Group activity for self help and mutual help - organisation of activities like fishing, coconut collection and coir production, and launching of boat etc. 3
 - iii. Cooperative as a group activity and business organisation - its advantages 2

(b) Practicals - Nil

5. FISHERY OCEANOGRAPHY

- (a) Theory (11 periods of 40 minutes each) No. of Periods
- i. Importance of ocean study - serves as a source for food, transportation, minerals and salts, energy etc; oceans; and seas cover 70% of the earth's surface; as a controller of weather and climate. 1
 - ii. Earth and its oceans - structure and size of the earth; Rotation upon its axis relative to the sun - solar day and relative to the moon - lunar day; major oceans and seas around India. 1
 - iii. Climate, weather, clouds and rainfall - idea of climate, weather, clouds and rainfall; the climate and weather conditions around Lakshadweep; Rainfall records around Lakshadweep. 1
 - iv. Air temperature - idea of temperature measurements; different thermometers in use, the data on temperature records around Lakshadweep. 1

v.	Atmospheric pressure - what is atmospheric pressure? the different barometers in use and their corrections (Mercury and aneroid), variation in pressure with altitude, atmospheric pressure observations around Lakshadweep.	1
vi.	Wind and humidity observations - measuring wind speed and direction; use of anemometers; effect of altitude on winds, winds around Lakshadweep; idea of relative humidity (Psychrometer) the data on relative humidity around Lakshadweep.	2
vii.	The effect of above meteorological features with reference to weather and climate around Lakshadweep.	2
viii.	The effect of above meteorological features with reference to sea conditions (rough and calm seas) around Lakshadweep. (All the Theory should be covered through specially developed charts and diagrams)	2
(b)	Practical (4 units of 80 minutes or 2 periods each)	No. of Units
i.	Earth and its oceans - To observe and identify the different portions of the earth, major oceans, different islands around Lakshadweep in relation to mainland through charts showing the structure of the earth, the oceans, the Arabian sea, Bay of Bengal and Lakshadweep.	1
ii.	Rainfall measurement - to observe and learn how to measure rainfall.	1
iii.	Temperature and wind measurement - to observe and learn to measure air temperature, wind speed and wind direction (hand-kerchief method).	1
iv.	Pressure observations - to know the function and measurements of mercury barometer and Aneroid barometer and how to convert pressure in millimetres.	1

Standard IX

Teaching Scheme	Examination Scheme
(Periods per week)	Theory : 60 Marks
Theory : 4 periods	Indoor Practicals :
Indoor Practicals : 4 periods	Term Work : 30 Marks
Fishing Trips : 8 periods (1 day)	Terminal : 30 Marks
	Fishing Trips
	Term Work : 40 Marks
	Terminal : 40 Marks

1. FISHING TECHNOLOGY

(a) Theory (25 periods of 40 minutes each)	No. of Periods
i. Fabrication of webbings and nets - braiding, tools required for braiding- needle and mesh gauge, method of braiding - foundation line, clove hitch, different knots used for braiding, shaping a netting- baiting, creasing, fly meshing, cutting of webbing, methods of cutting-point cut, bar cut, formula used for cutting mounting- definition,, hanging, coefficient, its definition,, formula and effect on the nets, methods of mounting - reeving, stapling and norselling..	3
ii. Choice of netting material for gill nets - requirements for gill net - visibility in water, breaking strength, elongation, elasticity and knot stability; properties of synthetic fibres- breaking strength, sinking speed, abrasion resistance,, visibility.	2
iii. Fishing gears in general - classification of fishing gears - without gear, grappling and wounding gear, stupefying devices, lines, traps, fishing in the air - aerial traps, bag nets, dragged gear, seine nets, surrounding nets, drive-in nets, lift nets, falling gear, gill nets and tangle nets with the help of chart; classifying the gears of Lakshadweep.	4

- | | | |
|--|---|---|
| iv. | Fishing methods in general with special reference to Lakshadweep - lines, seines, gill nets and drag nets - principle fabrication aspects of gears and operation. | 4 |
| v. | Fishing craft in general - mechanised and non-mechanised craft, advantages of mechanised craft, systematics of fishing boat - according to depth of operation, construction of the hull, materials used for construction, type of propelling system, fishing methods. | 2 |
| vi. | Stages of wooden boat construction - lofting, laying of keel, fixing of frames, planking, deck laying and installation and launching, (Describing with chart/model). | 3 |
| vii. | Engines - elementary knowledge, diesel and petrol engines - two stroke, four stroke, operation aspects. | 4 |
| viii. | Elementary navigation and navigational aids - types of navigation - terrestrial, celestial and dead reckoning, reading of Lakshadweep admiralty chart, buoyage system, storm signals with the help of charts. | 3 |
|
(b) Indoor Practicals (18 Units of 80 minutes or two periods each). No. of Units | | |
| i. | Making of webbing using 3 types of knots - making webbing with sheet bend, double sheet bend and reef knot having 10 meshes in 'T' direction and 9 meshes in 'N' direction (combination process). | 2 |
| ii. | Shaping of webbing by braiding - demonstration of baiting, single creasing, sliding creasing and fly mesh Practice of the above by the students in the next two classes, also to make a trapezium shaped webbing). | 3 |
| iii. | Shaping of webbing by cutting - demonstration of cutting point/bar/mesh cut (explain the formula for cutting); demonstration of cutting with the help of a example (Making by the students of trapezium webbing using the above formula). | 3 |
| iv. | Mounting of webbing - mounting the given nylon webbing provided in the laboratory with reeving and stapling. | 1 |

- v. Making of a gill net - making a simple gill net with the given horizontal hanging coefficient. 2
- vi. Identification of the fishing materials- floats made of different materials (aluminium, thermocole, PVC, HDPE); sinkers made of different materials (stones, concrete, iron); anchors (stone, stockless and stock anchors). 1
- vii. Structural members of a fishing boat - explaining different members of backbone assembly, frames and deck with the help of models; drawing of backbone assembly by students. 1
- viii. Internal combustion engines - (Explaining the different parts of a single cylinder unit with the help of chart for two stroke petrol/diesel and four stroke petrol/diesel engine). Blue print/Xerox of the chart should be provided to the students for labelling. 2
- ix. Chart reading - identifying the different islands in and around Lakshadweep using Admiralty chart. 1
- x. Fixing the hooks using guts/nylon - (Demonstration of fixing the hooks and practice by the students). 1
- xi. Making of pole and line gear - (Demonstration and making a model). 1
- xii. Determination of buoyancy of a float - (Demonstration of finding out the buoyancy of a float using buoyancy testing tank). 1

2. POST HARVEST TECHNOLOGY

- | (a) Theory (15 periods of 40 minutes each) | No. of Periods |
|---|----------------|
| i. Bacteria of different types - thermophils, mesophils, psychrotropic effect, temperature, pH, water, oxygen, toxic substance. | 2 |
| ii. Clean handling of fish : Hygiene-existing and improved handling; necessity of eliminating bacteria; removal of inedible parts of fish, like guts, head, gills, fins; role of ice blocks, crushed ice, flake ice; merits and demerits of different types of ice. | 3 |

iii.	Measurement of density and specific gravity by means of hydrometers/brinometer - study of degree of saturated brine and pure water.	1
iv.	Principles of drying; factors affecting drying; relative humidity measurement by hygrometer; different types of drying - sundrying/use of solartent (advantages), industrial dryers; vacuum drying/freeze drying; merits and demerits of natural sundrying and mechanical drying.	4
v.	Quality of dried fish - comparison of fresh fish/dry fish; weight loss during drying; packing and storing; constituents of fresh fish/dry fish.	2
vi.	Salting - types of salt, principles of salting, spoilage in salted fish.	1
(b)	Practicals (10 units of 80 minutes or 2 periods each).	No. of Units
i.	Dressing of fish (Demonstration and individual practice) - receiving, fish-grading; weighing/washing/icing; removal of gut contents; washing/weighing; beheading/weighing/washing; storing in the containers with ice.	1
ii.	Thawing of frozen fish-air and water methods; weight loss in thawing.	1
iii.	Use of hydrometer, brinometer and hygrometer-handling and practicing (drawing, diagram).	1
iv.	Preparation of brine in various concentrations and study of specific gravity of each concentration (demonstration and practice).	1
v.	Sundrying of fish on ropes/bamboo scaffolding/flat racks.	1
vi.	Weighing and packing of dried fish - packing/labelling/arranging.	1
vii.	Salting and sundrying of fish (threading/raised platform).	1

- viii. Weighing and packing of salted & sundried fish - packing/sealing/labelling/arranging. 1
- ix. Sensory/organoleptic tests of the sun dried fish products - texture/colour/odour - changes in appearance (Demonstration and Practice). 2

3. FISHERIES BIOLOGY

(a) Theory (15 periods of 40 minutes each)	No. of Periods
i. Field keys for the identification of ten common food fishes of Lakshadweep.	2
ii. Simplified keys to the identification of most common plankton forms and other food items of Fish.	2
iii. Elements of fisheries biology - body characteristics and their significance; food and its analysis; maturity and spawning; spawning season; age and growth.	4
iv. Diversity in size at maturity, spawning and spawning behaviour and growth (longevity, size, growth rate).	3
v. Elements and present status of capture fisheries, catch composition of pole and line and troll line fisheries.	2
vi. Five ornamental aquarium fishes; distribution, habitat and potential.	2

(b) Practicals (6 units of 80 minutes or 2 periods each)	No. of Units
--	--------------

(The items should be demonstrated, explained and described by the Instructor. The students should keep complete records of all practicals with labelled diagrams and basic description).

i. Measurable characters (morphometry) and countable characters (meristics) for species identification for two common species.	1
ii. Study of gut contents. Quantitative (volume)- and qualitative analysis of gut contents of a carnivore fish. (Major gross items).	1
iii. Any 5 most common plankton (phyto and zoo) items - illustration, labelling and salient features.	1

- iv. Measurement of total length and total weight of individual fish for plotting length-weight relationship. 1
- v. Weight measurements of gonads-immature and mature including ripe and their relationship with body weight. 1
- vi. Collection, preparation and demonstration of scales and otoliths for growth rings for determination of age. 1

4. SOCIO-ECONOMIC AND COOPERATION

- (a) Theory (9 periods of 40 minutes each) No. of Periods
- i. Fishing as a profession, costs of fishery - cost of boat, gear, labour, diesel, etc; income from sale of fish, concept of net profit-its distribution, examples from Tuna a fishing, pole and line fishing. 3
 - ii. Sale of fish - existing system of fish sale 1
 - iii. Meaning of marketing of fish; steps involved- pooling, initial processing, distribution; services like transport, storage, packaging standardisation; finance, risk bearing; potential markets - islands, mainlands and export. 3
 - iv. Advantages of cooperative marketing at various stages - pooling, storage, transport, finance, sales etc. 2

(b) Indoor Practicals : Nil

5. FISHERY OCEANOGRAPHY

- (a) Theory (11 periods of 40 minutes each) No. of Period
- i. Important marine zones - Geomorphology of the ocean, estuaries, creeks/definition, bays/definition, lagoons/definition, coastal waters, offshore waters, open oceans, territorial waters, exclusive economic zone, international waters. 2
 - ii. Temperature observations in the sea - Temperature variations at different depths; use of reversing thermometer; study of water temperature at different depths in the seas around Lakshadweep. 1

- | | | |
|---|--|---|
| iii. | Salinity of seawater - concept of salinity and its estimation by titration; vertical profiles of salinity in the sea; comparison of salinity around Lakshadweep Islands and Kerala coast. | 1 |
| iv. | pH of the seawater - concept of pH; estimation of pH using pH paper; comparison of pH of freshwater and seawater. | 1 |
| v. | Light penetration and its importance in the seelight propagation in seawater; method of measuring light penetration (Secchi disk); major factors affecting light penetration in sea; effect of light on plant production in the sea; influence of light on fish; behaviour vertical migration. | 2 |
| vi. | Dissolved oxygen in seawater - DO and its sources; importance of dissolved oxygen; estimation of DO in the sea water by titration methods; vertical variation of dissolved oxygen in the sea around Lakshadweep; the DO as an important factor for the marine ecosystem. | 2 |
| vii. | Influence of the circulation of water mass; impact on mixing, homogeneity and stratification of water mass. | 1 |
| viii. | The influence of physico-chemical properties of seawater on marine life; primary productivity; productivity, spawning, development and larval survival, feeding and growth, abundance, migration, shoal of fish, extreme conditions causing mass mortality. | 2 |
|
(b) Indoor Practicals (4 units of 80 minutes of 2 periods each) No. of Units | | |
| i. | Temperature and pH measurements of seawater; to learn to measure temperature of seawater at depths, to measure pH of seawater with the help of pH paper. | 1 |
| ii. | Salinity measurement of seawater by titration | 1 |
| iii. | Light measurement in the sea by Secchi Disk to understand the penetration of light in the sea. | 1 |
| iv. | Dissolved oxygen estimation in the seawater by Winkler's method. | 1 |

Standard X

Teaching Scheme	Examination Scheme
(Periods per week)	Theory : 60 Marks
Theory : 4 periods	Indoor Practicals :
Indoor Practicals : 4 periods	Term Work : 30 Marks
Fishing Trips : 8 periods (1 day)	Terminal : 30 Marks
	Fishing Trips
	Term Work : 40 Marks
	Terminal : 40 Marks

1. FISHING TECHNOLOGY

(a) Theory (24 periods of 40 minutes each)	No. of periods
i. Fish finding equipments - principle and operation of echo sounder, sonar and net sonde.	3
ii. Fish aggregation devices - importance in Lakshadweep, indigenous aggregation devices.	3
iii. Elementary seamanship and handling of the vessel - Compass - identify compass points and equivalent degrees and drawing them, anchoring, berthing the vessel against the tide, along the tide, against wind, along the current.	5
iv. Deck equipments - winch, gurdy line hauler - parts, operation and uses; care and maintenance of engine - daily, every 100/150 hrs - Every 250/300 hrs. Every 500/600 hrs. Every 2000/2500 hrs.	2
v. Boat designs and specification - tonnage gross and net, safety aspects of fishing vessels.	2
vi. Harbour - facilities required in harbour.	2
vii. Rules of the road in the sea.	3
viii. Buoyage system.	1

(b) Indoor Practicals (17 units of 80 minutes at 2 periods each)	No. of Units
i. Reading of gears - gill net, purse seine long line - (Demonstrating and explaining the different parts of the above gears and their uses with the help of models/charts).	2
ii. Identification of life saving appliances and fire fighting appliances - explaining the uses of life jacket, life buoy, life raft, the method of wearing the life jacket and using life buoy and life raft, method of using soda acid type, foam type and dry powder type fire extinguishers.	2
iii. Identification of navigation lights, local channel markings and storm signals (Explaining the uses of above with the help of models and identify. Permanent display has to be made in the class room).	1
iv. Splicing - Demonstrating the eye splice and joint splice. Students have to practice the above in the class room.	3
v. Mending - (Demonstrating the method of mending, simple tear, complicated tear, the trimming process. Individuals should do it without assistance).	3
vi. Starting of engines - (Demonstrating the starting procedure of engine with the help of engine in the workshop).	2
vii. Making tuna brench line and troll line - (Demonstration and fabricating).	3
viii. Tin-live bait storage tank (model) - (Instructor to help the students to fabricate tin live bait storage tank model)	1
ix. Engineering tools - Carpentry tools, engine maintenance tools. (Demonstration of elementary using techniques).	2
x. Basic first aid - (Demonstrating components and their use, artificial respiration, important slings, action to be taken in case of fracture and drowning).	2

2. POST HARVEST TECHNOLOGY

(a) Theory (17 periods of 40 minutes each)	No. of Periods
i. Bacteria - size, form, grouping; growth (4 phases); pathogens, toxin producing bacteria.	2
ii. Importance of chlorination of water - Percentage of available chlorine in potable water at different stages of handling.	1
iii. Smoking - principles, cold smoking/hot smoking, difference between traditional and mechanical kiln, non resinous hard wood, saw dust, wood shavings, as effective materials used for developing smoke and synthetic smoke flavours, composition of smoke, boiled and smoked fish products.	2
iv. Freezing - purpose, principles, changes in fish during freezing and cold store, types of freezers, air blast, contact plate (vertical/horizontal), I.Q.F. products, glazing, freezing of whole fish, fillets, minced fish, frozen shrimp.	2
v. Storage of frozen fish - deep freezers, cold storages/refrigerated holds (temperatures desirable).	1
vi. Canning - type of cans/materials, shapes and sizes; preparing fish for canning, packing in cans, addition of fill (brine, oil, curry or sauce), exhausting, closing/seaming, heat processing; labelling and boxing causes of spoilage.	4
vii. Tuna as an industry - tuna products	1
viii. Fish by products - fish oil, fish meal, fish silage.	1
ix. Indian standard specifications - fresh fish, frozen fish, canned fish, sun dried and salted fish, fish meal, shark liver oil, fish fins.	1
x. Emerging technologies for fast foods with reference to fish.	2

(b) Indoor Practicals (13 units of 80 minutes of 2 periods each)	No. of Units
i. Sensory/organoleptic test of fresh fish	1
ii. Total plate count (Demonstration)	1
iii. Gram staining - (only demonstration - cocci and bacilli)	1
iv. Chlorination of water/estimating available chlorine by indicator paper.	1
v. Salting of fish - dry method for shark (lean fish), weighing/labelling/packing/storing; wet method - mackerel (fatty fish) weighing/labelling/packing/storing.	4
vi. Smoking of tuna - cold smoking; weighing/labelling/packing/storage.	2
vii. Freezing of fish and glazed fish in refrigerator/deep freezer.	1
viii. Can analysis of locally canned products. (e.g. canned tuna or seer fish), assessment of water capacity using, and study of can seam.	1

3. FISHERIES BIOLOGY

(a) Theory (9 periods of 40 minutes each)	No. of Periods
i. Elements of capture fisheries - catch estimation production, relationship between fishing units (effort) and yield in respect of pole and line fishery; troll line/longline fishery; beach seine fishery	2
ii. Elementary principles of local specific mariculture practices - identification of potential culturable species - their ecology and habits; locations suitable for culture practices; techniques suitable for culture practices (plans, design, fabrication and operation with special reference to rafts, cages and hatcheries).	4
iii. Elementary principles of local specific mariculture practices, specific practices relating to seaweeds and lobster.	2

(b) Practicals (6 units of 80 minutes of 2 periods each). No. of Units

Note: All the items will be demonstrated, explained and described by the Instructor. The students should maintain complete records of all the practicals with neatly labelled diagrams and basic description).

- | | | |
|------|---|---|
| i. | Simplified taxonomic and diagnostic keys for the identification of local teleost (introduction of species concept) with special reference to tunnas. | 1 |
| ii. | Simplified taxonomic and diagnostic keys for the identification of local teleosts (introduction of species concept) with special reference to 5 local bait fishes. | 1 |
| iii. | Catch and effort data from readily available sources such as from CMFRI, and the Department of Fisheries, Lakshadweep and their possible relationships. | 1 |
| iv. | Plotting the catch and effort data on graphs and trying eye fitted lines. Fitting catch against years for trends. | 1 |
| v. | Potential mariculture species (Lobsters, mussels, baitfishes, aquarium fishes, Octopus and seaweeds). | 1 |
| vi. | Demonstrations of methods of mariculture techniques including cages, hatcheries, rafts and feed formulation (in active collaboration with the CMFRI and the Department of Fisheries). | 1 |

4. SOCIO ECONOMICS AND COOPERATION

(a) Theory (10 periods of 40 minutes each) No. of Periods

- | | | |
|-----|--|---|
| i. | Fishing as a commercial activity; costs of tuna fishing - fixed costs like cost of nets, diesel, wages to crew members, other costs like interests on money borrowed for buying the boat; depreciation, income from sale of fish; difference between gross income, net income. | 4 |
| ii. | Ownership of boats through co-operatives - advantages in supply of inputs, credit and marketing. | 2 |

- iii. Formation of co-operatives - Preliminary enquiries, minimum members needed - volume of business needed; factors for successful running of co-operatives - loyalty, leadership technology - finance; facilities for a cooperative - storage - transport - supply. 2
- iv. Success stories - Amul; Fishermen Coop. Society, Versova, Bombay. 2

(b) Indoor Practicals : Nil.

5. FISHERY OCEANOGRAPHY

- | (a) Theory (12 periods of 40 minutes each) | No. of periods |
|---|----------------|
| i. Major elements in sea water - composition of sea water, important nutrients (Phosphate, nitrate, and silicate); important dissolved gases (oxygen, carbon dioxide, hydrogen, and nitrogen). | 2 |
| ii. Tides, tidal currents and waves - tide and tidal currents, methods of measurement; waves and methods of measurement; types of tides and waves; tide table with reference to Lakshadweep. | 2 |
| iii. Ocean circulation/currents - ocean currents, forces causing currents in the oceans, methods of measuring current speed and direction, surface and deep water currents; upwelling, its importance, major areas of upwelling in the Arabian sea. | 2 |
| iv. The effect of currents, tides and waves on marine fishery - fish behaviour in relation to currents, tides and waves | 1 |
| v. Depth and sound propagation in the sea - depth zones in the oceans and seas and their measurement. | 2 |
| vi. Application of environmental analysis/forecasts to fisheries - a case study of tuna in the Eastern Pacific - tuna fisheries and its importance, tuna migration, the basis and methods of forecasts. | 3 |

(b) Indoor Practicals (4 units of 80 minutes of 2 periods each)	No. of Units
i. Tide measurements - to measure the tidal variations, by observing the fixed tidepole at the lowest low water region of the intertidal area and by marking the intertidal area during high tide and low tide and observing the tidal influence on a sandy beach.	1
ii. Current measurement - study of current meter (Fimkan type) with chart; to understand the current speed and direction by chart.	1
iii. Depth measurement by lead line and echo sounder. (may be done on board in a fishing vessel).	2

ANNEXURE 2

BIBLIOGRAPHY, REFERENCE MATERIAL FOR TEACHERS

A. COOPERATION/ADMINISTRATION AND EXTENSION

1. FAO, 1958. Report of the FAO Training Centre in Fishery Cooperatives and Administration. Food and Agriculture Organisation, Rome, Italy.
2. FAO, 1971. Manual of Fishermen's Cooperatives, (FAO Fisheries Studies No. 13). Food and Agriculture Organisation, Rome, Italy.
3. Kulkarni K.R., 1962. Theory and practice of the Cooperation in India and abroad - (Vol.1-4). Cooperators Book Dept., 5/32, Ahmed Sailor Bldg. Naigaum, Dadar, Bombay.
4. Bedi, R.D. 1965. Theory, History and Practice of Cooperation. International Publishing House, Near Govt. College, Meerut 24.
5. Mehta, S.C. 1975. Industrial Cooperatives in India. Atma Ram and Sons, Delhi.
6. Nordset Arne, 1959. Cooperation among fishermen in Norway. A/s. John Griggs Boktrykkeri, Bergen.
7. Digby Margaret, 1961. Cooperation for fishermen. International Cooperative Alliance, /FAO.
8. BOBP, 1984. Towards shared learning. (BOBP/MAG/1). Bay of Bengal Programme/Development of Small-Scale Fisheries, Madras./FAO.
9. BOBP, 1983. Towards shared learning (BOBP/MAG/2). Bay of Bengal Programme/Development of Small-Scale Fisheries, Madras./FAO.
10. SIDA/FAO, 1984. Bay of Bengal Programme - Identifying Extension A.P. Swedish International Development Authority/FAO.
11. SIDA/FAO, 1987. Non-formal primary education for children of Orissa. SIDA/FAO.
12. SIDA/FAO, 1986. Food and Nutrition Status of Small-Scale Fisherfold in India's East Coast States. Swdsh International Development Authority/FAO.
13. BOBP, 1982. Bay of Bengal News (Nos. 5-20). Bay of Bengal Programme/Development of Small-Scale Fisheries, Madras/FAO.

B. CRAFTS AND GEARS, NAVIGATION

1. Anrose A., 1986. Crafts and Gear Practical Course Manual. Central Institute of Fisheries Education, Bombay.
2. Cook Peter, 1971. Boatbuilding Methods. Adlard Coles Ltd., London.
3. Perry Mrin W.H. 1980. Fishermen's Handbook. Fishing New Books Ltd., England.
4. Rosman I. 1980. Fishing with botton gillnets. - (FAO Training Series). Food and Agriculture Organisation, Rome.
5. Tal K.B., 1969. An Introduction to Fishing Gear Technology. Metropolitan Book Co. Pvt. Ltd., Netaji Subhas Marg, Delhi.
6. Libert L. and Maucorps. A., 1973. Mending of Fishing Nets. FAO/Fishing News (Books) Ltd.
7. Holdgate, Charles, 1979. Net Making. Emerson Books, Inc. New York - 10511.
8. CIFNET, Fishing Gear Catalogue Trawl nets for vessels of HP 100-600. Central Institute of Fisheries Nautical Engineering Training, Cochin.
9. CIFNET, 1977, Hand Book of Tuna long lining. Central Institute of Fisheries Nautical Engineering Training, Cochin.
10. FAO, (Ben-Yemi M.), 1980. Tuna Fishing with Pole and Line (FAO Fishing Manuals). FAO/Fishing News Book Ltd., Surrey, England.
11. Klust Gerhard, 1973. Netting materials for fishing gear. FAO/Fishing News Book Ltd., Surrey, England.
12. Swaminath M., Nair M.K.R. and Pravin P., 1986. A CIFNET Bulletin - Oceanic Tuna; A feasibile in India EEZ. Govt. of India, CIFNET, Devan's Road, Cochin - 110016.
13. Indian Bank, 1982, Innovative Technologies for Integrated rural development, Indian Bank, New Delhi.
14. ICLARM, 1985, ICLARM Newsletter, Tilapia, Coral Reefs, Fish aging, Muro-ami, (Vol. 8 No. 1, 1985). International Centre for living Aquatic Resources Management, Metro Manila, Phillipines.
15. ICLARM, 1984, Coral Reefs, Albacore, Milk fish, red tide. (Vol. 7 No. 4 1984). International Centre for Living Aquatic Resources Management, Metro Manila, Phillipines.
16. NAGA/ICLARM, 1986. Fisheries Education and Training, (Oct., 1986). International centre for living Aquatic Resources Management, Metro Manila, Phillipines.

17. CIFNET, Cochin, (), Hand Book on Electronic equipment used on board fishing vessel. Central Int. Fisheries Nautical Engineering Training, Cochin - 110016.
18. CIFNET, 1977. Hand Book on Tuna Long Lining. Central Institute of Fisheries Nautical Engineering Training, Cochin - 110016.
19. Panicker, 1976-78, Marine Gastropod Shells of Lakshadweep, (Dissertation of Panicker), Central Institute of Fisheries Education, Bombay.
20. Oliver, R.C., 1965. Trawlersmen's Handbook. Fishing News (Books) Ltd., 110, Fleet St. London, E.C. 4.
21. Knight Austin M. 1953. Modern Seamanship. D. Van Nostrand Co., Inc., New York.
22. Burgess John, 1966. Fishing Boats and Equipment. Fishing News (Books) Ltd., London. EC-4.
23. Chappelle Howard. I, 1966. Boat Building. George Allen and Unwin Ltd., London.
24. Scofield W.L. 1948. Trawling Gear in California. (Fish. Bulletin No. 72) State of California, Deptt. of Natural Resources Division of Fish and Game, Bureau of Marine Fisheries.
25. HMSO, 1961. Manual of Seamanship (Vol. 1), Her Majesty's Stationery Service.
26. 1987, Papers for Technical Sessions I. & II. All India workshop on Motorisation of Traditional Fishing Crafts. Conference Hall, Circuit House, Annexe, Shahibag, Ahmedabad-4.
27. FAO, 1965. FAO Catalogue of Fishing Gear Designs. Food and Agriculture Organisation, Rome.
28. Albets Hillier, 1982. Introduction to net mending NAR/SEA Grant. Marine Advisory Service, Pub. Unit Bay Campus Narragansett RI 02982.
29. Puri, S.K., 1979. Manual of the Rule of Road. Marine Publishers of India, 2/1, Good Earth Housing Society, Chembur, Bombay - 71.
30. Bayliss R. 1961. Carpentry and Joinery. Hutchinson Technical Education.
31. Raoul Graumont, 1943. Fishermens Knots and Nets. Cornell Maritime Press.
32. Scott, R.W. 1948. handy medical aid for Sea farers. Fishing news Books Ltd., 110, Fleet Street, London - EC4.
33. Ambulance St. Jones, 1982. First aid by St. Johns Ambulance. St. Johns Ambulance, New Delhi.

C. MARINE FISHERIES

1. Firth Frank E., 1969. The Encyclopedia of Marine Resources. Van Nostrand Reinhold Co., 450, West 33rd St. N. York. 100001.
2. Fischer W. and Bianchi, G., 1984. FAO Species Identification Sheets for Fisheries Purposes, Western Indian Ocean Fishing Area 51 (Total Vo. 5). Marine Resources Service, Fishery Resources and Environment Division, FAO Fisheries Deptt. Rome, Italy.
3. Sharma G.S., 1982. Bulletin of the Deptt. of Marine Science University of Cochin. School of Marine Sciences, Ernakulam, Cochin-682016
4. Hornell James, 1984. Marine Fish-Farming of India. International Books and Periodicals Supply Services, 24 B/5, Desbandhu Gupta Road, Karol Bagh, New Delhi - 110015.
5. MPEDIA, 1980. Proceedings of the First National Symposium on Shrimp Farming, (Bombay, 16-18 Aug, 1978). The Marine Product Export Development Authority, Cochin - 16.
6. Bal, D.V. and Rao, K.V. Marine Fisheries. Tata Mac-Graw Hill Publishing Co. Ltd., 12/4, Asaf Ali Road, New Delhi - 2.
7. Misra K.S., 1962. Records of the India Museum, (Vol. 57, 1959), Zoological Survey of India, 34.
8. NAS, Allahabad and CIFE, Bombay, National Symposium on the Utilisation of Living Resources of the Indian Seas. "Abstracts". National Academy of Sciences, Allahabad and CIFE, Bombay-61.
9. Johnes, S. and Kumaran M. 1980. Fishes of the Laccadive Archipelago. The Nature Conservation and Aquactic Sc. Service, Santiniwas, Nanthancode, Trivandrum-695003.
10. James, P.S.B.R., 1986. Recent Advent in Marine Biology, R.K. Jain, Today and Tomorrow's Printers and Publishers, 24-B/5, Desh Bandhu Gupta Road, Karol Bagh, New Delhi-5.
11. CMFRI, 1986. Marine Fisheries Information Service, (No. 68 July 1986) - Central Marine Fisheries Research Institute, Cochin.
12. Koya, P.P., 1982-84. Hydrography and Fisheries of Lakshadwep (Dissertation Pvt. Trainee). Central Institute of Fisheries Education, Bombay-61.
13. Koya C.N. Haneefa, 1980-82, Bay Fish Fishing of the Kalpeni Islands of the Lakshadweep Trainee), CIFE, Bombay.

14. CMFRI, 1967. Souvenir 20th Anniversary, Central Marine Fisheries Research Institute. Central Marine Fisheries, Research Institute, Mandapam Camp.
15. Laevastu T. 1965. "Manual of Methods in Fisheries Biology. Food and Agriculture Organisation, Rome.
16. Permutter Alfred, 1961. Guide to Marine Fisheries. New York University Press.
17. Munro Ian S.R. 1982, The Marine and Fresh Water Fishes of Ceylon. Periodical Experts Books Agency, D-42, Vivek Vihar, Delhi-32.
18. James P.S.B.R., 1987. An appraisal of the Marine Fisheries of Lakshadweep. Special Publication of 40 Years - Central Marine Fisheries Research Institute, Cochin.
19. Samual C.T. 1968, Marine Fisheries in India. University of Kerala, Cochin-16.
20. Bashford, Dean, 1987. Fishes, Living and Fossil. Narendra Publishing House, 1417, Kishan Dutt Street, Malwara, Delhi-6.
21. Chhappgar, B.F. 1987. Common Fishes of India. S.K. Mookerjee, Oxford University, Press, Oxford House Apollo Bunder, Bombay-39.
22. Misra, S.R. 1987. Fisheries in India. Ashish Publishing House, 8/81, Punjabi Bagh, New Delhi.
23. Whitehead Peter, 1975. How Fishes Live. Elseveir Publishing Project.
24. Chandy, M. 1970. Fishes; National Book Trust, New Delhi.
25. Sharma G.S. Mahandas A. and Antony A. 1979. Contributions to Marine Sciences. Prof. Kurian's Shashyabdhapoorthi Felicitation Committee.
26. Khanna, S.S. 1978. An Introduction to Fishes. Central Bank Depot, Allahabad.
27. Vorchio Menico, 1972. The World Beneath the sea. Orbis Publishing, London.

D. OCEANOGRAPHY

1. Kohli, S.N. 1978, Sea Power and the Indian Ocean. Tata Mac-Graw Hill Publishing Co. Ltd., new Delhi.
2. Pickard George L., 1979. Descriptive Physical Oceanography (An Intor.) Pergamon Press, Oxfor, N. York.
3. Taylor James A. 1974. Climatic Resources and Economic Activity. David and Charles, London.
4. Sharma, R.C. 1985. The Oceans - Realities and Prospects, Rajesh Publications, New Delhi.
5. Iyengar Nankhini, 1985. India and the Indian Ocean. ABC Publication House, New Delhi.
6. Ilmo Hela, Taivo Laevastu, 1970. Fisheries Oceanography, Fishing News (Books) Ltd., London.
7. Lambert David, 1979. The Oceans, Ward Lock Ltd., London.
8. Sverdrup H.U. and etc. 1942. The Oceans, Physics, Chemistry, Gen. Biology. prantice-Hall, Inc. New York.
9. Bhatt, J.J. 1978. Oceanography, Exploring the Plants Ocean. D. Van Nostarand Co.

E. FISH PROCESSING

1. Kreuzer Rudolf. 1974. Fishery Products. FAO/Fishing News (Books) Ltd., 23, Rosemount Avenue, West Byfleet, Surrey, England.
2. D'mello, A.F. 1979. procds. of the 1979 School for First Line Supervisors engaged in Seafood Processing Richmond N.S.W. Australia.
3. Longeree Karla, 1980. Quantity food Sanitation. Wiley-Interscience A Division on John Wiley and Sons, Inc. N.York.
4. Cold Edith, (), Testing the Freshness of Frozen. Fishing News (Books) Ltd., London.
5. OECD, 1970. Packages and Packaging Material for Fish. organisation for Economic Co-op. and Development.
6. Fields Marion L. 1977. Laboratory Manual in Food Preservation. AVI Publishing Co. Inc. Westport.
7. D'mello A.F. 1981. procds. of the 1981 School for First Line Supervisors engaged in Sea food processing and Handling. Hawkesbury Agril, College, Australia.
8. Aitken A. and Mackie I.M. . Fish Handling and Processing; Her Majesty's Stationery Office, Edinburgh.
9. Stansby Maurice E. 1963. Industrial Fishery Technology, Reinhold Publication Corporation, London.
10. Amerine Maynard A. 1965. Principles of Sensory Evaluation of Food, Academic Press, New York.
11. Govindan T.K. 1985. Fish Processing Technology. Oxford and IBH Publishing Co., New Delhi.

ANNEXURE 3

LIST OF EQUIPMENT

LIST A - DEAD STOCK ITEMS

Sl.No.	Name	Quantity
1.	Dissection Box	20
2.	Compound Microscope with low and high power, 5 x and 10 x eyepieces	5
3.	Dissection Tray (Enamel) 10"x8"	24
4.	Dissection Board made of soft wood with lead sink, size 8"x5"	24
5.	Thermometers Mercury	
	o 0 to 50 C	12
	o 0 to 180 C	3
	o 0 to 250 C	3
6.	Alcohol Thermometer	
	o o -40 C to 50 C	2
7.	Maximum and Minimum Thermometer	1
8.	Reversing Thermometer	3
9.	Rain Gauge	1
10.	Anemometer	4
11.	Magnetic Compass for navigation	12
12.	Mercury Barometer	4
13.	Aneroid Barometer	4
14.	Secchi Disc with Marked Ropes	6
15.	Tide pole with marking	6
16.	Ekman Current Meter	3

17.	Depth rope	3
18.	Echo Sounder	3
19.	Magnifying Glass	6
20.	Plankton Collection net (bolting silk 200 no. mesh size)	1
21.	a. Fish Measuring Board 1/2m	3
	b. Fish Measuring Board 1m	3
22.	Spring Balances	
	a. Upto 5 kg.	2
	b. Upto 25 kg.	2
23.	Mono Pan Balance	
	a. Upto 1 kg.	1
	b. Upto 5 kg.	1
24.	Large Divider (Wooden)	2
25.	Divider (Metal)	4
26.	Refrigerator 165 Litres	1
27.	Incubator 45x45x45cm	1
28.	Spirit Lamps or Bunsun burners if gas facility exists	2
29.	Hydrometer	2
30.	Brinometer	1
31.	Hygrometer (Wet/Dry type)	1
32.	Vernier Callipers	2
33.	Litre measure plastic of 1 litre capacity	2
34.	Fish Washing Tanks (made of synthetic material of standard size having capacity of 1000 k.lit.	1
35.	Fish Dressing Tables Suitable for working for 4 students.	5
36.	Chopping Boards	12

37.	Knives 6" length	12
38.	Aluminium Trays about 15"x10"x1 1/2"	6
39.	Stainless Steel tray 2'x1'x4"	1
40.	Containers	
	a. Conventional type of different shapes and size	1 each
	b. Modern/Synthetic/Insulated viz made of Aluminium, Hardened Polythene and Poly Vinayl Chloride	1 each
41.	Buckets	
	a. Aluminium - Capacity 10 to 12 litres	2
	b. Perforated Aluminium - Capacity 10 to 12 Litre	1
	c. Plastic - Capacity 10 to 12 litre	2
42.	Sample of Fish Box used for Fish transport	1
43.	Racks for drying Fish	
	a. Flat racks	4
	b. Hanging racks	2
44.	Small size smoking kiln (To be made locally)	1
45.	Stainless steel vessels with lid of 1 litre capacity	4
46.	Can of different sizes S.R. lacquered and Aluminium	6
47.	Can Opener	2
48.	Scarf	1 Sample of each
49.	Apron	to be purchached
50.	Hand Gloves	for demonstration
51.	Gun Boots	
52.	Model of Backbone assembly of a fishing boat	1

53. Model showing framing and planking	1
54. Model showing the different structural members of a fishing boat	1
55. Model of Gillnet	1
56. Model of purse seine	1
57. Model of Longline	1
58. Model of Pole and line	1
59. Model of Cast net	1
60. Model of Seine net	1
61. Life Jackets	4
62. Life Buoy	2
63. Fire fighting appliances	
a. Soda ash type	1
b. Foam type	1
c. Dry chemical powder type	1
64. Set of Navigation lights	1 set
65. Operation model of a 4 stroke marine diesel engine	1
66. First aid kit	1 Box
67. Float made of different materials viz. Aluminium, Thermocole, PVC and HPDE	6 nos. of each type
68. Sinkers made of different materials viz. stones, Iron and Concrete	1 of each type
69. Anchors - Stockless and Stock	1 of each type
70. Model of Dugout	1
71. Model of Raft	1
72. Model of Built up canoe	1
73. Model of tuna fishing boat	1

- | | |
|--|--------|
| 74. Different types of Hooks | 1 each |
| 75. Lakshadweep Admiralty Chart | 1 |
| 76. 36' Fishing Vessel for imparting training on board | 3 |

Note: The Boats may be hired or may be purchased.

TEACHING AIDS

- | | |
|--|---|
| 1. Overhead projector for projection of Transperencies | 2 |
| 2. Slide Projector | 1 |
| 3. VCP with monitor | 1 |

LIST OF TOOLS FOR A SMALL WORKSHOP NEEDED
FOR MAINTENANCE OF ENGINE AND BOAT

1. Spanner Sets	1 set of each type
2. Variable size spanner upto 25 mm	3
3. Screw driver set	2 sets of different types (having variable lengths and tips)
4. Pipe Wrench upto 1 1/2" capacity	2
5. Pliers, Flat nose, long nose and cutting of different sizes	1 each
6. Ball pen Hammers with handle 1/2 kg. and 1 kg.	2 each
7. Steel Foot rule upto 30 cm	2
8. Outside and inside callipers	1 each
9. Tri-square	2
10. Tap and Die-set	1 box
11. Fitters Vice	1
12. Carpenter's Vice	1
13. Pipe Vice	1
14. Electrically operated small hand drilling machine upto 12 mm capacity with drill bits	1
15. Small electrically operated hand grinder	1
16. A Wooden Box containing carpentry tools consisting of 1/4", 1/2" and 1" Chisels, a medium size planer, tenon saw, small rip saw, marking gauge, hand drilling machine, carpenter's, screw driver and a mallet	6 sets
17. 12" Hack saw frames with blades	2
18. 12" Rough and Smooth Flat tiles	3 each

LIST B

GLASSWARES

1. Microscope Slides 75mm x 25mm	12 Boxes
2. Cover Slips	1 Dozen packet of each
3. Graduated Measuring Cylinders, 10 ml. and 50 ml.	6 each
4. Graduated Measuring Cylinders, 100 ml.	12
5. Watch Glass 2 1/2"	2 Gross
6. Petri Disk sets 100 x 17 mm	4 dozen sets
7. Wash Bottles (Plastic with tube) 1/2 litre capacity	12
8. Pipettes with teat	24
9. Pipettes graduated 1 ml. (Graduations 0.1 ml.)	24
10. Pipettes graduated 10 ml. (Graduations 0.1 ml.)	3
11. Museum jars with bakelite screw cap of assorted size and rectangular in shape	60
12. Museum jars (Cylindrical) with glass lids 18"	3
13. Museum jars (Cylindrical) with glass lids 24"	3
14. Specimen Tubes assorted size	1 Gross
15. Test Tubes 15 x 150 mm.	1 Gross
16. Glass Mortar and Pestle 10 cm. dia	2
17. Volumetric Flask 50 ml. and 100 ml.	2 each
18. Beakers 100 ml.	12
19. Conical flask 100 ml.	6
20. Dropping bottles 100 ml.	6
21. Glass Funnel	6
22. Reagent bottles	24

23. Platinum wire with holder	3
24. Test Tube Stands	6
25. Glass rods	15

LIST C

CONSUMABLE ITEMS

1. Cotton Absorbant	1 kg.
2. Cotton Non-absorbant	1 kg.
3. Estimation paper for estimation of available Chloride	12
4. Camel art brushes of small size	12
5. Commercial Formalin (5 litres pack)	5 packs
6. Potassium Hydroxide Pellets	1 packets
7. Xylol 500 ml.	1 bottle
8. pH Indicator Paper	12 dozen packets
9. Crystal Violet	25 gm.
10. Safranin	25 gm.
11. Iodine	100 gm.
12. Ethyal Alcohol	1500 ml.
13. Cedar Wood Oil	100 ml.
14. Dehydrated HI Media for total plate count	500 gm.
15. Sodium Hypochlorite	1000 ml.
16. Detergents	15
17. Disinfectants	15
18. Commercial Salt	15
19. Refined Salt	15
20. Plastic bags of assorted size	1 gross
21. Parts of Tuna long line gear for assembly	10 sets
22. Parts of Troll line gear for assembly	10 sets

- | | |
|---|----------------------|
| 23. Twines - Nylon, HDPE, PP, PES Twisted and Braided twines | Samples of each type |
| 24. Ropes made with 'S' Twist and 'Z' Twist | Samples of each Type |
| 25. Mesh Gauge, Iron Needle and Surgical Scissors and knife for net repair practice | 6 sets |
| 26. Cotton twines - 20/3/3 for making webbing | 1S |
| 27. Nylon Webbing - 210/3/3 mesh size 50 mm for making gillnets | 1S |
| 28. HDPE Webbing - 1.5 mm twine, mesh size 50 mm. for practice | 1S |
| 29. Ropes - Sisal 6 mm dia for practice | 1S |
| 30. HDPE - 3mm twine for practice of net repairs | 1S |
| 31. Diesel Oil and Lubricants | 1S |

ANNEXURE 4

LIST OF CHARTS

A. FISHING TECHNOLOGY

1. Chart showing international code of signals. (Sample enclosed).
2. Chart showing Navigation lights and local channel markings.
3. Chart of 'S' twist and 'Z' twist.
4. Chart of different type of knots VIZ clove hitch, rolling hitch, sheet bends and reef knot.
5. Chart of different types of Hooks.
6. Chart showing Terminology of a fishing boat.
7. Chart showing Parts of a gill net.
8. Chart showing Parts of a purse seine.
9. Chart showing Parts of a long line.
10. Chart showing parts of a pole and line.
11. Chart showing deck lay out of a tuna fishing boat.

B. POST HARVEST TECHNOLOGY

1. Chart showing the effect of cooling on the keeping quality of cod.
2. Chart showing different types of containers for fish handling.
3. Chart showing effect on temperature of position in load.
4. Chart showing misuse of refrigerated slab.
5. Chart showing ideal placement of fish on ice.
6. Chart showing Morphological forms of bacteria.

7. Chart showing the various steps to be taken before starting processing of fish.
8. Chart showing the different operation for closing the can.
9. Chart showing different type of kilns for smoking.

C. FISHERY BIOLOGY

1. Chart showing all Tunas of Indian Ocean.
2. Chart showing important representative fish of each group of commercially important fishes.
3. Chart showing 10 important bait fishes.
4. Chart showing (i) Alimentary canal, (ii) Other body organisation, of one perch and one shark.
5. Chart showing life cycle of one penaeid prawn or lobster.
6. Chart showing Plankton 10 Phyto and 10 Zoo plankton available in Lakshadweep water.
7. Chart showing sea weed 5 important commercial species.

D. FISHERY OCEANOGRAPHY

1. Chart showing the major oceans and seas of world.
2. Chart showing the Arabian sea and Lakshadweep.
3. Chart showing the earth's surface divided into distinct geographical domains.
4. Chart showing the estimate of fish productivity by major ocean provinces.
5. Chart showing the cloud pattern over the Northern Hemisphere.
6. Chart showing the rate of carbondioxide increase in the atmosphere.
7. Chart showing the structure of earth and size of earth.
8. Chart showing motion of the earth.

9. Chart showing rotation of the earth moon system around sun.
10. Chart showing hydrological cycle.
11. Chart showing different types of Thermometers including a reversing Thermometer and scale comparison.
12. Chart showing different types of Barometers and scale comparison.
13. Charts of wind instruments.
14. Wind direction chart.
15. Wind rose diagram.
16. Psychrometer Chart.
17. Chart of pH meter.
18. Chart showing important Marine Zones.
19. Chart showing the vertical distribution of salinity.
20. Chart showing the relation between temperature and salinity.
21. Chart of Sacchi disc/photoreceptor.
22. Chart of fish eye view.
23. Chart of Dissolved oxygen of Lakshadweep islands.
24. Chart showing major elements in sea water.
25. Chart of important nutrients.
26. Chart showing how the tides and waves are generated.
27. Chart showing different types of tides and waves.
28. Chart showing tide pole/tide gauge.
29. Chart showing a wave radar bouy.
30. Chart showing different instruments used for current measurement:
 - Viz.: a. Float
 - b. Drift bottles
 - c. Sea Bed Drifters
 - d. Ekman type mechanical current meter
 - e. Electrical sensing current meter

31. Chart showing different types of currents.
32. Chart showing major cause for upwelling.
33. Chart showing major areas of upwelling in the Arabian sea.
34. Chart showing the mode of circulation and distribution of current patterns in the Arabian sea with special reference to Lakshadweep.
35. Chart explaining the effect of currents on fishery.
36. Chart explaining the effect of tides on fishery and fishing operations.
37. Chart explaining the effect of waves on fishing operations.

Note: 1. Although photocopies of most of the charts have been given as Teaching Aid, still Department of Education is advised to contact the Director, Central Institute of Fisheries Education, Bombay for further clarification and guidance if necessary.

2. On the basis of Teaching Aid provided, the concerned teacher is advised to get the charts improved by colourful drawing on larger scale. Such charts can be displayed on laboratory walls.

ANNEXURE 5

LIST OF PERSONS CONSULTED

MEMBER OF REVIEW COMMITTEE

1. Dr. V.N. Vashist,
Managing Director
Ed.CIL,
New Delhi.
2. Prof. Y. Sreekrishna,
Director,
Central Institute of Fisheries Education,
Bombay.
3. Mr. A.G. Kalawar,
Ex-Director, Fisheries,
Govt. of Maharashtra,
Bombay.
4. Prof. K.K. Ghosh,
Scientist S3,
C.I.F.E.,
Bombay.
5. Dr. M.D. Zingde,
Scientist Incharge,
National Institute of Oceanography,
Bombay.
6. Prof. Raju,
Regional College of Education,
Mysore.
7. Mr. M.P. Bansal,
Director of Education,
Lakshadweep Islands.
8. Mr. B.L. Mathur,
Consultant,
Ed.CIL,
New Delhi.

EXPERT OF SUBJECT AREA

A. FISHING TECHNOLOGY

1. Mrs. Lata Shenoy,
Scientist S1,
C.I.F.E.,
Bombay.
2. Mr. Hari Das,
Technical Assistant,
C.I.F.E.,
Bombay.

B. POST HARVEST TECHNOLOGY

1. Dr. D.R. Rao,
Scientist S3,
C.I.F.E.,
Bombay.
2. Miss U.V. Gadre,
Demonstrator,
C.I.F.E.,
Bombay.
3. Mr. Ram Chandran,
Retired Technical Assistant,
C.I.F.E.,
Bombay.

C. FISHERIES BIOLOGY

1. Dr. M. Devaraj,
Scientist S3,
C.I.F.E.,
Bombay.
2. Mr. P. Acharaya,
Scientist S1,
C.I.F.E.,
Bombay.
3. Mr. D. Gulati,
Technical Assistant,
C.I.F.E.,
Bombay.

D. COOPERATION, SOCIO-ECONOMICS AND MARKETING

1. Mr. P.V.S. Rao,
Scientist S2,
C.I.F.E.,
Bombay.
2. Mrs. R. Tiwari,
Scientist S2,
C.I.F.E.,
Bombay.

E. FISHERY OCEANOGRAPHY

1. Dr. Govindan,
Scientist,
National Institute of Oceanography,
Bombay.

F. SECRETARIAL ASSISTANCE

1. Mr. Rangan,
Senior Administrator,
C.I.F.E.,
Bombay.
2. Mrs. Shembekar,
Librarian,
C.I.F.E.,
Bombay.

Sub. National Systems Unit,
National Institute of Educational
Planning and Administration
17 B Sri Aurobindo Marg New Delhi-110016
DOC. No.
Date.....

NIEPA DC



D04469