

FISHERIES EDUCATION AND TRAINING IN
GROWTH AND DEVELOPMENT PROGRAMS*

by

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ABSTRACT

Shortage of trained personnel to meet requirements of fisheries work constitutes a major deterrent to fishery development. The paper reviews various disciplines and skills required for fishery development including Government personnel, research workers, and personnel for fish production, processing and marketing. The paper further reviews various problems to be encountered and considerations to be given in determining training requirements both quantitative and qualitative, in relation to stages of development of countries. Possible programs for fishery education and training are discussed in relation to general education programs of countries with due regard to problems of administration and co-ordination.

EDUCATION AND TRAINING IN FISHERIES

It is often stated that fundamental improvement of fisheries and of life in fishing villages cannot be achieved unless there is an adequate development of fisheries research, extension and education. Shortage of trained personnel may be as great a deterrent to developments as is the absence of capital equipment and market. Only trained and experienced personnel can work out viable plans, without which no capital can be attracted either from private or public sources at home or abroad. At the same time, "educating and training personnel at different levels, for different purposes and in all the subject-matter

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areas of food and agriculture, according to the needs, resources, conditions and development plans of every country is a prerequisite for successful implementation of such plans".1/

The problems encountered in providing suitable and adequate education are general and universal ones, common to all industries and all countries. Education problems in fisheries cannot be dealt with in isolation. However, the peculiarities of fisheries to a great extent influence the way in which the situation is resolved.

The main features of fisheries are: firstly, as regards all ocean fisheries and most inland fisheries, it is primarily a hunting activity. The resources are invisible and mobile, and both these characteristics render management difficult or, in some cases, impossible. Owing to the absence of private ownership, the resources are open to anyone. This is a problem already on a national level, but it is accentuated by the fact that many resources are to be found in international waters. Secondly, as in agriculture, climatic, meteorological and biological conditions give rise to large fluctuations which could have catastrophic results. Attempts to resolve fluctuations should be made according to fisheries conditions prevailing in the country or the area concerned.

Thirdly, fishery products are perishable, perhaps more so than agricultural products, and demand different processing methods, resulting in different commodity forms, and they often have a more irregular marketing pattern.

Agriculture and fisheries are often closely connected insofar as a number of persons are employed in both industries. But it is also found, in a great many cases, that the fishing villages are remotely located and that such "fishing communities have a tendency to isolate themselves from the general economic and social life of a country. The social characteristic of a seafaring life, the special skills required for the capture of different stocks, and the uncertainties of trading in unpredictable quantities of a perishable commodity have limited fishing experience to a small part of society. For this reason, these communities, in common with others concerned with minor industries, have denied themselves the technical, economic and social advantages of communion with other sectors of society"2/. More on this later.

In many countries where it has been attempted, a close analysis of the structure of fisheries has revealed deficiencies in the existing manpower complements. This is often true for industrialized as well as newly developing countries.

1/ FAO Study of Agricultural Education Research and Extension in Latin America. (Not yet published)

2/ FAO, FAO Fish. Bull., 6(5): 181, Rome, Italy, 1953.

Industrialized countries are making greater progress, but compared with other industrial activities, fisheries lag behind. Competitive levels of income are difficult to retain and fisheries run the risk of losing qualified personnel at a time when a steady inflow of people with specialist knowledge is required. Many of fishery regions have the advantage of nearness to the resources, but often they are far from the industrial centres where the most prosperous consumers' markets are found. Thus, in many of the countries where the national income is high, pockets of underdeveloped fisheries regions are not uncommon. In some cases the problems may be described as an economic dualism which is, to some extent, connected with the class of interest between the coastal fisheries and those which are carried out in more distant waters.

No easy remedy can be described, but the situation calls for a considerable research effort not only with respect to technology, but also in social sciences.

In many developing countries, e.g. in Africa, the situation has been aggravated by the exodus of many well-qualified expatriate fisheries officers; nevertheless, most countries have managed to formulate, in general terms, their goals in fisheries development work and have, in some cases, worked out development programs. However, as these plans are being implemented, it becomes clear that there is a shortage - indeed, in many cases a complete absence of qualified people to carry them out. Large-scale recruitment of foreign personnel is sometimes attempted, but people of an acceptable professional standing are not easily available. It is also said that their stay in the country is not long enough for them to become conversant with local conditions. Local personnel, on the other hand, even though their general educational background is good, are often quite new to fisheries and unfamiliar with their problems. Generally speaking, the traditional pattern and size of fisheries administration is often found to be inappropriate for rapid development. In many cases, it is merely a branch of agricultural administration where the peculiarities of fisheries have not been taken sufficiently into account. As a result of these deficiencies wastage is greater and costs higher than they need be. The fisheries administration of many countries, in fact, face a manpower crisis and action on a broad front is required. Other developing countries, e.g. Asia and South America, may be somewhat better off with respect to fisheries personnel. But almost all of them are faced with a population pressure and a corresponding need for expansion of their fisheries beyond the present level of activity and output. All fisheries countries, without exception, need the expansion and rationalization in their fisheries which only a well-balanced education and training can provide.

There is a general agreement that "possession of greater skills by certain operatives and the availability of greater numbers of operatives at certain key points would reduce losses, increase production and

reduce unit cost"^{3/}. However, it must be borne in mind that the technical background against which such skills and numbers are measured, changes rapidly. One technical revolution succeeds another.

Some conclusions are to be drawn from this. Firstly, both the industrialized and the developing countries find themselves faced with a gap between traditional and modern fisheries and this gap is widening year by year. Secondly, many countries have come to realize that resources which are fairly close to their shores are being exploited by other nations whose fishing fleets are more efficient and modern than their own. Both factors point to the need for a rapid and well-balanced development of their own fisheries. Fisheries cannot develop in isolation and a harmonious relationship between fisheries and the general social and economic environment must be secured. Fisheries development must also be based on specific programs designed for this purpose. This study is concerned with ways and means of defining, acquiring and furnishing specific skills and aptitudes required for such programs. As the pace at which fisheries can be developed depends to a large extent on the competence and numerical adequacy of the manpower available to the industry, fisheries education and training becomes an urgent matter.

The above conclusions have a universal application both in the developed and developing countries. There is, however, another principal requirement which must also be emphasized, as it was done by the Committee on Fisheries Education (India) (see footnote 3/). "These developments require that a more practical outlook towards the problems of the industry should be maintained by all categories of personnel in the prosecution of their duties and in particular by those who are responsible for imparting training. There must be a shift from an academic training to training with a strong applied bias intended for the solution of practical problems in fisheries". Administrative and commercial acumen are also essential prerequisites for success with fisheries development programs.

It could hardly be overemphasized that education must be considered as purposefully as any other form of investment. Education may indeed be regarded as the "missing component" of fisheries development.

In newly developing countries there is a general lack of qualified personnel. They realize the importance of education, but because it is both costly and time-consuming, they are compelled to confine their training to the barest essentials. It is not a question of numbers, but also of the ability of the trainees available. Such a situation calls for a thorough educational plan. Some countries better equipped financially and with more personnel did not really devote much time to research, education or extension until fairly recently. As a result, they found themselves surpassed by competitors more alert to the situation.

^{3/} GOVERNMENT OF INDIA. Report of the Committee on Fisheries Education. New Delhi, 1959.

SKILLS AND APTITUDES

An attempt is made here to identify, classify and assess the types of skills and aptitudes in various fields of fisheries work and at different levels.

Modern development in fisheries as in all other economic activities has been achieved with a high degree of specialization and division of labour. A number of industrial achievements in other fields have been used in fisheries and adjusted to its peculiar situation. In this way electronic fish finders, highly improved engines, man-made fibres, freezing techniques, etc. were introduced. Conversely, improvements in fisheries inspired development in other fields and confirmed the fact that fisheries was in many respects an inseparable part of the general level of development in a country.

It is assumed that this process of modernization is a perpetual one to which there is no beginning and no end. The fisheries must always be alert to changes. In many countries the administrative structure has been outdated and they do not provide for specialized knowledge. True there is still need for the general administrator, but he must be supported by a specialized staff. This holds true for all countries, but it carries the greatest significance for those who want to develop their fisheries rapidly.

Manpower requirements in fisheries development depend on the characteristics of the industry concerned, on the countries' social and economic development, their patterns of production, trade and consumption, and many other factors.

It is also important to recognize in this connection the differences which exist with respect to political structures. Some countries may emphasize the public sector, i.e. that fisheries development is mainly a government concern. In these cases, developments planning will be connected closely to the overall plans for the economy. Centralized planning is therefore quite common, and the planning centres may be able to have a fairly large number of specialists attached to their offices. Other countries may look upon Government activities mainly as supporters of private enterprise where most of the planning is being done. In this case, the Government may help to co-ordinate various activities and render general services. Education may still be arranged by the Government, but for employment in private industries.

It follows from the differences indicated above that no hard and fast rules can be drawn up with regard to manpower requirements. Yet, many countries may benefit from the experience and considerations of others regarding the categories of personnel required in fisheries development work. The following pages will describe in some detail job descriptions for some fields of fisheries workers and also indicate the schedule

of posts necessary for people at various professional levels. Employment may be arranged in government administration, research institutes or private firms. If, however, the professional knowledge requirement and the work potential is considered regardless of place of employment, the following broad distinctions 4/ may be made:

1. Senior research and education personnel.
2. Administrative and development personnel.
3. Fishery engineers and technicians.
4. Fishing personnel.
5. Specialists in marketing techniques and administration.
6. Fishery economists and statisticians.

Senior fishery research and education personnel

In 1953, FAO Fisheries Division pointed out that "the direction and level of contemporary research has always been of special economic importance to fisheries because of the limitations imposed by fluctuations in the resource and the perishability of the catches"5/.

Fisheries science, unlike that of agriculture, is a fairly new concept. It includes both natural, physical and social sciences, such as zoology, physics, chemistry, economics, geography, etc., and would, in fact, be impossible without this foundation. For this reason, governments concerned, when considering manpower requirements, would have to bear in mind the general scientific climate of the country.

Fisheries scientists would mainly be concerned with the scientific approach to the whole range of fisheries problems. As each individual research worker, however, could not be expected to possess all the knowledge and experience required, fisheries research should, to a great extent, be organized as teamwork. However, it would be a general requirement that the scientist working on resource problems should have a fair knowledge not only of the working of the fisheries but also of the very special technique which has been developed in fisheries research work.

When initiating and building up a research staff, a fairly general level should be adopted. This will ascertain a reasonable balance in the approach within the framework set by the fisheries budget. Too often the approach has been "academic". Through a realistic education of young scientists much can be done to counteract this trend.

4/ GOVERNMENT OF INDIA, Ministry of Food and Agriculture. Report of the Committee on Fisheries Education, New Delhi, 1959.

5/ FAO Fish. Bull., 6(5): 185, FAO Rome, 1953.

From this point of view it would be advantageous if properly organized and staffed fisheries research institutes could take an active part in the education program of the country. For this purpose a good knowledge of pedagogical and didactic methods is required over and above scientific experience. Also it is important to stress that not only universities, but also other autonomous research bodies should, as has been pointed out in a Unesco publication "identify themselves with the societies they serve and actively contribute to the solution of their problems, immediate as well as long-term"^{6/}. In the long run, maximum utility from research will be achieved only if scientific analysis is permitted to operate freely on a sustained basis. The importance of this is the necessity of having a sufficient number of scientists and of granting them the right status, but it does not exclude the use of research institutes for training purposes. To many scientists, teaching may very well prove to be a source of inspiration and a useful means of establishing and retaining a much needed contact with the realities of the fishing industry. This is particularly true where the industry is changing rapidly. It may even be suggested that research institutes, whether they are organized as separate units or as part of a university, should contribute in the education not only of scientists but also of people who are to devote most or all of their time to teaching.

One conclusion from the foregoing is that many countries at various stages of development would benefit greatly from a better co-ordination of its teaching and research units. Problems will undoubtedly arise, but as will be explained later, they are mainly of an organizational nature and could be overcome. The main point to be stressed in this connection is the need to define realistic skills and aptitudes among scientists to man the expanding research institute of fisheries countries.

Senior teaching personnel will often receive their final education in research institutes, but they are also expected to have a university degree. It should be stressed, however, that the knowledge and the approach required is more important than the degree. And the teacher should at all times in his professional life have the acumen and the opportunity of keeping abreast of development. His teaching should be up to date and he should be able to assess new problems as they arise.

Administrative and development personnel

The professional head of fisheries administration - often known as the Director of Fisheries - may, in the opinion of the writer, be recruited from any professional field in fisheries. He should be a very

^{6/} UNESCO Conference on the development of higher education in Africa, held at Tananarive, 1962.

able administrator with a mature judgement. As his main task will be that of co-ordinating and interpreting the work of professional teams, he should have a wide, although not necessarily detailed, knowledge of the working of the industry and a deep understanding of the problems which may arise out of regional peculiarities. Often he may have to act as an arbitrator and settle disputes between groups of conflicting interests.

He should be able to initiate and formulate specific projects in various fields of fisheries, draft necessary legislation, implement, in professional terms, decisions made on a political level, and laws and regulations pertaining to fisheries matters. In this way, he will act as a liaison between the political head of the ministry concerned with fisheries and the professionals in research, administration and development work. This is bilateral. Politicians should give directions but also take advice, for policies should not be out of date. The Director of Fisheries is, or could be, the kingpin of the system, as he should have both courage and vision, boldness and candour. He should also recognize research developments and be flexible enough to adjust to them.

In private firms special managerial skills would be requested. The manager should have a flair for business opportunities and possess and execute entrepreneurial skill with constructive imagination. But he, too, should possess a considerable knowledge of the industry so that his firm may adjust itself to its peculiar structure and operational pattern.

Opinions vary greatly with respect to the role which private enterprise should play as compared with public sector in fisheries. This is basically a political question. In most countries, however, there is more weight now on public sector as compared with the situation say 15 or 20 years ago. Governments are beginning to play an increasing important role in fisheries development. As a consequence of this and of the general improvement of planning, the administrator should be well versed in business economics in general.

The necessity for economy in all phases of fisheries development is almost universal. This narrows the borderline between a civil servant and a business manager. In both cases, a deep understanding of economics has become essential and fisheries countries all over the world are about to recognize its significance. Admittedly, recognition of economics in the fisheries industry came late in many cases and may be over emphasized at the expense of other and equally important aspects of fisheries. It is, therefore, important to stress that a dynamic approach to fisheries administration is needed. With such an approach the various factors of growth and development should be studied simultaneously.

This was stressed by FAO in 1953 7/. "One of the main difficulties is that of developing an integrated fisheries policy which will ensure that improvement and reform proceed uniformly in all sections with the direct participation of the fishing population...".

The second in command. The designation given to this officer is not always a logical one. In some countries he may be called "Deputy Director of Fisheries", in others "Senior Fishery Officer", or sometimes simply "Fishery Officer".

At headquarters, he may be in charge of a sector of administrative work or, as a district officer act - to quote the Report of the Committee of Fisheries Education (in India) (page 92) - "as the Senior Governmental Officer with responsibility for the administration of governmental services of the fishery industries of his district, for keeping his government fully informed of the status of the industry along with their need for, and possibilities of, development, and with a special responsibility for the implementation of developmental programmes". His administrative duties would include the collection (through his assistants) of statistical and general information concerning the industries; functions relating to financial assistance, general regulator functions ... His developmental responsibilities would also include the management of extension services and of schemes for the distribution of new equipment and supplies.

In order to discharge the foregoing duties, the District Fishery Officer would have to be well acquainted with the natural resources being exploited and with the natural setting of the industry. He would have to know the technical character of its capital equipment, i.e. craft and gear, fish-farming units, and processing and transport equipment. He would also need to know the kinds of skill possessed by the manpower of the industry, the commercial and social structure of the industry, and be au courant with governmental programs and administrative techniques by which they are implemented. In particular, he should know the contribution that research work could make to fisheries management and development.

The fishery field officer is, in many respects, a key person in the establishment. The practical aspects of his education, besides an academic education, are very important. He should have not only the knowledge but also the ability to demonstrate.

In fisheries administration - apart from technicians and assistants - there are two kinds of work requiring different types of education and training:

7/ FAO Fish. Bull., 6(5): 187, FAO Rome, 1953.

1. Assistant fisheries officers, also known as Assistant fisheries development officers. These officers require what will be called a certificate type of education.
2. Fisheries Officers, also known as Fisheries Development Officers or Fish Rangers. These officers require what will be called a diploma of education. They carry great responsibility and must be able to do independent administrative work, to draft plans and programs and to supervise the work of others.

Assistant fisheries officers occupy a more subordinate position. With considerable responsibility, he will be the practical field worker who, aided by fishery assistants, will carry out the real extension work. Based on his contact with the industry, he will draft specific development projects for his immediate superior. Often, he will have to collect statistics on routine forms supplied by the Office of Fishery Statistics. When a fisheries census is arranged, he will act as an enumerator. In many cases, he will have the responsibility of passing judgement in connection with credit and financial support schemes for the industry. He will also help fishermen in applying for financial assistance. He may not be able to give advice on complicated technical problems but, in such cases, he will act as a useful liaison with technical experts of the fisheries service.

The success of any extension service largely depends on contact made with the workers. The assistant fisheries officer must, therefore, first and foremost, be able to make contact with people.

In practically all fisheries countries one of the weaknesses of fisheries development work has been the inadequacy of the extension service. Research is a necessary prerequisite to extension, for without it there are no findings which can be extended to the personnel of the industry. Any longterm improvement of extension services must therefore start with making research more efficient and realistic. However, in several fields, pertaining both to inland and sea fisheries, considerable advances have been in research laboratories, but their results seldom reach the fishermen or the fish farmers expeditiously. Thus, in many countries there is hardly any arrangement for instructing the fish farmer about the suitability of a pond for fish culture, sources of fish fry, species to be stocked, density of stocking, artificial feeding, if necessary, eradication of predators, pests and excessive vegetation, and other problems that arise from day to day. Similarly, in sea fisheries sufficient contact has not yet been established between the natural scientist and the fisherman, who is to exploit the resource. The entire technique of mechanized fishing involving new boats or engines for existing boats, new fishing gear and modern fishing methods, is another field of extension work in sea fishing. Fishermen in marine fisheries also need instruction in improved methods of handling, transport, preservation, processing and marketing of fish, utilization of seaweed and sea shells, etc.

Unfortunately, the extension worker in many developing countries will have to base his activities on experience gained in other countries. This may lead not only to misunderstandings but also to serious mistakes if the field officer is not fully aware of the pitfalls. As soon as possible, therefore, "imported" experience should be checked by local research.

Finally, there is often a shortage of senior clerical personnel, such as book-keepers, secretaries, stenographers and business machine operators. In an affluent society, one may sometimes count on the supply of such personnel as a matter of course. So many schools and training institutions are available and so many candidates are available each year and there may at least be a surplus from which the fisheries may benefit. It is a recent trend, however, that developed fisheries countries recognize the need for specialized education in these fields as well. In developing countries, where educational resources are scarce, there is probably no way beyond the establishment of a specialization from a fairly early age.

Fishery engineers and technicians

Personnel required for work on the shore at mechanized fishing centres and at larger assembling centres of inland fisheries are of various kinds. This category includes skilled labour and technicians for shore installations, cold storage, ice factories, processing plants, packaging and transport.

It is increasingly realized that persons with basic training in engineering and with special knowledge of particular fields of engineering related to fisheries activities are essential for the successful prosecution of some of the fishery programs. Shortage both of these and of skilled craftsmen of all kinds often exist, particularly in developing countries. Nine special fields of technical experience, which have a particular application in fisheries work, are listed below:

(a) Master mechanics

Fisheries development centres at which mechanization of fishing equipment will take place require proper workshop facilities for the installation and maintenance of engines. Each workshop needs a number of mechanics. At least one trained foreman or master mechanic is needed in each workshop. Many countries have had slow progress in mechanization of fishing boats on account of the inadequacy or lack of facilities for the proper maintenance of, and repairs to, diesel engines. The setting up of suitable equipped workshops under properly trained mechanics is necessary for accelerating the rate of mechanization. This is also essential to obtain long and economical service from the engines.

(b) Food processing technicians

Fish processing by the use of machinery is in its infancy in many developing countries, but rapid expansion is expected. Also, traditional processing methods are often in need of improvements and modernization. It is likely that persons required for fish processing industries will not be readily available in the open market. There is a need for a considerable number of persons trained in the chemistry and technique of processing fish and fisheries product. It is possible to differentiate between the higher category of technological work relating to fish processing industry as against a large number of technicians required for fish-curing yards, freezing plants, canneries, and other fish processing establishments. Industrial establishments would no doubt emphasize the need for providing trained personnel who would act as foremen in fish processing factories and who would be supervising the work of skilled and semi-skilled labour employed in the handling and processing of fish and fisheries products.

(c) Fish culture specialist

This type of specialist is often known as a fish culturist. He is primarily a naturalist with a background in characteristics of inland waters. He must be able to assess the ecology of fish physiology of the species concerned, their feeding problems and the most appropriate way of dealing with predators. The fish culturist should also have practical knowledge of collection and transportation of fish seed, artificial raising of fish seed, maintenance and stocking of nurseries, stocking of tanks and related skills.

(d) Fish farm engineers

Much could be achieved by improved methods in the design, construction and maintenance of fish ponds. This is particularly so if full use is to be made of available area and water supply. Fish pond engineering has also become important in connection with soil conservation problems. In the marine field also engineering problems impinge on questions of reclamation of coastal fallow waters for conversion into marine or brackish water fish farms. Persons required for this kind of work are essentially civil engineers who have had opportunities of specialization either by in-service training or by specialized study in this field after obtaining an engineering degree.

(e) Reservoir engineers

Fishery management in the waters of multipurpose river-valley projects is connected with engineering problems of a very different type. An example of these problems is the regulation of inflow and outflow, maintenance of water level, prevention of overflow of stocked areas, etc.

There is the special problem of migratory fish stocks, the maintenance of which, for regular fisheries, may depend on the provision of fish ladders, fish passes or other specially designed fish ways. For this also persons with basic engineering qualifications, but with special training or experience in this kind of work, would be required. A problem which has recently come to the fore in the development of fisheries of larger man-made lakes is the obstruction caused by boulders and large trees which have to be removed before the reservoirs are initially filled.

(f) Marine engineers

Engineers for large fishing vessels require very special training in the theory and working of internal combustion engines. The fishing industry of the world is at present largely based on diesel power and it is well known that qualified persons with sufficient experience in the operation of diesel engines for larger vessels are in short supply in most countries.

Apart from marine engineers with a high degree of competence in the operation and maintenance of marine diesel engines, there is need for a very large number of engine drivers, who, although not specialists in marine engines or sufficiently well-versed in theory, should have practical training in the handling of engines on the small and medium-sized fishing vessels.

(g) Naval architects and boat builders

Improvements in marine fishing techniques are closely connected with improved designs of boats. An increase in boat-building activities should be expected on a considerable scale, and, in consequence, boat-building engineers or naval architects. Such persons should be qualified naval architects or have engineering qualifications and practical experience in boat designing and building. They will design new types of boats, improve existing designs, supervise boat-building yards and organize the training of foremen referred to below.

Apart from naval architects, a certain number of persons skilled in the actual construction of boats is needed. These persons - boat-builders - would conform roughly to the category of foremen and their assistants in the boat-building yards. They could be selected from existing craftsmen, but in this case it is desirable, and in the case of the foremen it is necessary, that they be given organized and specialized training in their particular profession.

(h) Refrigeration engineers

Large scale expansion in fishing and the attendant increase in the secondary and tertiary phases of the fisheries industries would place

heavy demands on skilled persons, familiar with installation, operation and maintenance of ice and cold storage machinery and refrigerated transportation. There are again specialized engineering skills to be acquired by persons with basic training in electrical engineering.

(i) Electronics engineers and technicians

Electronic equipment has become important both in fish finding and in navigation and may be used on mechanized fishing boats of almost any size. Experts both for the further development and refinement of these gadgets and for their maintenance must necessarily be provided for in any modern fisheries development plan.

Fishing boat personnel

The skills and aptitudes required on a fishing boat depend not only on the waters fished but also on the size of the boats and their equipment. Generally speaking, on small boats each man has a wide range of functions, while the bigger ones afford a more specialized staffing pattern. Fishing personnel in larger enterprises include, boatswains, coxswains, mates, skippers, masterfishermen, gear technicians, machinists, electricians and deckhand fishermen, who are trained for mechanized fishing.

Considering the risks and uncertainties connected with fisheries, one would think that a detailed knowledge of weather conditions, the productivity of the waters fished, the characteristics of the species would be essential knowledge for the fishermen. On this point, however, there is a wide range of opinion, for even in highly industrialized countries, the fact remains that the ordinary fisherman cannot be expected to penetrate sufficiently deeply into these matters. He must usually abide by forecasts prepared by scientists, and his intuition and the inherited sense of how resources behave, which is so common in fishermen's communities.

If, on the other hand, all this knowledge is to be learned from scratch, it would take many years of schooling and training. Environmental, tribal and other heritage and up-bringing are no doubt decisive factors. It has been shown over and over again what sea-faring traditions and skill really mean. The problem is that these factors are difficult to define. In most cases they are only spelt out with respect to navigation, etc., and not to fishing.

On big trawlers in distant water fisheries the skipper may be in charge of a crew of 50 and more and a considerable amount of managerial skill is required. In other respects also his job is very demanding. Not only must he be a navigator, often in seas which are far from the regular waterways of the world, but he should also be an expert on the techniques of fishing and fish handling and processing.

An example of skills required in navigation is found in Nigeria's Merchant Shipping Act 1962 8/.

A list of subjects is quoted below on which satisfactory answers to questions must be given in oral examinations for coxswains:

- To be able to use an admiralty chart or plan and to have a sound knowledge of bottom, navigation lights and marks, etc.
- The marking and use of the lead line.
- How to improvise and use a sea anchor.
- Fire-fighting on board ship.
- Lifesaving appliances and fire appliances required to be carried in fishing boats of up to 70 feet in length; care and maintenance of lifeboats and their equipment, buoyant apparatus, lifebuoys and life-jackets.
- Man overboard and necessary action.
- Management of lifeboat in heavy weather and in surf.
- A good knowledge of the collision regulations.
- Signals of distress.
- The uniform system of buoyage.
- The single flag meanings of the International Code of Signals.
- Any other questions relating to the duties of a coxswain of a fishing boat which the examiner may think necessary.

Specialists in marketing techniques and administration

In many countries marketing arrangements require a great deal of improvement. The difference between the price paid to the fisherman and that which the consumer pays is often considered unduly large. In some cases, there are several stages of "middlemen" operating in the marketing chain and this has an adverse effect on the interests of both the producer and the consumer. Supplies of fish are not only uneven in different parts of the year, but there are areas of glut side by side

8/ NIGERIA. Merchant shipping (Examination for certificate of competency fishing) Regulations, which entered into force in January 1965.

with large parts of the country where the supplies are extremely meagre. Loss through spoilage is often heavy. With proper marketing arrangements and the expansion of transport, packaging and refrigeration facilities, the position can be greatly improved.

Fisheries countries with a high standard of living and a great variety of product forms in fish marketing have come to recognize the need for continually making improvement and adjustments to meet the changing taste of the consumers and the competition from other food products. And even though fish marketing in developing countries may still be dominated by traditional products, such as the smoked fish in Africa, their pattern too must be expected to change. Proper fish marketing requires experts both with a technical and an economic background.

On account of the increasing emphasis which many governments place on co-operation, there should be reason to expect that a noticeable part of the development work in fisheries in future will be handled by co-operative societies of different kinds, such as those dealing with production, marketing and other services. For a proper organization and management of these societies, personnel specially trained in co-operation work are urgently required. These people will not only help in promoting the setting up of co-operative societies, but managers, secretaries, etc., to such societies may be recruited from their ranks.

Fisheries economics and statisticians

The job of the fisheries economist is a dual one. Firstly, he should describe and assess the social and economic setting of the fisheries, the environment in which it is placed and has to operate. Secondly, he should study the economic interrelationship between various sectors of fisheries and, in individual enterprises, the profitability and the efficiency of various factors of production such as nature, capital and labour. Thus, he must apply both a micro- and a macro-method of approach and be well versed in analytical methods both with respect to production economics, price formation, marketing schemes and pattern of international trade. The domain is the same as for any economist but the fisheries economist must possess a fair technical knowledge of the way in which fisheries work. Only then can he apply his economics efficiently.

In many countries there is no organized machinery for the collection of fisheries statistics. Others have developed systems, but they are in many cases inadequate. It is often found that while some information is available about the total landings of sea fish, data may not be available on the production of inland fisheries, utilization methods for fish catches, market prices, etc. Usually there is also no arrangement

for statistical assessment of the progress made in the implementation of various development schemes. The collection, analysis and interpretation of fisheries data of various kinds in a reliable manner are of great importance not only in assessing the present status of the resources and its exploitation, but also in planning future development.

Like the economist, the fisheries statistician should have a general background. A thorough education in statistics is, therefore, a necessary prerequisite, but, like the economist, he should also know the operational pattern of fisheries. On this basis economic analysis could provide comprehensive knowledge about the structure of fisheries sufficient to permit more effective and timely interpretation of factual data.

GENERAL PROBLEMS IN DETERMINING EDUCATIONAL REQUIREMENTS

Universal methods for determination of manpower requirements and corresponding educational requirements do not exist. In some countries, fisheries development is fairly primitive and a manpower program is out of the question. In others, plans are worked out in a fairly haphazard manner.

When reviewing some of the countries which have made substantial progress in fisheries development, little specific planning has been found and a minimum of educational arrangements used. Nevertheless, it is clear that better planning and more efficient education might have obviated some of the mismanagement and losses. A great many countries have had to subsidize their fisheries and governments have become more aware of factors which improve efficiency. In all of them, in industrial society the role of government planning is becoming more important. In recent years, governments of most fisheries countries have faced greatly increased responsibilities in coping with the changing situation in fisheries. Fisheries are changing or ought to be changing very rapidly and any realistic analysis of educational requirements must be of a dynamic nature. A development plan is not realistic if the planners do not attend to the most crucial step: a long-range projection of the manpower requirement. There is good reason to stress, therefore, that specific methods ought to be developed, and that an analysis of this kind, carried out both in a quantitative and qualitative sense, would be desirable.

This would imply working toward developing in each country a classification of all types of fisheries employment opportunities and a corresponding and fairly accurate description of the types of education and training required. But the task is seldom as simple as this. In a changing world with changing fisheries, many factors external to fisheries must also be taken into account. In the process of development, changes occur not only in the magnitude of the fisheries, but

in the composition of the catch and its use, in the type of work to be done and in priorities.

In his article "Manpower planning", C. Davis Fogg ^{9/} presents a suggested methodology for determining manpower requirements on the basis of the development plan in Eastern Nigeria. The author analyses the relationship between the level of activity and the personnel of various grades and skills required to maintain the planned activity. Fundamentally, the approach should be the same in fisheries. This is not an easy task, but it is worth trying, for there is an urgent need to lay down certain general criteria for the qualitative relationship between various categories of skills in fisheries. This could help to clarify issues in the general effort to assess human resource problems and requirements in fisheries.

Firstly, an assessment should be made of the number of persons with skills and aptitudes necessary to catch a certain quantity of fish, process this quantity and pass it on to the consumers through various trade channels at home and abroad. No rules can be laid down with respect to this. For instance, in Iceland, 1 million tons annually are produced by 5,000 well-equipped fishermen; in India, at least 500,000 fishermen are engaged in catching 1 million tons; in Norway, with a total catch of $1\frac{1}{2}$ million tons, one million are caught by some 50,000 fishermen, and in Japan, about 7 million tons by 600,000 fishermen.

In conclusion, regarding the output per man, this varies from 1 ton per fisherman per year in a primitive non-mechanized fishery to 200 tons per man in an extremely efficiently mechanized fishery.

Although occupational statistics may, of course, include some disguised unemployment, there is still a very big difference, which can only be explained by a difference in efficiency.

The first step in mechanizing a fishery may lead to an increase from 1 to 5 tons per man, when small mechanized boats are used. When the entire country has been embraced in the mechanization process, 100,000 tons may be taken by 20,000 men with say, 4,000-5,000 boats. Each boat should have at least one navigator and one machinist, while the rest of the crew is in no immediate need of education as far as the fisheries are concerned. This indicates the magnitude. If larger boats are used, the crew would be more numerous and varied.

Based on experience in Nigeria, R. Rowat ^{10/} approaches the manpower problem with the agricultural extension worker, who is often

^{9/} Published in Managing economic development in Africa. Cambridge, Mass., U.S.A. M.I.T. press, 1963.

^{10/} FAO Report to the Federal and Regional Governments of Nigeria 1964 on the development of education and training in the field of agriculture and related subjects, by R. Rowat. Rome.

considered the key person in agricultural development. In fisheries, he more or less corresponds to the assistant fisheries field officer. The number of agricultural extension workers required depends on both the level of intensity, which the Government is prepared to attain, and on the scope of these services. Considering these policy matters, R. Rowat finds that "for the developing countries in Africa, an objective of one full-time extension worker per 1,000 farm families is a practicable one, which will give reasonable average and be within the countries' resources to maintain ...".

In fisheries, production is organized differently. However, one may perhaps say, for lack of a better basis, that there should be one extension worker per 1,000 fishermen, or at least one for each village. If there are five men on each boat, this means 200 boats for each extension worker; this is, no doubt, the maximum he can be expected to handle. On this basis it would mean that 100 extension workers would be required for 100,000 fishermen. It may be claimed that extension services in fisheries, at least for the time being, takes less time than in agriculture simply because there is less knowledge to extend. But the assistant field officer will undoubtedly have a considerable amount of non-extension work as well, and this is likely to increase as the economy of the country expands. In his calculations of the number of agricultural assistants needed, R. Rowat applies a flat rate increase of 20 percent. In fisheries, an even higher figure might have to be used.

If the above calculation is used in newly developing countries a serious shortage will be revealed. Without question this points to the urgent need for education at this level. But the problem is not confined to developing countries. Thus, in a relatively advanced country like Norway, plans are being prepared for the introduction of what is called fisheries "secretaries" or "inspectors" in fisheries communities to meet an urgent need for advice and service.

As regards senior supervisory and specialist staff, R. Rowat considers "that for broad planning purposes, a useful indication of total requirements at this level is given by the ratio of one senior to five intermediate-level staff ... This allows, very approximately, for supervision at the field level on the basis of 1 to 10, the remainder to cover headquarters personnel and the supporting subject-matter specialists". This means if it is applied to fisheries, that where there are 100 assistant field officers, there should be at least 20 field officers and 4 deputy directors of fisheries. Similarly, other and more specialized jobs in fisheries might be considered. It is doubtful whether a realistic forecast can be given. Mr. Harbison (see References [page 126]) finds that generally "It is neither necessary nor desirable to estimate needs for a larger number of specialized occupations. In dynamic economics there is a great amount of movement from one occupation to another, and the needs for specialized skills are apt to fluctuate rather sharply".

Table I gives a list of fisheries personnel who might be needed and for some of them an indication of the number required. This estimate is based on an annual output of five tons per fisherman. Where this level has not yet been achieved, it seems to be a realistic target for a not too distant future.

A more detailed consideration of manpower requirements and the corresponding educational requirements in fisheries follows. The writer does not propose to offer a complete guide for calculating the requirements, but simply hopes that the comments, although incomplete, may be used as a basis for further considerations.

Determination of quantities to be produced

The first step in fisheries planning is to establish a target quantity to be produced. Therefore, a fisheries development program should be based on a fairly comprehensive study of present consumption and potential demand at home and abroad. Targets of production and its breakdown by species, areas and commodity forms should be stated in quantitative terms. This is a necessary background for a more precise study of how the planned availability of new technical knowledge may affect the rate of growth through increase in productivity, and the creation of new products.

Survey of available manpower

An inventory should now be made of people who are already employed in the public and private sectors of the fisheries industries together with an assessment of their educational background. Such an assessment of the human resource in fisheries is perhaps the most logical starting point. This has been done only in a few countries. The reason for this is perhaps that the need for such information has not yet arisen. Private industry has, by and large, managed without any government scheme for fisheries education and it is only in specific cases that education schemes have been requested. This situation obtains in advanced as well as newly developing countries. It may well be, however, that a new epoch is starting and all parties concerned realize the importance of educational planning.

Determination of organizational patterns

Proposed organizational patterns should be clear. It is often useful to think in terms of operational units (firms, co-operatives, village community development projects, etc.).

TABLE I

LIST OF TRAINED FISHERIES PERSONNEL AND
AN INDICATION OF THEIR NUMERICAL IMPORTANCE ^{11/}

Designation (some of these may overlap)	Total quantity of country's catch				
	Less than 100,000 tons	100,000 to 300,000 tons	300,000 to 500,000 tons	^{12/} 500,000 to 1 million tons	1 to 2 million tons
NUMBER OF FISHERMAN (in thousands)	20	60	100	?	400
<u>Senior research and educational personnel</u>	<u>10</u>			<u>300</u>	<u>80</u>
mainly in research	5			...	
senior teachers	1			...	
junior teachers	4			...	
<u>Administrative and development personnel</u>	<u>63</u>			<u>850</u>	<u>1200</u>
Senior officers	3			...	
Field officers	15			350	
Assistant field officers	45			500	
<u>Fishery Engineers and technicians</u>	<u>10</u>			<u>570</u>	<u>1000</u>
Master mechanics				50	
Food processing technicians				120	
Fish culture specialists)				^{13/} 30	
Fish farm engineers)					
Reservoir engineers)					
Marine engineers				50	
Naval architects and boat building foremen				60	
Refrigeration engineers				...	
Electronic engineers and technicians				...	
<u>Fishing personnel</u>				<u>250</u>	
Master fishermen					
Skippers					
Mates					
Boatswains					
Coxswains					
Machinists					
Gear technicians					
Electricians					
<u>Specialists in marketing techniques and administration</u>				<u>75</u>	<u>200</u>
<u>Fishery economists and statisticians</u>	<u>2</u>	<u>6</u>	<u>8</u>	<u>50</u>	<u>100</u>

^{11/} Note: this table is meant only as a basis for discussion, which might lead to a clarification of concepts and magnitudes.

^{12/} Report of the Committee on Fisheries Education (in India), p. 32. "Revised assessment of technical personnel required by 1966", p. 36. The list does not include trained fishermen, field staff or lower administrative and extension staff below the level of inspectors.

^{13/} Refrigeration engineers and electronics engineers and technicians.

The range of characteristics of various types of fisheries development may be indicated by the use of models. The main purpose of the change may be an increase in quantity with or without an extension of the fishery to other areas, or it may simply be a modernization of methods with a view to making the fisheries more profitable.

Methods to be chosen, and hence the skill required, will depend on the waters to be fished. In coastal waters, fairly simple methods will do, while distant-water fishing demands advanced techniques, even if they are carried out by newly developing countries. Similarly, quantities can increase even if traditional processing methods are retained, but if a change is desired, then additional skill must be introduced. An increase in fish consumption is the desire of many fisheries countries. So far, the easiest method has been to increase the manufacture of fish meal and oil from the additional catches.

TABLE II

TYPES OF FISHERIES DEVELOPMENT IN RELATION TO MANPOWER AVAILABLE

Purpose of change	Status of country	Most important waters fished	Policy regarding processing methods	Marketing goal	Unskilled manpower supply
Modernization	Developing	Coastal	New	Replace imports	Abundant
Increase in quantity	Developing	Distant	Traditional	Mainly fish meal	Abundant
Modernization	Developed	Coastal	New	Retain consumption level	Science/abundant
Increase	Developed	Distant	Traditional	Increase domestic consumption	Science/abundant

With different types of cross-references new models may evolve, and each of them would certainly lead to different figures for manpower requirements.

Comparing various stages of economic development

Newly developing countries can have the maximum benefit from the experience of other countries both at an advanced and an intermediate level of development, including the use of modern techniques. In modern times most nations tend to formulate their economic, social and political goals by comparisons with other countries. They may seek to follow good examples, set by others; they may be intent on following a divergent path from a certain country, or they may wish to learn from particular mistakes made by others.

The time element here is important, and long-term considerations should be distinguished from short-term ones.

Such comparisons should primarily be made between countries having similar economic, social and climatic conditions. Comparison with more distant countries may be inspiring, but such experience gained may be difficult to apply. It is natural that newly developing countries look to the wealthier countries for advice and guidance in order to find a good co-ordination of research and experiments, fisheries education and advisory services. This, however, may give a somewhat "bewildering choice of alternatives". Flexibility of outlook and willingness to adapt and modify are vital to the evolution of viable systems 14/.

Time element

When examining further the methods of estimating the needs for personnel, certain pertinent points expressed in an FAO paper 15/ in a more general context of food and agriculture would be emphasized.

"Both short-term (5 to 10 years) and long-term (10 years or more) targets should be considered in agricultural education and planning. Short-term targets are those dictated by existing or prospective agricultural development plans, programs and projects ...".

However, even the educational needs which are known to exist cannot be satisfied immediately. Even the satisfaction of such needs require long-term planning. Therefore, long-term targets should consider two aspects:

1. Long-term satisfaction of existing needs.

14/ It should be borne in mind that differences between nations may be exaggerated. Prof. de Vries says (p. 62): "... Basically the forces in dynamic societies are the same, the impediments or the brakes upon development very similar. But ... the generality of theory does not lead to uniformity of methods".

15/ FAO Study of agricultural education, research and extension in Latin America (not yet published).

2. An estimate of the expected increase in present needs and the corresponding educational requirements.

From the point of view of the "users" the ideal situation would have to be the number and kind of services, and the number and kind of people with a given training to satisfy the total needs of a country and to perform well the proposed functions. The proposed method for estimating the needs for personnel includes two main aspects:

1. Macro- socio-economic indicators and relationships.
2. Use of known relationships based on the accumulated working experience of institutions and services.

The latter would mean an estimate of existing and desirable relationship between the number of people in the various categories of fisheries work while the former would be concerned with problems such as the balance between fisheries and other industries. If fisheries were the mainstay of the economy of a country, competition with other industries would not mean very much. But as fisheries in most countries is a relatively small industry, it must be expected that a relatively large number will leave fisheries and seek employment elsewhere.

Planning fisheries education involves a projection of skills expected to be needed and used in future production processes.

Before calculating manpower requirements - even when these are no more than informed guesses - the future structure of a country and its fisheries industry should be envisaged. Then, it is theoretically possible to estimate the number of people required in each broad category of skills, and consequently, the "output" (from educational schemes) of each category. This is an *ex ante* evaluation. As an *ex post* test, the placement situation will reflect the effectiveness of the training program, the extent to which fisheries have been developed as an industry in a country and its ability to absorb professional people. There is always the possibility, however, that if fisheries develop their education program more rapidly than other industries, the problem of "leakage" of fisheries trained personnel to other occupations will occur.

Further consideration of manpower requirements

In an affluent society mistakes made in calculating manpower requirements or failure to make adequate arrangements for recruitment are not always easy to detect and an impression may be created that

there is no need for special educational arrangements in fisheries. However, in the opinion of the writer this is a fallacy. Several countries, which are otherwise well advanced, suffer from the inadequacies of their fisheries education. The need for specialized education in fisheries has arisen in both developed and developing countries and may be traced back to the very rapid speed at which technological innovations have been introduced. In many cases, losses due to the absence of appropriate education are perhaps difficult to identify, and failure of some educational schemes which have already been tried may be due to lack of adjustment of schemes to the absorptive capacity of students at different levels.

All countries still need universally oriented people for their fisheries administration, but this is no longer enough: teamwork of specialists has become imperative both in administration and in business management.

In a medium-sized fisheries industry in a typical African country, where the goal is to expand from, say, 100,000 to 300,000 tons of fish in ten years, the staffing problem in government administration might be summarized as follows: in addition to the Director of Fisheries and his deputy, three assistant directors, five senior fisheries officers with a general background, and five technical officers (all on the diploma level), 15 development officers (certificate level), 50 fisheries assistants and 50 clerks.

Another example is Nigeria. By 1975, the total estimated requirements of certificated personnel for all sections of the industry are: 10 skippers, 34 mates, 68 coxswains, and 10 engineering officers.

Qualitative aspects

Sufficient attention has not yet been paid to the qualitative aspects of fisheries education, nor to specialization. This may be due to indecision so far regarding the objectives of education. Fisheries education should not be arranged for its own sake or as a matter of prestige. Education which is under review should be looked upon as an investment and not as consumption.

Development plans in many countries will mean radical changes, which will entail difficulties in making reasonable reliable estimates of skill requirements. For this reason educational schemes should be flexible so that adjustments can easily be made without sacrificing consistency or efficiency.

Most fisheries training is built on basic education and particularly on secondary education. However, in this respect, conditions vary from one country to another.

Placement policy

An educational program should run parallel with a placement policy so that graduates can apply for positions both in public administration and in business, with remuneration and promotion opportunities comparable to those of other industries. As in most countries fisheries play a relatively small part, career opportunities are limited. Fisheries officers are also often stationed in remote areas where communications are difficult. Some of them have to go to sea in research and inspection ships where working and living conditions are arduous. From the viewpoint of career opportunities, it might be an advantage to let fisheries be a part of agricultural administration. The job is more varied and promotion opportunities are better. However, in most cases the advantage is outbalanced by a number of difficulties. The link with agriculture which exists in some countries is hardly anywhere the result of a calculated attempt to solve the career problem. Some countries have tied their fisheries service in with their merchant navy, others with wildlife administration. In a great many cases, however, difficulties have been encountered in attracting people of the right calibre into the fishery services.

On a national basis several things could be done about this:

1. Fisheries work must be recognized both with respect to status and pay which is given to the professional government staff.
2. A reward system for excellent performance should be established.
3. The opportunity of systematized education on the job should be created.
4. All fisheries workers should be given frequent opportunities of meeting each other and seeing the various aspects of development work.

PROGRAM FOR FISHERIES EDUCATION AND TRAINING

Skills, aptitudes, educational needs and requirements having been discussed, there remains now only the types of educational and training arrangements to be made to meet the potential needs of any country under review and to indicate their scope. Conditions vary from one country to another, not only because of the difference between industrialized and developing countries but also because of basic differences in general education.

An examination of the fisheries situation may reveal a wide range of educational needs, from elementary to the very specialized technical courses. The scope, which is found desirable, may vary from brief orientation courses to full-time comprehensive education lasting years. Regardless of this, however, as pointed out by the FAO Conference, 1965, fisheries education should be both "progressive" and "cumulative".

Fisheries education schemes and the development plans which they support should be adjusted to the general educational level in the country concerned. It should, in effect, be part of the general education program and considered other education arrangements for fisheries purposes could often be explored with great-developed, other industries may benefit from them. In promoting adult education, developing countries will often find it useful to arrange specific schemes for the purpose of introducing new techniques in a minimum of time. In such cases there will normally be opportunities to combine this teaching with a general literacy drive.

There are various types of training: full-time; part-time; on-the-job; in service; mobile schools; extension service; etc.

Full-time education should be the regular and normal means of teaching in fisheries. However, in the present situation, changes are so great from one year to another, that also people who are already engaged in fisheries work may be in need of additional knowledge. In such cases the need can only be met through part-time arrangements such as evening classes, week-end courses and intensive seminars and excursions of relatively short duration. Normally, this would be arranged in co-operation with the employer and could be called "inservice-training", which covers a systematized training where both aims and means are well defined.

When planned by professional educators such special arrangements carry several advantages as compared with what is often called "on-the-job-training". The results could be identified through an examination, if so desired, while "on-the-job-training" would be a more haphazard and less tangible way of acquiring knowledge. But this, too, could be tried in connection with specific programs of education. It is a fact that the simplest operations in fisheries are normally taught on the job only. However, this method has several short-comings, when changes are so rapid that often the "father has to learn from the son". Traditions and heritage should not be too heavily relied upon; rather, arrangements should be made for adult education and re-training.

Opinions vary with respect to the role which training on-the-job and in-serving might play. Frederick 16/ claims that "Better

16/ "Human resource assessment" published in UNESCO's Economic and Social Aspects of educational planning, p. 117.

craft training would result from shifting more responsibility for skill development to the employing institutions". But he adds that "... the discovery of the lack of concerted on-the-job training efforts is in itself important. An attempt should be made also to ascertain in degree of co-operation between the employing institutions and the vocational schools ...".

The Indian Committee on Fisheries Education commented on in-service training as follows and with specific reference to public service:

"In-service training always tends to become stereotyped and in the long run means isolation and stagnation, unless sustained effort is made to assimilate from outside full knowledge of recent advances. The reliability of in-service training alone is questionable as it is more by accident than by design that a man who goes through the fisheries service at the various stages of promotion will have as his superior an officer who has a real ability for training his subordinates. Further, the training is in most cases haphazard and in-effective. The Committee feels, therefore, that the country should not place too much reliance on in-service training unless it is preceded by regular institutional training".

There is no ready recipe which can be used by countries attempting to improve their fisheries training or to determine the types of training centres they should have, and their location. As a general rule, a few training facilities which are good, if not excellent, are much to be preferred for many inferior arrangements even if the latter may engender some temporary advantage and may be easier to arrange from the political point of view. It is for such reasons that the writer has suggested, in the case of some English-speaking countries in Africa, that country wide schemes should be the aim in all cases, and that for higher education, where in normal circumstances only a few candidates are required each year, regional co-operation should be arranged.

Teaching at all levels should be linked as closely as possible with actual development work in fisheries. This in itself is one valid reason why development plans may provide for well-defined and comprehensive education project.

Training illiterates, adult education and vocational training may here be considered special arrangements. A fairly normal but by no means universally accepted education scheme is indicated below and might well serve as the basis for discussion both in newly developing countries and those which are at an intermediate or advanced stage of development.

General education

Education is a means to an end, e.g. to improve literacy. Here, it is an investment project toward fisheries progress. Thus, fisheries education should be accepted and recorded as an integral part of the national plans for policy making with respect to fisheries.

Many countries, for which this report is intended, have already eradicated illiteracy among their people, others are still engaged in an uphill struggle against it. The role of both primary and secondary education must be viewed differently in these two types of countries. A subsistence economy has thus limited the capacity to absorb primary school graduates while in most advanced countries they are absorbed as a matter of course. However, education serves more than economic ends.

Every country has to face the question of what priority it should give to education in its budget as compared with the importance of consumer goods and capital investment projects. Regardless of how the funds are economized, educational policy should also be related to the need of economic development projects. Experience in a great many developing countries can no doubt confirm that the failure to make adequate provision for secondary education is a major handicap to economic development. These schools supply the persons who, with two or more years training in specialized schools, become the technical personnel who are so essential to technical and economic progress.

Some authors feel that technical teaching should start at an early stage; others favour the academic and universal type of secondary schools.

It has been pointed out by some people that a good general education in primary and secondary schools inculcates in students an appreciation of the importance of the primary industries (agriculture and fisheries) in the economy of their country. At the same time, it contributes the basis for vocational or technical preparation for specialized studies at both the intermediate and the more advanced levels. Many competent educators have warned that, on the contrary, a move into agricultural education as such in primary and secondary schools is likely to alienate students from their rural environment. One example may be quoted 17/.

"Almost without exception these attempts to teach agriculture, particularly at the level of primary education, have proved unsuccessful. Indeed, they have often served no useful purpose whatever. They

17/ See References - Wilson and Tissot.

have occupied significant amounts of teaching time which could more profitably have been employed in giving children a better foundation of education".

These conclusions confront fisheries development workers with a dilemma, for often they might be tempted to teach fisheries subjects at any level rather than have no such teaching at all. Also, it has been shown, such as in northern Ghana, that useful purposes can be served. On the other hand, one should not be unmindful of the specific conclusions drawn by specialists in agricultural education. This is a difficult point on which more experience and opinions should be sought from various countries. Tentatively, the writer is tempted to draw the conclusion that neither the primary nor the secondary schools of the academic type should be used for any form of vocational training.

In developed countries education is available to everyone and recruitment has not created serious problems in fisheries development. Here too, however, conditions have changed. In these countries also the general educational system should be examined with a view to assessing it as a basis for detailed and specialized studies in fisheries.

Vocational training

Fishermen. Many countries have well-organized systems for training fishermen for small-scale fisheries in inshore waters. Schools intended to cater for distant-water fisheries are also available particularly in more developed countries, but in many cases these are operated jointly with schools for personnel for the merchant navy.

Regardless of the type of school used for training fishermen, this education should be linked with practical work for the use of the new knowledge. This particular point was properly stressed in the Report on the FAO Seminar on Fisheries Development Planning, held in Accra, Ghana, in 1963. One of the conclusions which was endorsed by most participants was that: "the training of fishermen can better ... be done by in-service training than by training in a teaching institution. But it was recognized that improved fishing techniques, mechanization, introduction of new and larger vessels with modern gear and fishing aids have created the need for additional training in these fields in many countries. Facilities for this purpose should be developed according to the needs of the country."

"The efficiency of the in-service training will determine the professional standard of the fishing population, and the efficiency of their fisheries. Governments, therefore, should pay more attention

to this aspect of training by organizing the in-service training and supervising its progress, and should make these activities a part of their fisheries administration and development activities".

This realistic statement underlines the need for an unbiased approach. Fishermen's education should not be arranged for the sake of education, and much effort is no doubt wasted on education which has been poorly planned. On the other hand, in some "new" countries there is urgent need for educating coxswains, mates, skippers and machinists for the developing distant water fleet. Because of the fairly advanced level at which such education has to be conducted, entrants' qualifications should be no less than school certificate at 'O' level. In arranging such education, co-operation with ordinary nautical schools should be considered, as is already the case in some industrialized fisheries countries.

Boat-building and other trades. The training of craftsmen is fairly well organized in many countries. Many developing countries have both trade (craft) centres and technical schools. A good start has been made and considerable effort is being put into the improvement of both these types of education. It seems clear that fisheries will benefit greatly from close co-operation with such educational schemes. Adjustments to meet the peculiar needs of fisheries must be considered, but in the experience of the writer in some African countries, the management of such schools has been very eager to adjust to the needs of fisheries.

Boat-building might perhaps be used as an example. Trade centres and technical schools or colleges have done much to improve standards in carpentry, both with respect to design and technique. It is often found easy to adjust the same principles to the fields of boat-building. Also, local boat builders, who are used to non-mechanized craft, may be brought into such trade centres or special boat building schools if and when they want to change to mechanized craft, which in most cases will have to be constructed differently.

In Uganda, a special boat building school has been operated for some time under the aegis of the Ministry of Education. Students enter at the junior secondary level and after a four-year course they are ready for the City and Guilds Boat-building Certificate. Having completed their education, they can apply to the Department of Fisheries for assistance in setting up business.

Other professional fields where similar arrangements may be made are those of engine mechanics, fitters, welders, refrigeration technicians, electronics technicians and repair personnel, laboratory technicians, etc.

In most fisheries countries the demand in terms of the number of persons required may not be very large, but the success of development plans will nevertheless be hinging on such people being available. In a majority of these cases, fisheries have more in common with mechanical industries than with agriculture, and co-operation with technical rather than agricultural schools is to be recommended. It cannot be emphasized too strongly, however, that all education of this kind must be linked with practical work in fisheries through a well-considered apprenticeship scheme.

Middle-level training

Regarding agricultural education in Africa, R. Rowat points out that "in the immediate short-term situation, the greatest need is for people with what is called middle-level training, i.e. diplomas and certificates at less than university degree level" 18/.

This is very much in line with the general principles stated by FAO in a paper contributed to a Seminar 19/ held in 1963, on middle-level manpower. Effective middle-level training institutions were found to have such common characteristics as listed below and these apply to fisheries as well:

1. Training should be directed to prepare for specific tasks.
2. Instructors should, by virtue of administrative attachment, have continued contact with developments in the field of instruction.
3. Build on sites to provide facilities for practical instruction in the environment in which the students will later work.
4. Acceptance of students who are sufficiently mature to have decided on the vocation they wish to follow and well enough prepared in general education to make good use of the specialized training.

18/ ROWAT, R. Some problems in the planning of agricultural education at the level. In FAO Seminar on Agricultural Education, Kampala, Uganda.

19/ FAO Report of the FAO Seminar on Agricultural Education, Kampala, Uganda, 1963.

Needless to say, in middle-level fisheries training schemes there should be no thought of its being merely an inferior form of degree. This is a point which has been extensively debated in agriculture circles. Some experts have even claimed that the purpose, methods and approach in middle-level education should be quite different from those followed at university level.

As far as fisheries are concerned it would be an advantage to consider the "university level" as one of the many variables and thus be subject to improvements and adjustments. Furthermore, the universities will no doubt have a very important part to play in the planning and execution of middle-level education programs. The writer is satisfied that an effective link between the various levels of education would benefit the universities just as much as it would other parties concerned.

The highest scale of middle-level training is the diploma level, which is to educate field officers and people holding similar positions in business firms. In countries where the aggregate fishery is at a level of 100,000 tons or so each country would need to recruit only 2 or 3 persons at this level each year. In this case, regional or international schemes for their training will often be the only workable solution. More important fisheries countries could be self-sufficient, but for them, too, several advantages could be derived from participation in regional schemes. This is true for industrialized as well as developing fisheries countries. Perhaps the most suitable arrangement would be to admit students from the school certificate 'O' level. However, industrialized countries may start at a more advanced level, and developing countries may raise the requirement later. There should be a three-year training, 16 months of which should be devoted to practical work, arranged and organized (in a "sandwich" system) in between the theoretical courses. These courses should preferably, but not necessarily, be organized by a university, and there should, in principle, be no objection to arranging them - in due time - as a degree course. When starting such schemes it is advisable to begin at a fairly modest level, but, from the beginning, outstanding candidates should be allowed to switch to university education and enter degree courses without having to start at the very bottom of the ladder.

For the junior fisheries worker a certificate level education is recommended. The general level of admittance in many developing countries has been standard 8. Almost all the training which the junior workers have received so far has been given on-the-job. Some countries have organized courses so as to make it a real in-service training, and have thus succeeded in elevating the standard of efficiency. As the general educational background is fairly weak, training has often been of three years' duration, but this aspect should be adjusted in each individual country. When the initial difficulties have been overcome, two years' training should normally be sufficient.

Content and method of middle-level education may vary. It may be worth summarising here briefly the system used in Sweden for a diploma education of fisheries workers in government service:

Entrance qualifications correspond to junior level of secondary schools as it is found in some English-speaking countries (7 years of elementary school and 2 years secondary school). The course covers 21 months' duration. During the first 9 months, the student receives a basic education which, apart from fisheries biology, hydrography, etc., also embrace general subjects, such as mathematics, physics, Swedish, English, etc. This is followed by a 4-month period of practical work at a fisheries station. The last 8 months are spent in a final theoretical course which, apart from English and statistics, concentrates on specific fisheries subjects, such as fishing gear, techniques, resource management, fish handling and processing, navigation, engine operation and maintenance. Excursions are also built in to this last part of the course.

Fairly advanced fisheries countries would no doubt benefit from a middle-level training of the Swedish type; others may be compelled to seek simpler solutions.

Some countries have tried to tie fisheries training in with well-established agricultural training arrangements. Evidently, this can be done. The difficulty is that often these two professional fields have not much in common except sometimes that they belong to the same ministry. Also, as far as accommodation and practical work is concerned, agriculture and fisheries students are difficult to blend as working hours would have to be adjusted to the needs of the industry, but to some extent the joining of forces is a very sensible thing to do. Thus, basic courses in subjects such as language composition, physics, chemistry, etc., could be run jointly. Here, the trend is, however, to improve the general secondary education, and thus improve the foundation on which technical education should rest.

The conclusion must be that in planning middle-level training the long-term goal should be special fisheries training arrangements both for diploma and for certificate courses. The professional advantages of this would, in most cases, outbalance the difficulties in setting up a few separate fisheries schools. There may, however, be cases where a joint arrangement might be preferred.

There may be countries which cannot afford to have a sufficient number of fisheries field officers; thus the agricultural officers have to attend to fisheries matters. Where this is so, agricultural officers should be given a certain educational background in fisheries so that they at least may know when to call in a fisheries specialist.

Apart from such considerations, the general trend is toward a more extensive use of specialist rather than general administrators. The great range of problems to be dealt with in fisheries development work and the multitude of skills required, makes this necessary, and the consequence is that the educational system must permit specialized education in a number of fields. Parallel to the diploma courses in public and business administration there must be a comprehensive technical education in fields such as fish processing, refrigeration techniques, communications and electronic engineering, marine engineering, etc. In a majority of countries - developed as well as developing ones - much of this education could best be arranged in conjunction with existing technical schools and/or craft centres.

Here, too, it should be stressed that the transfer of knowledge is a continuing process and that no students should cease to learn the moment they leave a training centre. The need for keeping abreast of developments at all times is the main reason why the location of the training centre and its professional connection with development work is of paramount importance. Development centres, where they are of the community development type or more affected by a pure business approach, must be the place where administrators and technicians of various professions work as a team.

Education at university level

Even in the earliest stages of development, senior fisheries administrators, research workers and teachers should be trained at university level. As, however, their number in most countries is relatively small, the specialized part of their training has often been obtained abroad. For a great many years to come many countries will, no doubt, continue to avail themselves of such opportunities of specialized education, but the advantage of a university education, which is synchronized to the development program of the country, should be kept in mind. In the "climacteric in the history of higher education" ^{20/}, taking place in Africa, the pattern will undoubtedly change to meet the needs of the developing countries much more efficiently than is now the case. The question of how far one should specialize and at what stage students should go into specialized fields remains a basic policy problem in all countries.

Traditionally, a natural science education has been the basis for senior posts in fisheries administration, but this is changing rapidly to match the broadening in scope of government activities. The characteristics of effective training at university level would,

^{20/} ASHBY, ERIC. African universities and Western tradition. London. 1964
Oxford University Press.

therefore, include a realistic adaptation of the curricula of the different university careers to the functions that the graduates from these careers actually are to fulfil. And there are indeed a score of types and contexts of specialization.

Many branches of science should be considered with a view to their being represented in teams, to study fisheries problems. This is one reason why the establishment of a separate faculty or school of fisheries is not always to be recommended.

Much of the success in university education and almost all the reputation of particular institutes often depend on the quality and integrity of the individual teacher concerned. It is generally recognized, however, that a professor should have an opportunity to keep abreast of new problems, developments, domestic and foreign, and to carry out research. He should, therefore, along with his teaching duties, have the facilities and possibilities, and indeed the urge, for participating in fisheries research. To achieve this it is suggested that the faculty concerned be given an active role to play in the national fisheries research program. And this applies to all countries. For, regardless of all the striking variations between regions, countries and areas, all of them need people well versed in fisheries matters who are trained and able to use their own initiative.

The majority of current senior administrators, who are now first- or second-in-charge, has either a legal education or a university degree in some biology subject, and, in developing countries, a fair number of them have received postgraduate training abroad. Ad hoc courses arranged by FAO and others have also played an important part in the training of senior personnel. While it is hoped that developed countries will continue to offer scholarships of this kind, the question of adjusting courses to the needs of developing countries may also be raised. There seems to be an obvious need for a course which could give training to young graduates who are already engaged in, or wish to qualify for fisheries service either in public administration or in fisheries enterprises. A course of this kind would be useful to fisheries workers from any country, but might be adjusted to the needs of developing countries.

Some time ago the Institute of Fisheries Economics at the Norwegian School of Economics and Business Administration worked out tentative plans for a fisheries economics course of this kind to be held in Bergen, Norway. These plans were based on a clear recognition of deeper understanding of the inter-play between numerous factors of production. For these reasons a technical description of fisheries industries and an analysis of their development would form an important part of the course. The basic idea, however, was to remove, as far as possible, the partitions between the various sciences concerned with fisheries and train the students to a comprehensive approach.

The curriculum was worked out with these points in mind. The plans for holding it in Bergen were shelved, but, regardless of site, there should be a broad approach, more or less along the following lines:

1. The place of fisheries in the total economy of a country should be described in terms of its contribution to the gross national product, to export earning and to the employment situation.
2. This may be illustrated with a view of fisheries structures in selected countries with which it is natural to make comparison.
3. For some participants an introduction to marine biology and oceanography, fishing technique, fish processing industries and legal problems involved in fisheries.
4. Having thus created a common starting point which can be used regardless of the basic education previously received, the role which other sciences might play in fisheries should be elucidated by a review of, say, economic geography, sociology and social anthropology as related to fisheries and fisheries communities.
5. Short course of cost accounting and estimating fishing operations and fish marketing
6. Fish marketing problems - wholesale and retail - should be reviewed in some detail and systems for providing finances, credit and insurance, should be described and discussed. Finally, an outline of alternative administrative structures in fisheries, and an assessment made of organizational aspects in fisheries both in the public and the private sector.
7. The second part of the course should include a review of international co-operation in fisheries and international aspects of policy making, both with respect to resource management and marketing. A fairly thorough examination of fisheries statistical problems should follow.
8. Discussion of the micro-economics of a fishing fleet and the macro-economics of fishing operations.

9. Economic theory of fisheries problems with specific reference to resource exploitation and marketing. This would include both production economics and some price theory and lead to a discussion of development stages in fisheries, illustrated by case studies from various countries.
10. Planning, evaluation and implementation of development programs in fisheries.

Within this general framework the syllabus of the course should be adjusted to the background and requirements of the students. The ideal duration would probably be one year. The total number of entrants should not exceed 30. These should have a very good working knowledge of English and possess a degree in economics, natural or physical science, or engineering, or have a similar educational background.

The course could be divided into two parts, each of five to six months' duration. The first part covering the basic preparation of the student in some university in a newly developing country, and, the second in a country where the fisheries are more developed.

The basic idea underlying the proposed course is to give administrators the broadest possible orientation in fisheries industries. The writer's recent African tour made it clear that the need for this is very great.

PROBLEMS OF ADMINISTRATION AND CO-ORDINATION

A review of training in many countries, industrialized as well as newly developing, would reveal that the present standards and the extent of the training are insufficient to meet the basic requirements of a dynamic and well-balanced development. In addition to its traditional aims, the education policy has to provide suitable education capable of meeting the country's needs when industrial life is in the process of constant change. The basic requirement is that the educational system should be responsive to the needs of development plans, and these needs must be translated into curricula, courses, etc. But it must be kept in mind that "Human resource development usually requires a longer time perspective than that encompassed in most economic development plans" ^{21/}. In many fisheries countries, which are otherwise well advanced, this point has not yet been fully realized.

The predominant problem is, therefore, apart from creating the necessary educational institutions, to lay down directions for their operation.

^{21/} See References - Frederick Harbison.

It has been suggested as a basic principle in middle-level-agricultural training that "Administration must be in the hands of an authority fully familiar with practice, problems, policy, and developments in the field for which training is given". In many fisheries countries the same principle is adhered to, but it does not really go without saying that the Department of Fisheries should always be in charge of fisheries education at this level. The problem should be examined from various points of view.

Ministerial responsibilities

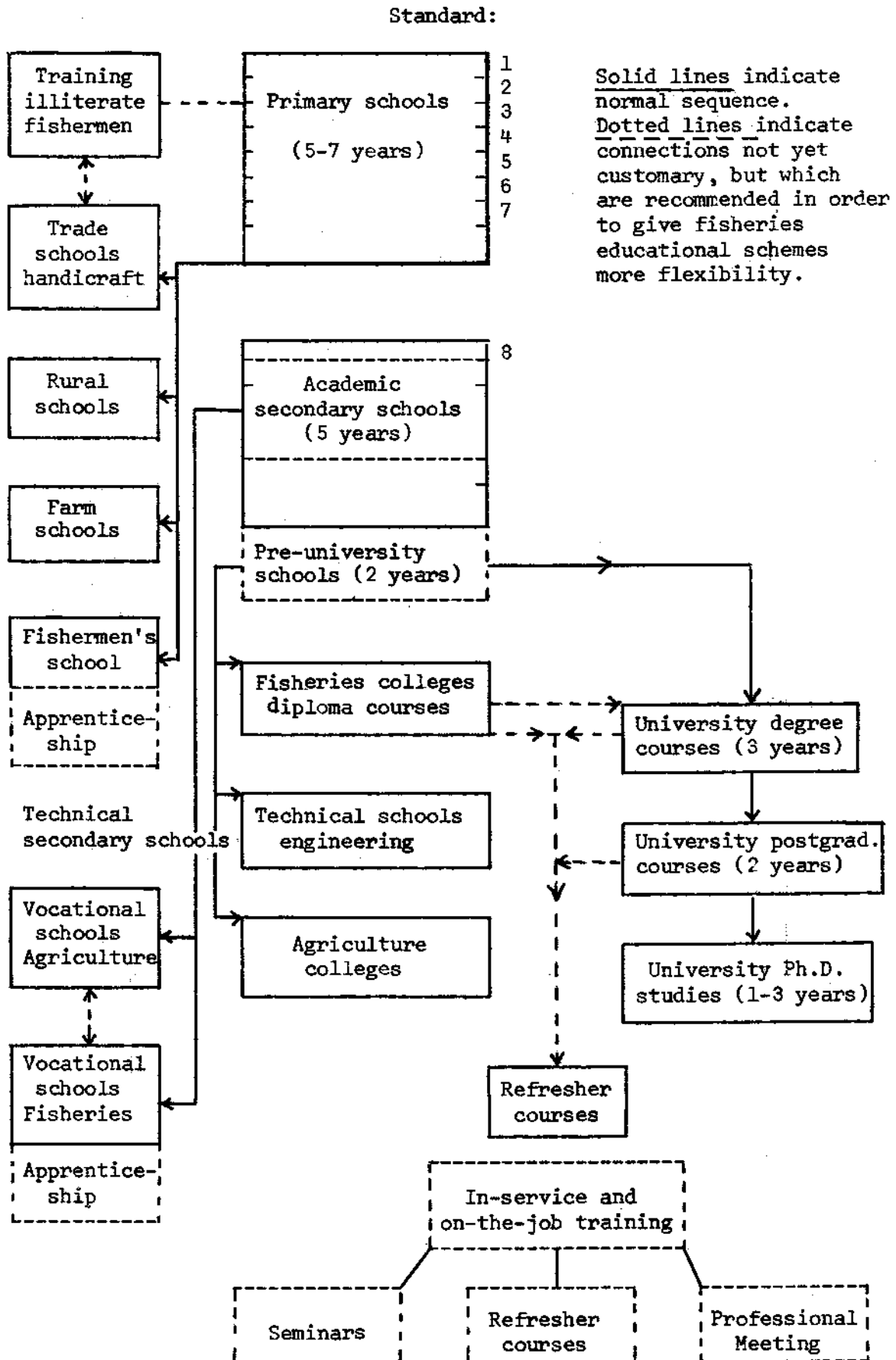
This will vary from one country to another. In some, the development of the fisheries is mainly the concern of the Government; in others it is primarily that of the private sector. Others again have a "mixed economy". Regardless of such differences, however, the consensus of opinion seems to be that teaching and training is mainly a government responsibility, or at least that the Government should provide guidance and co-ordination.

In most countries the Ministry of Education and the Department of Fisheries are concerned with education both with respect to programming and implementing fisheries education and training. The common arrangement is that the Ministry of Education deals with higher level education or formal school education and the Department of Fisheries as a specialized technical department, with vocational training. But there is no reason why this should be so.

Problems arise as to the division of responsibilities which is most suitable in given local conditions and as to the co-ordination of the work. These problems cannot be settled here and now, once and for all, or any clear-cut conclusions reached. Some of the problems involved are discussed below.

As far as the universities are concerned, in many countries they are fairly autonomous bodies over which the Government has little or no control. This, apparently, is one reason why there is often difficulty in establishing perfect working relations between fisheries laboratories and university faculties. For instances, to what extent should the principle of academic integrity be interpreted? An acceptable formula for efficient co-operation is elusive. However, in Japan and the U.S.S.R., specialized education at university level seems to have played a very important part and fisheries expansion has been most impressive.

Figure 1. The place of fisheries in the educational system



Another problem is the technical diversity of fisheries work. In a modern fishing fleet, and in the corresponding harbour installations, complicated machinery is used and it would be logical to look to trade centres and technical schools for the education which is required even though these may be administered by another ministry. For example, in the United Kingdom, the Tory Research Station, which deals with fish processing and handling, is now under the Ministry of Technology. Similarly, navigation falls naturally under the Ministry of Trade and Commerce or whichever ministry is responsible for the merchant navy's supply of navigators.

No uniform pattern can be found when comparing various developed fisheries countries. In any case, it is true both for developing and industrialized countries that efficiency in the educational system, and not heritage, with respect to administration, should be guiding principle.

Fisheries need a closer and more effective integration of research, education and extension. These three major fields of activity are complementary components of fisheries progress everywhere. So far they have often been developed in isolation, but the basic idea of education, apart from acquiring useful knowledge, is to develop thinking power in a flexible mind. If an educational scheme is successfully developed, research and education will mutually support each other and become a symbiosis which is genuine extension service, and an application of systematized knowledge to current fisheries development problems. Problems also occur over the time each person, who is in charge of both teaching and research, should devote to each of these activities. With a centralized administration a fair balance might be easier to achieve.

Another advantage of centralized administration of educational effort is a better control and more efficient use of scholarship funds.

In many countries the best arrangement would be to establish an Institute of Fisheries Education, administered by the Ministry of Education, but in close co-operative with other ministries.

Such an institute could serve many useful purposes. It could carry over all responsibility of fisheries educational schemes at all levels. Educational programs could still be carried out in several parts of the country. Through an institute, however, maximum use of available manpower for teaching could be ascertained. Duplication of effort would be reduced to a minimum.

Problems of creating expedient systems

If fisheries education is to achieve its real objectives, an unbiased review of purpose and means must be made. This involves both the balance and relationship between various steps on the educational ladder and the proper arrangements on each step.

In a paper (1963) on problems in the planning of agricultural education, R. Rowat points out that in the present economic and social circumstances in African countries and their acute shortage of trained manpower, there would appear to be at least four guiding principles in planning a system of education in the post school level. While some circumstances differ in fisheries, these principles can apply to many fisheries countries as well. In any case, they would form a useful basis for discussion. The proposed guiding principles are:

1. The course should be designed specifically to meet the needs of the country and should be under constant review.
2. Courses should be stream lined to the shortest possible time, consistent with adequate coverage of their contents.
3. The number of levels at which courses are given should be reduced to the minimum. It is suggested that one level only below university degree should be the target.
4. The system should be sufficiently flexible to provide a ladder up which the intelligent and capable person can climb to the highest post available.

It is easy to understand that small countries in particular try to save money by joining forces with other sectors of industrial life and benefit from training and education schemes which are already in operation. Thus, in many cases, fisheries being a primary industry, it may seem natural to teach fisheries in agricultural schools, college and faculties. Experience has shown that sometimes this arrangement is successful, but in most cases it is not so and considerable difficulties have arisen.

Basically, it is an administrative problem. Even though much specialized fisheries training may be achieved through a concentrated effort, fisheries must always benefit from the general educational system. This can best be done when the peculiar needs of fisheries are full identified and recognized. Whether fisheries should be taught in elementary schools and in the junior stages of secondary education is another question. Some have tried this and some, it is presumed, believe in it. However, the consensus of opinion in agricultural circles seems to be that, at an early age the education should be of a general nature. Nobody should be forced to choose a profession prematurely.

There is a problem of providing suitable textbooks of sufficiently high quality. True, nothing can replace the well qualified teacher at the various levels of education, but an excellent textbook will enhance this work very much and help to achieve and maintain adequate and uniform standards.

International aspects of education and training programs

Development programs provide the long-term solutions to national fisheries problems. They also include plans for a harmonious system of national research, extension and education. The program must take into account not only the natural and physical, but also the economic and social, aspects which characterize the fisheries of the country concerned, and the whole social environment that seems amenable to economic policy.

Research which has been carried out and experience gained in other countries plays an important part in the initial stages of the implementation of a development plan.

To a great extent both education and the extension service in developing countries has to be based on external knowledge imported into the environment.

Recent experience has shown that much is to be gained from the services of foreign experts. Indeed, if development is to start immediately and if advanced knowledge and experience is to be utilized by countries who have not yet the necessary skills available in their own ranks, foreign aid must be sought. However, foreign assistance should not be used to shortcircuit the educational system and thus delay the "production" of qualified experts on the national level. The on-the-job training, which an expert can and should impart, can by no means replace a systematical educational arrangement. However, in the interim - pending the establishment of an adequate system - efforts could be made to improve the education effect of the experts' stay and work in the field. Generally speaking, the pedagogical and didactic problems involved in technical assistance schemes in fisheries have not yet received as much attention as they deserve.

The importance of international co-operation in fisheries education and training is growing. One specific reason why such co-operation is recommended - in most countries - is because of the modest size of fisheries as compared with other sectors of industrial life and the specialized nature of fisheries work. As a consequence, fisheries educational schemes in specialized fields, although important, cannot be expected to attract a great many students.

The line of thought described in proposals which have already been made with regard to national arrangements, might be extended to the fields of international co-operation in fisheries. Generally speaking, the international exchange of students might be confined to the diploma and university level, but an exchange of teachers, literature and textbooks at all levels should be encouraged.

For ages, foreign experts have played an important part in fisheries development, paying professional visits, conducting and study tours. International trade in boats; engines and fishing equipment has also done its share. There is much evidence to confirm how knowledge and experience has been transferred from one country to another and inspired and guided fisheries development.

All countries would benefit from a much greater activity in fisheries co-operation. International fisheries universities in the real and restricted sense would hardly be a realistic proposition, but the building up of, say, regional educational schemes, which benefit from existing national universities, particularly those which have been specializing in fisheries, would be of great advantage. "Crash" programs to meet the most pressing needs for training and education could be included. FAO could act as a catalyst of such work, but the real responsibility should continue to rest with individual countries and their academic authorities.

Finally, all teaching should recognize the national peculiarities of the fisheries industry. There are still wide areas of knowledge in which textbooks could be shared by several countries. Here, therefore, is a field in which much can be done and much time and effort saved. Some textbooks which already exist may be adjusted to suit readers of other countries and, where necessary, translated.

SUMMARY OF PROBLEMS

This report reveals that education and training are "missing components" in economic development, and that the peculiarities of the fishing industry are distinct from those of other industries. Education should be organized to comply with its needs. Fisheries should not be treated in isolation, but avail themselves of educational schemes which, when modified, suit their requirements.

Problems vary from one country to another, according to the structure and magnitude of their fisheries and their development. The salient features of most problems described in this report are summarized below:

1. During the last 20-30 years, countries have found great potentialities in their fisheries. Some development plans, therefore, call for a doubling or trebling of fish production over a 10-year period or less. Others emphasize improving the quality and modernizing production processes. Most countries are faced with considerable changes. This situation requires more trained people to assess, formulate and implement development plans. In many cases, the need for training and education has been neglected or, at best, underestimated.

2. Shortage, and in some fields a complete lack, of trained personnel, constitutes a limiting factor in many countries and may impede a balanced growth in fisheries. Even countries, which by all standards have been considered rich, have recognized their failure to provide adequate training. Developing countries have not been able to afford such education even if the need was obvious.

3. An assessment of skills and aptitudes required in fisheries development, reveals a wide range of professional fields. Not only zoology and other natural sciences, but also technology and social sciences must be taken into account and made to stimulate fisheries development through an educational system. However, there is no point in promoting education unless there is also a long-term placement policy for the graduates.

4. In Governments' administrative structures departures will gradually have to be made from the traditional pattern according to which universally oriented fisheries officers are used at all levels. In the future, expert workers trained in various professions should be engaged.

5. Technical schools and colleges as well as trade centres may be used as bases for education in several technical fields within the fisheries industries.

6. Although specific methods for calculating manpower requirements in accurate terms are not sufficiently clear to warrant immediate attention, there is an obvious need to establish objectives and priorities.

7. The following questions may be raised with respect to national problems:

- (a) It appears that national plans for the training of fishermen should be confined to essential subject matters and consolidated in view of the experience so far gained, both at home and abroad. But to what extent is experience gained in one country applicable to others?

- (b) Should educational schemes for fishermen be co-ordinated with community development centres and with the provision of capital equipment through loans schemes, etc.?
- (c) Could middle-level education in fisheries be strengthened by improving secondary school education, i.e. should the secondary schools be the foundation on which fishermen's training should rest?
- (d) Should training courses for fisheries officers at certificate level be organized in conjunction with development centres, and how could this be arranged?
- (e) What is the need for refresher courses for fisheries officers at various levels?
- (f) How could universities and other research units be encouraged to take an interest in the development of fisheries and, where practicable, make facilities available for education and extension?

8. The following questions may be raised with respect to international (regional and worldwide) problems:

- (a) Should regional schemes for diploma courses for fisheries officers be organized, and if so, where?
- (b) Could regional training of teachers for national fishermen's training schemes be organized in connection with such courses?
- (c) Should post graduate courses, suitable for the needs of developing countries, be organized in countries which are technically more advanced?
- (d) Is there an interest for "crash-programs" to meet the immediate educational need of fisheries officers already employed? Should they be organized in one or more developed countries?
- (e) Would small regional meetings be useful to consider ways and means of co-operation on a regional basis with respect to education and development?
- (f) Should the preparation of textbooks and other educational material be initiated by the international organizations? Would member countries be ready to surrender material already available?

REFERENCES

- Ashby, E. (1964). *African universities and Western tradition*. London, Oxford University Press.
- Bruton, H.J. (1965). *Principles of development economics*. Englewood Cliffs, N.J., U.S.A. Prentice-Hall.
- Coomes, P.H. (Chairman). Policy Conference on Economic Growth and Investment in Education, 1961. I. *Summary reports and conclusions; keynote speeches*. Paris, OECD.
- Correa, H. (1963). *The economics of human resources*. Amsterdam, North Holland Publishing Company.
- Ewers, C.D. (1963). *The planning of agricultural education*. In FAO Seminar on Agricultural Education, Kampala, Uganda.
- FAO (1953). Improving fisheries contribution to world food supplies. *FAO Fish. Bull.*, 6(5): 159-188. Rome.
- (1953). Improving fisheries contribution to world food supplies. *FAO Fish. Bull.*, 6(5): 181. Rome.
- (1963). *Report of the FAO Seminar on Agricultural Education*, Kampala, Uganda, 1963.
- (1963). *Report of the FAO Seminar on Fisheries Development Planning*, held in Accra. Rome.
- (1965). *Report of the Ad Hoc Working Party on Agricultural Training Programs in Europe Intended for Trainees from Developing Countries*. Rome.
- *Study of agricultural education, research and extension in Latin America*. (Not yet published).
- *Report on fisheries education and training problems in Ghana, Sierra Leone, Nigeria, Tanzania, Kenya and Uganda. Based on the work of G.M. Gerhardsen. Rep. FAO/UNDP(TA)*. Rome. (In press).
- Fisjeristyrelsen (1962). (Directorate of Fisheries). Letter dated 20 August 1962, outlining a scheme for fisheries education.

- Fogg, C.D. (1963). *Manpower planning*. In Managing Economic Development in Africa, Conference, 1962, of the M.I.T. Fellows in Africa Annual Conference. Cambridge Mass., U.S.A. M.I.T. press.
- Foster, P. (1965). *Education and social change in Ghana*. Problems of educational development in a semi-modernized country. Chicago, Ill. U.P.
- Fourre, P. (Ed.)(1963). *Adult education techniques in developing countries*. A Greek case study. Paris, OECD.
- Halsey, A.H. (Ed.)(1963). *Ability and educational opportunity*. Paris, OECD.
- Harbison, F. *Human resource assessments*. In *Economic and social aspects of educational planning*. Paris.
- Ikejiani, O. (Ed.)(1964). *Nigerian education*. Longmans of Nigeria (Ikeja).
- ILO (1965). *Vocational training of fishermen*. Prepared by the ILO for the Preparatory Technical Conference on Fishermen's Questions. Geneva, Switzerland.
- Lewis, W.A. (1961). *Education and economic development*. Revised and extended version of a paper presented to the UNESCO Conference on the Educational Needs of Africa, held at Addis Ababa, Ethiopia, 15-25 May 1961.
- Myers, C.A. (1964). *Human resources for economic development*. In Managing Economic Development in Africa Conference, 1962, of the M.I.T. Fellows in Africa Annual Conference, Cambridge Mass., U.S.A. M.I.T.
- Norwegian Agency for Economic Development. *A plan for educating second hands and skippers (Ghana)*. Mimeo.
- OECD (1962). *Aspects of training in economic development*. Papers and proceedings of the First Meeting of Directors of Training Institutes in the Field of Economic Development, The Hague, Netherlands, 11-14 September 1961. Paris, OECD.
- Rowat, R. (1963). *Some problems in the planning of agricultural education at the national level*. In FAO Seminar on Agricultural Education, Kampala, Uganda.

- Thorp, W.L. (Ed.)(1964). *Development assistance efforts and policies*. Paris. OECD.
- UNESCO (1962). Conference on the development of higher education in Africa, held at Tananarive. Paris.
- (1964). *Economic and social aspects of educational planning*. Paris.
- Vries, E. de (1962). *Training in the field of economic development*. In Aspects of Training in Economic Development Meeting. Paris, OECD.
- Wilson, F.B. (1963). *Development toward closer co-operation in teaching, research and extension*. In FAO Seminar on Agricultural Education, Kampala, Uganda.
- (1963). *Staffing needs for institutions of agricultural education at all levels African countries*. An appraisal of the problem and some implications. In *ibid.* and Tissot, P.C. Agricultural education in African Countries with reference to the special program for education and training in Africa. Rome, FAO.
- and P.C. Tissot (1965). *Agricultural education in African Countries with reference to the special program for education and training in Africa*. Rome, FAO.
- Yarborough, L.I. (1965). *Proposal for a study of agricultural education in Malaya as a basis for preparing a national plan for agricultural education and training, based upon the needs of the country*, Rome, FAO.