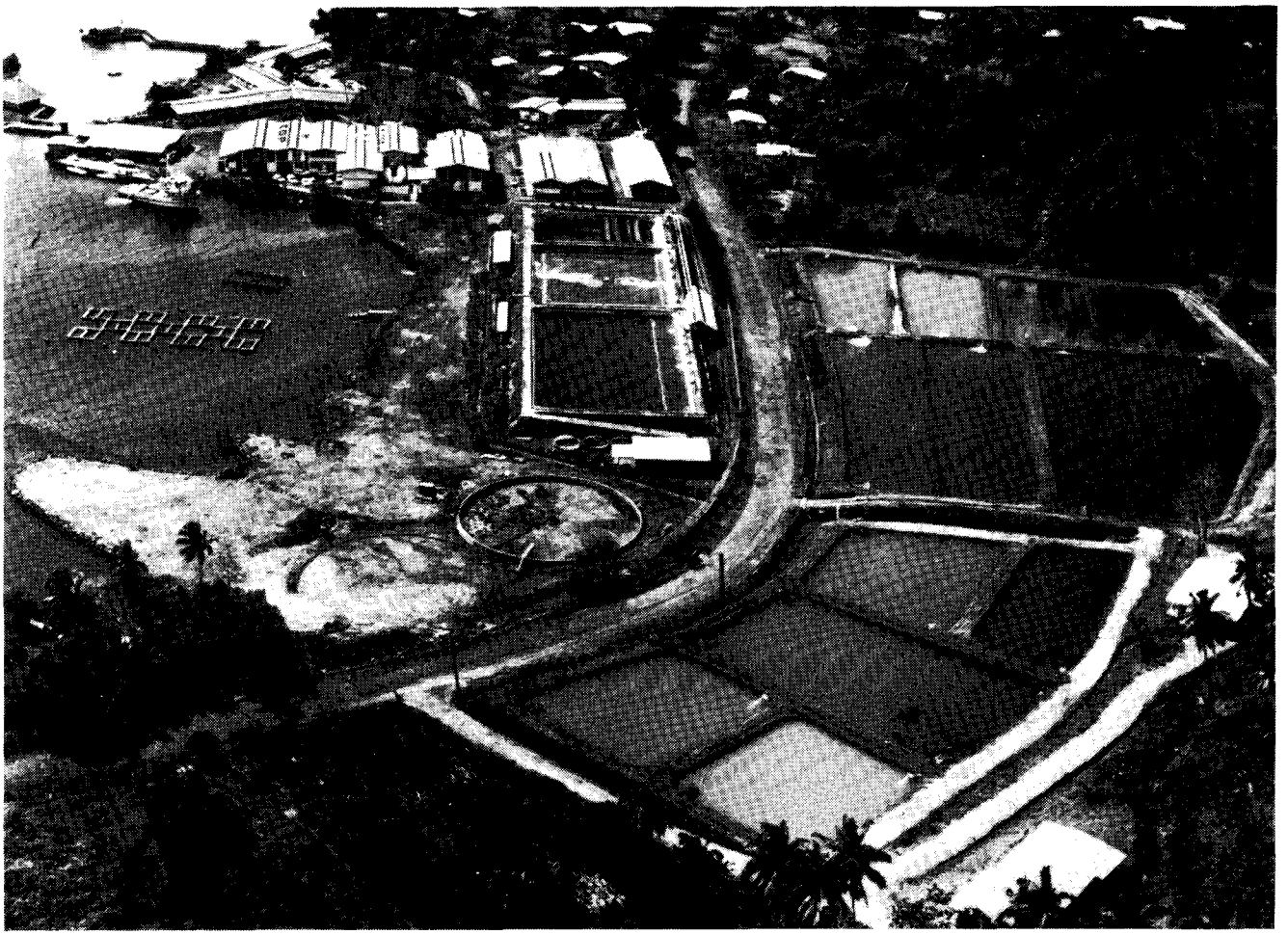
Aquaculture and its problems



Aerial view of the Pacific Oceanological Centre of CNEXO in Tahiti. (Photo : A Sylvain, Tahiti)

By AQUACOP*

In recent years, many articles have been devoted to aquaculture and the promise it holds for coastal states in general, and South Pacific islands in particular. This article aims to state the facts as they are and to describe the problems faced in developing this type of activity.

The world has now come to realise that the resources of the sea, long regarded as inexhaustible, are in fact quite limited. Despite the use of ever more sophisticated fishing techniques, total world catches are not progressing, and are even showing a tendency to regress. Experts have forecast a shortage of sea products within the next ten years.

To counteract this trend, a variety of solutions has been suggested: more systematic exploitation of known resources, prospecting for new resources, prevention of wastefulness in all its forms. While it is true that marine aquaculture could also contribute appreciably to reducing the deficit, we shall see that this is unlikely to happen in the short term without a particularly determined effort on the part of the countries concerned.

Aquaculture is the raising of fresh-water and sea-water plant and animal species under the control of man. In other words, aquaculture is to

*AQUACOP is the abbreviation used for the group of scientific teams of the Centre Oceanologique du Pacifique (COP), based in Tahiti, which is an offshoot of the Centre National pour l'Exploitation Des Oceans.

water what agriculture is to the land, but, agricultural activities have been carried on in all civilizations from time immemorial, while aquacultural activities are, on the whole, very recent. We know, of course, that carp were being raised in China 2,000 years ago, and oyster-farming has been practised in Europe for several centuries, but the economic impact of these activities remained confined to a relatively small geographic area.

Modern agriculture is the result of long years of research by specialists, who, little by little, succeeded in adapting species to varied environmental conditions. Aquaculture, on the other hand, has no such tradition — hence a shortage of qualified staff and almost total ignorance as to what species lend themselves to cultivation.

Lastly, it must be remembered that farming, whether on land or water, has never been an easy occupation. Preparation of the ground, pest control, harvesting, sale of produce — in fact, all the typical stages of agricultural production — have their counterpart in aquaculture, and the care and perseverance needed to negotiate every hurdle successfully is even greater in the latter case, where the problems that arise are often so new that solutions to them must be discovered and applied simultaneously.

Fortunately, not everything remains to be invented since aquaculture accounted for about ten per cent of the world fisheries production in 1975. The bulk was composed of fresh-water species, mainly from continental China. In South-East Asia, aquaculture is traditionally practised in vast brackish swamps where the natural aquatic population is very dense. It chiefly produces fish (mullets and milk fish, *Chanos chanos)* to provide much-needed protein for the inhabitants of this area. However, some countries (Thailand, Philippines) are now planning to re-orient their aquacultural activities towards the production of luxury items for export (fresh and sea-water shrimps).

Of the industrialised nations, Japan is the one which relies most heavily on the sea to meet its needs for animal proteins. Aquaculture has always been carried on there to some extent, but in the past 30 years a special developmental effort has been made. Modern aquaculture in Japan makes use of fisheries by-products and mainly turns out luxury goods which fetch very high prices.

Although oyster and mussel breeding are traditional to certain parts of Europe, and carp breeding to eastern European countries, it is with the raising of fresh-water salmonids (trout, in particular) that aquaculture really began to make headway in Europe and the United States.

We must therefore distinguish between two forms of aquaculture, both of which are still practised today. One is traditional and small-scale; the other modern and large-scale.

Traditional aquaculture consists of collecting fish or shellfish juveniles in their natural habitat and putting them into enclosures to grow on. No supplementary food is given; growth of the natural food present in the enclosures is simply stimulated in various ways. This type of acquaculture is thus extremely dependent upon environmental conditions. Although a number of techniques have been developed to maximize the collection of juveniles (oyster-spat for instance), it, too, remains a tricky business, subject to stock fluctuations beyond anyone's control. An improvement is to breed juveniles from genitors captured in the natural habitat, but this considerably increases production costs. Production is in the vicinity of 200 to 500 kg per hectare per year, which is low in comparison with present agricultural yields. This form of aquaculture is widespread in South-East Asia, where its contribution to the protein intake of the population is far from negligible.

Modern aquaculture proposes to raise aquatic animals just as one would raise sheep or cattle, that is to say, controlling their reproduction, ensuring maximum survival rates in the young, vulnerable stages, and feeding adults up to marketable weight in the shortest possible time. Outstanding examples of this form of aquaculture are trout farming (in fresh water) and salmon farming (in sea water), which are becoming profitable operations. Modern aquaculture is minimizing environmental constraints by controlling every stage of the life-cycle in captivity and supplying the animals with everything they need. Under such conditions, yields can reach several tonnes per hectare per year. This form of aquaculture, requiring less space than the traditional form, but rather sophisticated technology and a great deal of energy, is the only one feasible in industrialized countries, and also the only one which can some day be expected to produce the quantities

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from the initial planning and design of the questionnaire to the collection of the data. Unfortunately it did not prove possible in the time remaining for the course to complete the analysis of the data. This is being done by SPC and it is hoped that the results will be published by the Western Samoan Department of Statistics in the near future.

The Future

During the next two years, it is hoped to be able to improve and extend SPC's statistical training programme. By the end of 1979, a basic course should have been held in each country and territory in the region that has requested one. In some countries, there is likely to be a demand for repeat courses at regular intervals as new staff are recruited and operations expand. In other places, however, a demand might develop for training at a more advanced level. One area of importance which, as yet, has not received much attention is the training of middle-level and senior government administrators in the use of statistics as an aid to decision-making. With the move in many countries to decentralisation of decision-making this area is likely to become increasingly urgent.

It is proposed, therefore, within the next 18 months, to develop the existing notes for the basic level course into a more comprehensive training package. This will need to be flexible so that it can be readily adapted to the needs of particular countries. A large variety of subjects will need to be covered so that these can be included to a greater or lesser depth depending on the actual circumstances. The ultimate aim should be to make this package more or less self-contained so that it can be slotted into countries' own training programmes as required. □

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of proteins the world will need.

Complete mastery of the breeding cycle of a species involves controlling every stage of the animals' life. The first step is to get juveniles to reach maturity and to lay eggs. The characteristics of the larvae which hatch out are usually very different from those of the adults of the same species. Rearing the larvae consists of providing for their every need until these tiny dots, sometimes of microscopic size in the early stages, develop into creatures that look like their parents in every respect except size. This is the trickiest stage during which mortality can be very high, since the animals, because they are so small, are extremely vulnerable and can tolerate only very special foods. Then comes the growing or fattening up stage, which is the longest one, ending with the production of individuals of marketable size.

It is not, however, enough to control the biological cycle in the laboratory. This is merely the **experimental phase** of the operation, which involves only a few thousand animals and does not directly lead to industrial production. The development of a reliable semi-industrial procedure occurs in the course of a **pilot phase.** This involves the raising of several million individuals and may be expected to yield a few tonnes of marketable produce. However, disease problems often appear here that were not encountered during the experimental phase. Both these phases require an intensive and extensive research effort (such as nutrition, water control, building works) which can only take place in specialised centres. The techniques developed during the pilot phase are then applied on a trial farm to assess their economic feasibility. Only if this **demonstration phase** proves beyond a reasonable doubt that the new activity has the makings of a profitable industry is it possible to encourage private investors to develop it.

The phases described above are the same for every species of marine animal. Whether one is dealing with molluscs, crustaceans, or fish, a good two or three years are necessary for controlling the life cycle under laboratory conditions (experimental phase), a further two or three years for breeding on a semi-industrial scale, and two or three years again for assessing economic feasibility; that is time for two or three harvests and a study of marketing problems (demonstration phase).

A government or private company may conceivably decide to carry out the economic demonstration itself, using the techniques developed in the pilot stage. However, all this amounts to no more than the cleaning of virgin bush and it will take ten years or so of uninterrupted activity before the industry can be regarded as well and truly established. □

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