# THE SHAPE OF FISHERIES TO COME SOME THOUGHTS ON FISHERIES DEVELOPMENT AND EDUCATION WITH SPECIAL REFERENCE TO AQUACULTURE

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## INTRODUCTION

The world fisheries is still mainly (90% of the total production) capture-oriented, which is just the reverse of plant-based and animal-based food production systems. In spite of the fact that the surface area of waters in the world is over 3–times that of the land and is also less accessible, given time, aquaculture would clearly point to this development. Leaving out the aqua-food (rice excluded), cultivated crops are the main source of human food. Man's unfamiliarity of the watery environment might only delay the process of development of aquaculture. But now with the global awareness of population explosion and food/protein shortage and limitations of terrestrial and aquatic production and also with the advances of science and technology, capable of penetrating millions of miles into the starry world, man would certainly 'plough' the waters as successfully as he does with the land.

## EVOLUTION OF WORLD FISHERIES

I have suggested in Figure 1 three stages in the evolution of world fisheries (aquaculture) in the future. Stage I depicts the present position. The relative areas for capture (cp) and culture (Cl) fisheries approximate the contributions to overall fisheries production. The present global culture fisheries production is about 10% of the total, but in the 'near' future (Stage II), it (Cl) would increase and in the farther future (Stage III), it (Cl) would be over 50% of the total production. "Capture" would still be about half of the total production, but inroads of 'culture' into 'culture' will be much more for the capture operations will be based greatly on contributions from culture (Stocking and artificial recruitment), as the world's wild stocks would be overfished and man's intrusions (industrialization/ pullution) would reduce the wild stocks considerably. Thus in the real sense, the major portion of production (hatched area in the stages in Figure 1) would be strictly aquaculture-based but due to the nomenclature (accepted as 'capture') and indeed the major need for capture of the stocked fishes, 'captured fisheries' would continue to be about half or diminished half of the total.

Unbroken and broken horizontal arrows in the figure indicate greater and lesser influences (Cp or C1) on each other - the trend being a greater influence of capture (wild) fisheries on culture fisheries in the beginning, as now, which changes with time, as human control over the total fisheries increases.

The element of time involved is not specified, because of, as it appears, the telescoping effect of time on human progress or at any rate the telescoping of the progress in scientific achievements of man with time. Therefore, events conceived to take place in 50–100 years now could take place in 5–10 years from a fixed point in time in future. However, one might guess that in the next 50 years aquaculture production would be equal to capture fisheriee sproduction.

### *Disciplines in Fisheries*

The various components involved in fisheries are indicated in Figure 2 as affecting all the changes in fisheries through time. The four major components, which may be treated as disciplines inside fisheries, are depicted as biology of the species involved., environment, technology/ engineering and socio-economics. Thed sub-components concerned are also indicated. A moment's reflection would make it obvious that the component with some modifications are also more or less common for not only the capture and culture fisheries, but also for most of the living resources - would's plant and animal crops.

An overall viewing of this type of obvious help to planners and educators as is recognized, but not often realized, especially in curricular planning and development.

The various sub-components in Figure 2 are the various subjects, courses or topics, depending on the stress needed to be covered, under the broad component/discipline headings in the figure. These are not complete but do suggest most of the interests. In long-established systems as for agriculture and animal husbandry these are well-formulated but for disciplines such as fisheries, the systems are relatively new, in spite of the fact that fisheries and allied subjects are taught for some years in various biology departments in the universities and also in a few fisheries colleges and universities - the latter especially in certain advanced countries such as Japan and U.S. are exceptions. Again, here the total approach is for fisheries, with aquaculture getting a subsidiary role if any at all.

It is of interest to view the role or importance of the various components sub-components depicted in the figure on the type of fisheries either capture. The approaches of the two subdivision of fisheries would be entirely different. For example, we can look up the interplay of the environment on the capture fisheries and explain the past and also future performances in a detached sense, with much less control. But, as is obvious, with the culture systems, we would look at the environment e.g. a fish-pond environment as soil conditions of a farm as controllable. The technology/engineering for aquaculture will often be much profound and meaningful.

As indeed is well recognized aquaculture is this more akin to agriculture for study of most scientific disciplines than it is to fisheries (capture fisheries). It is the water and biological materials which are the common links of capture fisheries and aquaculture, but if one looks at pond culture, areas such as soil-water interaction and regulation of the chemical environment are as important for aquaculture as they are for agriculture.

While, the technology of high yielding varieties of crops might reduce the compatibility of fish-crop-livestock growing advancement of science and the need for integration of such systems (also need for recycling and pollution control and adoption of biological control methods, evolution of resistant varieties etc), would bring aquaculture and agriculture to real proxity universally, if not immediately, in the future, as is indeed realized and practised in certain ancient parts of the world.

From the point of view of the educator, it is convenient to teach many aquaculture subjects with specialists in the field so close to agriculture. Both these will fit-in together in the rural scene of developing countries also. The situation in most areas connected with capture fisheries is somewhat different.

Again, as recognized, in one area, especially post-harvest technology and marketing of the product, capture and culture fisheries are identical. Species biology and environment also have many common grounds in capture and culture, but here again one's approach is to manipulate the populations in an uncontrolled environment while the other's is to manipulate the environ for controlled populations. Indeed as is suggested, the two systems would drift towards each other but may remain separate considering the space involved.

In academic programme as indicated, it would be convenient to have aquaculture programmes going in proximity to agriculture programmes, but an obvious common groups for capture and culture fisheries should be maintained wherever the two programmes can coexist. Much of the basic aspects often included in the first degree in the university can be offered together.

In as much as fisheries and aquaculture programmes are developed new in several universities all over the world, aquaculture training programmes are actively planned and organised by

ADCP global network of FAO (this Centre) is a part, it is useful as indeed had been done, in some cases to view proximity and interdependence of the various components or disciplines of fisheries and agriculture and formulate teaching programmes accordingly.

For a general programme in fisheries, as a first degree or bachelor's degree of a university, it would be pertinent to offer together all the disciplines (biology, environment, technology/engineering and socio-economics complexes), cutting across the two divisions, capture fisheries and aquaculture.

*Explanations for Figures*

*Figure 1*

Likely changes in capture (Cp) and culture (Cl) fisheries contributions to overall fisheries production (harvested biomass) with time. The present global culture fisheries production is less than 10% of the total (Stage I, Figure 1), but in the 'near' future (Stage II) it (Cl) would increase and in the 'far' future (Stage III) it would be over 50% of the total production – capture would still be about half of the total production but inroads of 'culture' into 'capture will be much more, for the capture operations will be based on contributions from culture (stocking and artificial recruitment) as the world's wild stocks would be over-fished and man's intrusions (industrialization/pollution) would reduce the wild stocks considerably – thus in the real sense the major portion of production (hatched areas in the 'stages' in figure) would be strickly aquaculture based, but due to the nomenclature accepted as 'capture') and indeed the major need for 'capture' of the stocked fishes. 'Capture' fisheries would continue to be about half the total. Unbroken arrosw and broken horizontal arrows indicate the influence of one type of culture or the other ('Cp' vs 'Cl') – the trend being a greater influence of capture (wild fisheries) to culture fisheries in the beginning as now (Stage I) which changes with time (Stage II and III), as human control over the total fisheries increases.

At higher levels of specialization, say for the second or third degree programmes, it would be useful to branch off into capture fisheries or aquaculture and to individual disciplines affecting each division, as the subject of interest needing deeper study. Indeed, the accent of course programming contents for capture fisheries and aquaculture, as has been pointed out, will be more different as also are the expertise and facilities required. Having both these broad divisions under the same roof especially in higher level academic programmes will be highly expensive, though helpful, as is indeed experienced in a few such centres existing.

The ideas presented here have been collected/developed (1–5) in the course of my association with fisheries teaching, organising a fisheries programme (Fisheries College, Tuticorin) of the Tamil Nadu Agricultural University and also my involvement as Aquaculturist (Training) with the Post–graduate course for senior aquaculturists offered at the African Region Aquaculture Centre, Port Harcourt, Nigeria, which is part of the global network of the Aquaculture Development and Coordination Programme (ADCP) of the F.A.O.

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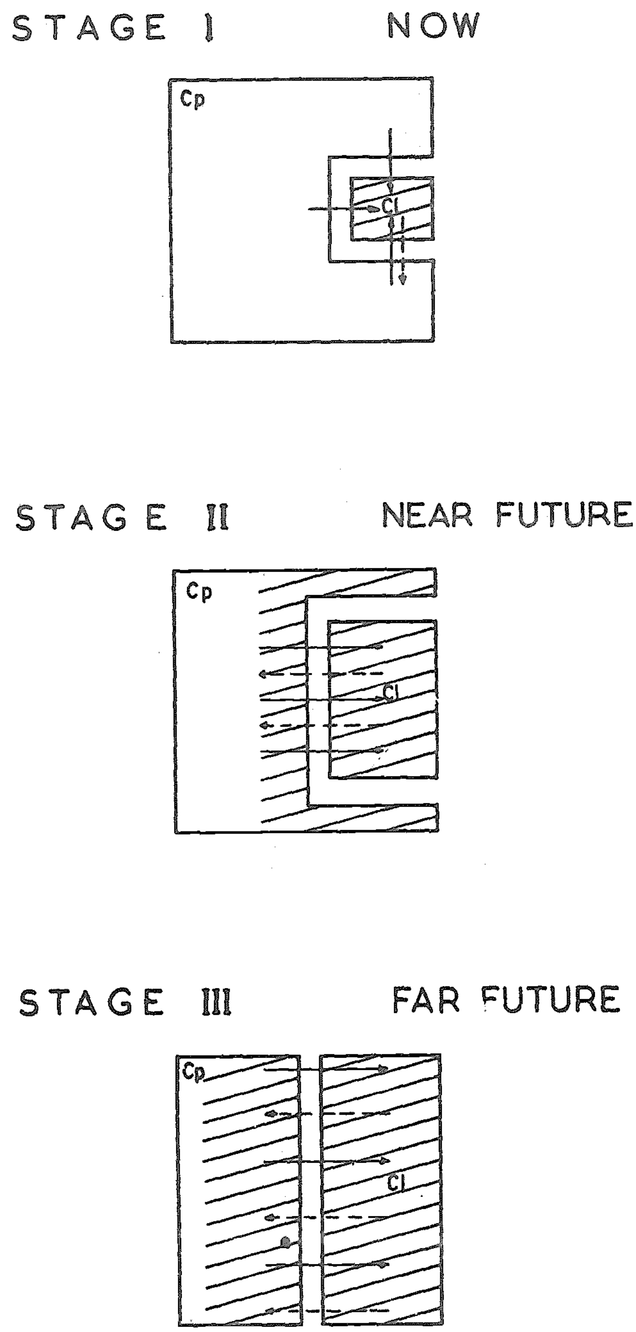
STAGE I
NOW
Cp
Cl
STAGE II
NEAR FUTURE
Cp
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STAGE III
FAR FUTURE
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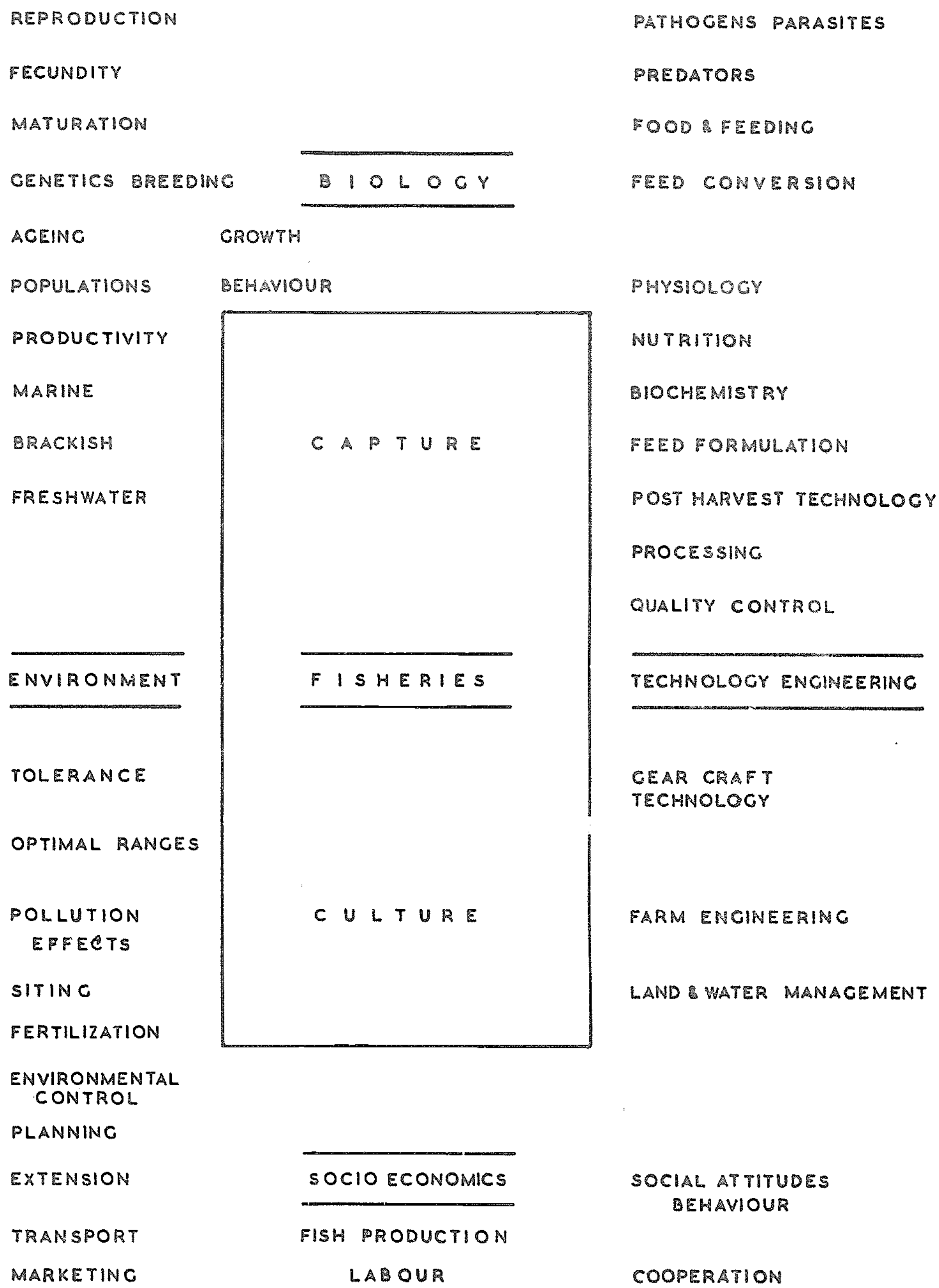
FIGURE 1.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LAND & WATER MANAGEMENT
SOCIO ECONOMICS
FISH PRODUCTION
LABOUR
SOCIAL ATTITUDES BEHAVIOUR
COOPERATION

FIGURE 2.