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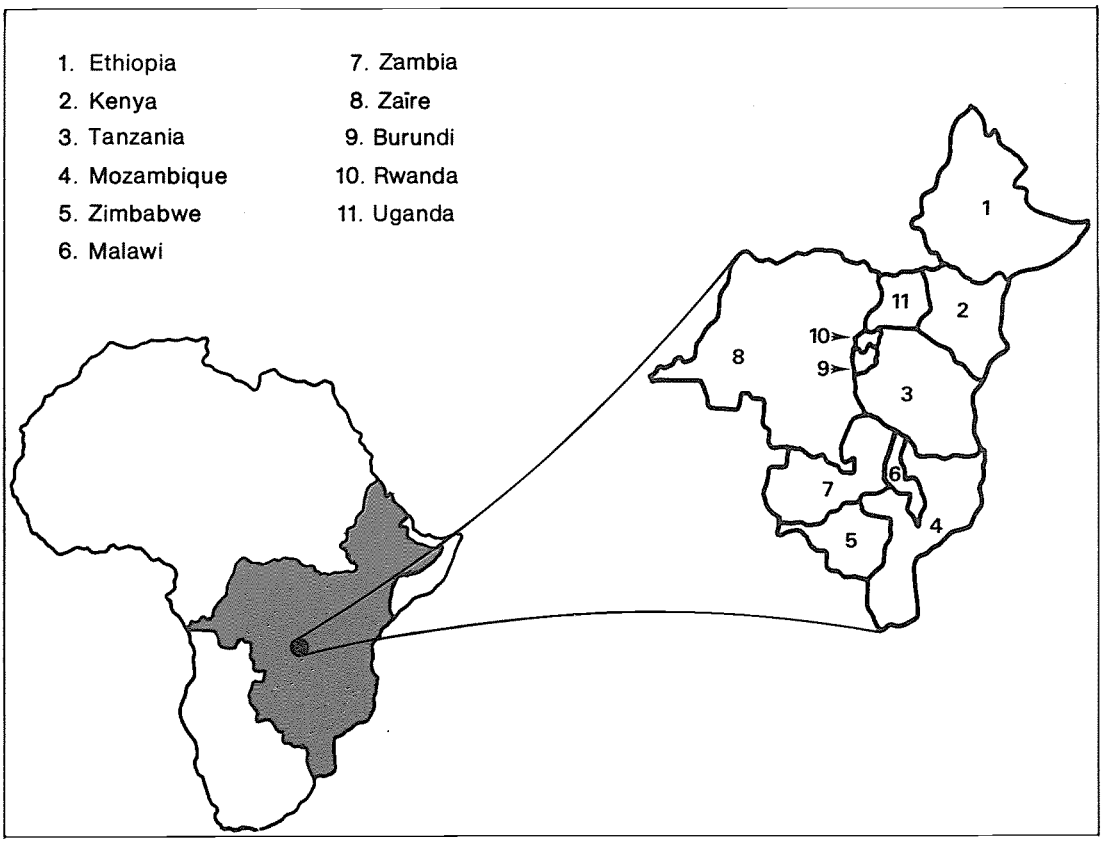
REGIONAL PROJECT FOR INLAND FISHERIES PLANNING, DEVELOPMENT AND MANAGEMENT IN EASTERN/CENTRAL/SOUTHERN AFRICA (I.F.I.P.)

IFIP PROJET

RAF/87/099-TD/12/90 (En) June 1990

PAPERS PRESENTED AT THE IFIP/SWIOP WORKSHOP ON THE ECONOMIC ASPECTS OF FISHERIES DEVELOPMENT AND MANAGEMENT

(October 30 to November 9, 1989
Dar-es-Salaam, Tanzania)



UNITED NATIONS DEVELOPMENT PROGRAMME

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

UNDP/FAO Regional Project
for Inland Fisheries Planning
Development and Management in
Eastern/Central/Southern Africa

RAF/87/099-TD/12/90 (En)

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UNITED NATIONS DEVELOPMENT PROGRAMME
Bujumbura, June 1990

The conclusions and recommendations given in this and other reports in the IFIP project series are those considered appropriate at the time of preparation. They may be modified in the light of further knowledge gained at subsequent stages of the Project. The designations employed and the presentation of material in this publication do not imply the expression of any opinion on the part of FAO or UNDP concerning the legal status of any country, territory, city or area, or concerning the determination of its frontiers or boundaries.

PREFACE

The IFIP project started in January 1989 with the main objective of promoting a more effective and rational exploitation of the fisheries resources of major water bodies of Eastern, Central and Southern Africa. The project is executed by the Food and Agriculture Organisation of the United Nations (FAO), and funded by the United Nations Development Programme (UNDP) for a duration of four years.

There are eleven countries and three intergovernmental organisations participating in the project: Burundi, Ethiopia, Kenya, Malawi, Mozambique, Uganda, Rwanda, Tanzania, Zambia, Zaire, Zimbabwe, The Communauté Economique des Pays des Grands Lacs (CEPGL), The Preferential Trade Area for Eastern and Southern African States (PTA) and the Southern African Development Coordination Conference (SADCC).

The immediate objectives of the project are: (i) to strengthen regional collaboration for the rational development and management of inland fisheries, particularly with respect to shared water bodies; (ii) to provide advisory services and assist Governments in sectoral and project planning; (iii) to strengthen technical capabilities through training; and (iv) to establish a regional information base.

...

This document includes the six technical papers presented at the Workshop on Economic Aspects of Fisheries Development and Management. The Workshop was held from October 30 to November 9, 1989 at the Kunduchi Fisheries Institute, Dar-es-Salaam, Tanzania. It was co-sponsored by the Regional Project for Inland Fisheries Planning, Development and Management in Eastern/Central/Southern Africa (IFIP) and the Regional Project for the Development and Management of Fisheries in the Southwest Indian Ocean (SWIOP).

The report of the workshop and the case studies presented during the workshop are issued by the project in two separate publications.

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IFIP PUBLICATIONS

Publications of the IFIP project are issued in two series:

A series of technical documents (RAF/87/099-TD) related to meetings, missions and research organized by the project.

A series of working papers (RAF/87/099-WP) related to more specific field and thematic investigations conducted in the framework of the project.

For both series, reference is further made to the document number (12), the year of publication (90) and the language in which the document is issued: English (En) or French (Fr).

For bibliographic purposes this document should be cited as follows:

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TABLE OF CONTENTS

+1. INTRODUCTION

PREAMBLE:

This document is the Proceedings of the Workshop on Economic Aspects of Fisheries Development and Management. The Workshop took place at the Kunduchi Fisheries Institute, with the participants being accommodated at the nearby Kunduchi Beach Hotel. It was sponsored by the Regional Project for the Development and Management of Fisheries in the Southwest Indian Ocean (SWIOP) and the Regional Project for Inland Fisheries Planning, Development and Management in Eastern/Central/Southern Africa (IFIP).

Local support was provided through the host agencies, namely the Tanzania Fisheries Research Institute (TAFIRI) and the Department of Fisheries within the Ministry of Natural Resources and Tourism. The funding source was the UNDP, indirectly through SWIOP and IFIP.

BACKGROUND AND PURPOSE:

For some time FAO has taken a lead role within the African Regions towards improving the capabilities of national scientists in undertaking fisheries investigations. Much of the emphasis has been directed to having persons trained in assessing and monitoring the fish resources. The emphasis has more recently shifted towards experience training in the formulation of development and management plans at the sectoral level in many countries and also in respect to specific fisheries.

It is well recognized that the formulation of such plans requires not only a consideration of the impact on the resources and the magnitude of sustainable catches, but also the economic and socio-economic consequences of a variety of management options. As such it is highly appropriate that at least equal attention be directed towards improving national capabilities to undertake economic and socio-economic studies and evaluations.

In concert with the above it was decided that the SWIOP and IFIP should jointly sponsor two Workshops on Economic Aspects of Fisheries Development and Management. These Proceedings provide an account of the first of the Workshops which was conducted in the English language. The second workshop, to be conducted in French, is scheduled for mid-1990.

PARTICIPATING COUNTRIES:

Ethiopia, Kenya, Malawi, Mauritius, Mozambique, Seychelles, Somalia, Tanzania (mainland and Zanzibar), Uganda, Zambia and Zimbabwe.

STRUCTURE OF WORKSHOP AGENDA:

In structuring the agenda for this Workshop, it was decided to focus on the following broad subjects:

- Introduction to management concepts, instruments and strategies
- Conduct of socio-economic baseline studies
- Conduct of costs and earnings studies
- Conduct of cost benefit studies

- Marketing studies and monitoring
- Financing the fisheries sector
- Sectoral planning in fisheries

A verbal introduction supported by a written account of the subject matter in respect of each agenda item was provided by staff members and consultants of the sponsoring Projects. These written accounts provide much of the substance of these Proceedings.

In addition, eight case studies were presented, mostly by national participants who had prepared experience papers under authors contract arrangements with FAO. Five of these case studies are included in these Proceedings. The other three, because of their size, are to be published separately.

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3. PAPERS PREPARED FOR THE WORKSHOP

INTRODUCTION TO MANAGEMENT CONCEPTS, INSTRUMENTS AND STRATEGIES

by

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ABSTRACT

This paper provides an introduction to the bio-economic relationships in fisheries, the objectives and instruments of management, and the strategies of implementation. The coverage of these aspects includes treatment of the special difficulties of managing fisheries set within a poorly managed economy having chronic unemployment procedures.

1. INTRODUCTION

The intention underlying the preparation of this paper is to provide an introduction to the principles and practices of fisheries management. In doing this the author has chosen to consider separately two types of fishery situation.

The first of these is set within a well managed economy, with adequate employment opportunities and where the distribution of wealth is reasonably equitable (Part I). Often such a fishery will be semi-industrial or industrial, involving a single gear, a single target species, and relatively few fishing units.

The second is within a poorly managed economy, where there are wide socio-economic disparities and severe unemployment or under-employment (Part II). Here, fisheries are typified by being over-crowded and small scale, based on a multitude of species, and often involving the concurrent use of several gears.

In concert with the above, there are two important presumptions which are embodied within the contents of the paper. The first is the presumption that the fish resources are the common property of the people. The implication from this is that all the people should have the opportunity to benefit (directly or indirectly) from the exploitation of the resource.

In an open access fishery some people will choose to realize this opportunity through direct involvement (e.g. fishermen and fish traders) while others will not. By contrast, in a limited entry fishery some potential fishermen will be excluded from direct involvement, and may expect to receive compensation for their loss of entitlement.

The second and related presumption is that the managers of fisheries (normally governments), in seeking to manage according to a policy of furthering the well-being of the general public, will do so in accordance with the following two objectives:

(i) to achieve benefits through the full and proper use of the available resources (e.g. fish, capital and manpower), and

(ii) to ensure that these benefits are equitably distributed.

The former is concerned with the allocation of inputs and the latter with the distribution of benefits (e.g. income, employment, consumables).

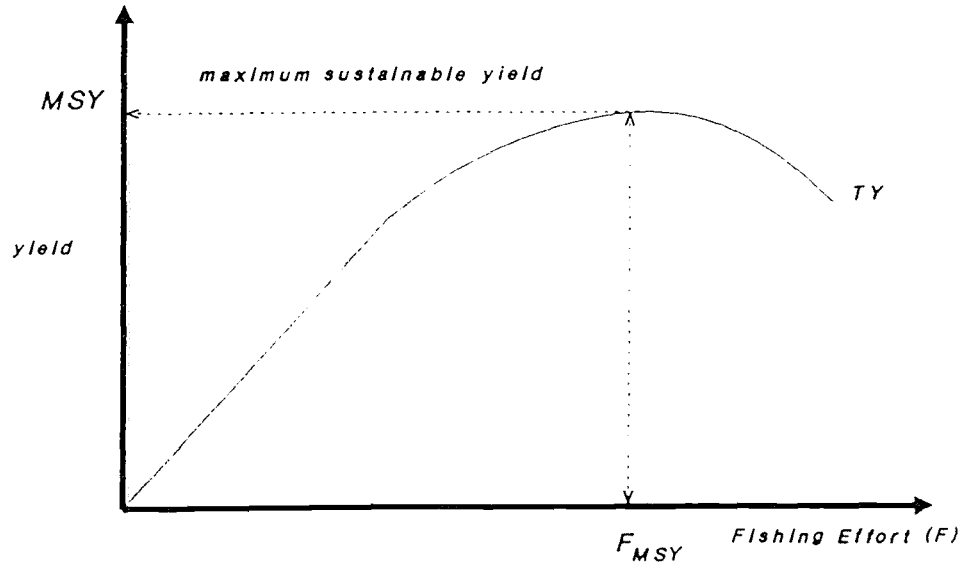
PART I

BIO-ECONOMIC RELATIONSHIPS

2.1 Fishery Inputs and Outputs

The first relationship to examine is that between given levels of annual fishing effort (applied over many years) and the resulting mean annual weight of catch (Figure 1). The observed features of such a relationship include there being a maximum (i.e. the productivity of the resource is limited) at which point the annual catch is commonly referred to as the maximum sustainable yield (MSY). The level of effort to attain the MSY is called the effort at MSY (F_{MSY}). The application of higher levels of effort will result in less catch. The extent of reduction with increasing effort may be substantial (for long-lived species having low fecundity, e.g. sharks and whales) or relatively minor (for short lived species with high fecundity, e.g. shrimp and sardines).

Figure 1: Relationship between Yield and Fishing Effort.



The second relationship is that between given levels of annual fishing effort and the resulting gross revenue (Figure 2). Again the relationship is associated with a maximum. The average gross revenue at this point is often called the maximum gross revenue (MGR). This will be attained when the fishing effort is the same as the effort at MSY, provided that the price of the fish remains constant for all levels of catch and effort.

The type of input considered so far has been the fishing effort. Another important input is fishing cost. This is normally assumed to be linearly dependent on the level of fishing effort, with increasing efforts being associated with increasing costs (Figure 3). The fishing costs will include both fixed and variable components, as well as local currency and foreign currency components. When the fishing effort is high, the costs may equal or exceed the gross revenue from the fishery.

Figure 2: Relationship between Fishery Gross Revenue and Fishing Effort.

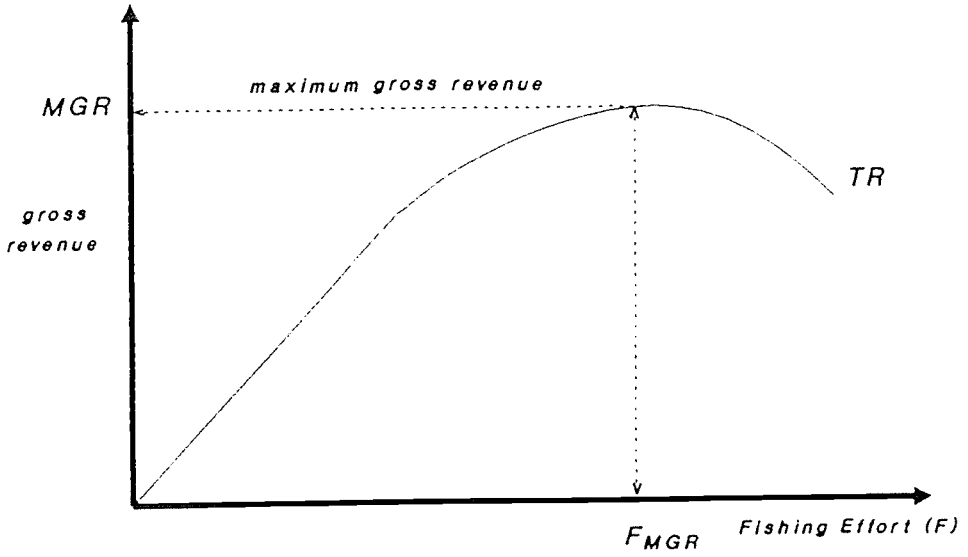
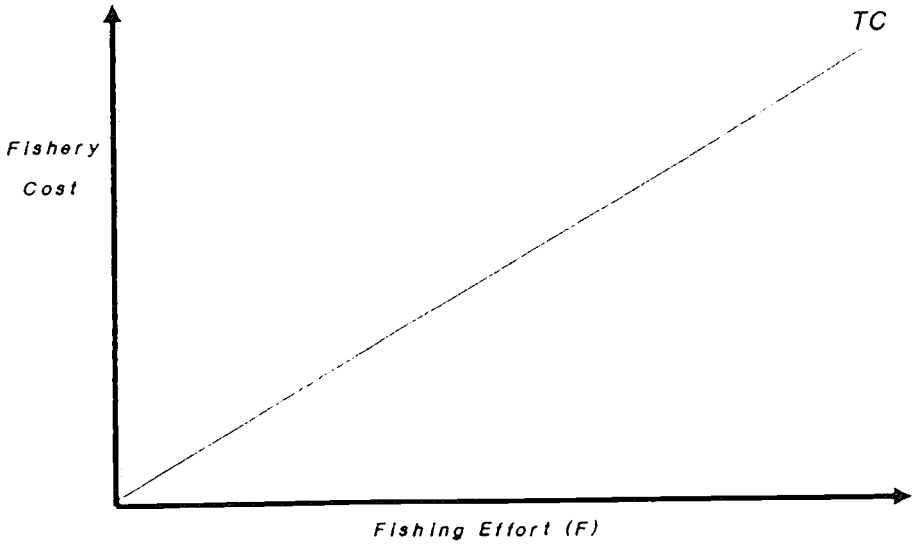


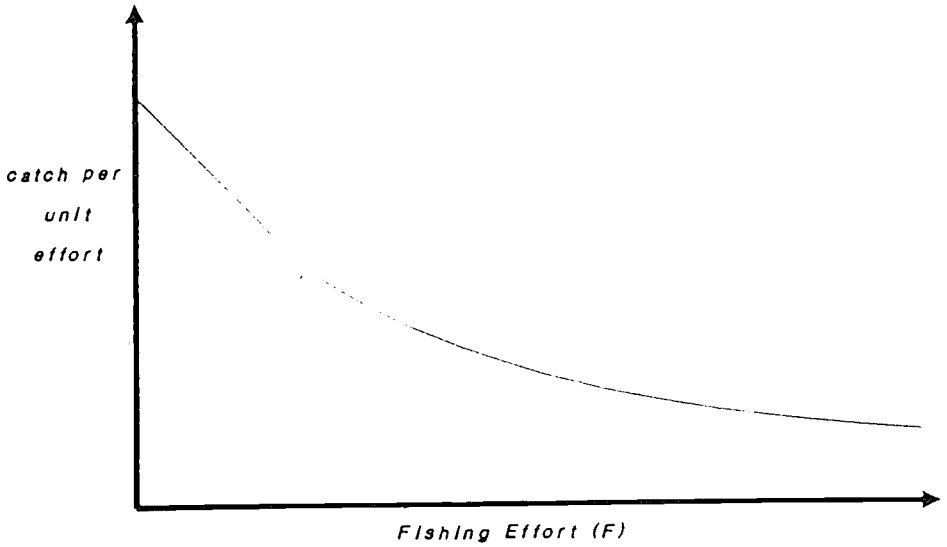
Figure 3: Relationship between Fishery Cost and Fishing Effort.



2.2 Fishery Inputs and Performance

The first indicator of performance considered here is the mean annual catch weight per unit fishing effort. Its relationship with fishing effort (applied over many years) can be derived by dividing the observed annual fishing efforts into the associated mean annual catch weights (i.e. yield). The highest catch per unit effort occurs when the fishing effort approximates to zero. Increasing levels of fishing effort are associated with decreasing catches per unit of effort.

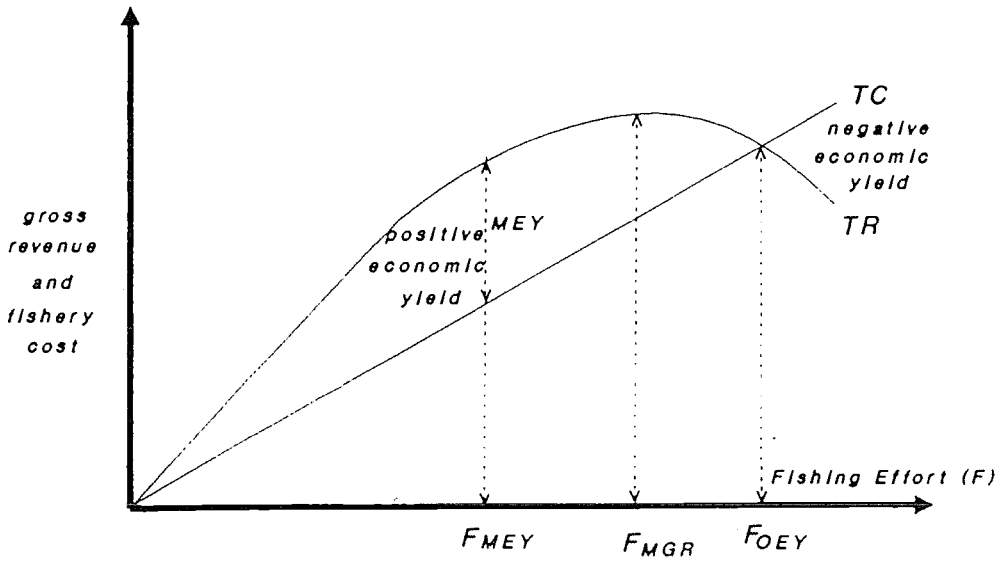
Figure 4: Relationship between Catch per Unit Effort and Fishing Effort.



Two alternative mathematical forms to the relationship (between catch per unit effort and effort) are commonly used when modelling the dynamics of particular fish stocks. In one, it is assumed that the relationship is linear and in the other that it is exponential.

The second indicator of performance to be considered is the economic yield (or resource rent) to the fishery. This is defined here as the difference between the gross revenue and the fishery costs for a given level of fishing effort (Figure 5). In this, the fishery costs include a return to the participants (e.g. boat owners) for their labour, management and capital. It is assumed here that the opportunity cost of the inputs (e.g. labour, management and capital) are the same outside the fishery. (If not then the difference between gross revenue and fishery costs is profit. The relevance of this distinction will become clearer in Part II).

Figure 5: Relationship between Economic Yield and Fishing Effort.



The relationship between fishing effort and economic yield is associated with a maximum, called the maximum economic yield (MEY). The level of effort to attain the MEY is indicated by F_{MEY}. The latter will always be less than the effort at MSY, possibly as much as 50 percent less. At high levels of fishing effort the economic yield might be zero (at F_{OEY}) or even negative.

While the above depiction of equilibrium situations are highly useful, it is important to be aware that such things as fish prices and fishing costs will change (in real terms). These in turn will change the magnitude of MEY and probably also the position of F_{MEY}. This has additional importance in the context of management. It may be prudent for managers not to define the management objectives (e.g. MEY), with a high level of specificity, unless they are also prepared to make the necessary adjustments to the management regime as circumstances change.

3. OBJECTIVES OF MANAGEMENT

3.1 Why Manage Fisheries

The need for fishery management arises from the fact that the fishing effort would otherwise continue to increase, at least until there is no economic yield remaining in the fishery (i.e. at F_{OEY}). The rate at which this might occur will tend to be greater for fisheries which are easy to enter (e.g. requiring little capital or skill) and where the opportunity costs associated with the inputs are highest compared with alternative uses outside the fishery.

An important contributing factor will be the tendency for the existing or potential fishermen to expect that the returns per unit of additional input will remain as they were prior to the inputs. This ignores reality, as the return per unit input (e.g. catch per fishing effort) will decrease as the magnitude of the total inputs into the fishery increase. (This may not be so in the short term, but will certainly be so in the long term).

In the earlier part of this paper, it was proposed that management policy should be to further the well-being of the general public. The objectives to achieve this would be the proper and full allocation of inputs and equitable distribution of the benefits (from fishing). In a well functioning economy, the proper and full allocation of inputs is most likely to imply the attainment of the maximum economic yield as an objective.

In reality, there will be other subsidiary objectives. All countries at one time or another will be concerned with problems of international balance of payments, and as such will tend to give priority to encouraging net foreign currency earnings (where possible).

The maximization of net foreign currency earnings in the case of export fisheries will occur at a fishing effort greater than F_{MEY}. Where there are no foreign currency components within the fishery costs and all the product is exported, the net foreign exchange earnings will be maximized at MGR, at a fishing effort corresponding to F_{MGR}.

The attainment of MSY as a long-term management objective is unlikely in a well managed economy. It does have a certain appeal as a short-term objective, particularly where fishing effort is already excessive, as the concept of maximizing yield is easily understood and is associated with little political controversy.

> *Example: The International Council for the Exploration of the Sea (ICES) which coordinates fisheries research and provides recommendations on total allowable catches (TACs) for the North-east Atlantic countries, does so with MSY as the objective for each of the fish stocks under consideration. It is subsequent to the allocation of quotas at the national level that some countries have implemented management regimes aimed at reducing fishing effort and costs presumably in order to ultimately move their fisheries closer to MEY.*

3.2 Some Additional Considerations

Much of the above concerns the long-term consequences of a particular management regime. It is necessary to be aware, however, that the short-term consequences of implementing the same management regime will usually be different. If the fishing effort being applied is greater than the

effort at MSY, for example, the long-term consequence of reducing the effort will be to increase the mean annual catch. In contrast, the short-term consequence would normally be a reduction in the catch. The latter is because it takes some time for the fish population to adjust (through growth and survival effects) towards achieving a new equilibrium. The time to adjust is greater for the longer lived species.

Managing a fishery at the higher levels of fishing effort will cause the variability of catches from year to year to be greater than if lower levels of effort are applied. This will tend to be particularly so for the short-lived species as compared with long-lived species. The latter is due to there being less year classes in the catches when the fishing levels are high, in which case the intrinsic variability in the "strength" of each year class becomes more noticeably reflected in the catches. In recognition, managers may seek to apply a lower fishing effort than otherwise in order to cause less variability in the annual catches and incomes.

4. INSTRUMENTS OF MANAGEMENT

4.1 Licence Limitation

The instrument here is the fishing licence which may be applied in respect to the fishing unit (e.g. boat) or to a person (e.g. fisherman-in-charge). The process of limiting the number of fishing units or persons participating in the fishery is licence limitation. The number would be determined in reflection of the management objectives. If the fishery is to be managed at the MEY, for example, then the desired number will be that consistent with achieving a combined fishing effort equal to the F_{MEY}.

Invariably, it will be necessary not only to limit the number of licence holders, but also to restrict their fishing power (often administered through endorsements written on the fishing licence). If this is not done, the competitive nature of fishing will cause the fishermen to increase the fishing power of their units, with the result that despite licence limitation the fishery effort will exceed F_{MEY} and the objective to attain MEY will not be achieved.

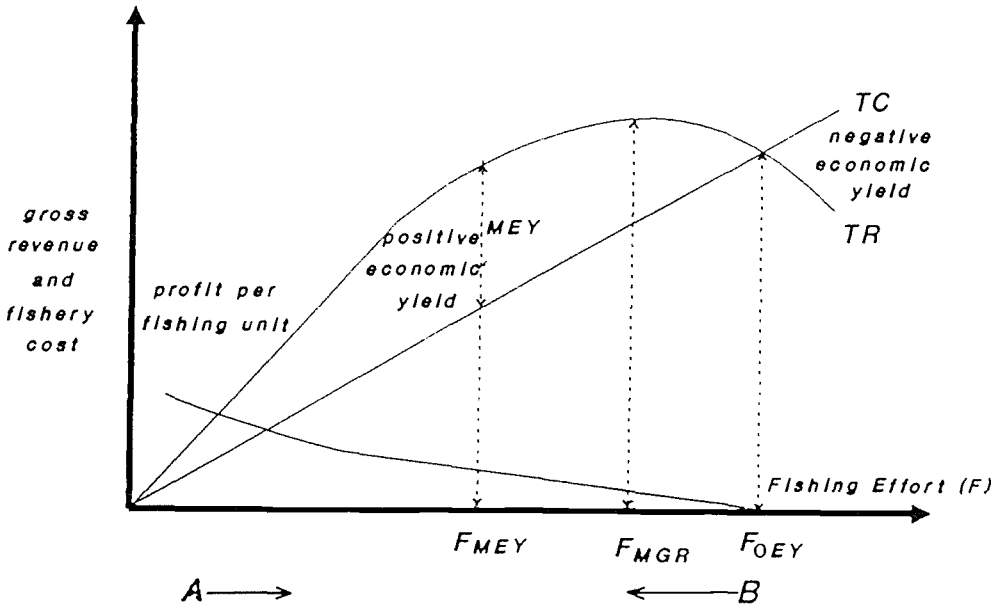
The determinants of fishing power are many. For example, the fishing power of a trap fisherman is likely to be increased as the consequence of using more traps, larger traps and traps of a superior design. Lifting the traps more frequently may enhance fishing power, as also will the choice of a more attractive bait.

The extent by which it will be necessary for management to impose restrictions on fishing power will vary substantially between fishery types.

This aspect of licence limitation is somewhat unfortunate in the sense that the associated restraints on fishing power tend to mitigate against economic efficiency. Innovations which enhance fishing power are discouraged. It does not, however, act against those innovations which reduce costs.

An extremely important aspect of licence limitation (as with individual catch quotas) is that the licences, by virtue of being limited, accrue a value. The extent of this value will relate in large part to the economic performance of the fishery, either real or envisaged. This value will not be static, but will adjust along with the economic performance of the fishery (and alternative occupations), and in particular as the average economic performance per fishing unit changes (Figure 6).

Figure 6: Diagrammatic representation indicating direction of loss of entitlement value (A) and gain in value (B).



4.2 Catch Quotas

Catch quotas are the most direct way of controlling the annual catch. The quota may be set at achieving MSY, MEY or some other objective, that is, as with the other instruments of management, the precursor is the identification of the fishery objective.

A total fishery quota will not in itself lead to economic efficiency. If nothing else is done, the existing fishermen will seek to maximize their individual share of the quota and, together with the entry of additional units, the fishery will tend to become over-manned and overcapitalized. Ultimately, the level of fishing effort will be reached whereby all the economic yield will have been dissipated (i.e. at F_{OEY}).

The more efficient approach in the economic sense will be to divide the fishery quota amongst the fishery participants, that is, to administer a system of individual catch quotas. The individual catch quotas may be in the form of tonnages, although it will usually be preferable to allocate them as percentages (of the fishery quota).

If there are already too many fishing units and the annual catch is in excess of the desired catch, the associated problem will be to reduce the annual catch and remove fishing units. In this context, individual catch quotas are often associated with allowing the quota holders to trade their quotas (this is discussed more fully in a later section).

The disadvantages of catch quotas can be substantial. Obviously there must be an enforceable means of ensuring that the quota is not exceeded. Where there are a multitude of vessels, operating from many landing sites and marketing outlets, the enforcement difficulties can be insurmountable. Quota holders will tend to under-report their catches.

The second difficulty concerns resource variability. Where there is substantial variability in the abundance of the fish stocks, for example, in order that catch opportunities are not lost during years of above average stock abundance, the managers may feel obliged to alter the fishery quota. This would imply an ability to forecast future catches, which may not be difficult for some fisheries, but extremely difficult for others.

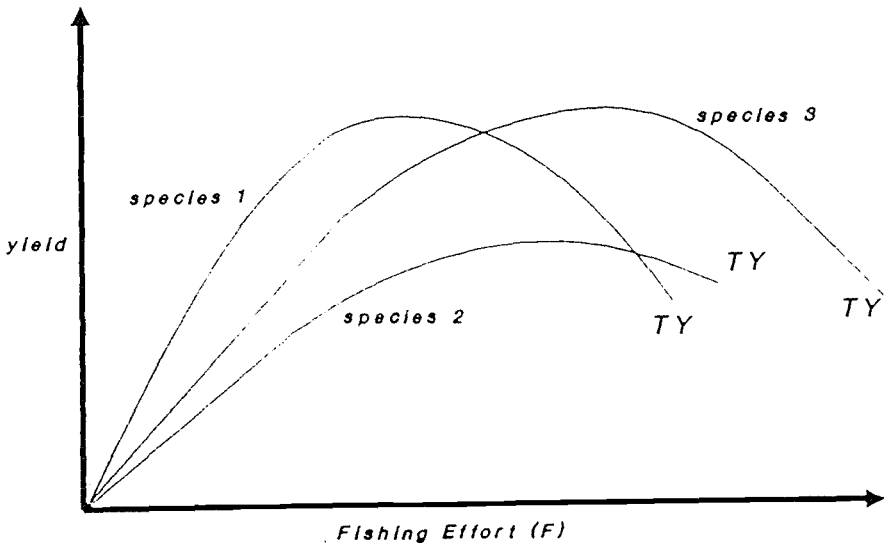
In the event of reasonably frequent changes in the fishery quota, an approach would be to allocate the new quota amongst the fishing units in the same proportion as for the old quota (hence, the justification for allocating the individual quotas as percentages of the fishery quota). In the event that quotas are transferable (i.e. may be bought and sold), it may be necessary to establish a

mechanism by which the management agency buys and sells quotas. Apart from the administrative costs (which could be met by a levy on the fishery), there would be the danger that the agency might incur a financial deficit from this process.

A third problem with catch quotas concerns multi-species fisheries, where each species is associated with a fishery quota, and it is not possible for the fishermen to target the individual species. The danger here is that in meeting the quota for one species, above quota catches for other species may be difficult to avoid.

In such a situation, it seems inevitable that dumping at sea or illegal sales would occur. The preferable approach in the sense of ease of management would be to administer a single multi-species fishery quota, although this will be associated with the danger of biological overfishing (and hence changes in species composition) for some of the species (Figure 7).

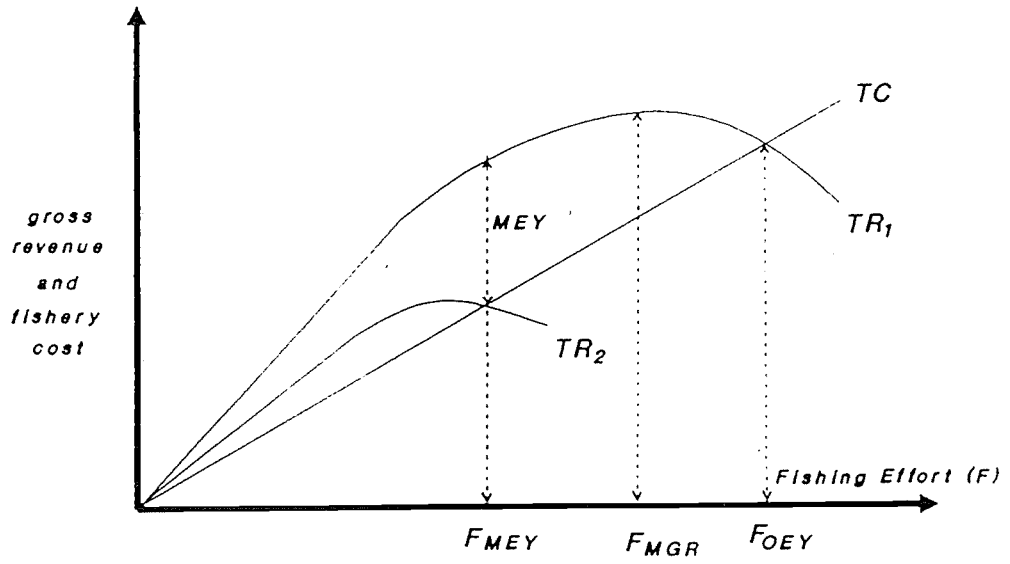
Figure 7: Relationships between Yield and Fishing Effort in a multi-species Fishery.



4.3 A Special Resource Tax on Fishing

The resource tax approach works by increasing the costs and hence reducing the profitability of fishing (Figure 8). As such, its introduction will be a disincentive to further investments in new fishing boats and equipment. Furthermore, marginal operators will be induced to leave the fishery due to non-viability. These are useful consequences when the fishing effort is already excessive.

Figure 8: The effect of an optimal special Resource Tax per Unit of Catch.



There are several difficulties in administering a resource tax. Where the tax is levied on the catch it will be necessary to have good catch statistics, ideally for each fishing unit. As there will be an incentive for the fishermen to under-report their catches, the inherent difficulties of collecting these statistics are likely to be accentuated.

The difficulty of having adequate statistics would be even more a problem in the case of taxes on the amount of fishing effort, unless applied on a per fishing unit basis. The problem with the latter is that it is likely to encourage increases in the fishing power of the vessels (e.g. more gears), defeating the objective of the taxing mechanism. To be fully effective, a tax on fishing effort would need to apply to all of the components which comprise fishing effort (e.g. fishing time, quantity of gear, type of gear, etc.).

Having in mind these difficulties, a resource tax would rarely be contemplated as a mechanism for controlling fishing effort in isolation from others. It is more likely to be used as a supplement to licence limitation or individual catch quotas, with the objective being to divert some (or all) of the economic yield into the public purse. This would not be unreasonable, particularly where the fishery is being well managed as a consequence of government intervention.

The revenues gained in this way could be applied to the benefit of the general public (hence, in part compensating those excluded from entry to the fishery as through licence limitation) or to defraying the government's costs on fisheries research and management. Where reduction in fishing effort is deemed necessary, they might be used to buy and retire catch quotas or fishing licences.

4.4 Fish Price Controls

Where possible to implement, controlling the price of fish has a somewhat similar effect as a special resource tax (see Figure 8). Reducing the price, for example, in the case where fishing effort is excessive, would have the consequence of lowering the profitability of fishing, discouraging further investment and encouraging marginal operators to quit.

The difficulties are largely practical. It will be necessary to adequately enforce the price control, including the prevention of product diversion through illegal outlets. This will be most difficult if the fishing units are operating from many landing sites and supplying many marketing outlets.

There is also the substantial difficulty in determining that price most likely to achieve the fishery objective (e.g. MEY). (This criticism is equally valid in respect to the application of a special resource tax). There will always be a high level of uncertainty about how the fishermen will respond to a change in fish prices.

In contrast to a special resource tax, there is no money directed to the public purse. The principle beneficiaries of price control, at least conceptually, will be the consumers of fish. Whether these potential benefits are actually passed on through the marketing chain is problematic and would need to be studied. If not, then the beneficiaries will be the fish traders.

5. STRATEGIES OF IMPLEMENTATION

The introduction of management to a previously unmanaged fishery is not easy, particularly where the fishing effort is already excessive. Management invariably involves restraints on fishermen's behaviour, they will be apprehensive about the changes, and need to be persuaded of the likely benefits. If they can be persuaded, then the measures will be easier to enforce.

Ideally, a management regime should be introduced relatively early in the development of a fishery. It is at this time that the consequences will be least disruptive. Even when the state of knowledge about the fishery is low, there is a strong argument for interim management which can be modified as the state of knowledge improves (e.g. through research).

5.1 Formalizing the Status Quo

This is a common and useful first action when introducing a management regime involving licence limitation or individual quotas. Licences or quotas are issued to those actively engaged in the fishery at the time. The fishery quotas for example, may be based on the average catch over recent years. Differences between fishing units may be preserved, or all units may be allocated the same quota.

In the case of introducing licence limitation, for reasons previously mentioned, it would be normal to also formalise the status quo in respect to the fishing power of the fishing units.

> *Example: In association with limiting the numbers of licences in the Port Phillip Bay (Australia) scallop fishery, this was done by restricting the individual width of dredges to that currently in use (through an appropriate endorsement on the licence) and restricting fishing to daylight hours.*

At the time of formalizing the status quo, it may be desirable to attempt exclusion of part-time or low performance fishing units from gaining a licence or quota. (This will be easier when the licence is applied to the fishermen rather than the boat). If this action is not taken, in the case of licence limitation, there will remain the possibility of the under-utilized potential of the low performance units being subsequently transformed to increased fishing effort. The latter would be unfortunate if the management strategy was directed towards reducing the fishery effort.

> *Example: Provisions were included in the Fisheries Act of Victoria (Australia) which required low performance holders of licences to "show cause" why the Minister should not refuse re-issue of the licence. The administration of this was vested in a Licensing Committee (with 2 industry and 2 government members) who applied the criterion defining low activity fishermen, previously established through a consultative process with the industry.*

Following the formalisation of the status quo other management measures would normally follow. In the case of licence limitation, where the fishery effort is already excessive, the number of licence holders would need to be reduced. Likewise, if the initial fishery quota is greater than the desired annual catch (e.g. to attain MEY), it would be necessary to progressively effect some reduction in the quota.

It is worth noting that formalizing the status quo through implementing individual transferable quotas when the fishing effort is already at or near F_{OEY} will alone lead to progressive reductions in the fishery costs and possibly also to reductions in the fishery effort. The first will arise due to the tendency for the purchasers of quota to be more cost efficient than the sellers. The second will result if there is a net accumulation of fish stock (from above normal recruitment) in the years immediately following implementation of the new management regime.

5.2 Transferability of Licences or Individual Quotas

This is the process by which the entitlement may be traded. A virtue claimed of transferability is that it encourages economic efficiency, particularly as applied through individual catch quotas. The argument in respect to the latter is that, as the fishermen will not be allowed to exceed their quotas, attention will be focused on ways of reducing costs. Another argument used in support of transferability is that in its absence, the fishermen, in recognition of the potential value of their entitlement, will remain in the fishery for longer than they might otherwise. Transferability provides a means of readily facilitating the movement of fishermen in and out of the fishery, with those leaving gaining some monetary compensation.

In the situation where licence entitlements are purchased by more efficient operators having a greater fishing power (e.g. from being more skilled), the fishery effort may inadvertently exceed that required to achieve the objective (e.g. MEY). Hence, allowing licence entitlements to be transferred requires monitoring the eventual changes in the level of effort.

The first generation who gain the right to trade their entitlements will clearly appreciate that they are receiving a substantial benefit (unless all or most of the economic yield is removed as with a resource tax at the time of introduction). This largely "one-off" event has sometimes been used to consolidate the management regime.

> *Example: In the southern rock lobster fishery of Tasmania (Australia), vessel owners were permitted to buy other licensed vessels, to retire one of the vessels and merge the licences, enabling more lobster pots to be used from the single vessel. In "exchange" for this right to trade in licences, the owners agreed to retire a portion of their total pot entitlement, and hence reduce the fishery effort.*

One of the substantial inequities of transferability concerns the almost inevitable "windfall" gain to the initial generation of entitlement holders. It is often in anticipation of these gains that the first generation participants will lobby strongly at the political level in support of transferability.

> *Example. In the abalone diving fishery of Victoria (Australia), following almost a decade during which the trading of licences has been permitted, roughly two-thirds of the first generation have remained active in the fishery. The current selling price for a licence exceeds the equivalent of US $ 1 million. (As a supplementary measure, effected through regulation, the divers are restricted to an individual annual quota of 40 tonnes (whole weight) which can be readily achieved in less than half a year).*

Transferability will also tend to have social implications. It mitigates against people without money gaining entry. Also, the proportion of owner-operators may tend to decrease in the event, for example, that processing establishments purchase the entitlements. In the extreme, all the licences may be held by a single company, although, whether this monopoly situation was detrimental or otherwise would need to be judged in respect to each particular case.

> *Example: There exists a quasi-exclusive right for a single company to engage industrial shrimp trawlers in Zone 1 of north-west Madagascar. In each of the three years since this was introduced (1985) the trawler catch from this Zone has been roughly 100 tonnes (whole weight) above the previously estimated MSY of 1,600 tonnes.*

Perhaps the most persuasive argument in support of transferability is that once licence limitation or individual catch quotas are introduced, the introduction of transferability is virtually inevitable. This is especially so where the entitlement attaches to the boat, and less so when it is the fishermen who are entitled. The major exception to this claim of inevitability are the fisheries which are state owned. In the case of these fisheries, transferability has little or no relevance.

5.3 Buy-back Schemes

Where the fishing effort is already excessive and it is necessary to reduce the number of licences or individual quotas, an approach is the administration of a "buy-back" scheme. The latter is the process by which the entitlements are purchased and retired.

The question remains concerning who should finance the process of buy-back. Where the beneficiaries of the reduction in fishing effort are the remaining fishermen, it seems most reasonable that they provide the funds. This might be administered by the government (through using the moneys from a resource tax as previously mentioned or licence fees), or by the industry itself.

Alternatively, where the beneficiaries of the reduction in fishing effort is the government, which would be the case if all the new found economic yield were being extracted by a resource tax destined for the public purse, then it would seem most reasonable that the government finances the buy-back scheme.

Where the fishing effort is excessive to the extent that the economic yield is already being fully dissipated, it will be necessary for some funds to be advanced in order to get a buy-back scheme started. Furthermore, it will take some time for the economic yield to emerge (as this depends on the recovery of the fish stocks) and hence, for the funds advanced to be recovered (by fees or taxes on those remaining in the fishery).

5.4 Determining the Value of an Entitlement

Conceptually, the value of a licence or quota should be based on a realistic expectation of the future earnings of those seeking to enter the fishery, as modified by the sellers expectation of earnings from outside the fishery. The problem here is that future earnings cannot be forecast with any certainty. The possibility of overstated values occurs if there is a tendency for the successful buyers to include those who are overly optimistic, including those who just want to get into fishing whatever the cost.

> *Example: The "buy back" scheme for removing licences in the salmon fishery on the west coast of Canada ceased due to excessive expectations by the fishermen of their future earnings. Licences were bid up and their price went beyond the reach of the "buy back" scheme. Ultimately, those who bought dearly on the basis of over-optimistic expectations found themselves bankrupt. (Taken from Hannesson, 1988).*

In applying a buy-back scheme, the administration will seek to buy entitlements at the lowest possible price, while allowing sufficient compensation to entice the sellers to trade voluntarily.

> *Example: The buy-back of quotas in the inshore fishery of New Zealand involved inviting fishermen to tender for sale on the understanding that the lowest bids would be accepted, with all the accepted tenderers receiving the same price, equal to the price of the highest accepted tender (Taken from Hannesson, 1988).*

5.5 The Beneficiaries of a Well Managed Fishery.

In the absence of a resource tax (or price control), the increase in economic yield arising from better management will go to the fishermen. This is so whether there is transferability or not. Having in mind that the resource is common property, such a situation (particularly if the majority of people are excluded from the fishery) may be considered to be indefensible.

This would be particularly so in the situation where the first generation (following management) gained their entitlements free, and are ultimately able to sell these at an abnormally high profit.

These are rather strong arguments in support of a special resource tax as a complement to other management measures. There are some counter-arguments which presumably are also strong, as the author is not aware of any examples where an administration has introduced a special resource tax which represented more than a small proportion of the available economic yield.

One of these arguments for choosing not to extract all or much of the economic yield through a resource tax is that it represents an approximation to controlling the profits of the individual fishermen or boat owners. In free enterprise societies, controls on the profits that individuals can achieve are likely to be highly unpopular and politically sensitive issues.

The other counter-argument of relevance is that, even when there is no special resource tax, the normal application of national income tax laws will ensure that part (possibly only a small part) of the economic yield accrues to the public purse.

The choice of whether to introduce a special resource tax and its magnitude will largely be settled according to the socio-political implications.

If a resource tax is to be introduced along with transferability, it will be easiest if these are done together. Once transferability has been introduced and the trading in entitlements has taken place, the additional costs within the fishery associated with subsequently introducing a special resource tax will cause the value of the entitlements to drop. In the extreme, some late entrants may become bankrupt as a consequence of the additional costs.

5.6 The Issue of New Licences or Quotas

Much of what has been written in this section has concerned the removal of excess fishing effort. In managed fisheries (e.g. involving licence limitation or individual quotas) still in a developmental phase, it will be necessary to consider strategies for increasing effort. Conceptually, there are several possibilities.

Where the entitlements are already transferable, the preferable option will be for the administration to sell the available new entitlements as through an auction or tendering system. Providing the entitlements at no cost, whose value could be realized later through the transferability process, might represent an unjustified "gift" to the new entrants.

Where transferability is not being contemplated as a part of management, then the options include issuing the entitlements to the most "meritorious" applicants on the waiting list.

> *Example: As a component of the establishment of licence limitation within the inshore fisheries of Victoria (Australia), a set of merit criteria were established to facilitate the issue of new (and the replacement of retired) entitlements. The criteria gave priority to applicants having close filial relationship with existing fishermen, living proximal to the fishing grounds in question, and according to the number of years of prior fishing experience (e.g. as a crew).*

Other options include the issue of entitlements on the basis of luck (e.g. a lottery amongst those on a waiting list), or simply according to the length of time on a waiting list.

Having in mind the view expressed earlier that licence limitation and individual quota schemes almost invariably lead to the introduction of transferability, it is likely that the alternative approaches just mentioned would have limited duration. Furthermore, those receiving a licence through one of these alternatives would do so at no cost, and hence, presumably be another of those possibly receiving a "windfall" gain should transferability be subsequently introduced.

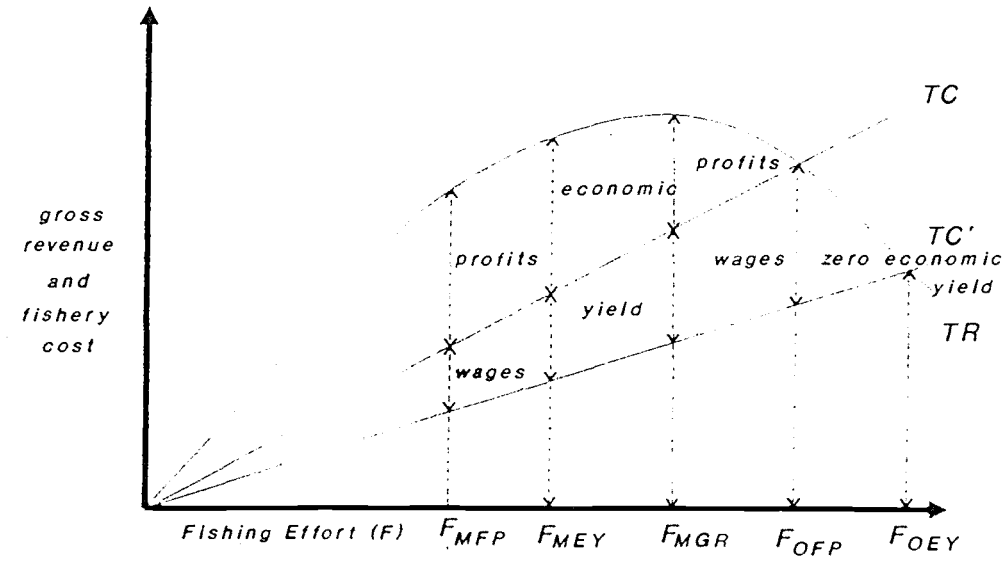
PART II

6. BIO-ECONOMIC RELATIONSHIPS

6.1 The Influence of lack of Alternative Employment.

When there is considerable unemployment, fishing wages do not reflect the true opportunity cost of labour. When there are no alternative employment opportunities, the opportunity cost of labour is close to zero. Hence, when estimating the fishery cost curve relevant to the determination of economic yield, the wages of the fishermen should not be included (Figure 9).

Figure 9: Relationships between Economic Yield, Fishery Profit and Fishing Effort (when the opportunity cost of labour is zero).



The importance of the above is that the F_{MEY} will become progressively greater, hence more persons can be justifiably employed in the fishery (in the economic sense) as the opportunity cost of the fishermen's labour approaches zero. The corollary to this is that, as employment opportunities for fishermen improve outside the fishery, the opportunity costs of labour will improve from zero, and the F_{MEY} will decrease. That is, the new F_{MEY} will be associated with fewer employment opportunities within the fishery.

It is also worth noting that, as the opportunity cost of the fishermen's labour approaches zero, F_{OEY} will increase, and hence the extent of over-manning and stock over-exploitation (i.e. the extent of exceeding MSY) will be greater. The linkage between the health of the national economy and the health of the fishery is obvious.

6.2 The Influence of Limited Mobility

Fishermen can be expected to remain in the fishery as long as they earn income at least as high as the opportunity cost of their labour (and capital). When this cannot be achieved, the fishermen might be expected to leave and change both occupation and location if necessary. In fact, many of the socio-economic problems of small scale fisheries arise from the asymmetry between entry and exit. To enter the fishery, especially in a good year is easy. To leave, especially in a bad year, can be quite difficult. Along with all the other factors, this accentuates the trend for the fishery effort to ultimately increase to F_{OEY} or beyond.

6.3 The Influence of a Subsistence Orientation to Production.

It is sometimes argued that certain groups of small scale fishermen are engaged in fishing not for profit but for subsistence. This will be particularly so in isolated communities where there are few consumer products available for purchase or barter.

Such fishermen will behave differently from those seeking to maximize personal profit. Subsistence fishermen, for example, may reduce their fishing effort at times of high catch rate, and increase effort when catch rates are poor, somewhat the opposite of what profit oriented fishermen might do.

> *Example: In establishing the Combinados Pesqueiras (fishing communities) in Mozambique, the government has provided not only the inputs necessary for fishing (e.g. boats and gears), but have in association established stores containing consumer goods (e.g. food items,*

clothing and electronics). This has been to encourage a more money-oriented economy in these communities and hence more incentive to increase fishing effort and catch.

6.4 The Influence of Competition between Small and Large Scale Fisheries.

The range of the small scale fishermen is generally limited to nearshore waters. The resources they exploit may also be exploited further offshore with large scale vessels using more advanced technologies. The larger scale operators will often also have the capacity to fish close to shore. In these ways the small and large scale fishermen will be in competition on the fishing grounds and possibly also in the market place.

Industrial fishing close to shore may also result in damage or loss to the gears of the small scale fishermen. Resolving this competition must relate to an equitable distribution of the benefits from the allocation of the various fishery inputs, and the common property nature of the resource.

Ideally, the bio-economic and sociological inter-relationship should be well understood as a precursor to resolving any complaints. More often, this is done largely at the political level, usually but not always with the small scale fishermen having less political influence.

Example: In Indonesia, after a series of clashes and demonstrations and a court trial concerning some 1.000 trawlers operated illegally in inshore waters, the Government has, since October 1980, banned trawlers altogether from Indonesia. (Taken from Panayotou, 1982).

7. OBJECTIVES OF MANAGEMENT

The policy of managing fisheries for the well being of the general public is equally relevant to small scale fisheries, as are the primary objectives of proper and full use of the available inputs and the equitable distribution of the benefits. In identifying the subsidiary objectives of management, the substantial social constraints applying to small scale fisheries will often over-ride purely economic considerations.

7.1 Identifying the Objectives

In the sense of the community at large, the objective should remain the attainment of MEY (or the net foreign currency earnings if this should be a particular concern of the particular government). Where the fishing effort is already excessive and the employment opportunities outside the fishery are negligible, the achievement of this objective will be extremely difficult in other than the long-term.

Furthermore, in such a situation it is likely to be extremely rare that sustained improvements in the economic performance of a fishery can be achieved through fishery management alone. In most cases, the essential requirement will be improvement in the national economy.

The extent to which the provision of employment becomes important as a subsidiary objective, will obviously relate to the level of unemployment within the national economy. Even in the event that the unemployment situation is extreme, it might be difficult to justify a fishing effort in excess of F_{MSY}. This is in the context of the loss of potential catch, and also because there would presumably be some loss of employment for those involved in the processing and marketing of fish (to the extent of off-setting the gains in fishing employment).

As already mentioned, in the scenario of excessive fishing effort and chronic unemployment any substantial improvement in fishery performance will be dependent on improvements within the national economy. Actions to improve the fishery performance (other than a reduction in fishery effort) would merely attract additional entrants (who could hardly be refused if they have no alternative employment) and the economic benefits would soon be dissipated.

In fact, such actions are likely to worsen the situation in the sense of increasing the F_{OEY}. The latter can be appreciated by considering the effect of an increase in fish prices (Figure 9) and a decrease in costs as would arise from a subsidy (Figure 10).

Figure 10: Relationship between Economic Yield and Fishing Effort as influenced by a change in Fish prices.

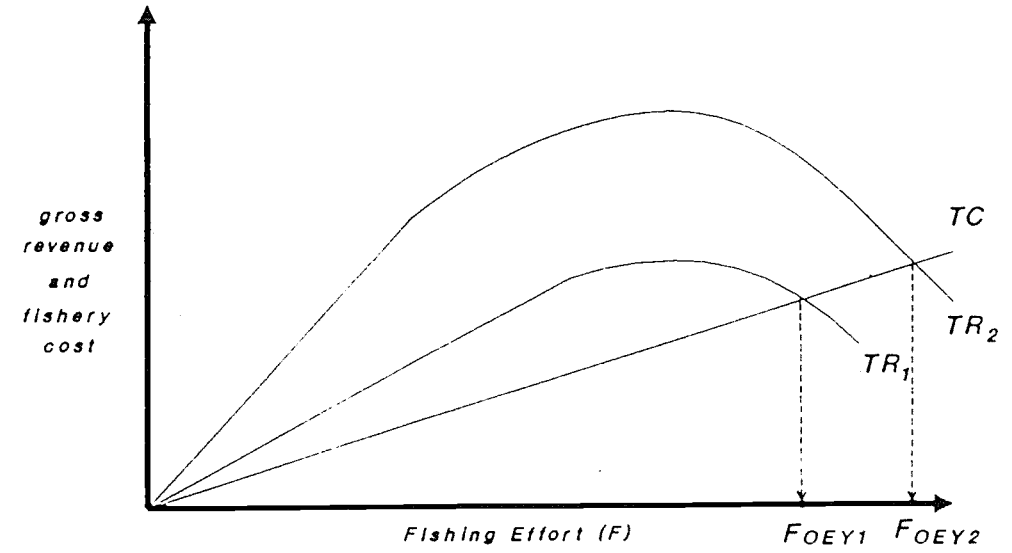
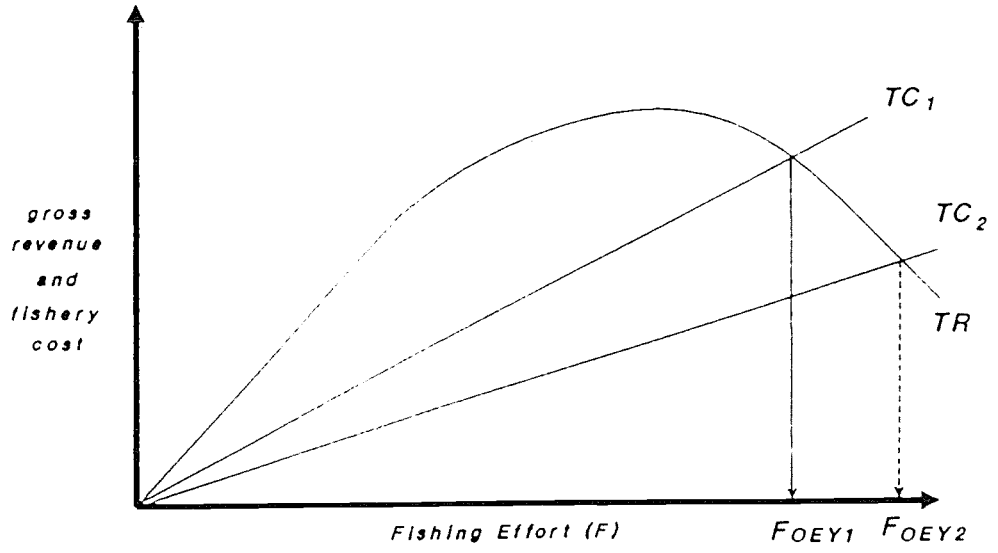


Figure 11: Relationship between Economic Yield and Fishing Effort as influenced by a decrease in Fishery Cost.



8. THE INSTRUMENT OF MANAGEMENT.

8.1 Resource Allocation through Territorial Rights.

The instrument here is the exclusive right over the fishery resource(s), within a defined geographical area of water. Normally, the exclusive right would be conferred to an existing community or natural grouping. Where the community or grouping are highly cohesive, as might

be the case if based on traditional customs, common heritage or religious beliefs, the chances of achieving benefits through the exercise of territorial rights are greatest.

> *Example: In Sri Lanka, small-scale fishermen have been able to earn substantial profits due to limiting entry. This is done within "closed" communities which exercise territorial rights. Outsiders are not allowed to anchor or beach fishing boats along the shoreline of the community and labour is not recruited from "outside". This may subsequently be broken down by population pressures, intermarriages across communities, and other internal and external pressures (taken from Panayotou, 1982).*

It would be expected that those who have been granted the exclusive right, and hence will be the major beneficiaries of improved management, will engage in self-management directed towards maximizing the net benefits to the community. In large part, the implementation of this type of management represents a transfer of responsibility from the government to the local community.

This would not be desirable, however, if the chosen community did not have the capability to self-manage, and/or attempts at self-management led to the creation of *within* or *between* community tensions. Where the resources are already over-exploited, and hence there is a need to reduce fishing effort, the possibility for such tensions occurring is substantial.

The additional and related problem of allocating exclusive territorial rights is that the recipients of the privilege may choose not to manage the fishery, or similarly may adopt management objectives and strategies which have little or no complementarily with the national objectives. It is highly desirable, therefore, that the granting of exclusive territorial rights should be associated with the maintenance by the government of some facility to influence how the fishery is to be managed.

> *Example: In respect to the shrimp fishery off northwest Madagascar, industrial trawling is prohibited within two nautical miles of shore. This, by effect, allows the small scale fishermen exclusive rights to exploit the shrimp in shallow waters, but in itself provides no encouragement towards improved economic performance.*

9. STRATEGIES OF IMPLEMENTATION.

9.1 Implementing a Scheme of Territorial Rights.

Once having identified a fishery situation in which management through the allocation of territorial rights might be applicable, a most important aspect of implementation would be to have the community understand some of the basic principles of management. The fishermen should understand that the fish resource is limited (which will be more readily understood in an enclosed lake or lagoon fishery). They should also understand why it might be necessary to restrict entry.

In the event of the territorial rights being conferred and limited entry being applied, the principles of selecting those to be granted access to or excluded from the fishery should be understood, and the system for doing this must be seen as fair. This will be much easier in a "closed" society and difficult in an "open" society. Compensation for those retired from fishing or assistance in finding alternative employment may be necessary. This would imply the need for an integrated approach, involving the non-fishing groups within the community.

Having in mind that the outcome from the conference of territorial rights cannot be predicted with any certainty and may well prove to be unacceptable, it would be desirable to limit the term of the rights. The term should not be too short, however, otherwise there would be no incentive for the community to engage in beneficial strategies having a long term effect. As a guide, a term of 10 years would seem to be reasonable at the outset of such a management approach.

In implementing territorial rights in respect to a particular fishing community, it will be essential that the performance of the regime be continuously monitored by the fisheries administration. Also the administration should where possible provide, or arrange for the provision of, the additional material support and guidance that the community might require in order that the regime have the best chance of being successful.

9.2 Creating Employment Opportunities outside the Fishery.

Where unemployment (or under-employment) is exceptionally high, the use of management strategies having the effect of 'forcing' the marginal operators out of the fishery will not be practical. The only possibilities are likely to be withdrawing labour into other occupations, possibly involving re-training, maybe also resettlement, and/or financial recompense.

The fishery managers should seek to influence this process by identifying under-utilized fishery resources (e.g. through exploratory fishing) and hence creating the opportunity for some fishermen to transfer from the over-crowded fisheries. Events at the national level can have a profound effect in providing employment opportunities (e.g. discovery of oil).

Whatever the mode by which some fishermen are encouraged to leave, the economic performance of the fishery will remain unchanged if these fishermen are quickly replaced by others. Hence, the creation of alternative employment opportunities for fishermen in over-manned fisheries will need to be associated with applying some constraint on their being replaced by others.

9.3 Improvements to Fishery Infrastructure.

Strategies to improve infrastructure in order to enhance the economic performance of a fishery have most relevance when the resource is under-exploited and the objectives are development oriented. In an "open access" fishery which is over-exploited and over-manned, any increase in economic performance from improved infrastructure will tend to be quickly dissipated (through additional entry, increased effort and fishing costs, declining catch rates, and declines in the size of the fish).

One of the very important aspects that is often lacking in the case of small scale fisheries concerns access to remunerative markets. The problem might be a lack of adequate transport infrastructure (e.g. roads) and suitable vehicles and boats for collection and transport. The lack of infrastructure might likewise deny to consumers an adequate access to the product.

> *Example: An interesting development in Madagascar and Somalia has been the rapid development, largely by private sector entrepreneurs, of a system for collecting lobster caught at isolated locations by the small scale fishermen. This has involved the use of boats, vehicles and aircraft. This development of infrastructure in association with competition between companies for a valuable product has been highly beneficial to the economy of both countries in boosting their net foreign currency earnings.*

In the case of marketing, it might not be sufficient in itself to merely improve infrastructure. Where new products are concerned there might be a need to develop necessary consumer awareness and appreciation of the product. These can be somewhat technical and expensive undertakings, usually best done by private sector entrepreneurs, possibly with support from government and aid organization.

> *Example: In respect to the shrimp fisheries of Madagascar and Mozambique, most if not all of the by-catch of fish is discarded at sea. A conservative estimate of the magnitude of the discarded catch is roughly 18,000 tonnes in each country. The considerable challenge which has not yet been addressed is to get these fish at affordable prices to the consumers.*

9.4 Foreign Aid Assistance

The relevance and importance of foreign aid assistance are obvious. The agencies having interest in providing assistance to fisheries tend to direct priority to the small scale fishery sub-sector. This is because both the catch and numbers of fishermen involved is usually large, and the communities are usually at a low level of economic development.

The types of assistance available through aid is extremely broad, including reviews and formulation of management plans, institutional support to fisheries administrations and research organizations, the drafting of fisheries legislation, resource surveys, experimental and exploratory fishing, the transfer and development of new technologies, the building of fisheries infrastructure, etc.

Example: The major element of the fisheries development strategy for Somalia is to have a foreign aid project established at strategic locations around its entire coastline. The activities of these projects all relate to improving the productivity of the fishing communities through material support (e.g. fishing gears), the provision of support facilities (e.g. repair workshops), encouraging improvements in fishing technologies, providing a fish marketing infrastructure (e.g. management, ice supply, vehicles), and providing training to counterparts from the fisheries administration (who are to continue the support beyond the life of the project).

Much of the foreign aid support has and will continue to be directed to working with the government fisheries administrations towards improving fishery performance. In recognition that the private sector may be more effective in undertaking fishery development (where the potential for future profits provides incentive) some aid organizations are also linking more directly with private sector entrepreneurs.

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11. ACKNOWLEDGEMENT

While having substantial direct experience in the management issues described in this paper, the author nevertheless wishes to acknowledge his extensive referral to the FAO Fisheries Technical Papers of Hannesson (1988) and Panayotou (1982)

Paper 2

CONDUCT OF SOCIO-ECONOMIC BASELINE STUDIES

by

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ABSTRACT

The paper defines the concepts and uses of socio-economic studies, as well as dealing with the practical aspects of their implementation. A checklist of the types of information obtained during such studies is also provided.

1. INTRODUCTION

Small-scale fishermen and their families are often among the poorest section of the community. They typically live in remote areas and lack access to supplies and services for their daily needs and markets for their products. They often lack adequate housing, clear water supplies and other basic social services. In many countries, they earn a precarious livelihood and, in spite of the fact that they contribute significantly to the national food supplies, they fall into the category of desperately poor and disadvantaged people.

Fisheries policies in many countries currently emphasise the development of small-scale fisheries, primarily for the socio-economic benefits they bring to the community. These potential benefits were summarised by Lawson (1984). They include: employment generation, the creation of socio-political stability in rural areas and prevention of rural-urban drift, high employment multipliers (created especially in the tertiary sector), low energy use and the maintenance of a regional balance in the economy.

Statistical data (both current and historical) comprise the quantitative foundation upon which fisheries policies and development programmes should be based. Part of the database pertaining to fisheries development should be derived from socio-economic investigations. The lack of reliable socio-economic data is presently one of the main obstacles to fisheries planning in Africa. Major constraints in the acquisition of socio-economic information were, and still are, the scattered nature and isolation of fishing communities. Also, the high seasonality of the operations and the seasonal migration of fishermen are impediments to a systematic acquisition of (socio-economic) information.

2. DEFINING SOME CONCEPTS

The concept "socio-economic" covers a wide range of subjects. As a result, a short and precise definition cannot be given. Here, it suffices to say that elements of surveys with the adjective *socio-economic* can be classified under the headings: demography, economy, social welfare and environment. "Baseline" could be defined as *a set of indicators/parameters assessed at a specific moment in time against which future changes may be measured.*

Socio-economic data can be collected from a defined fishing population by recording the appropriate information about every member of that population. This is a census. Alternatively data can be collected for only some of the members of the population. This is a sample survey or merely a survey. The phrase *sample census* is sometimes used to refer to major regular (often decennial) efforts to collect data regarding the composition and structure of a population, which

do not cover every member of the population. It may be better to avoid this term because many find it confusing.

In short, "survey" involves investigation, analysis and interpretation of data. This definition is necessarily general, as the purposes it serves, the type of data concerned and the methods applied are extraordinarily diverse.

A survey may involve the investigation of one or several subjects. These surveys are described as 'single subject' and 'multiple subject'. The terms 'single purpose' or 'multiple purpose' are sometimes used. The UN definition states that a 'multiple-subject' survey is a simultaneous investigation of several subjects, not necessarily closely related in a single survey operation, for the sake of economy and convenience.

Depending on the objective of the survey, a longitudinal or a single round survey can be undertaken. In case we have to collect data over a long period of time, a longitudinal approach is preferable to a single round survey. A longitudinal approach means the collection of information with a daily, weekly or monthly or any other frequency. Surveys requiring only one visit to each respondent are highly desirable, allowing a large size of a sample for a given cost. This will normally also be the case in socio-economic baseline studies.

Later in this paper we will elaborate more on the purposes, planning and execution of socio-economic baseline surveys, but we will first have to say more about the use of socio-economic information in fisheries development and management.

3. USE OF SOCIO-ECONOMIC INFORMATION

In August 1985, an expert consultation on the acquisition of socio-economic information in fisheries was held in Rome. It was noted that the range and information required to make management decisions in fisheries policies on economic and social grounds was very great.

The use and thus the required types of information are manifold and will vary with the types of decisions which have to be made at different levels in the government hierarchy, in different fisheries situations and stages of development and for different sub-sectors within the fisheries sector. This great variation in the information needs of different fisheries and groups of users is the main impediment to a clear-cut definition of subjects to be included in a socio-economic survey. Given this diversity, the consultation decided to concentrate on those types of information which are considered critical for a wide range of decisions in fisheries management and development. It was noted that these key types of information may then have to be supplemented by other specific socio-economic information, depending on the particular conditions and issues at hand.

For further details on socio-economic data needs, the reader is referred to Willman (1983), to the Report of Expert Consultation on the Acquisition of Socio-economic information in fisheries (1985), and to papers presented at the SADCC/FAO Workshop on Fisheries Management and Development Planning (1988).

3.1. Fisheries Development and Management

The expert consultation of 1985 endeavored to identify those types of decisions which are of general relevance in fisheries development and management. At the consultation, a checklist of socio-economic data needs was drawn up (Appendix 1).

Information needs and subjects in (socio) economic surveys will differ according to the types of decisions. The decisions were grouped into two separate although interdependent and interrelated categories, namely (i) decisions in regard to the management of fully or over-exploited fisheries and (ii) decisions in regard to development of underexploited fisheries.

There are, however, many overlaps of management and development measures which have consequences for the scope and extent of information requirements. Willman (1983) noted that "*One of the difficulties in determining the economic information needs in fisheries management lies in deciding on the measures or interventions subsumed under this term and in demarcating them*

from development activities. In some recent literature, management has tended to be considered in increasingly broader terms, incorporating social, institutional and economical development. This 'extended' concept of management cannot be seen in isolation from developments in the surrounding coastal and rural economy. It also reflects the greater awareness of the multitude of political, cultural, social and economic aspects which affect the mobility of productive factors in and out of fisheries. . . . For example, the provision of better educational facilities may increase the labour mobility out of fisheries; family planning measures may reduce the natural population growth in the fisherman population, or the abolishment of cultural barriers, e.g., caste system, may increase labour mobility into fisheries".

Willman comes to the conclusion that fisheries management can at best be concerned with attaining second, third or . . . nth best solutions. These solutions relate to the avoidance of severe ecological, economic and social disturbances. He divides management into three interconnected functions, namely: monitoring, intervention and evaluation.

3.1.1. Monitoring

A first set of information required for monitoring a fishery, which provides early indication of likely disturbances, relates to the ecological, social, economic and regional balance of the fishery. Economic and social imbalances may be measured in increasing regional and personal income disparities, in absolutely declining incomes, in rising costs of fishing at constant level of catch, in increasing unemployment, in reduced supply of fish to rural areas, in increased conflicts, etc.

Caddy (in press) suggests some characteristics of a fishery which are likely to be sensitive to underlying changes in the 'environment' of the fishery, and may therefore be worth monitoring. Some suggestions on these factors and their potential significance are:

> *"Look at the characteristics of new gear/vessels and other new capital investment currently entering the fishery, and compare it with the existing fleet and onshore characteristics.*
>
> *Look at the age structure of fishermen in the various types of fisheries: does this suggest a new type of activity, one with a stable historical level of recruitment, or the last phases of an obsolete technology?*
>
> *Look at the age structure of vessels in each vessel/gear class: does it suggest anything about the recent history of the fishery, and its possible stability? Are we discussing a 'steady state' fishery, a cyclic one, or a fishery in a state of senescence? In the case of a 'senescent' fishery, is the apparent lack of new entries to the fishery a function of loss of options to make transfers to other fisheries because of lack of training or financing, or because the fishery is operating close to the point of zero rent."*

3.1.2. Intervention

The second function of fisheries management, the intervention, can have various features. Most measures undertaken in the name of developing a fishery will have management implications, as they affect fishing effort, income levels and distribution, employment, geographic and social mobility, etc. In an underexploited fishery, management will be more concerned with distribution considerations, while in an exploited fishery the limiting function of management, which also has distributional implications, become more prominent. Economic information is required to decide on the right types of interventions to accelerate or slow down the expansion of fishing capacities, to limit or reduce fishing effort and to solve distributional problems.

3.1.3. Evaluation

The third function of fisheries management, the evaluation, is closely linked to the monitoring function. It basically tries to monitor the efficiency of the selected set of interventions in achieving their pre-described objectives. In the context of evaluation, socio-economic surveys will often be longitudinal i.e. the before-after evaluation in which an attempt is made to evaluate the results of (for instance) a project by comparing the situation before the project started (base line) with the situation after the project has had its effects.

3.2. Geographical coverage and subject matter of socio-economic baseline studies

Socio-economic baseline surveys may thus cover a whole range of social and economic information, starting from demographic and educational data and ending with information on the fish marketing system, or they may be more specific, concentrating on one or two aspects of the fisheries sector, such as the functioning and effects of a credit system.

As mentioned before, different checklists of information needs have resulted from different consultations/workshops attempting to define the social and economic information needs in fisheries development and management. Certain economic information will be generated by 'purely' economic surveys. Other economic items in these checklists may well be incorporated in socio-economic baseline surveys in various combinations and degrees of detail.

A broad distinction could be made between socio-economic baseline studies conducted within the context of a development project/programme and those which encompass a whole fishery.

3.2.1. Socio-economic baseline studies in projects

Socio-economic baseline surveys will be particularly valuable when they are conducted in advance of or during specific development projects or programmes.

They are especially relevant within the context of measuring the effects of a project, as they set the baseline (at a certain moment in time) of (selected) parameters against which future changes may be evaluated. Inputs of specialist skills (such as from sociologists and economists) may be needed to devise suitable indicators. Developing the indicators to test whether objectives of a project have been achieved will be easier if the objectives are clearly stated. For example, if a project objective is to increase incomes of fishermen by providing improved fishing vessels and gear, the effect of the project on their incomes should be assessed. It has to be noted, however, that income is a notoriously difficult variable to measure, so project planners may opt for some index of income appropriate to the location, such as the ownership of a highly regarded family asset (for example bicycles, radios or building materials of the house).

The spheres where the contribution of a social scientist (socio-economist, sociologist) are expected when constructing an adequate picture of a small-scale fishery within the context of a small-scale fisheries development project were summarized at the SADCC/FAO workshop, Zimbabwe in 1988. They concern five main areas as follow:

(a) The description of the people within the project area and affected by it: The issues addressed are aspects such as size, age and sex distribution of the population, its ethnic and tribal characteristics, the class structure;

(b) The collection and analysis of data concerning the relationship between the proposed project activity and the people affected: for fisheries projects, plans must take into account the extent to which fishing is currently carried out, how it is done, who does it, where the fishermen are in the social and economic scale, why it has its current economic and social status and similar issues;

(c) Looking towards what the project might do for the affected population, social analysis in relation with the project's acceptability and its capacity for bringing about sought-after changes in socio-economic behaviour; for example, it might be desirable in fisheries projects for fishermen's groups or communities to be strengthened to encourage the capacity of a target population to manage fisheries resources themselves;

(d) Indicating how the objectives and the design of the project should be adapted to elicit the sought-after response from the people concerned; for example, a social recommendation of a project might be that the project should include special training courses for mothers in child health care;

(e) Fifthly, to give advice on the monitoring of the project's social effects. This is part of monitoring and evaluation, but at the preparation stage, planners need to know what administrative structure must be set up and with what personnel and skills to conduct the monitoring and evaluation of the project.

3.2.2. Socio-economic baseline studies of the fishery

A socio-economic baseline study may be conducted to provide an overview of socio-economic conditions in a fishery in the country or a region. This could also be done in a situation where the objectives of management or development are not yet clearly spelled out.

Caddy (in press), argues that because of the complexity of many small-scale fisheries, a preliminary 'snapshot' of the phenomena is necessary before finalizing a long term plan of action. The results of a socio-economic baseline survey could be included as a product of a preliminary survey of a small-scale fishery. Such a survey might have as one subject (among others) the age composition of the fleet (different boat types) and of fishermen. This should provide some insight into the dynamics of fleet renewal, as well as the long term health of the industry. Collecting data without an idea of the likely models to be used is generally not a very productive exercise, but may be necessary as a first step in order to provide the 'snapshot' which defines the system being studied. In real world situations, the linear system of deciding on development or management objectives, choosing a model, defining and collecting the type of data needed, analysing the data and applying the model, providing options to decision makers, defining new objectives and so on is less than realistic.

As mentioned before, the type of data needed depends primarily on the objectives of development and management. It is the author's feeling that where not much is yet known about artisanal fishermen, their communities, their mobility etc., and where development and management objectives have not yet been spelled out clearly, socio-economic baseline surveys are valuable studies to provide part of the 'snapshot' as described by Caddy.

It should also be noted within the present context that socio-economic baseline studies conducted in coastal areas or areas surrounding lakes do not necessarily relate directly to small-scale fisheries development (projects). This type of survey may well be conducted by other government agencies or carried out within the context of (broader) urban or regional development projects. They can be very helpful in providing socio-economic information on fisheries. Fishery administrators should be aware of other sources of information and should make efforts to influence the kind of data collected.

4. SOME METHODOLOGICAL CONSIDERATIONS

In case data cannot be derived from any other sources such as documents, literature or statistical records, field work in the form of interviews is needed. As a rule, socio-economic investigations yield data concerning:

- the population
- their environment
- activities
- opinions and attitudes

4.1. Purpose and objective of a survey

Surveys have been classified by various criteria. One dichotomy often regarded as fundamental is that between the descriptive and analytical survey. 'Descriptive' describes itself; an analytical survey may be defined as one where "*comparisons are made between different subgroups of the (fishermen) population in order to discover whether differences exist between them and to form or verify hypotheses about the reasons for these differences*". It has been commented, however, that the distinction between the two types of survey is not clear-cut and that many surveys serve both purposes. This dual function is especially common in surveys in developing countries.

For fisheries development studies, practical purposes prevail: socio-economic surveys are mainly carried out in the framework of planning projects and are mainly directed at plan formulation, design and organization. On the other hand, many surveys are requested simply because it is hoped that the results will help those commissioning the survey to take policy decisions about a problem they are facing. The first result of the user (administrator, planner, project manager) - surveyor dialogue is usually to make the customer define his problem more precisely. It will usually require

a great deal of effort to agree upon a common approach. Important decisions relate to time and place of the survey, the subject matter(s) and definition of the unit of enquiry and the data collection method.

4.2. Time and Geographical Frame

Naturally, the issues will vary from survey to survey, but decisions have to be taken with respect to:

Time:

The period to which the survey refers and the period in which it takes place. These are usually not independent, since most surveys of human population involve memory; and,

Place:

Is the survey to be national, regional or cover a smaller area? Is it rural or urban? Has the most appropriate area been properly identified already?

4.3. The subject matter

From the questions to be answered by the survey, various types of subject matter have to be derived. In general, the subject matter can be classified as follows:

- Facts and conditions like household size, income and housing characteristics; (Sometimes these facts include weights or measures e.g. boat length, plot sizes)
- Knowledge, often the subject in an evaluative survey;
- Behaviour, which is usually the subject in psychological and sociological studies;
- Opinions and attitudes.

4.4. The study population

The definition of the population and the unit of enquiry is as important as an accurate definition of subjects of a survey. An aggregate of well defined objects is called a "population of units". (Example: Population of units = Total number of fishermen at Lake Victoria; Unit of population = A fisherman at Lake Victoria).

In statistical and socio-economic surveys, the definition of a "population of units" involves:

1. The definition of the unit of population;
2. The geographical limitation of the population;
3. The fixing of limits other than merely geographical ones e.g. whether fishermen living in institutions like prison or hospital should be excluded from the survey.

As the total fish production of a fishing industry is the result of the operations of the fishing economic units, the Fishing Economic Unit (FEU) may be the unit of population to be studied in an economic survey.

The fishing economic unit has three components:

1. Fishermen
2. Fishing gear
3. Fishing craft

For a further classification of these components the reader is referred to Bazigos (1974).

The objectives of a survey often require some stratification. The Fishing Economic Unit may be stratified according to ownership. For example:

1. Private ownership;
2. Agreed partnership;
3. Cooperative Units.

Within the context of a socio-economic study (depending on the objectives of the survey) the unit may well be the fisherman, (one component of the fishing economic unit). For example, in a

socio-economic study investigating the occupational and/or geographical mobility of fishermen, the unit of enquiry of a survey will be the individual fisherman. These may be classified according to employment status. For example:

1. Fishermen boat owners;
2. Fishermen with gear only;
3. Assistants.

Few fishing communities are socially and economically homogeneous. Some people own one or more boats, while others may be poor, sometimes migrant, hired hands. In a socio-economic study to assess the occupational - and/or class structure in a fishing community, the unit of enquiry may well be fishing and non-fishing individuals or even households (i.e. including the dependents of the fisherman). In overall regional studies, it may even be sufficient to conduct the survey per village or some other small administrative unit.

4.5. Data collection methods

Although much more could be said on the actual planning and preparation of socio-economic baseline surveys (see also case study artisanal fishery survey Zanzibar), some attention should at least be given to the selection of a data collection method. Some characteristics have to be identifiedFor the selection of a suitable data collection method, which are:

- the geographical distribution of the population;
- the literacy rate of the population;
- the (probable) interest of the population in the subjects concerned; and
- the total population and its variability with respect to the subjects concerned. This relates to the aspect of coverage and sampling.

The major types of data collection are observation and interviewing. Observation is mainly used in sociological and anthropological surveys. It is nevertheless a tool often used in association with interviewing (e.g. to check validity). In socio-economic baseline surveys, the data collection method most frequently used is interviewing. We can distinguish various types of interviews:

- Formal interviews with the use of a structured questionnaire;
- Informal interviews with the use of an open - ended questionnaire, often for detailed and qualitative information;
- Unstructured depth interviews in which no use is made of any list of questions. Often some specific topics are discussed in these types of interviews.

Combinations are possible in which part of the interview consists of so-called closed questions, supplemented with open questions of a more qualitative nature.

The amount of data required in an investigation influences the design of a survey. Moreover, the larger the amount of data needed, the more time its collection, processing and analysis will take. This yields a powerful argument in favour of a simple questionnaire design with pre-coded questions (if possible).

In an open question, the respondent has the opportunity to phrase his answers as he likes. In a closed or pre-coded question, the respondent is given a limited number of alternative answers, like "yes" and "no". The main disadvantage with this is the loss of spontaneity and expressiveness on the side of the respondent and even the danger of introducing a bias by forcing a choice (which is not the respondents' own) in a rather short time.

Open questions are easy to ask and difficult to answer, more difficult to process and even more difficult to analyze.

The choice between using open or closed questions depends, among others, on the subject matter, the knowledge of alternative answers, on the cultural and social background of the group to be surveyed and the amount of data in relation to time and/or money.

The choice between open-ended and closed questions is often not easy: much depends on the type of questions. If we have a factual question with a restricted range of mutually exclusive and well-defined answers, preference may be given to closed or even pre-coded questions. If we are not sure, however, that we can provide the full range of answers, as for instance in a pilot survey, open ended questions should be preferred.

4.6. The need for pre-testing

For the proper planning of the actual interviewing, it is essential to pre-test the questionnaire. This can be done first among interviewers (also as a first training), but only a real pilot survey in an area similar to (or inside) the survey area will provide the necessary answers:

- Is the questionnaire too long and how much time does the interview take?
- Is there a problem concerning any question and how do the respondents react to sensitive issues?
- Is the questionnaire adequately structured?
- How much time will the survey take (or how large can the sample be)?

4.7 Selection of a sample

There is a wealth of literature on the subject of sampling techniques. Here, we deal very briefly with sampling.

Sampling, as compared with a census, has several advantages. In a census, a complete enumeration of the population takes place, whereas in a sample, only a portion of the total population is surveyed. The advantages of sampling are obvious: it saves time, labour and money. Another advantage often mentioned is higher accuracy, as better qualified staff can be hired and more time can be spent on checking, processing, analysis and interpretation.

Two basic principles underline all sampling techniques: avoiding bias (every unit should have an equal chance of being sampled) and achieving an adequate level of precision. For a thorough discussion of sampling, the reader is referred to Bazigos (1974). Here it suffices to say that selection of a sample method depends on the following criteria:

- availability of a sample frame
- time and money
- objective of the survey
- variability of the population

From a theoretical point of view the design of a survey and its requirements in terms of funds, time and manpower should be dictated by its purposes and required validity and reliability. Practical restrictions, in terms of time, funds and money will usually prevail.

In the conduct of socio-economic baseline studies, compromises will be unavoidable.

5. CONCLUSION

In this paper, an attempt was made to stress the importance of the conduct of socio-economic baseline studies within the context of small-scale fisheries development and management. The conduct of socio-economic baseline studies in small-scale fisheries is a fairly recent phenomenon. It is hoped that fishery administrators will become increasingly aware of the importance of this type of study, be it within the context of project preparation, monitoring and evaluation or in providing a first 'shapshot' of socio-economic conditions in small-scale fishery.

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APPENDIX 1.

INDICATIVE LIST OF INFORMATION REQUIREMENTS FOR A SELECTED SET OF IMPORTANT GOVERNMENT MEASURES AFFECTING THE FISHERIES SECTOR

Legend

A = Information which should be routinely acquired by Departments of Fisheries or fisheries research institutes

B = Information which should be routinely acquired by non-fisheries agencies

C = Information which commonly requires special studies, either to collect basic data or to analyze data available with fisheries and non-fisheries agencies

* These data should be collected during a frame survey and should form the basis for catch assessment surveys and costs and earnings.

MANAGEMENT REGULATIONS

Effort (A)

No. of vessels* (A)

- *by type**
- *by size class**
- *by horse-power class/outboard-inboard/petrol-diesel**
- *by harbour/landing place**
- *by type and quantity of gear (used)**
- *by fishing ground*

Size of crew (A)

- *Investment costs of vessel/gear combination (A/C)*
- *Other fixed costs (A/C)*
- *Operating costs (A/C)*

Catch (A)

Quantities: (A)

- *by species*
- *by vessel/gear combination*
- *by landing place/harbour*
- *by fishing ground/area*
- *by season*
- *by disposal/self-consumption*

- *by waste and trash fish (A/C)*

Values: (A)

- *by trip*
- *by vessel/gear combination*
- *by landing place/harbour*
- *by season*
- *by disposal*

Ex-vessel prices: (A)

- *by species*
- *by season*
- *by markets*
- *by location*
- *by daily range*

Resources: (C)

As far as not obvious from catch and effort statistics (- shared between different vessel/gear combinations) (- shared with other countries)

Conflicts: (C)

- *kinds and frequency of conflicts*
- *costs of conflicts (individual/national/political)*

Taxes/Subsidies/duties:

- *on inputs (B)*
- *on catch value (B)*

Ownership patterns (A)

- *owner operated*
- *cooperative ownership*
- *absentee owner*
- *company owner*

Sharing System: (A/C)

- *by vessel/gear combination*
- *by landing place/region*

Opportunity costs of labour: (B/C)

- *by qualification*
- *by location/region*

Opportunity costs of capital:

- *on informal credit market (C)*
- *on formal credit market (B)*

Population Growth (B)

Past trends in immigration/emigration (B)

Past trends in entry into/exit from fisheries (A/C)

Other sources of income (employment) of fishing households by ownership status: (A/B/C)

- *type of economic activity*
- *number of economic activity*
- *income in cash/kind by type of activity and by season*
- *dependency on fishing for subsistence/food supply*

Barriers to exit from fisheries:

- *ownership of property (land, house) (B/C)*
- *level of indebtedness/savings (B/C)*
- *level of skills, qualification, education (B/C)*
- *age structure (B)*
- *caste/ethnic group (B/C)*
- *level of awareness of other employment opportunities (C)*
- *level of un- or underemployment in region/location (B/C)*

Barriers to entry into fishery (apart from regulations):

- *caste/ethnic groups (B/C)*
- *skill (A/C)*
- *traditional forms of management (kinds, effects)(C)*

Fish Processing: (A/B/C)

- *types and capacities of processing facilities*
- *investment costs*
- *number of employees by sex*
- *income to employees*
- *income to owners*
- *ownership pattern*
- *taxes, duties, subsidies on inputs and outputs*

Fish marketing/distribution

- *types of traders (A/B/C)*
- *number of traders by sex (A/B/C)*

- *income by type of trader (C)*
- *quantity of fish sold*

  (i) urban areas by income groups (C)
  (ii) rural areas by income groups (C)
  (iii) export (A/B)

- *wholesale prices (A/B)*
- *retail prices (A/B)*
- *export prices (A/B)*

Input industries (boat-building, net-making): (A/B/C)

- *number of employees by sex*
- *income to employees*
- *income to owners*
- *ownership pattern*
- *taxes, duties, subsidies on inputs and outputs*

RESEARCH AND DEVELOPMENT

- *amount of un- or under-exploited fishery resources by species and area (C)*
- *post harvest losses (C)*
- *technical options/improvements in harvesting, processing and distribution (C)*
- *infrastructure requirements of technical options (C)*
- *capital/labour ratios of technical options (C)*
- *labour productivity of technical options (C)*
- *training requirements (no. by required qualification) (C)*
- *requirements in maintenance and repair facilities (C)*
- *economic efficiency of technical options (C)*
- *processing yield (C)*

In regard to choice and dissemination of technology the following information may be required

- *economic efficiency of present technologies (C)*
- *level of un- or underemployment (B/C)*
- *other sources of income/employment of fishing households (A/B/C)*
- *access to and costs of capital on the formal/informal credit market (B/C*
- *opportunity costs of labour (B/C)*
- *present ownership patterns (and expected changes) (A/B/C)*
- *present level of incomes (and expected changes (A/B/C)*
- *present income distribution/sharing system (and expected changes) (A/B/C)*
- *present flow of fish (and expected changes) (A/B/C)*

- *present barriers to entry into/exit from fisheries (and expected changes) (A/B/C)*
- *present levels of fish prices - ex-vessel: wholesale, retail, export (and expected changes) (A/B/C)*

Training

- *types of skills required (A/C)*
- *numbers of people to be trained (A/C)*
- *present educational standards (B)*
- *present attitudes, preferences, etc. (C)*
- *costs of training and extension (A/B/C)*

PROVISION OF INFRASTRUCTURE (EXCLUDING SOCIAL INFRASTRUCTURE)

- Inventory of present infrastructure

  (i) landing facilities (A)
  (ii) access roads (B)
  (iii) electricity/water supply (B)
  (iv) preservation, handling and distribution facilities (A)

- Assessment of benefits and costs of providing improved/additional infrastructure (A/B/C)

  (i) increased catch/catch revenues
  (ii) reduction in waste
  (iii) changes in incomes
  (iv) change in fish flow/distribution
  (v) change in fish prices
  (vi) change in product quality
  (vii) costs of providing and maintaining infrastructure

Fisheries Laws (data requirements will depend on specificities mentioned in the law eg. management regulations, marketing regulations, etc.

Taxes/Subsidies/Import and Export Duties (data requirements similar to those mentioned under management regulations and R & D)

- *international market prices for inputs and outputs (B/C)*

Credit Schemes (information requirements similar to those mentioned under management regulations and R & D)

- *present sources of credit (A/B/C)*
- *access to formal credit market (B/C)*
- *administrative procedures/requirements to obtain credit on formal credit market (B/C)*
- *economic, social. cultural/ethnic or family ties on informal credit market (C)*
- *present level of indebtedness/savings by ownership/household characteristics and by use of credits for : - (C)*

  (i) investment in fishing implements
  (ii) special celebrations
  (iii) daily/seasonal basic needs

(iv) investments in other property (land, house) and economic activities
(v) operational/working capital

MARKETING AND PRODUCT QUALITY REGULATIONS

- *number and types of traders (A/B/C)*
- *costs of marketing (C)*
- *product quality standards/regulations in export markets (A/B)*
- *fish prices and qualities on beach, wholesale and retail levels (A/B)*
- *present handling, processing and distribution facilities and practices (A/B/C)*
- *present flow of fish by species/products (rural/urban by income group, exports) (A/B/C)*
- *present sales arrangements on beach and wholesale level (number of buyers/sellers, auctioning, price fixing, price negotiations, etc.) (A/B/C)*
- *economic, social, ethnic, family ties between sellers and buyers (C)*
- *influence of fishermen's and traders'organisations on fish supply/demand and fish prices (C)*

EXPORT AND IMPORT REGULATIONS ON FISHERIES PRODUCTS

- *supply and demand of fish and fishery products in domestic market (including prices on retail level) (B/C)*
- *supply and demand of substitute food items (including prices on retail level) (B/C)*
- *protein intake in percentage of requirements by income group (B/C)*
- *product quality standards/regulations in export markets (A/B)*
- *product prices (demand and supply) in international markets (B/C)*

Negotiating access to foreign zones/markets (this is only relevant for industrial fisheries)

- *set of information listed under export/import regulations, expected catch, catch rates, costs of fishing (including licence fees/royalties) (C)*
- *legal requirements/regulations of foreign countries which affect operational efficiency, costs, revenues, transfer of profits, etc. (B/C)*
- *foreign government plans in regard to development of national fishing capacities (C)*
- *demand/supply and fish prices in foreign countries and/or domestic market (A/C)*
  set of information on alternative deployment
- *options of fleet in national zone (see information listed under management regulations and R & D)*

MONITORING, CONTROL AND SURVEILLANCE

- *losses/costs to national fleet/treasury through poaching (C)*
- *set of information listed under management regulations/R & D for assessing benefits of MCS*
- *costs of MCS (A/B/C)*

Provision of information on availability/concentration of fisheries resources (see management regulations/R & D: impact will be seen in greater operational efficiency eg. lower costs and/or higher landings/revenues) (A/C)

Fish trade agreements (see export/import regulations)

Quality standards/quality inspection for export (see export/import regulations)

- *costs of inspection (A/B/C)*

MARKETING INFORMATION SYSTEM

- *basically prices and quantities traded on beach, wholesale and retail levels by species/products/qualities and areas (see above)*

Market promotion (consumer education - attitudes/preferences)

- *food/eating habits by various personal characteristics such as: (C)*

  (i) income group
  (ii) religion
  (iii) ethnic group
  (iv) location
  (v) sex
  (vi) education, etc.

- *marketing network (C)*
- *prices of fish and fishery products and substitutes (see above)*
- *information derived from product acceptability tests (C)*
- *costs of consumer education (C)*

Promotion of social organizations/unionization (A/B/C)

- *traditional leadership structure/decision-making procedures*
- *ethnic, religious and occupational composition*
- *ownership pattern (means of production and other property)*
- *income distribution*
- *role of women*
- *kinship ties*
- *coherence in interests/objectives*
- *activities of political parties*

Traditional fishing rights/management (C)

- *origin and kinds*

- *effect on effort reduction/catch*
- *effect on income distribution*
- *effect on efficiency*
- *effect on technological progress*
- *effect on employment*
- *effect on entry into/exit from fisheries*

Environmental protection (A/B/C)

- *social costs of pollution/degradation*
- *causes/causers of pollution/degradation*
- *costs of pollution prevention*
- *distributional consequences of pollution/degradation*
- *nutritional consequences of pollution/degradation*

Paper 3

AN INTRODUCTION TO COST AND EARNINGS STUDIES

by

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ABSTRACT

This paper outlines the goals and fundamental elements of cost and earnings studies in the small-scale fishery subsector and defines the economic concepts currently in use. It describes the different phases of a cost and earnings study: planning the survey, carrying it out, presenting and analyzing the results. It also mentions the problems most frequently encountered, trying to bear in mind that the financial and human resources available for these studies are often limited.

1. INTRODUCTION

Interest in the socio-economic problems of the small-scale fisherman is increasing for several reasons: (a) it has become obvious that small-scale fisheries do not constitute a transitory phase in fishery development; (b) there is an increased determination to improve the socio-economic situation of low-income groups; and (c) the extension of fisheries jurisdiction has provided new opportunities for local fisheries and prompted governments to take a new look at both industrial and small-scale fishery development.

This explains why better knowledge of the socio-economic situation of the small-scale fisherman has become essential to fishery development planning. It is all the more important because while improving the living standards of fishermen is a worthwhile goal frequently mentioned by governments, it is one which may conflict with other goals, such as creating employment, increasing fish production for domestic markets, acquiring foreign currency through exportation or maximizing the economic benefits produced by the fishery.

The objectives of small-scale fishery development are generally the following: increasing production for the domestic market, augmenting employment in the sector, increasing fishermen's earnings, expanding their range of activity and protecting them against industrial fishery development. However, there is very little information available (e.g. about the average small-scale fisherman's income) even though ever more efficient methods of collecting data on catch and fishing effort are now being used. It therefore seems important to demonstrate the value of cost and earnings studies of small-scale fishing activities to those responsible for fishery planning and development.

The present paper is based on a more comprehensive document in preparation by the author. It is composed of 9 sections. After the introduction, the second section discusses the main objectives of cost and earnings studies. The third provides some definitions. The fourth and fifth sections identify the elements of the cost and earnings of fishing units. Section Six describes the major differences between financial and economic analysis. Section Seven is a general introduction to carrying out cost and earnings surveys of small-scale fisheries. Finally, sections Eight and Nine introduce methods of presenting and analyzing the results of cost and earnings studies.

2. OBJECTIVES OF A COST AND EARNINGS STUDY

Each and every fishery is made up of specific characteristics such as the type of boat and fishing gear, the target species, the number of fishermen involved and the area fished. The objective of a cost and earnings study is to evaluate the fishing unit's earnings as well as its fixed and variable costs. This is generally done by examining a representative sample. The principal result expected of these studies is an estimate of fishermen's earnings and return on capital in the sector. A cost and earnings study as conceived of in this document is a process of gathering, processing and analyzing economic data relative to the harvesting sector. Like catch and effort studies, they require observations over time and space so as to provide reliable statistics and a wide range of information.

There are six specific areas for which the basic information derived from cost and earnings studies can be very useful: (i) development planning and monitoring, (ii) management policies and programmes, (iii) sectoral analysis, (iv) investment studies, (v) project evaluation, and (vi) income distribution.

2.1 Development planning and monitoring

Just as rational fishery management would be almost impossible without gathering, processing and analyzing data on catch and effort, development planning is impossible without the analysis of data on the earnings derived by producers and the costs which they bear. Development policies should indeed be based upon the most complete knowledge possible of the economic opportunities and constraints of the sector concerned.

Just as there can be no fishery planning without stock assessment work and the careful evaluation of stock dynamics, neither can there be any rigorous planning without a careful evaluation of the costs and earnings of the different components of the industry and a precise analysis of the interrelations between these components.

A rational planning strategy for the harvesting sub-sector is to begin by determining the renewability of the resource, as well as the costs and earnings of each main type of fishing unit, and then to determine, with the government's general policies as a guideline, which ones will receive priority. It is obvious that the government's objectives may not be limited to economic or financial profitability alone. Other criteria important to policy makers will be the cost of creating employment in the sector, the cost per ton of protein landed, etc.

Many of these goals will appear to be contradictory but it is the planners' responsibility to demonstrate this and calculate the social cost of technically feasible development alternatives.

In addition to the need for macro-economic data, it is important for the fisheries administrations to monitor the effects of fluctuation of input prices upon fishermen's earnings.

2.2 Management policies and programmes

Management measures are intended to regulate fisheries so as to maintain their productivity at an optimal level. These measures are taken in order to avoid or to correct biological and/or economic over-exploitation, to encourage the development of one fishery or to limit that of another. Management policies try to reach and maintain a certain level of fishing effort by adopting specific regulatory measures concerning, for example, mesh size, catch quotas, the length of fishing seasons, the number of licences issued, etc.

Fishery management theory teaches that the levels of effort which correspond to the optimal levels of resource exploitation from a biological and from an economic point of view are different. It is for this reason that monitoring of costs and earnings is an indispensable element of resource management and that fisheries administrations have to monitor the impact of an increase or decrease of fishing effort upon fishermen's earnings and social benefits.

2.3 Sectoral studies

Sectoral studies aim at assessing the role of the fisheries sector in the national economy as a whole. This involves the assessment of the sector's contribution in terms of added value, employment, or foreign currency earnings, and the quantifying of economic linkages to other sectors. In other words, such studies seek to assess the economic importance of inputs from other sectors and of

products from the fishery sector destined for local consumption and for the processing sector or export companies.

The main suppliers of inputs to the harvesting sub-sector are the producers or importers of fuel, the ship building sector, and the makers or importers of nets and other fishing equipment. The harvesting sector will supply the fresh market, export companies and processing plants such as fish canneries. Obtaining specific data on the relationships between these sub-sectors is essential in assessing the impact which measures to support the industry have upon the economy as a whole.

Sectoral studies should also identify existing or potential conflicts between the industrial and small-scale subsectors. Such conflicts may arise over competition for the resource, access to credit, input acquisition, obtaining labour or access to markets.

2.4 Investment studies

Choosing one among many investment alternatives is always a complex and important matter. The choice may affect the financial institutions, be they public or private, the owners, the sectors which are directly or indirectly concerned, and the overall national economy. Information concerning the costs and earnings of those operating in the fishery sector will often be an indispensable aid in evaluating an investment project.

It should be noted that once an investment is made, limited financial resources are assigned to a given project, and will no longer be available to finance other projects. Hence the importance of comparing the economic profitability of different types of small-scale fishing gear or comparing small-scale to industrial fishing. The fact that the industrial fishing sector has traditionally received the largest share of investment is perhaps linked to a misunderstanding of the financial and economic profitability of small-scale fishing and the lack of studies devoted to it.

2.5 Project evaluation

Even if a development project entails no direct costs to the benefitting country, as is the case with many grants, the recipient government would be well advised to measure the impact of such projects upon the society as a whole and not only their financial and socio-economic impact upon the direct beneficiaries.

First, this will allow the government to shape the strategy of future projects so as to provide the greatest benefits to target groups. Second, it is often overlooked that development projects usually involve some recurrent costs to the government. These costs should be measured against the benefits derived from the project in an economic rather than financial analysis. Costs and earnings studies also provide for continuous project evaluation and monitoring based on processed data.

2.6 Income distribution

More equitable distribution of income is a goal often pursued by governments, particularly in Africa. Because the fishery sector, and especially small-scale fishing, provides a living for many of those who make the poorest segment of the population, analysis of income distribution would be of great importance to policy makers.

A thorough understanding of income distribution, whether by region or sub-region, between labour and capital, or between segments of the fishery production line, (production, processing, marketing), is in fact an essential decision-making tool. Policy founded on such analyses can better correct social or geographical inequality through appropriate taxation or by offering credit or subsidies to encourage investment.

The findings of cost and earnings studies help to identify and quantify the taxes and subsidies applied in the sector, to estimate the total amount of transfers within the society and to evaluate their effects in terms of income redistribution.

3. DEFINITIONS

Before presenting the various elements which make up the costs and earnings of small-scale fishing units it is necessary to define terms such as "primary sector" and "fishing unit".

3.1 The primary production sector

There are three sectors common to all industries : the primary sector which is directly involved in production, the secondary sector which regroups processing activities and the tertiary sector, concerned with services and marketing the finished products. The segment of the fish production process of interest to this document is the primary production sector or, in other words, fishery activity from catch to fish sale, usually at the point of landing. Processing and marketing activities, are also important, but require a different approach from the one presented here and are therefore not examined.

Throughout the world, and particularly in Africa, marine fisheries are composed of two sub-sectors: the industrial and the small-scale. African inland fisheries, however, are primarily small-scale fisheries.

There are no standard definitions of small-scale and industrial fishing but distinctions can be made in reference to vessel size, gear type, distance travelled to the fishing grounds, volume of capital invested or the way in which crews are paid. The sub-sector with which we are concerned is that of those fishermen who, due to the limited range of their boats and an entire set of interrelated socio-economic characteristics, must operate upon the narrow band of land and sea bordering their villages. They have few if any alternatives and are totally dependent upon local resources. It is usually the boat owner himself who conducts small-scale fishing activity with a small crew, little capital and using simple and labour-intensive technology.

3.2 Fishing economic units

Due to the diversity of fishing techniques, the type of boat used does not seem useful as a statistical unit. Boats may vary in length from 3.5 to 20 meters, and be used with a wide variety of gear: pole and line, purse seine, beach seine, long line, gill net, etc. For this reason, the fishing economic unit is a more useful statistical unit. The fishing economic unit presupposes one or more target species requiring a certain type of gear and one or more boats requiring a certain means of propulsion, the whole presupposing a specific crew. These five elements; target species, fishing gear, boat, means of propulsion and crew compose the fishing economic unit.

By way of illustration, these components of a simple fishery can be broken down into two types of fishing unit:

Component	Type A	Type B
Target species	Small pelagics	Small pelagics
Fishing gear:	Purse seine	Beach seine
Vessel:	7-12 m canoe	5-7 m canoe
Means of propulsion:	Out-board motor	Oars
Crew:	8-12 fishermen	12-15 fishermen

Such a deliberately simple example should not obscure the difficulty usually encountered in identifying the different types of fishing units evolving in a given fishery. The difficulty is found in the elements of which the fishery unit is composed. For example, it is rare for a fishing unit to have only one target species throughout the year. Several species are usually sought and these change seasonally. Even the crew may change during the course of the year, some fishermen transferring to other units while new fishermen arrive. This situation, rather than invalidating the above-mentioned system of classification, points to its limitations and difficulty.

4. COST BREAKDOWN

Total costs include all expenses incurred by the fishing unit's owner during a specific time, usually one fishing day, week or year. In the long-term all the costs are variable, but in the short-term (at a defined and fixed production capacity) these costs may be broken down into fixed costs, or costs independent of the fishing unit's level of activity and variable costs, which are directly related to fishing operations. Variable costs are also called direct operating costs. It can be said that the

variable/fixed costs ratio is much higher in small-scale than in industrial fishing because small-scale fishing is less capitalistic[1], or capital-intensive. However, the distinction of being more or less capital-intensive can also be made between the different types of small-scale fishing units.

There are two reasons for differentiating between fixed costs and variable costs. First, it allows us to determine the point to which fishermen will continue to fish. In the short term, even when total costs exceed total earnings, they will in fact continue fishing as long as total earnings exceed variable costs. This margin allows them to pay a portion of the fixed costs which they must pay in any case in order to meet payments on their equipment and fishing gear (i.e. capital expenses). However, in the long term the fishermen will exit the fishery if variable and fixed costs cannot be covered (i.e. total revenues must at least equal total costs).

The second interest of this differentiation is methodological and concerns data collection. Fixed costs are assessed periodically, usually once a year, and only variable costs need to be surveyed continuously at selected landing sites. This considerably reduces the cost of data collection.

4.1 Fixed costs

4.1.1 Definition

Fixed costs are directly related to the ownership of a boat, a fishing gear and, if the boat is motorized, an engine. Fixed costs include insurance fees for the fishing unit; interest due on borrowed capital; licensing fees; the fixed portion of crew remuneration if there is one; depreciation and cooperative membership fees, if any. For small-scale fisheries, all fixed costs are generally borne by the boat owner. Payments may be made on a weekly or monthly basis, but fixed costs are generally appraised on an annual basis.

These costs are divided into two categories; cash expenditures for services independent of the level of fishing activity (for example, fishing licence fees or boat insurance premiums) and costs related to the use of capital (interest and depreciation).

4.1.2 Depreciation

Depreciation, unlike other fixed costs previously mentioned, is not a cash outlay. It represents the "anticipated reduction in the value of an asset over time that is brought about through physical use or obsolescence" (Gittinger, 1985). In practice, a part of the input's original value is written off each year so that its value has reached zero by the end of its estimated "useful life"[2]. An input's resale or residual value at the end of its useful life can also be taken into account. There are many ways of calculating depreciation. The method described here is the most common and the simplest to use. It is called the linear depreciation technique.

Suppose that:

(1) a fishing boat is bought today for 10,000 monetary units (MU)(a)

(2) its useful life is estimated to be 10 years (n) and

(3) its resale value at the end of 10 years is 500 MU (b).

(4) annual depreciation (d) is calculated according to the formula:

$$d = (a-b)/n,$$

or $(10{,}000-500)/10,$

or $9{,}500/10 = 950$ *MU.*

If the owner hopes to recover the capital at the end of 10 years, or buy another boat comparable to the one he is now buying, he must save 950 MU each year for 10 years.

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1 Production technique A is said to be more capitalistic than comparable technique B, if the capital/labour ratio is higher for A than for B.

2 An input's "useful life" is the number of years at the end of which it is physically or technologically obsolete and must be replaced.

Very few small-scale fishermen keep account books or have bank accounts. The framework study will therefore be able to furnish no direct information about depreciation rates, and it will be the analyst's job to estimate the length of "useful life" of each type of input (boat, fishing gear, engine), their purchase price or replacement cost and their residual value.

The true value of a fishing unit after several years' use is often difficult to estimate. A fisherman may not accurately remember the price he paid for a boat years earlier. It may also be that the economic situation has changed radically, with currency devaluation, inflation, etc., preventing comparison of the original purchase price with that of current means of production. Finally, there may have been special purchase conditions or terms, especially as regards loan repayment to a friend, family member or merchant. For these reasons, where small-scale fishing is concerned, it is preferable to calculate the present value of equipment on the basis of replacement cost adjusted to reflect the number of years the boat, gear and motor have been used. A residual value of zero is usually retained in order to simplify the calculation.

4.1.2 Interest Payments

Depreciation guarantees the reconstitution of capital. Interest, which is a cash payment, represents the return on invested capital. For example, when a relative loans a fisherman the 10,000 MU he needs to purchase a boat, he will expect to earn interest at a rate at least equal to the interest he would have earned had his money been deposited in a savings account. The annual interest payments the fisherman makes to him are the return (his earnings) on the 10,000 MU he has invested in the enterprise.

Calculating interest payments for small-scale fishing is a challenge to the analyst. Credit institutions are seldom represented in rural areas or are ill-adapted to the needs of fishermen who usually turn to the informal sector (family, merchants, etc) for credit. The informal sector is usually better-suited to the cycle of fishery production, as it is not deterred by the apparent risk and variability involved and can adapt financing and repayments to the annual production-consumption cycle.

Interest payments in the informal sector may take very different forms and in some cases are more easily assimilated as variable costs than as fixed ones. Payment may be made in cash on a regular basis (by week, month, year) or as a percentage of the value of fish landed, in kind (fish), or by selling fish to the merchant/money lender at less than market price. In view of this situation, the analyst must compare the estimated increase in the cost of the study with the information to be gained if he intends to include in his survey the method of financing used. Let it suffice to say that the cost of credit to the small-scale fisherman should often be the object of a special study because of the complexity of the systems used and the often limited financial and human resources of the Fishery Department.

4.2 Variable costs

These costs may be broken down into costs shared by crew and owner and costs borne by the owner alone. This breakdown of variable costs may be done differently for different types of fishing units, regions and ways of sharing the catch. In the interest of simplification, however, it is usually assumed that all variable costs except repair and maintenance costs are shared by the crew and the owner.

Another useful distinction is the one between variable costs per fishing trip and other variable costs. The main variable costs per fishing trip are fuel and lubricants, ice, bait if bought, food, equipment rental fees, crew's wages and other miscellaneous fees.

Some variable costs which are not treated as fishing trip costs[3] are maintenance and repair costs, which are distributed over a year, and crew's shares if a share system has been established on a weekly or monthly basis. This type of share system is relatively rare but should be mentioned, especially as regards some fishing communities of East Africa (e.g. Tanzania) and migrant

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[3] A fishing trip is defined here as the unit of time elapsed from the moment of departure to the return to shore. It is less ambiguous than the term 'fishing day' as each trip may last more than one day, although this is not usual for small-scale fishing.

fishermen in West Africa (Ghanaians organized in companies in Benin, for example). In some cases fishermen receive a fixed wage plus a percentage of the catch.

Gathering data on maintenance and especially repair costs is difficult but necessary. Major repairs following an accident, for example, are the result of factors very difficult to quantify: the technical ability of the captain, weather conditions or bad luck. There is a risk that these variable elements might distort the results when they are in fact only the occasional result of bad luck, bad weather or the inadequate technical skills of some crews.

Crew earnings, which are a cost to the boat owner in financial analysis, also represent return on labour, just as interest paid represents return on borrowed capital, whatever the form the payments take. These distinctions are unimportant at this point but will be essential in analyzing the results of the study from the different viewpoints of owner, investor, fishermen or society as a whole.

5. EARNINGS BREAKDOWN

Earnings derived from fishing activity should be analysed from different perspectives. Their origin and composition are of course fundamental but analysis of how they are distributed from both the private and social point of view should not be neglected.

5.1 Revenue definition

The gross earnings, or gross revenue, derived from fishing, a more precise term than "the value of production", can be defined as the total sum of money received by a fishing unit when it sells the catch to the first buyer. In practice, one simply multiplies the price paid for each category of fish by its weight and takes the sum of all categories. Net revenue to owner is defined as the difference between gross earnings, or sales, and all costs mentioned in section 4 (fixed and variable costs). Net production revenue is gross earnings minus operating costs.

In his study the researcher should differentiate as much as possible between the categories of fish landed and register the price received for each. This will allow the analyst to determine the economic importance of the principal species and quantify their contribution to total earnings. Fish may be sold in a variety of ways which the researcher should document. For example, small-scale fishery catches may be sold with all species mixed at one unit price, at a price determined by commercial class (small pelagics, demersal, etc), or under a mixed system with specific prices for certain categories and another price for all other species together.

The fishing unit may generate earnings which are not the result of fish sales. These earnings, called "exceptional earnings" are usually derived from transporting goods or passengers, or from insurance settlements following a major accident (this latter kind of earnings should be subtracted from the fishing unit's repair costs).

Knowledge of earnings from activities other than fishing such as aquaculture, agriculture or raising animals is important to the understanding and analysis of the fishermen's seasonal and professional mobility. However, due to the cost and complexity of collecting this information, it is preferable that it be done in complementary studies rather than within the small-scale fishery costs and earnings study.

5.2 The share system

Knowing how earnings are shared within the fishing unit is vital to determining individual earnings. It will enable the analyst to use the estimated total costs and earnings of the fishing unit to determine the share allotted to each crew member and also to the owner or owners of the other production factors (boat, fishing gears, motor). Another method which consists of directly questioning fishermen about their individual share takes longer, is less reliable and tends to arouse suspicion among fishermen.

Each type of small-scale fishing unit generally has a different share system. This is why the census and the classification of all fishing units by relatively homogeneous types is extremely important to the estimation of individual earnings. The general rule is that each production factor

will receive one or several shares of the earnings - in currency or in kind (fish) - according to an agreement established between the owner(s) of the means of production and the crew. Although these share systems are sometimes difficult to grasp, they are fairly homogeneous and remain relatively stable over time.

The boat owner is very often a fishermen as well and receives his share as a crew member. It is very important to the analyst to make the distinction between his two kinds of earnings - what he receives as a fishermen and what he receives as owner of the boat. This distinction is important in cases of multiple ownership, or when one or more fishermen contribute a part of the fishing equipment, like nets; or when a supplementary share is allotted to the owner as captain rather than as owner of the boat. Each production factor must be clearly identified and the number of shares allotted him specified.

The distribution of earnings in small-scale fishing is in fact often based upon quantities landed rather than on earnings from catches sold. The total quantity of fish landed rarely belongs to the boat owner alone as it does in industrial fishing. Crew members seldom receive a cash payment from the owner and their share upon landing is a certain amount of fish which they sell to whomever they please.

For this reason it is easier and usually accurate to hypothesize that each share is equal and determine the value of one share (e.g. that of the captain), and use this value to extrapolate individual earnings according to the number of shares allotted to each factor of production.

5.3 Autoconsumption

Autoconsumption, which we aggregate as earnings in kind, is typically the equivalent of withdrawal of a portion of the catch which is kept by crew members - or helpers on shore, as in the case of beach seining - rather than sold. It should be noted that this share is relatively small in commercial fishing, while there are rarely any earnings in cash in subsistence fishing.

The portion allotted to autoconsumption must nevertheless be evaluated and its weight registered as part of earnings in kind, in order to compare different types of fishing units, on a geographical basis for example. In general, the portion received for autoconsumption is larger on the average at landing points far from large urban centers, where alimentary alternatives are few. This does not imply subsistence fishing unless nearly the entire catch is destined for autoconsumption or traded for other consumable goods. In true subsistence fishing, the catch never enters the monetary circuit.

5.4 Return on labour

Labour revenue is the value of the shares, including the owner's share if he is a fisherman. It is thus equivalent to the value of the sales less the common costs.

When some crew members receive a larger share because they are qualified to perform certain tasks, it is necessary to specify the different tasks on board which create a division of labour. As a general rule it can be said that such division is rare and that one crew member seldom earns more than another given the simplicity of small-scale fishery techniques.

5.5 Return on capital

Gross return on capital is made up of the value of the shares due on capital invested less fixed costs. Once depreciation is subtracted from gross return, we speak of net return. As for the labour production factor, each element of the investment must be identified and the share of the earnings due each element must be estimated.

A distinction is made therefore between borrowed capital, which usually receives a fixed return - interest- and the owner's personal capital for which he receives remuneration -a share- based on the fishing unit's earnings.

6. ECONOMIC ANALYSIS

6.1 Difference between financial and economic analysis

Financial analysis is based on market prices, or the price actually paid by producers for inputs and the price received per kilo of fish landed and sold. This type of analysis is the most pertinent to private parties: the fishing boat owner, the crew, the trader or even the consumer. In a free-market economy these prices are a true reflection of the value of goods and services.

In practice, market prices are affected by diverse economic phenomena and by government policies on tariffs, taxes and subsidies, or by an official exchange rate. In such cases, the prices which fishermen pay or receive do not always correspond to the economic value of the goods and services paid to or received by the society as a whole.

Thus, for example, gear might be sold to fishermen at a subsidized price. This represents a financial gain for the fishing sector but not for the economy as a whole. In economic analysis, gear is valued at a higher shadow price[4], i.e. the price actually paid by fishermen plus the amount of subsidy. In this case social costs exceed individual costs.

If the State levies a tax on fish landed, the tax does not represent a decrease in earnings for the economy, but rather a simple transfer to the collecting agency. In economic analysis, the shadow price for fish will be the market price minus the tax. In this case, the result is that social earnings exceed individual earnings.

Four major differences between financial and economic analysis should be emphasized :

- Goods and services are usually assigned different values. Market prices (prices actually paid) are always used in financial analysis, as they are used in household or business bookkeeping. In economic analysis, "shadow prices" which differ from market prices, are often used in order to better reflect economic value.

- Economic analysis is neutral regarding distribution of earnings and ownership of capital. Total social earnings are calculated without regard to individual welfare, but to society as a whole.

- In financial analysis, taxes and subsidies are treated respectively as "costs" and "profits" to the private entrepreneur. In economic analysis, they are treated as transfers between various components of the economy. Taxes levied are a social benefit while subsidies represent a cost to society.

- Although interest paid on borrowed capital represents a cost for the individual and is treated as such in financial analysis, interest payments represent a return on capital for society as a whole and are considered as such in economic analysis.

Calculating shadow prices is a highly complex task, and costly as well. It is therefore obvious that for the fishery sector and for the small-scale fishery in particular, it would be futile to calculate shadow prices for most goods and services. It is usually sufficient to make use of market prices, to which the following adjustments are made for economic analysis:

- taxes and fees included in the market price of major items (boats, motors, fuel, etc.), should be deducted;

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[4] A "shadow price" is the value given in economic analysis to costs or earnings when it is believed that market prices constitute an unsatisfactory estimate of their economic value. For fish landed and sold the shadow price is the value in use (i.e. purchaser's willingness to pay for final goods). For intermediate goods and services, the shadow price is the opportunity cost. Shadow prices are meant to express the value of goods and services as determined by their availability, as there are various mechanisms which prohibit market prices from adjusting to the degree of abundance or scarcity of these goods and services. Shadow prices are also intended to take into account government policies meant to encourage or limit the use of certain resources or goods.

- subsidies awarded by the government in order to encourage fish production and consumption (i.e gear, engine, fuel subsidies etc.) should be added; in the case of fish price control, the "value in use" should be taken into account;

- interest paid on borrowed capital is not considered as a social cost and simply ignored;

- if foreign exchange is a concern, a second calculation of the cost of imported and exported merchandise should be made (using, in this case, the foreign exchange shadow price suggested by the central planning office);

- similarly, the cost of capital should be made (i.e. using the capital shadow price suggested by the central planning office).

When these shadow price calculations have not been made by the central planning office, it is often better to do without them than to undertake approximate or erroneous calculation which might falsify the analyses.

6.2 Opportunity costs

The opportunity cost is one of the most important concepts of economic theory. The opportunity cost of an activity is the foregone value of the best alternative use of the activity (i.e. the fisherman stays in fishery as long as he can earn no more or less elsewhere). If resources were unlimited, no activity would be pursued at the expense of another, and all could be undertaken, and the opportunity cost of any particular production factor (capital or labour), the best possible alternative, would be zero. The opportunity cost is clearly positive in the real world, where resources - labour and capital - are limited.

In small-scale fisheries, and particularly those of Africa, fishermen's wages are not a true reflection of the opportunity cost of labour. If unemployment is widespread and fishermen have no alternative to fishing the opportunity cost of labour may be quite small and not far from zero, and society loses nothing by employing them in the fishery. In this case, relatively common in Africa, the cost of paying labour is not included in an economic calculation of total costs or costs per unit of effort. These wages do not represent a cost to society because they represent the use of unused labour. A low level of professional and geographic mobility is another factor which tends to lower the opportunity cost of the labour factor. If some alternative employment opportunities exist, the opportunity cost of labour may be based upon the minimum wage of hired labour or the minimum earnings of rural agricultural populations, so long as the small-scale fisherman could indeed have access to arable land.

The concept of opportunity cost of capital is based on the same principle. Invested capital, or the means of production present in a fishery (boats and fishing gears) being virtually immobile , having no alternative use other than fishing, also has an opportunity cost near zero. This limited mobility is one of the reasons why, in the short term, boats will continue to operate as long as they are able to cover all of their variable costs and a portion of their fixed costs. It is easier to estimate the opportunity cost of invested capital for industrial fishing than for small-scale fishing. By supposing, for example, that a fisherman sells his fully equipped boat to another equally competent fisherman and that the latter mortgages the boat in favour of the former owner, the minimum interest rate acceptable to him is also the capital opportunity cost. A simpler procedure sometimes used for small-scale fishing is to estimate the opportunity cost of the capital invested in the boat on the basis of the earnings the owner would realize if he transformed his fishing boat into a boat to be used for transportation.

In an underexploited fishery, the opportunity cost of capital will be clearly positive and this is also true in an over-exploited fishery if the boat can be used in a less exploited or more profitable fishery without major and expensive technical modifications.

The concept of opportunity cost is fundamentally linked to that of "mobility". Only if there is mobility can there be an alternative use of the factors of production. This is why it is important to distinguish carefully between the calculation of the opportunity cost of factors of production already being used in a given activity and calculations which are made during project analysis. In

project analysis capital has yet to be invested and labour has yet to be employed. It is supposed that capital is perfectly mobile and may be put to use in the most profitable sector.

Thus, if a potential public or private sector investor possesses 10,000 MU and plans to invest them in a fishing boat rather than a tractor or by placing them in a savings account, the opportunity cost of his investment is what he could have earned in the most profitable equally risky alternative[5]. In this case of course the opportunity cost will be positive and could, for example, be based on the interest rate offered by the bank for the deposit of 10,000 MU in a savings account. In cost- earnings studies, it is clear that the mobility of capital already invested and therefore also its opportunity cost will be much less than in project analysis. While money can easily be deposited in a bank, the same cannot be said of a motorized canoe.

6.3 Special treatment of taxes and subsidies

Taxes levied by the State are treated much differently in financial analysis than in economic analysis. For the private entrepreneur (the fisherman), taxes represent a cost - a sum to pay - while for society as a whole taxes are only a transfer from one national agent to another which has no effect upon the social profitability of the investment. However, taxes are not neutral from the analyst's point of view because they directly affect distribution of earnings within the society. It is therefore important to identify the goods and services which are taxed and to calculate the total for the sector as a whole.

Subsidies or subventions awarded by the state to the small-scale fishery sector may take very diverse forms: guaranteed low-interest loans, ice supplied at lower than market price, tax-free fuel supplies, etc... As in the case of taxes, an economic analysis should identify and make allowance for these subsidies. However, as is also found in the case of taxes, this is easier to do by considering the sector as a whole rather than each fishing unit individually.

In economic analysis, taxes and subsidies are therefore treated as transfers within the society. The analyst studies the economic profitability of the sector, comparing it to that of other sectors of the national economy, rather than that of the individual fishing unit for which financial profitability is the principal object of analysis.

7. COSTS AND EARNINGS SURVEYS

The purpose of continuing costs and earnings surveys is to collect data concerning elements which fluctuate regularly. As we have seen, the more stable elements of costs and earnings are collected during the preliminary survey or census. Annual monitoring of costs and earnings is justifiable due to the seasonal fluctuation of results in a fishery. This seasonality of fishing activities often implies a change of target species, fishing gears and intensity of effort during the year.

It is important to emphasize the confidentiality of the cost and earnings survey. Nothing in the questionnaire should allow the boat owner to be identified to prevent the statistics from being used for other purposes. This guarantee of anonymity is fundamental if the fisherman is to trust the researcher and provide reliable data. Anonymity alone is not of course sufficient to ensure the reliability of the data.

7.1 Planning the survey

Because human and financial resources for conducting specific cost and earnings surveys are often limited, particularly in Africa, it is desirable to combine costs and earnings surveys with on-going catch and effort surveys. Although this solution has some drawbacks, it has the advantage of being realistic. It obliges the planner to concentrate on those elements really essential to estimating costs and earnings and avoid lengthy and complicated questionnaires. In addition, trying to collect exhaustive data reduces the size of the sample it is physically possible to cover in the short period of time between one boat's return and the next. Moreover, questionnaires which are too long and

5 Here it should be understood that we cannot refer to possible gains (or losses), should the investor choose to gamble his money at a casino or in a lottery.

detailed lead to confusion, suspicion and weariness among the fishermen, upon whose good will the success of the survey depends.

The table below summarizes the different elements of costs and earnings and the timing of data collection. It is understood that "continuous" timing means throughout the year and refers to the cost and earnings survey questionnaire specifically, while "periodic" timing means once a year, usually during the frame survey or census.

Cost elements	Collection timing
Variable costs per trip	
Fuel and oil	continuous
Ice	"
Bait (if purchased)	"
Food	"
Crew's wages	"
Equipment rental fees	"
Miscellaneous fees	"
Other variable costs	
Maintenance and repairs	
- of boat	continuous
- of motor	"
- of fishing gear	"
Fixed costs	
Insurance	periodic
Fishing licence	"
Cooperative fees	"
Interest on borrowed capital	"
Depreciation	
- of boat	"
- of motor	"
- of fishing gears	"
Earnings components	
Fish Sales	continuous
Exceptional Revenue	"

7.2 Field operations

It is important to identify the earnings which come directly from fishing and to avoid over -or under- estimating them.

Factors of over-evaluation come essentially from fish landed on shore but which was not caught by the boat's crew. This is the case of fish the crew buys at sea from other boats and resells for its own profit, which is not a fishing but a commercial operation. It is also the case of fish the boat transports which belongs to other crews and which will be delivered to a representative of the other boat owner. These should be included in the exceptional revenues.

Factors which contribute to under-evaluation are earnings from fish sold at sea to other boats. These occur for three very different reasons: to postpone returning to shore because the crew has found a very productive fishing ground ; to remove a portion of the catch from the notice of an absent owner in order to increase the crew's real share; or to avoid landing the catch on a carefully monitored beach to avoid taxes or be able to sell at a higher price than the price set by the government or by local authorities, etc.. Another error, which is more difficult to detect during the survey, is that of noting prices which include an interest rate.

7.3 Problems and constraints

Because fishing operations take place off-shore, direct observation is difficult. One must therefore rely upon the fishermen themselves for accurate information and they are generally the only ones in a position to supply it. However, and perhaps because they are often ill-informed of the purpose of the study, fishermen frequently are reluctant to provide information which they fear might be used to levy taxes, set closed seasons or ban certain types of gears.

The situation becomes even more delicate when it comes to surveying earnings. The researcher must use common sense and a good deal of tact. Carrying out the survey can be facilitated by the use of researchers recruited from fishing communities, who are natives of the survey zone and fluent in the local language, provided they receive proper training in the use of questionnaires and understand the goals of the survey.

Too often field researchers do not speak the local language well, do not themselves know for what use the information they are gathering is intended, do not know the survey's objectives and are never informed of the results. This is to be avoided whenever possible.

The field observers' main problem is to strike a balance between the quality of the information and the speed at which it is obtained. It is therefore important not to burden them with either too many units to survey or too many questions to ask.

8. PRESENTING THE RESULTS

Numerous tables and graphs can be derived from costs and earnings surveys. Some of the most common are listed below. It is preferable that results be given in terms of values - market prices - and only at a later stage should the analyst seek an economic interpretation. It is essential that the data furnished by the field surveys be accessible to anyone involved in the fishery sector and to people with no background in economics. Improving the quality of the questionnaire and therefore the quality of the survey results depends upon adequate diffusion of the information and feedback. The field observers themselves should be involved in interpretation and diffusing the results. They are too often thought of as necessary but little motivated intermediaries in the process of data collection.

The volume of data to be processed during a cost and earnings or a catch/effort survey makes the use of a computer increasingly necessary. Use of a computer also reduces errors due to manual calculations and allows the analyst to cross-check results.

8.1 Catch and earnings

Catch composition, average price by category of fish and turnover per trip, per month and per year for each type of fishing economic unit (FEU) are the first results supplied by cost and earnings studies. Daily, monthly and seasonal variation in the composition of earnings as well as in total sales per type of FEU are synthesized in tables and later shown in graphs.

The principal recapitulative tables per FEU are the following:

- *mean catches per fishing trip*
- *average number of trips per month per boat*
- *average value of a fisherman's share per trip and month*
- *average value of the boat owner's share per trip and per month*
- *average catch per month*
- *average price per kilo of fish*

8.2 Costs and profitability

Both the cost breakdown and the value of shares received by the different means of production are shown in relation to the evolution of total earnings.

The steps used in calculating the different results which the analyst hopes to obtain from cost and earnings studies from a financial point of view can be summarized schematically:

(a) gross revenue (catches x average price/category) - (b) common costs
(c) revenue to share - (d) crew shares[6]
(e) gross return on capital - (f) shares due the means of production - (g) interest paid on borrowed capital - (h) fixed and variable costs to the owner
(i) net return on owner's investment

8.3 Remuneration of labour

The production factor "labour" is often more homogeneous in small- scale fishing than in industrial fishing, differences in qualifications and specializations being less marked. It is possible, however, that fishermen's shares within one fishing unit may have a different value due to a difference in qualifications and/or competence.

In this case, distinctions may be made between each employment category: captain, fisherman, helper, ...

8.4 Remuneration of capital

The analyst must distinguish between personal capital, brought to the enterprise by the owner of the boat, means of propulsion or fishing gears, and capital which is borrowed from either the institutional sector (bank) or the informal sector (family, friend, merchant...). This is an important distinction because the two types of capital tend to be remunerated differently. Remuneration of borrowed capital is generally independent of turnover, while the remuneration of personal capital is directly related to catch and sales (remuneration "by share").

The distinction should nevertheless be made with care, as it often depends upon the conditions of the loan. Loans from the informal sector may be repaid according to the "share". This usually occurs when a fishery is very profitable. It may also occur when the social linkage of the partners in the enterprise is so close that risks are shared.

The share which each means of production receives can be assimilated to a gross earning from which depreciation must be deducted to obtain net earnings.

8.5 The cost of producing animal protein

The cost of production per kilo of fish landed can be calculated on the basis of the data concerning total costs (fixed and variable) supplied by the survey. This analysis in itself is of limited interest if it is not continued throughout the process which ends with the consumer (processing and marketing) in order to compare this cost with the cost of other animal protein. It is also interesting to calculate costs on an economic rather than a strictly financial basis. This allows the analyst to take into account market distortions and frequent government interventions (i.e. taxes, fixed prices, subsidies) in favor of a specific animal product.

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6 Including the share received by the owner as a crew member if such is the case.

8.6 Risk

Calculating the element of risk inherent to fishing activity is worthwhile to the extent that in this activity the level of risk is largely responsible for determining the return on capital and has a considerable influence upon the small-scale fishermen's ability to save.

Risk resides in the unpredictability of catches and earnings. It can be measured by the seasonal variations in catch and earnings, by daily variation or by the number of fishing trips which yield no catch or a catch much smaller than the minimum deemed necessary for the crew's subsistence.

9. RESULT ANALYSIS

9.1 Economic benefits

The profitability of the investment can be measured by the annual profit/unit of capital invested ratio.

The productivity of capital is defined as the ratio: product/unit of capital. When capital is remunerated in physical terms there is no common denominator for comparison, hence the need to convert these physical units into monetary units in order to allow an economic analysis.

The distributive effects of government policy can be analysed beginning with the importance and distribution of earnings among the different production factors : labour and capital, and between the different operators: owners, money lenders and fishermen.

The economic benefit produced by the sector can therefore be calculated as follows:

(a) gross revenue (using the market price of fish plus or minus taxes and subsidies, or the "value in use" in case of price control)
- (b) total costs
- (c) taxes included in the market price of inputs
- (d) subsidies included in the market price of inputs
- (e) opportunity cost of labour
- (f) opportunity cost of capital

(g) economic benefit

9.2 Sensitivity analysis

The purpose of sensitivity analysis is to anticipate a possible modification of the price of inputs, or of earnings (in terms of price, quantity or catch composition) and to evaluate its impact upon the profitability of fishing operations. The neutral level of exploitation can also be determined in relation to catches, average price by category, and fixed and variable costs.

9.3 Technical efficiency

Efficiency is the rate at which effort is converted into fish, fuel into knots, costs into earnings or investment into profit. Thus, efficiency can be defined as being the relation (ratio) input/products. The lower the ratio, the greater the efficiency. Technical efficiency also allows us to distinguish between the different types of fishing units. It can be measured by ratios such as :

- kilos/fishing day
- kilos/man-day
- variable costs/kilo
- variable costs/fishing day.

9.4 Added value

The difference between the final value of production and the cost of intermediary consumptions constitutes the added value of a sector for the national economy. It is the sum of the economic value created by each unit of production in the economy. Gross added value is the total of all

earnings created during the production process, which are shared among the factors of production (capital and labour) involved in an enterprise. Therefore, when calculating gross value added, taxes and depreciation are not considered as costs.

The total of gross added values produced by all units of production in the country's economy contributes the gross national product (GNP). If we deduct depreciation, we may refer to net added values and their total, the net national product.

The added value of a fishing unit may be found, by using the exploitation account history as reconstructed by the analyst.

The sector's added value is naturally greater than the result of exploitation of all fishing units. Beyond that which is due to the entrepreneur (the gross result of exploitation), this in fact includes the remuneration of labour, payments to the state (licence fees, taxes, social rates) and to suppliers of capital (interest).

Calculating the added value of the artisanal sub-sector is of great interest when comparing it to the industrial one.

9.5 Balance of payments

Countries which dispose of limited financial resources, especially in convertible currency, and which are often dependent upon imported fishing equipment will be interested in learning the amount of foreign currency spent and earned by the sector. This amount will be calculated as the difference between the value of exports and the value of imports.

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TECHNIQUES OF COST BENEFIT ANALYSIS

A summary of Concepts, Terminology and Methods with special reference to Project Analysis

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ABSTRACT

This paper provides a summary of concepts, terminology and methods of undertaking cost benefit analysis, with special reference to project analyses.

1 BASIC PRINCIPLES

Cost-benefit analysis is not a technique confined to the analysis of projects but it is most commonly encountered in that role. Cost-benefit analysis is applied in project appraisal to give an objective measure of a project's worth in order to aid investment decisions and to improve project formulation and preparation. It can be used for comparing alternative investments across a wide range of sectors and types of project. All projects which are candidates for financing are analyzed to assess their wider economic impact and to produce an estimation of their value in today's money, together with the rate of return expected from the investment.

Before embarking on the arithmetic of project appraisal it is worth re-checking a few basic points about the project itself.

- Is the project really a single project or is it in fact two or more which could be analyzed and implemented separately? What are the project's boundaries? For example a good marketing project may have new vessels tacked onto it which may not be necessary for the new project to succeed and which should be evaluated separately.
- Will the project automatically exclude other investments or necessitate additional investments? If so, these effects must be incorporated in the analysis.
- Is the project the most cost-effective way of meeting the needs which the project addresses? Check design, size, location, timing and technology.

Cost benefit analysis automatically involves three steps:

1 Identification of the financial and economic costs and benefits of the project (including external effects on other parts of the economy, even when these are not very apparent or not even quantifiable).

2 Valuation of financial and economic costs and benefits

3 Comparison of costs and benefits, discounting and calculation of net present values and rates of return.

The key test to apply when identifying the financial and economic impacts of a project is :

What are the benefits/costs WITH the project?

What are the benefits/costs WITHOUT the project?

The need to avoid the "Before and After Fallacy" cannot be overemphasized. New projects should not be given credit for benefits which would have arisen anyway and which occur contemporaneously with the project. Conversely, the costs of lack of action if a new project is not implemented should also be counted.

2 ADJUSTING FOR TIME

2.1 Accrual Accounting and Cash Flow

One of the purposes of money is to provide a store of value. Money values are thus ascribed to the various assets and liabilities in the accounts of a business as specific magnitudes which can be compared with each other and which in theory should ultimately be convertible into money at that value.

This *numéraire* facilitates trade, banking and financial transactions and the recording of debts. However, how does one compare investment proposals which may be of different size or which have different profiles in terms of the returns they generate? The conventional measures of profitability such as return on investment in a given year or the number of years before an initial investment is paid back are very poor indicators of the performance of alternative investment proposals and often provide a defective indication.

Conventional accounts are based on accrued obligations and accountants spend a lot of effort matching their accounts to the period associated with the transaction in question, for example, attributing profits to a particular trading period even though the purchases may not be paid for till much later. Conventional accounts are also based on the concept of a going concern, usually a more or less steady state, whereas projects usually mean rapid changes within a few months or years. Moreover, how does one deal with the fact that a small project with a high rate of return may be mutually exclusive of another larger project with a lower rate of return but with an overall greater benefit to the economy. Again, a project may show a fast pay-back but not be particularly profitable. Or a project may produce very high returns after a long period of waiting. Clearly different tools are required for project analysis.

It is the time dimension which creates the difficulty and which has to be incorporated into the analysis. This is the economic concept of **time preference**. The principle is very simple. Values received earlier are worth more than when received later and the analysis is conducted exclusively in terms of cash flows as and when they occur: hence the term **Discounted Cash Flow (DCF) Analysis.**

This difference between the accruals basis and a cash flow basis arises from the different purposes of each type of analysis. There is nothing inherently superior or inferior about either method. Accruals are aimed at efficient record keeping concerning indebtedness and financial control. DCF analysis is more concerned with the quality of decisions concerning investment, and, in the case of economic analysis, about the implications of development projects from the point of view of society as a whole. So DCF analysis places a stress also on when cash flows actually take place. Timing is important and directly affects value.

It is self-evident that delays in payment are undesirable and that people expect to be compensated for satisfaction postponed. A money lender expects more back than he lends after an elapse of time. Goods purchased on hire purchase involve a greater total expenditure than goods bought for cash. Somebody with savings which he does not immediately require expects them to grow on deposit in the bank, while the bank puts the claims they represent on the economy's production to work.

The actual extent of compensation for delayed use of the funds depends on many things including the degree of risk, the state of the economy and the supply and demand for loanable funds, as well as the rather abstract concept of the society's "time preference". A society which thinks "there is no tomorrow" will behave differently from one which applies a very low discount rate to future benefits. One imagines that the ancient Chinese and the ancient Egyptians probably had a low social time preference. Some Marxist regimes have also openly professed a willingness to forego

current consumption in order to bring about ideal conditions which they expect to flow from present sacrifices.

2.2 Net Present Value

The mechanics of DCF analysis are the same regardless of whether the analysis is in financial terms (as in the case of an individual enterprise) or economic terms (as when the benefits to the whole economy are considered). The differences between the two types of analysis relate to the values of the various cost elements and benefits taken into account. When moving from a financial to an economic analysis some items are excluded, some added and some modified. The differences between these two approaches, both of which are usually needed in the analysis of a project, will be discussed later.

The compensation for delayed access to funds is called **interest**. In simple terms:

Present value + Interest = Future value

Let P = present value, F = future value, r = the rate of interest

The rate of interest is most easily handled mathematically as a coefficient i.e. 10% is shown as 0.1; 5% as 0.05. The interest rate relates to a given period on which interested is calculated, usually one year, but sometimes a month, in which latter case one would expect the rate to be correspondingly smaller.

So we may write

$$P + Pr = F \quad \text{or} \quad P(1+r) = F$$

We now have a means of translating a present value into a future value, given the rate of interest. By turning the formula round we also have a way of doing the reverse, of working out the present value of a future sum or of **discounting** a future value to arrive at its present value.

$$P = \frac{F}{(1+r)} = F(1+r)^{-1}$$

Thus the **discount rate** and the **interest rate** always have the same value and are simply mirror images of each other

The principle applies also when the future date is more than one period away and when interest is compounded.

For example, to find out the future value three periods away (F_3) of a given amount it will be necessary to compound the interest three times:

$$P(1+r)(1+r)(1+r) = F_3 \quad \text{or} \quad P(1+r)^3 = F_3$$

So we may also write $P = F_3(1+r)^{-3}$

More generally, where n is the number of periods involved:

$$P = F_n(1+r)^{-n}$$

and the term $(1+r)^{-n}$ is known as the **discount factor** which may be applied to a future sum **n** periods away to determine its present value when the rate of interest is r. For example the discount factor for a future value two years into the future at 5% will be:

$$(1+.05)^{-2} = 0.90703$$

Given a projected stream of successive cash flows we can now calculate the stream's **present** value by adding up the present values of all the future values. These are obtained by multiplying the future values by the relevant discount factors.

Pre-computed discount factor tables are available but the process can be tedious when done by hand. However, with the advent of computer spread sheets these manipulations can be performed

instantaneously. Many economists also find dedicated hand-held financial calculators such as the Hewlett-Packard 12C of great practical value.

At a given interest/discount rate, therefore, we can calculate the Net **Present Value (NPV)** of a project by working out the value of the net cash flows of each future year in present day terms, not forgetting to include negative cash flows such as the major outflow of investment expenditure which normally occurs at the start of the project. It is common practice to base these initial investment outflows in year zero and thus not to discount them. Investments carrying over beyond year 0, however, are treated simply as negative cash flows in the relevant year and are thus discounted.

The Net Present Value of a project is thus the value of the benefits net of the costs, both discounted at an appropriate rate, usually the **Opportunity Cost of Capital.** The meaning of this concept of the opportunity cost of capital will be explained more fully below, but for the moment we may assume it is the rate below which it would be better to do something else with the money. The rate actually used in the analysis is known as the **Accounting Rate of Interest (ARI)** which is only jargon for the rate at which the analysis is actually done.

The NPV may be an economic NPV or a financial NPV depending on the type of analysis being performed. Any project which has a positive net present value at the ARI therefore receives a "green light" from the analysis. Of course, the net present value must also be higher than or as high as the net present value of mutually exclusive project alternatives. In cases where projects are mutually exclusive the project with the highest NPV should be selected (this applies even if the one with the smaller NPV has a higher IRR - see 2.4 below).

(Note that acceptance should not depend on any single criterion: many social and environmental factors may need to be taken into account as well as several other financial and economic tests and sensitivities.)

In the case of a stream of equal flows which continues over a period of time, it is possible to use tables for **annuities** which may facilitate computation but the short cuts these annuity tables allowed in the days before personal computers were widely available are no longer of such practical value. The formula for an annuity i.e. the present value **P** of a stream of <u>equal</u> payments of an amount of **one** unit at interest rate of **r** over **n** periods is given by the formula:

$$P = \frac{1-(1+r)^{-n}}{r}$$

The resulting value P may be multiplied by the actual value of the equal payments. This formula is derived from that for the sum of a geometric progression (see Ayers 1963 Ch 9).

2.3 Choice of Discount Rate - The Accounting Rate of Interest

The choice of discount rate (r) can be a difficult issue and is fertile ground for intellectual debates among economists. Its theoretical foundation is the idea that, to the extent that capital for the project is generated from additional savings, its economic cost is the price (or rent) savers must be paid to forego an additional unit of consumption, the so-called **Consumption Rate of Interest.** This however is not an easy value to discover. In practice it is somewhat easier to think in terms of the **Opportunity Cost of Capital.**

It must be remembered that investable funds always have alternative uses and no project should be embarked upon if its return is lower than that obtainable elsewhere. **So the opportunity cost of capital should be the marginal rate of return on investment to society.** Note that optimal development requires that this rate be the same for all sectors (the rates of return for the marginal projects in each sector should be equal) and this rate should be set at the level which just absorbs all the investable resources available to the economy.

In Third World countries these concepts can be complicated by the fact that supplies of funds from overseas are sometimes available only to the project in question and are thus not easily fungible; for example in the case of foreign mining ventures or special bilateral loans. Moreover, capital markets in most developing countries are highly imperfect and fragmented, and are often distorted by government interest rate policies. Certain sectors often receive priority. So there are

difficult conceptual and practical problems in translating market interest rates into an Opportunity Cost of Capital.

Fortunately for the fisheries project economist it is not usually necessary to calculate an ARI from scratch, merely to enquire at the central planning unit (or its equivalent) what ARI is being used in the country. After all it is invalid to use a different ARI in the Fisheries Sector from that used elsewhere. If as in many developing countries an agreed national ARI is not available, it may be necessary to employ some "nominal rate". As noted above, domestic interest rates are a poor guide, so it is common World Bank practice and also that of sister institutions like the Asian and African Development Banks and the Inter-American Investment Bank to apply nominal rates for the sake of the analysis - usually 10 to 12 per cent - when computing NPV.

The following is a very simple example of the calculation of an NPV for a rather short-lived project.

(1) Year	(2) Investment	(3) Running Costs	(4) Revenue	(5) Total (2)(3)(4)	(6) Discount Factor @10%	(7) Present Value
0	(112,000)			(112,000)	1.0	(112,000)
1	(50,000)	(23,000)	55,000	(18,000)	0.909	(16,363)
2		(30,000)	82,000	52,000	0.826	42,927
3		(30,000)	82,000	52,000	0.751	39,068
4		(30,000)	82,000	52,000	0.683	35,517
5	20,000		20,000		0.621	12,418
				Net Present Value@10% =		1,568

In this case the project only just passes the test: it has a small positive NPV at the ARI of 10 per cent. Note, by the way, that the sale of equipment for some alternative use (scrap perhaps) at the end of the project results in a positive cash flow under the heading of investment.

2.4 Internal Rate of Return

The Net Present Value criterion for acceptance of a project is normally preferred from a theoretical point of view to the **Internal Rate of Return (IRR)** because it is less likely in special cases to give a misleading indication. But it must be acknowledged that the IRR is more popular. The obvious advantage is that IRR gives an instant indication of profitability, regardless of the size or type of project, conveniently expressed as a percentage and it does not directly pose the headache of what discount rate to use, except perhaps when a project is marginal, that is, when its IRR is close to the ARI.

The internal rate of return concept makes use of the fact that the early cash flows of a project tend to be negative, whereas benefits tend to be realized later. Progressively higher discount rates tend to diminish the importance of the future positive cash flows, whereas most of a project's negative cash flows (in the form of investment) occur in year 0, or at least in the early years, and are therefore little affected. By increasing the discount rate on the same projected cash flows, therefore, one would expect there to be a corresponding reduction in the NPV until a point is reached where it is zero. **The discount rate at which the NPV is reduced to zero is known as the internal rate of return (IRR) of the project.** In the example given under 2.3 above the IRR would be only slightly higher than the ARI of 10% since the NPV is quite low.

The IRR may be an Economic IRR or a Financial IRR, depending on whether financial or economic cash flow values are being used. The acceptance criteria is that a project receives a "green light" from the calculation if the IRR is above the ARI. In practice most projects should have an IRR significantly higher than the ARI.

If done manually, the IRR has to be calculated by an iterative method (that means trial and error, each successive calculation using a discount rate which will bring the resulting NPV closer to a

value of 0) or it can be done graphically. However, the use of dedicated calculators and computer spread sheets has eliminated the tedium of this exercise, though care should be taken to ensure the correct formulae and data input procedures have been followed when using such aids.

The IRR method has a few drawbacks. It may in rare cases have more than one mathematical solution when there are reverses in the cash flows; for example when one or more major negative cash flows occur in the middle of a project's life (eg when the engine has to be replaced on a fishing boat. But the negative flows do have to be relatively large for this to happen). The method is also not valid for selecting between mutually exclusive projects: a small project with a high IRR but a low NPV is not to be preferred over a large one with a lower IRR but a higher NPV. It is also a poor basis of comparison for projects with very different economic life spans since the comparison implicitly assumes that the project with a shorter life can be re-invested at a similar rate of return. This may not be so. Care should also be taken when comparing projects across different sectors. However, the concept is widely understood and can be related directly to the opportunity cost of capital. No investment study is complete without it.

2.5 Benefit - Cost Ratio

This is really a variant of the NPV measure with a distinction made between benefits and costs: both being defined in terms of their present values. If the net present value is positive the benefit-cost ratio will be greater than unity. The problem with this method is that it is sensitive to the way costs and benefits are classified (eg whether to "net out" operating costs and take only net benefits or whether to take both revenues and operating costs in gross terms under their respective headings). Thus it is a rather blunt instrument. Moreover the BC ratio has the same disadvantages as IRR. However, the World Bank does use the BC ratio in types of projects where IRRs tend to be very high (some types of road projects for example).

3 EVALUATION OF COSTS AND BENEFITS

3.1 Economic and Financial Analysis

As already mentioned the mechanics of calculating NPVs, IRRs and BC ratios are identical for both economic and financial analyses. The differences between the two lie in the conceptual approach, in particular from what point of view the investment is being considered. Financial analysis is undertaken using actual prices and values at which transactions affecting the project will be concluded. The project is treated as a business enterprise and the return calculated from the point of view of an investor. In contrast, an economic analysis addresses the question of what benefit the economy as a whole will obtain from the project and, of course, what costs will be incurred by the economy as a whole.

3.2 Whose Investment?

A word or two of warning is appropriate, however, concerning the way in which financial analysis is conducted in project appraisal as opposed to that done by financial analysts in capital markets. In Discounted Cash Flow project appraisal it is usual to assess the investment proposition as an entirety, ignoring the source of the capital. Thus the analysis will not normally be undertaken from the point of view of equity investment, which would usually be complemented by loan capital. This is sometimes a source of confusion.

The investment required for a project will be viewed in total cost terms, and comprising the real items being supplied to the project or being constructed within it. This investment may in reality be funded partly by the equity of the owner, partly by a Development Bank loan and partly by commercial borrowing. This is not relevant in terms of the NPV or IRR of the project as a whole, even in the case of financial project analysis.

Of course it is possible to calculate these indicators from the point of view of the equity while taking into account all the cash flows generated by the various sources of finance, including the inflow when the loans are received and the repayments of capital and interest during the life of the project. This calculation will yield a different value and one would expect a much higher return than on the project as a whole because most of the risk is taken by the supplier of equity.

However this is not always done in project analysis. It is nevertheless often essential to project forward cash flows generated in a "financial plan" in order to help the overall management of the project and to meet the information needs of the bankers. The World Bank and its sister banks often play a close supervisory role in projects which they finance, and cash management is closely monitored.

3.3 Value Added and GDP

A convenient insight into the philosophy of an economic analysis is given by the concept of **Value Added**, an idea which also provides a link with the national accounts of a country. **Gross Domestic Product (GDP)** is the total of what is produced within the state's physical borders. It is gross because it does not take into account capital consumption, the fact that capital depreciates and some of GDP goes towards replenishing it.

GDP may be measured as the total of final goods and services produced or as the total of all factor incomes or as the sum of the value added by all the productive units in the economy. The three measures are equivalent. The last measure is convenient for us because an increase in value added as a result of the project must be the increased economic benefit to society as a whole.

Gross value added is the value of gross output of the productive unit less the purchase of external inputs. The capital and labour of the unit are regarded as internal inputs. Thus gross value added also means the income generated by production which is distributed to the factors of production: labour and capital. Returns to labour include all kinds of remuneration (wages, salaries, bonuses, payments in kind, etc.). Returns to capital include interest, tax, duties, re-invested earnings, dividends, amortization and depreciation.

What we are interested in is the *incremental* net benefit to the economy attributable to the **capital resources** invested in the project, which is the **gross value added less the return to labour.** We have to eliminate labour costs (even though labour constitutes part of the enterprise's total value added) because we are concerned with benefits arising from capital investment and because labour has an opportunity cost in the economy. In an economic analysis this may well not be the wage that labour has to be paid. The relevant question is - "What output would be lost elsewhere in the economy by the application of labour within the project?"

So it is worth bearing the value added concept in mind when looking for the benefits of a project.

It is convenient in most cases to start cost benefit analysis with a financial analysis, since the economic analysis usually involves modifications to the numbers assembled for the financial analysis.

3.4 Exclusions and Inclusions

3.4.1 Sunk Costs

Some projects make use of facilities in existence before the project starts. Regardless of whether these facilities were the result of a successful or unsuccessful previous project, if they have no alternative use they should not be incorporated into the project's analysis: they represent "dead money" - they are "sunk costs" which should not be allowed to inflate the costs of the project under consideration. Project analysis must always look forward and ignore historical costs about which nothing can be done, in spite of their possibly embarrassing nature!

Having accepted this principle, however, it is sometimes useful to calculate an overall return when a project forms part of a sequence of related investments. It is interesting to know whether a project is capturing benefits which may have eluded previous attempts. Projects which do this usually have high returns. In this special wider analysis previous costs would be included, as would benefits realized earlier.

3.4.2 Treatment of Inflation

Inflation is not normally taken into account in project appraisal. The evaluation is made in constant prices usually those of the base year (year 0). In some rare cases there may be grounds for believing that one or more elements in the costs or benefits may be subject to relative price changes, in which case the recalculation should be done as part of a sensitivity analysis.

Inflation may pose budgetary problems in terms of cash management, as for example when output prices cannot be adjusted quickly enough against rising input prices. Such aspects should be considered at the time of project formulation and adequate measures taken to avoid difficulties. Price control by government is a common headache for large, high-profile projects at a time of inflation. This does not affect an economic appraisal because by definition constant prices (those of a specific point in time, usually year 0) are used. Substantial embarrassment may nevertheless be caused to the project's management and to its debt repayment capabilities under such circumstances.

Technical and financial analyses often contain references to **"contingencies"**. These should be decomposed into two elements: (1) price contingencies and (2) physical contingencies. Price contingencies are simply the effects of inflation which have just been discussed and should be excluded from an economic analysis unless they take the form of relative price changes which can be handled as part of a sensitivity analysis (see section 5). Physical contingencies, however, which represent likely, but perhaps as yet unspecified, additional costs should be included. If, on the other hand, they are considered relatively unlikely costs then they are more appropriately treated as part of a sensitivity analysis. In any event, assumptions should be clearly stated.

3.4.3 Working Capital

This is usually defined in accounting terms as net current assets consisting variously of stocks, work-in-progress, accounts receivable less accounts payable, plus the necessary amount of liquid cash for carrying on the affairs of the enterprise. A certain amount of working capital is usually needed to operate fixed assets which represent the bulk of the project's investment. How much working capital is needed is likely to vary from project to project. In the case of a financial analysis all working capital as shown in the accounts should be included. However, in the case of economic analysis changes in indebtedness within the economy (such as represented by accounts receivable and payable) should be excluded and working capital in an economic analysis should consist **only of real items** which create claims on the nation's resources (usually only physical stocks and work-in-progress).

3.4.4 Depreciation

The accrual accounts of a project will include provisions for depreciation on the basis of prevailing accounting practice. This should be closely related to the expected life of the asset concerned.

In many countries there may also be a preferential **accelerated** rate of depreciation for tax purposes which allows assets to be depreciated more quickly so as to provide a "shield" against company profits tax, which is assessed on profits after depreciation as defined by the tax rules. This has the effect of postponing tax payments and thereby improving cash availability in the immediate post investment period. It is a way of encouraging companies to invest. Accountants "even out" the distorting effect which this special depreciation for tax purposes would have on after tax profits by means of a Tax Equalization Reserve (TER) account.

In DCF project analysis, whether financial or economic, depreciation is not included. Investments are taken in full when they are made since this is when the capital resources are provided. To include depreciation as a charge against the operating cash flow or the benefits of the project would amount to double counting. However, both financial and economic analyses must include real costs which the assets in question generate, such as routine preventive maintenance including replacement of short-lived components and repairs. Salvage values if applicable should also be included as positive cash flows at the end of the asset's life.

3.4.5 Transfer Payments

Transfer payments are transfers within the economy which do not involve the use of resources or the generation of wealth - they merely constitute changes of claims on society's output. They may affect the distribution of financial costs and benefits to the project but they do not affect the economic costs and benefits of the project. Thus transfer payments are **included in the financial analysis** of a project but **excluded from the economic analysis.**

Examples of transfer payments are taxes on goods and services, subsidies, and credit transactions. Subsidies and taxes are often not immediately apparent in fuel, electricity, transport and water charges.

3.5 Opportunity Cost and Shadow Prices

Shadow pricing arises only in the case of economic analysis and is the logical consequence of applying the principle of **opportunity cost**, which we have already encountered in the case of the opportunity cost of capital.

Most resources have alternative uses. Foreign exchange may be used to buy a wide range of goods and services from overseas. Land may be used for housing or factories or agriculture. The **opportunity cost of a resource is defined as the value it has in the next best alternative use.** From a financial point of view, the opportunity cost of an input is most likely what has to be paid for it. From society's point of view, however, this is not always so. Market prices may differ from society's opportunity costs for several reasons. Taxes and subsidies already discussed above represent one possible cause of such divergence. Other distortions arise as a result of quotas, monopolistic practices, restrictive practices, minimum wage legislation, etc. Artificially maintained foreign exchange rates or foreign exchange rationing in particular bring about distortions.

There may also be hidden costs to third parties not involved in the project, through pollution for example. In fisheries this may easily take the form of consequences for other fisheries or fishermen or other users of water resources. These are called externalities and are discussed below.

A **shadow price** is the use of a value different from the market price which aims to reflect the **true opportunity cost to society** of the resource in question. An equivalent term commonly used for shadow pricing is "**efficiency prices**", meaning prices which will reflect efficiency in maximizing National Income (GDP). It could be the cost in the next best alternative use or the marginal cost of producing more of it, or the cost of importing it (or its substitutes), depending on the context. The practical challenge of shadow pricing all the inputs of a project can be daunting and is not always necessary. But the analysis of a project using only market prices may produce erroneous answers in terms of the desirability of the project for the economy and for society as a whole.

3.6 Methods of Shadow Pricing

It is not always necessary to employ one of the more rigorous methods of shadow pricing such as the use of conversion factors. An economic analysis is conducted by analyzing costs and benefits and by shadow pricing them according to the availability of data and the relevance to the project, and above all in accordance with the principles of opportunity cost. It is of course also important to be clear about the *numéraire* that is chosen for evaluating these. However, conversion factors take into account more comprehensively the pricing of non-traded inputs and outputs that are specific to the project and they tend to yield more reliable results.

In most fisheries projects it will in any case be necessary to examine cost items to weed out taxes and subsidies, to investigate the value to the economy of unskilled labour, to check the basis of the price of land (if relevant), to investigate the exchange rate when there is exchange control, and finally to choose a *numéraire* for the evaluation. Thus some understanding of the mechanics of shadow pricing will be helpful to fisheries administrators confronted by a detailed project appraisal document and will also be instructive in understanding the differences between financial and economic analysis.

The most widely used method of shadow pricing is the conversion factor approach developed by Little and Mirrlees (1974) and also by Squire and van der Tak (1975). <UNIDO (1972,1975) has also developed a theoretically equivalent though computationally different method>. It is normal World Bank Practice to use conversion factors and "border prices" as the *numéraire* for the analysis of Bank projects. The differences between border prices and domestic prices will be explained below.

The technique is to look at the various cost items in a project in terms of their elements. Most cost items can be decomposed into elements for which a shadow price is known or can be easily computed and so by weighting these elements a shadow price can be worked out for almost any cost item. The projects inputs are first divided into

- traded goods
- non-traded goods
- primary factors (labour and land)

Again, it is important to be clear about the *numéraire* in which the costs and benefits are to be evaluated. In the Little and Mirrlees method traded goods are priced at their **world prices** net of import or export taxes and adjusted for freight costs including transport internally to the project and, of course, net of all transfer payments (taxes and subsidies etc). This is the so-called **border price**. In the case of an export, the border price is the price F.O.B. less the local transport price to the nearest port. In the case of an imported item the price is the C.I.F. price plus the local transport price to the project site, and also net of transfer payments. For each project cost item and, where appropriate benefit item,

A conversion factor is calculated and used to translate domestic prices for a particular item or group of items into its border price. Thus

(Market Price of item *i*) x CF_i = Border Price of item *i*

This procedure is usually followed on an item by item basis only for the major project items which are traded. Minor traded items are usually shadow priced using a **Standard Conversion Factor for traded goods** (SCF_t), an estimated average ratio of adjusted world prices to domestic prices. In a case where an imported item is costed exactly at its border price and there are no transfer payments included (and no other distortions) then the CF for that item would be 1. A domestic price 25% above border prices would result in a CF of 0.8 applied to the domestic price. A cost item which is wholly a transfer payment will have a conversion factor of 0. In other words it will simply be eliminated. Items with subsidies would need their domestic prices uplifted so one would expect CFs with a value greater than unity.

Shadow prices for **non-traded** goods are based on their opportunity cost and are also calculated by applying conversion factors to market prices. For final goods the shadow price is the value in the economy **in use**. For intermediate goods (ie inputs) it is the value of the marginal physical product in the next best use.

In calculating conversion factors, the elements which go to make up non-traded goods are broken down into traded and non-traded elements, the former element of course evaluated at border prices in the same way as traded goods. The non-traded elements are evaluated according to their opportunity costs. Again a **standard non-traded goods conversion factor** (SCF_{nt}) may be used when the element is not a major proportion of the total.

Some types of non-traded goods (like some types of transport and utilities), have tariffs which are far removed from the actual costs to society of their use. These should always be investigated for subsidies or elements of tax. If it is an important element in total costs it will merit the attention needed to calculate its own specific CF.

There is sometimes a certain degree of confusion concerning the concept of **shadow exchange rates**. When using Little and Mirrlees conversion factors the process is to convert domestic prices into border prices and the resulting value is in an international *numéraire*. Thus the adjustment for artificial exchange rates is done automatically by the conversion factor.

In the Third World, a shadow exchange rate implies an adjustment, invariably a premium, on domestic currency values above the official rate to arrive at the real cost of imports. Thus if an all-embracing **Standard Conversion Factor** (SCF) were used on domestic prices it would have a simple mathematical relationship to the shadow exchange rate:

$$SCF = O(1/S)$$

Where S = Shadow exchange rate, O = Official exchange rate.

Thus an SCF of 0.8 will correspond to a shadow exchange rate of 1.25. Such a SCF would, however, be a very crude device and is not recommended!

An alternative approach to that of the World Bank and Little and Mirrlees to the problem of artificial exchange rates/overvalued currency and which differs in methodological terms, is to

evaluate all costs using a *numéraire* based on domestic prices and to apply a shadow exchange rate to all imported elements and exported elements. In our example, therefore, the domestic prices for exports and imports would be shadow priced upwards by 25%. Thus when domestic prices are the *numéraire* the imported items/elements need to be increased to reflect their true economic cost in domestic terms and when the *numéraire* is border prices the domestic prices of most items would normally have to be reduced to arrive at a border price.

It should be noted that adjusting for transfer payments may work in the opposite direction and may offset these adjustments for exchange rates.

The shadow exchange rate approach (as normally practiced) is a simpler procedure though less thorough than the conversion factor approach because of the former's more cursory treatment of non-traded inputs and outputs.

The two methods are equivalent when in the case of the World Bank method a single standard conversion factor is used to convert the entire cost of non-traded outputs and inputs valued at market prices into their border equivalents and when in the alternative method a shadow exchange rate is used to convert the values of traded inputs and outputs into domestic prices. They are not equivalent when more detailed and specific conversion factors are derived.

Conversion factors are labour saving for the analyst when many projects are being evaluated and when the support of other macro-economists or planners working in the country is available, but not always so helpful in the case of "one-off" project appraisals which need to be conducted quickly.

The fisheries project analyst is unlikely to need to compute standard conversion factors directly and is advised in the case of large projects which will be competing for funds outside the fisheries sector to consult the central planning unit or the resident macro-economists/planners in the country in question. This is not "passing the buck" but essential to the validity of the approach. The **same conversion factors and ARI must be used across the economy if funds are to be allocated efficiently among competing projects and between sectors.** Of course conversion factors for individual items can usually be computed quickly by using weighted combinations of standard conversion factors (see section 3.7 below) according to the cost elements of the item.

Generally speaking, industrial fisheries projects have a high import content which can easily be evaluated at border prices. The most likely candidates for shadow pricing will be fuel and electricity charges which need to be purified of any taxes or subsidies.

Shadow pricing of labour although commonly done in agricultural projects is not often a critical factor in the economic evaluation of fishing projects. Industrial fishing projects generally employ relatively small amounts of labour, usually skilled, whereas artisanal projects do not normally involve incremental direct employment of unskilled labour (as for example in plantation agriculture or irrigation schemes or road construction).

Nevertheless, the need for a shadow wage may arise, as for example in the employment created by a canning factory or the construction of a fish farm or where a fisheries project results in an increase in employment in the fisheries sector. Here the opportunity cost criterion applies as always. For example in the case of the cannery, because the factory is in the "formal sector", it may be necessary for the project to pay the statutory minimum wage rate which is artificially high in relation to the informal agricultural sector. It may be that there is high unemployment or underemployment so that the opportunity cost of labour may be a fraction of the minimum wage. In such a case an appropriate shadow wage would be the marginal physical product of labour on the land - if it can be measured. Again the analyst should consult economists who already have had to tackle this issue in other project evaluations.

It must also be remembered that a shadow wage rate once determined by the opportunity cost principle in domestic prices will need to be converted to border prices in the usual way using an appropriate conversion factor. The conversion factor will depend on the nature of the project.

The finesse of the shadow pricing will depend much upon the accumulated experience of others and the time available to devote to this absorbing but sometimes tricky aspect of project evaluation.

Land should also be shadow priced if the price at which it is transferred to the project is not based on its productive capacity with the next best use (be it agriculture, residential or whatever).

3.7 Manipulating Conversion Factors: an Example

Having explained the definitions of and philosophy behind shadow prices, an example of the derivation of a CF will help to show how the various elements come together when moving from a financial analysis to an economic one, and how in the Little and Mirrlees approach the CF performs the necessary arithmetic to change the market price to a border price.

We may suppose that the central planning unit has given us a conversion factor for the shadow wage rate of 0.7 (already adjusted to border prices) and an SCF_{nt} for non traded goods of O.9. Cement and steel prices domestically are 25% higher than border prices (so $CF_{c\&s} = 0.8$).

In the case of fuel oil we assume that while the country is a net exporter the domestic price to electricity generating plants is kept well below the border price. The border price is 93% higher than the domestic price so the $CF_{fo} = 1.93$. Imported machinery is valued at border prices exactly as tariffs are not charged to the project so the $CF_{im} = 1.0$.

Suppose we want to work out a shadow price for electricity (this example is developed from one given in the Asian Development Bank's Guidelines: Asian Development Bank 1987).

The first step is to decompose the **cost per kilowatt**, as obtained from the power generating company, into its elements. Note, this is not necessarily the price charged to the project. **In the analysis of projects, the market price means the price the project has to pay.** Although the preferential price to the project is 50c/kWh, the cost of production per kWh is estimated to be 60c/kWh and is decomposed as follows:

```
Fuel oil   0.27c (45%)
O & M      0.03c ( 5%)
Capital    0.30c (50%)─┐
                       │
Total      0.60c       │
                       │
                       └Civil works    10% ─┐
                        Imported mach  58%  │
                        Other dom       2%  │
                        Transfer pmts  30%  │
                                            │
                                            └ Cement     20%
                                              Steel      20%
                                              Unsk Lab   40%
                                              Other dom  20%
```

Capital charges constitute a large element so they need to be decomposed into their constituents, and civil works also merit decomposition in order to establish their constituents.

We now have the following weights and can therefore multiply the weight by the appropriate conversion factor:

	Weights	CF	CF x wt
Fuel oil	0.45	1.93	0.8685
Operations and Maintenance	0.05	0.9	0.0450
Cement	0.01 (0.5x0.1x0.2)	0.8	0.0080
Steel	0.01 (0.5x0.1x0.2)	0.8	0.0080
Unskilled labour	0.02 (0.5x0.1x0.4)	0.7	0.0140
Other domestic (1)	0.01 (0.5x0.Ix0.2)	0.9	0.0090
Imported Machinery	0.29 (0.5x0.58)	1.0	0.2900
Other domestic (2)	0.01 (0.5x0.2)	0.9	0.0090
Transfer payments	0.15 (0.5x0.3)	0	0.0000
	1.00		1.2515

The resulting figure when all these weighted CFs are added up is the cost of production converted to a border price. However, remember that we started with cost of production, not market price. To obtain the specific conversion factor to apply to our market price we have to make one final computation based on the following relationship.

$$\frac{\text{Border Price}}{\text{Cost of Production}} \times \frac{\text{Cost of Production}}{\text{Market Price}} = CF_e$$

We have just calculated the first term and the second we knew at the start, so:

$$CF_e = 1.2515 \times 60c/50c = 1.5018$$

The conversion factor for electricity which we apply to the market price charged to the project in order to derive the economic cost is therefore 1.50 correct to two decimal places.

So the CFe is applied to the 50c/kWh market price to find the efficiency price or the economic cost of electricity:

$$50c/kWh \times 1.50 = 75c/kWh.$$

All electricity costs will be calculated using this price of 75c/kWh in the economic analysis.

4 EXTERNALITIES

The process of undertaking an economic analysis is itself an assessment of externalities, a process of examining effects on the wider economy reaching beyond the project itself and not reflected in a financial analysis.

The analysis of fisheries projects requires special attention to the external effects of any project on other fisheries. The scope for damage to an artisanal fishery by an industrial or semi industrial fishery is obvious. It is essential to consult a fisheries scientist on the likely external effect of any innovation in the fishery on the resource as a whole as well as on other users of the resource. This is a special field which lies beyond the scope of the present paper. But in economic terms an example of an externality which should be incorporated in the project analysis would be the case of the costs to small scale fisheries of the harvesting of a common resource by trawling. A high financial IRR may not reflect the external costs of the activity on other fishermen or on the longer term productivity of the resource.

But the search for externalities should not stop with the fisheries aspects of the issue. It is now usually understood that "externalities" means costs or benefits which would not ordinarily be taken into account in a financial analysis either because they are external to the project or because society has not found a way of quantifying them or because people are not aware of them. Since they do not appear in the financial analysis no simple conversion factor can spirit them into existence in the economic analysis and they have to be separately identified.

There is a growing concern about certain types of environmental externality which project appraisal must attempt to address. These are such external effects as pollution of water, the atmosphere or the beauty of the landscape, damage to the world's wildlife and genetic resources, contributions to global warming etc. Sometimes these effects are felt in other countries (as in the case of downstream effects of dam projects and the atmospheric damage caused by acid rain or burning forests). Fisheries are probably more often a victim of pollution than a cause of it but there are usually complex ecological links with wider environmental issues.

These effects are very difficult to quantify. If the direct costs of external impacts such as pollution cannot be quantified, the cost of making good any damage should be taken into account wherever possible. But these might be prohibitive or the technology might not be available. On a fairly mundane level one way of assessing the costs of pollution is to take into account the effect through changes in land or property values. Ugly factories and polluted air tend to lower property values. But these tend to be rather localized effects and assume awareness on the part of local people. Fish canneries for example are notoriously smelly. But some pollution (nuclear radiation, asbestos) may go unnoticed till serious health problems emerge in later years.

Externalities are not always negative, and positive external effects may include improved recreational facilities from the creation of a man-made lake for example, or the wider benefits of imported skills and technology helping domestic research and technical progress in a wider national context. Drainage schemes may improve health by reducing the incidence of waterborne diseases.

But externalities remain extremely hard to quantify. This is not, however, a reason for ignoring them and they ought to be searched for in all projects, quantified if possible and, if not quantifiable, faced up to nevertheless in the project formulation process.

5 SENSITIVITY ANALYSIS

No project analysis is complete without an analysis of how possible changes in key variables or events would affect the project's viability.

Generally, sensitivity analysis concentrates on the IRR and how changes in key variables change the IRR of a project. Examples of key variables would include: Prices; costs of key inputs; yields or catch rates; the achievable utilization rates of capital equipment (such as fishing vessels); and timing.

The first step is to determine the variables most sensitive to change and to estimate a realistic envelope within which each may change.

Except where combinations of adverse conditions are quite likely to afflict the project simultaneously, combinations of changes are best avoided. It is better to examine sensitivity of the IRR to individual variables in order to be able to distinguish individual influences. The main analysis of the project is taken as the **base case** and departures from this are analyzed on a case by case basis.

Investment costs are easily handled, and a ten to fifteen percent escalation is usually a sufficient overrun factor.

In the case of miscellaneous operating costs, the larger the component represents of total operating costs the greater will be its effect on IRR. So in the presentation of the sensitivity analysis a simple table showing the percentage composition of operating costs by item will save a lot of unnecessary calculations. Operating cost items may then be considered together and the effect of say 10% and 20% cost escalations examined.

More important items, however, such as fuel costs will probably need individual treatment and the range of variation may need to be wider.

Output prices may also be highly unstable and hence their sensitivity must be explored. International tuna prices for example have been known to vary as much as 40 per cent over a period of 18 months.

It is important also to show the sensitivity of the project to delays in implementation either as a whole or perhaps of key elements. Fishing vessel projects often take unduly optimistic views of the intensity with which the vessel can operate. Hence some exploration of the effects of fewer trips per year would be warranted.

The sensitivity need not be elaborate. A simple table such as the following illustration should suffice:

		Economic IRR	Sensitivity Indicator
Base Case		22.01	
1 Investment costs	+10%	20.36	0.75
2 Operating Costs	+15%	20.66	0.41
3 Output Prices	-10%	19.94	1.26
4 Capacity Utilization	-10%	19.81	1.00
5 Delay in construction	1 yr	20.21	-

If desired, additional percentages may be considered. The sensitivity analysis should attempt to anticipate the kinds of questions the decision makers will wish to ask. What happens if...

The sensitivity indicator is simply $\frac{\text{\% change in IRR}}{\text{change in variable}}$

Another approach to sensitivity analysis has become popular in recent years and this is to turn the process around somewhat and ask by how much a variable may change before the IRR is reduced to the minimum acceptable rate, usually the opportunity cost of capital. This can be enlightening and is easily done. The method is known as the **switching** or **crossover value** test. One might be able to say for example that the cost of fuel oil may rise by 25% before the IRR of the new vessel project is reduced below the ARI.

6 RISKS

Where possible, risks should be handled in the sensitivity analysis, but fisheries projects are notoriously risky and the risks tend to be as much of the technical variety as the commercial. Often the project analyst is in the hands of the technical expert. It is often a matter of whether this type of gear, or that type of boat, will work at all! And there may be no intermediate position between success and failure.

Another difficult area is predicting the abundance of fish stocks. Another is the risk of some dispute over access to certain waters which would undermine the whole venture. For these reasons, fisheries projects require particularly exacting technical scrutiny. In some cases it may be possible to apply a probability analysis in which possible outcomes are analyzed according to their probability distribution. Unfortunately the data on which to estimate such probabilities is rarely available in fisheries situations.

7 CONSUMER SURPLUS

No discussion of the economic analysis of projects is complete without mentioning consumer surplus, a topic which always crops up in cost benefit analyses. This concept is the idea that there is a difference between what consumers pay for a product and what they would be prepared to pay. The concept normally only needs to be considered when additional output of a commodity as a direct result of the project causes a drop in price.

The most likely occurrence of this in fisheries project analysis is when a substantial increase in fish production leads to a fall in fish prices. If there is some idea about the shape of the demand

curve and hence the price elasticity of demand in the range concerned, an estimate may be made. In graphical terms, consumer surplus is the area below the demand curve but above the price line as illustrated in the figure below. When the price is lowered from P_1 to P_2, more will be

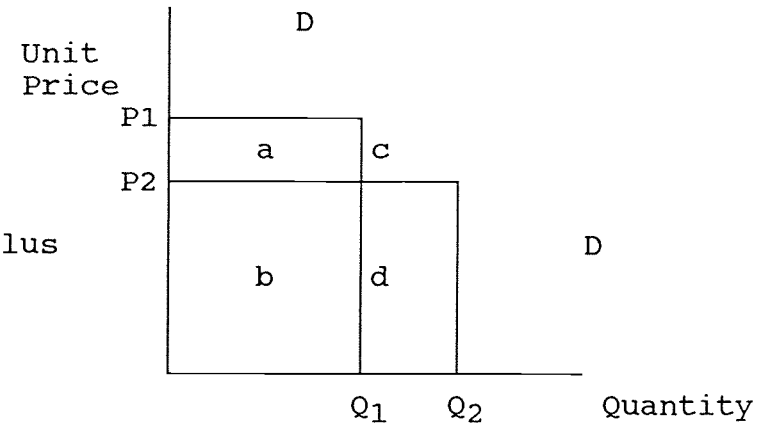

Figure:
Consumer Surplus

consumed. This corresponds to the area **a+c** under the demand curve. But the area **a** represents a loss of revenue to fishermen as well as an increase in consumer surplus when the price line drops to P_2. However, the small additional "triangle" of consumer surplus **c** will be added as a benefit. In approximate terms with the usual downward sloping demand curve the gain in consumer surplus will be the area of the little triangle which will be roughly equal to half the additional quantity they consume multiplied by the price reduction (from the formula for the area of a triangle).

It is important not to overlook consumer surplus in cases where price falls in the value of the project are foreseen with a corresponding effect on the value of the project's output.

8 SOCIAL ANALYSIS

This summary of the cost-benefit approach to project analysis is of necessity brief and no attempt has been made to go into the finer theoretical points. It should be noted however that there is one further stage of refinement in project analysis which economists have attempted to apply in certain types of large project. This is a further elaboration of the conversion factor approach aimed at taking into account (in addition to the economic considerations already discussed) what are known as **distributional effects.** An explicit attempt is made to take into account the impact of the project on the distribution of income between investment and consumption and between rich and poor and sometimes between regions. Obviously this type of analysis in encroaching deep into political issues as well as into the turbid waters of welfare economics.

It is unlikely that an analyst tackling a fisheries project would have the resources or time to calculate the sets of distributional weights that this approach requires, although it is conceivable that, as in the case of shadow prices, a central planning unit might be able to assist. Squire and van der Tak (Chapter 10) provide a good explanation of this approach.

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SUPPLY, DEMAND AND THE FISH INDUSTRY

by

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ABSTRACT:

This paper gives an introduction to the basic economic theory of supply and demand as applied to the fisheries sector. It offers to non-economists an elementary exposé of both theoretical and practical implications of market analysis. Elements of statistical methods applied to market analysis and monitoring are also discussed.

1. INTRODUCTION

This paper is about the basic theory of supply and demand as applied to the fish industry. It begins with an elementary exposition of the theory and then goes on to explore some of the practical implications. It includes short discussions of a statistical approach to market analysis and market monitoring systems.

2. THE THEORY OF SUPPLY AND DEMAND

The theory of supply and demand is fundamental to an understanding of the economics of the market place. Lack of a grasp of the key points of the way economists think about markets is probably one of the most important reasons for some of the failures in fisheries projects, especially those which plan to increase supply. For example in the context of a programme to increase the supply of fish through the expansion of small scale fishing enterprises, plans may be made which assume that the price of fish will remain constant in the face of increased supplies in a small local market. Planners may suggest that because the price of fish is relatively high, demand is buoyant, and that therefore "there is significant unsatisfied demand". A reading of the basic theory of supply and demand would immediately raise doubts about the validity of this inference.

In a free market reasonably well supplied with substitutes for fish, large numbers of people wanting to buy fish at existing prices over and above the current levels would not normally be expected. Substantial extra supplies on the market would almost certainly depress the price in the absence of other factors such as a vent for surplus in export markets.

The Demand Curve

At the heart of the theory of demand is the idea that there exists at any one time a definitive relationship between the market price of an item, be it a kilogram of fresh fish, or an advanced "value added" product like a pre-cooked package with significant fish content, and the quantity demanded of that good. This relationship between the price and the quantity the consumers want (in the sense of "are willing and able") to buy is known as the "demand curve". The amount the consumers want to buy also depends on other factors, such as the prices of other goods, their tastes and incomes. These are included in the "demand function" and are discussed under Sections 3, 4 and 6. For the moment we assume that these are unchanging and so do not influence the demand curve. ("All other things remain equal").

Table 1 is plotted in Figure 1 and is a typical example of a demand curve. For each of the prices listed there is a definite quantity of fish that consumers are willing and able to buy.

Table 1: Demand relative to Price

Price of Fish ($ per kg)	Quantity Demanded (kg)
5	9,000
4	10,000
3	12,000
2	15,000
1	20,000

If the price in the market place falls then the amount people want increases, and similarly, if the price increases then the amount people want to buy falls. This relationship is shown in Figure 1.

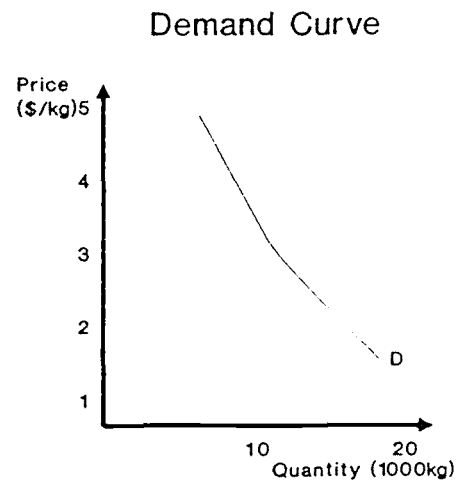


Figure 1

There are two important points to note about this graph.

First, the demand curve slopes downwards to the right. This means that the price and the quantity demanded are inversely related. This is true of practically all commodities, and is what must normally be expected when markets are considered.

Second, the demand curve is continuous. Thus prices cannot be increased without there being at least some effect on the quantity demanded, and under normal circumstances, a reduction in price brings about decrease in the quantity demanded. This amounts to the same thing as saying that one can only dispose of more fish on a market if the price falls to an extent which attracts enough new buyers or the same buyers buying more fish.

The reasons for this being so are not hard to identify, and are known, at least in a vague way, to most people. When the price of fish is very high only the rich are able to afford it and the poor have to make do with staple commodities such as bread, rice and potatoes. When the price of fish falls then more of the poor are able to buy it. The lower price coaxes in new buyers. This is also one of the reasons why we expect the shape of the demand curve to be reasonably continuous, because the new buyers are coaxed in a few at a time. The second reason is that a lower price coaxes each buyer to buyer more of the same good. The fall in the price of fish makes him feel richer because the cost of his purchases has fallen and he substitutes out other goods, probably other foodstuffs, into fish. Conversely if the price of fish rises his real income falls because he now has less to spend on other goods and he will be tempted to substitute out of fish towards other foodstuffs.

The Supply Curve

There also exists a relationship between the amount producers supply and its price. This relationship is known as the supply curve.

Table 2: Supply relative to Price

Price ($ per kg)	Quantity producers are willing to supply (kg)
1	0
2	7,000
3	12,000
4	16,000
5	18,000

This relationship can be plotted on a graph in exactly the same way as a demand curve. This is done in Figure 2.

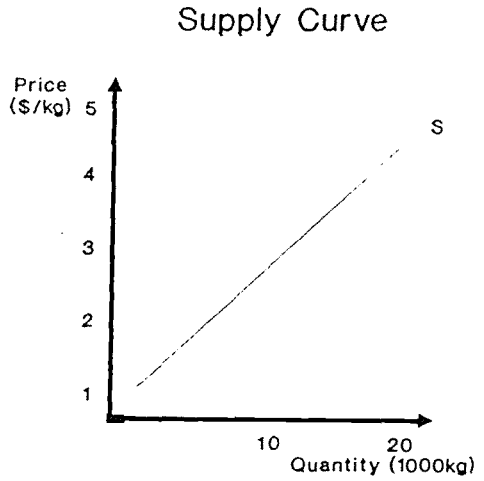


Figure 2

The reasoning behind the shape of the supply curve, sloping upwards to the right is consistent with common sense. The higher the price, the more producers are encouraged to supply, and conversely, the lower the price, the more producers are discouraged from supplying.

Fisheries are a special case with respect to supply, because the law of supply does not always work in the way that the text books predict. When a fishery is subject to a resource constraint because it is already heavily fished, the effect of a price increase can be to reduce supply because more fishermen are encouraged to go fishing and fish the resource more heavily. In other words the supply curve for capture fisheries is expected to be backward bending beyond a certain price level. The subject of fisheries economics is addressed to sorting out some of the complications of the supply relationships in fisheries.

3. The Equilibrium of Supply and Demand

The analysis of supply and demand can now be combined to see how a competitive market determines price. To do this, the contents of Tables 1 and 2 above are combined in Table 3.

Table 3: **Equilibrium Market Price Where Supply and Demand Match**

Price per kg ($)	Quantity Demanded (kg)	Quantity Supplied (kg)
5	9,000	18,000
4	10,000	16,000
3	12,000	12,000
2	15,000	7,000
1	20,000	0

So far both demand and supply have been considered in relation to a range of prices - how much will be demanded or supplied if the price is $5, $4, $3, $2 or $1. We have not discussed how the actual price is determined and how much then will be produced and consumed. At prices above $3 per kg more of the commodity will be produced than the market requires, so suppliers who do not find buyers at this price will be under pressure to cut prices so as to attract consumers. At prices below $3 unsatisfied consumers will bid up the price in the hope of persuading the suppliers to produce more product. At $3 per kg supply and demand are in equilibrium. This is the only price that can last because it is the price at which the amounts willingly supplied and demanded are equal. The intersection of the supply and demand curves can be shown on a diagram (Figure 3 above).

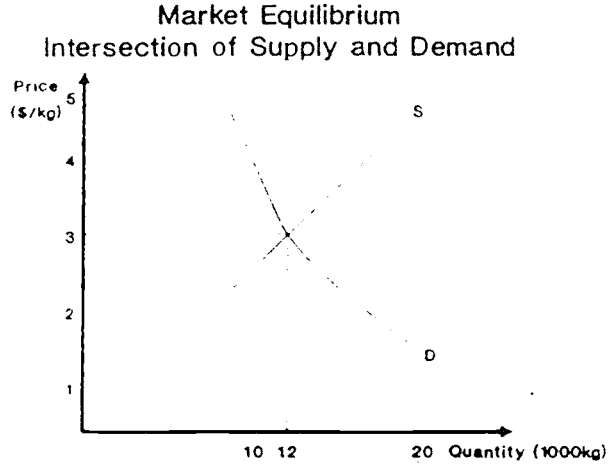


Figure 3

Effect of a Shift in Supply or Demand

Supply and demand curves show the relationship between the quantity supplied or demanded and price all other things remaining equal. The analysis holds everything else apart from price constant so that the impact of price changes can be assessed. However, if all other things do not remain equal and the position of the supply or demand curve alters as a result, this is known as a shift in the curve. The impact of shifts in supply or demand can best be illustrated by means of another diagram (Figure 4).

If there is a shift in the supply curve to the left, that is to say that circumstances alter and producers decide that the old price is not high enough to induce them to supply the same quantity as before, then prices will tend to be bid up as consumers seek to satisfy their requirements.

Figure 4. The Effects of Supply and Demand Shifts

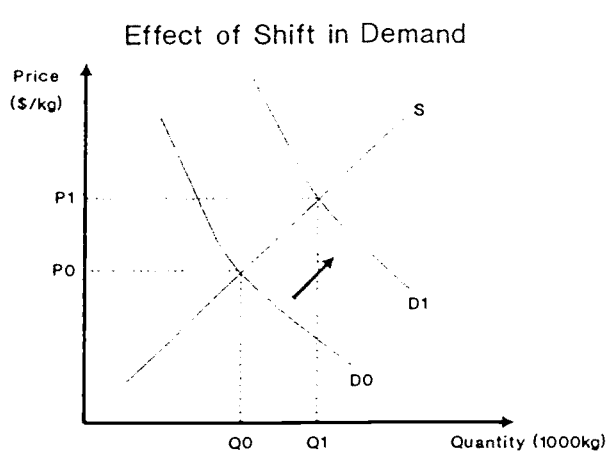


Figure 4A

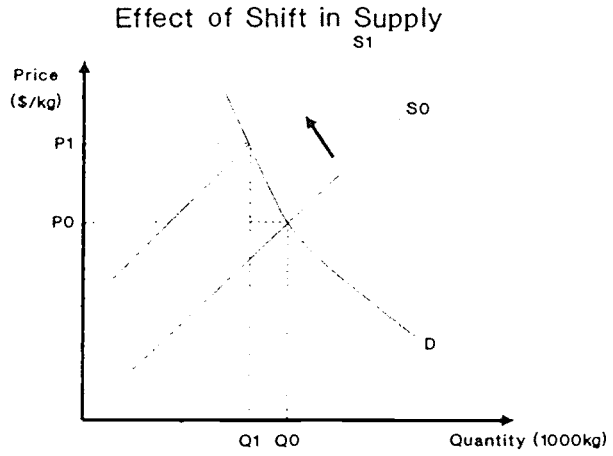


Figure 4B

If there is a shift in the demand curve to the right, perhaps because the price of some alternative foodstuff such as chicken has suddenly become very expensive causing consumers to wish to substitute out of it, then the price of fish will be bid up.

These changes are illustrated in Figure 4. In the diagram on the right, the supply curve shifts to the left. Suppliers are no longer satisfied with the old prices and now insist on more money to supply the same amount, or, to put the same point another way, at P(O) they supply less than before. The supply curve shifts from S(O)S(O) to S(1)S(1) and the price rises to P(1) as buyers compete for the more limited supplies. In the upper diagram the demand curve shifts to the right, but supply conditions remain unchanged. The demand curve D(O)D(O) shifts to the right to D(1)D(1), buyers compete more vigorously for fish, and the price rises from P(O) to P(1)

4. MOVEMENTS ALONG SUPPLY AND DEMAND CURVES AND SHIFTS IN SUPPLY AND DEMAND CURVES

It is important to understand the distinction between movements along supply and demand curves and shifts in the curves. In the case of demand, if, for some reason or other, all other things do not remain the same, perhaps because of a change in consumer tastes, then the schedule of quantities which consumers want at each price may alter, in other words the demand curve may shift but the supply curve does not. The demand curve slides along the supply curve until a new equilibrium is reached (Fig. 4). For example, if there is a scare about the contamination of canned tuna, the normal behaviour of consumers towards their food purchases may change quite dramatically. Far less canned fish would now be saleable at the same price as before. In other words, the demand curve would have shifted to the left. Conversely, if fish became associated in the minds of the majority of consumers with amazing health giving properties, the demand curve may shift to the right.

The supply relationship may change in the same way. For example, if fish producers suddenly found that it became more profitable to use their vessels as oil rig support vessels or as taxi boats, a higher price would be needed to induce them to supply fish at the old level, in other words the supply curve would shift to the left and would move up the demand curve to a new equilibrium point (Fig. 4). The "all other things being equal" condition could change in other ways too, such as a drop in the price of fuel or the introduction of an operating subsidy for fishermen, both of which would result in more vessels being engaged in fishing.

The key to spotting a change in supply or demand should be understood as a movement along the curve or a shift in the curve is to ask whether any of the other conditions, apart from price have changed.

In the real world the process of reaching equilibrium, when supply and demand are in balance, is dynamic. This simply means that the process takes place over time. Economics has developed modelling tools for analysing dynamic processes, and it need hardly be added, much of the simplicity of the static theory disappears. For example, it is quite possible to envisage and model a situation in which reduced supplies result in higher prices, inducing an increase in supply, resulting in lower prices, inducing a reduction in supply; an endless cycle of overshoot and undershoot. Complicated models can be used to analyse many other forms of dynamic paths.

5. SUPPLY AND DEMAND AND THE FISH DISTRIBUTION SYSTEM

Systems of fish distribution vary greatly between different countries. For example, in a developed country with a small or non-existent catching sector the chain of distribution may commence at the country's frontiers, either at the ports or road and rail customs posts. Frozen fish may be imported for direct distribution by processors or wholesalers of frozen foodstuffs. It will then be sold to retailers, other wholesalers or the catering trade. In a developing country where the trade is predominantly in fresh fish and dried fish, fish supplies landed at the fishing harbours may go through a wholesale stage before sale to the consumers through very small retail outlets. Methods of transportation, sizes of businesses, quality of product, presentations, containers, business practices etc. may alter with different circumstances.

Although some of the features of a fish marketing system will be country specific, it is also essential to appreciate that the insights from the basic supply and demand model have very wide application in all countries, as demonstrated in Figure 5.

Consumer demand interacts with the supply of fish provided by retailers to give the retail price. We can see how the retail price is influenced by two sets of factors, those which influence consumers, such as income, taste and the prices of other substitute commodities such as meat, poultry and other foodstuffs. These are the influences on demand. There are also influences on retailers, such as the price they must pay to obtain fish, the wages they pay themselves and their helpers and the costs of running their establishments. These are the influences on supply at the retail stage.

Working backwards from the retail market the next stage in the fish distribution system is the demand for fish by retailers. In the system depicted they buy their fish from wholesalers. Their demand is a derived demand as the retailers only buy what they can reasonably sell to consumers. The supply of fish at this intermediate stage in the fish distribution system is influenced by the amount that wholesalers pay for their fish and wholesalers' costs and margins. Once again there is an interaction between supply and demand to give the wholesale price of fish.

Wholesalers may purchase their fish from port wholesalers who have in turn bought their fish direct from the fishermen or the fishermen's agents. Each stage can be represented as a simple supply and demand model. The model demonstrates forcibly that the price that fishermen ultimately receive depends crucially on consumer demand.

Supply and Demand
Applied to Fish Distribution

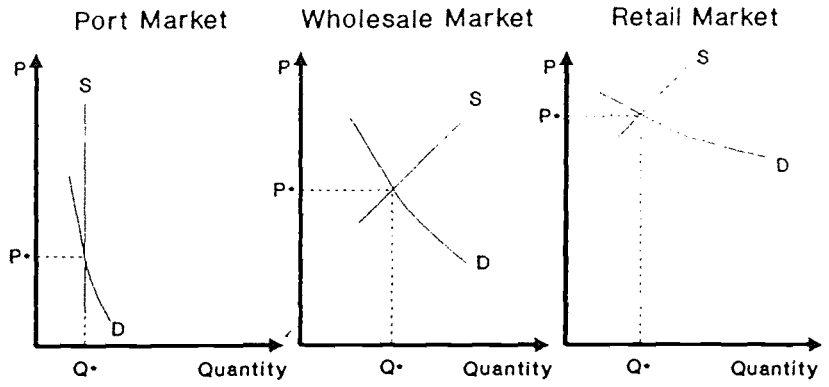


Figure 5

For many fresh fish distribution systems (although not all) economists might expect the price of fish at the quayside to be less stable than the retail price. This is because the retail price is more strongly influenced by the prices of alternative commodities; for example, housewives buying fish from retailers will often substitute away from fish if its price is much above the prices of alternatives, and similarly, they will substitute towards fish if there is much price advantage to them in doing so. So the pressure on retailers to keep fish at the quayside may be subject to much wider fluctuations because the port wholesaler has a requirement for fish whatever the price as he has costs which he cannot escape. He will wish to keep his customers in fish and he will want to ensure that his employees are kept busy. In other words, the demand for fish is likely to be at its most elastic, or responsive to price change, in the retail market, and at its most inelastic, or unresponsive to price change, at the port market.

Elasticity of Demand

Percentage change in quantity demanded divided by the percentage change in the price that brought it about.

Elasticity of Supply

Percentage change in quantity supplied, divided by percentage change in the price that brought it about.

The public is often quite surprised by the magnitude of the margin between the prices at the various stages in the distribution of fish. Popular opinion has it that the retail price should be very close to the ex-vessel price, and that any significant differences between them are due to excessive profits by various categories of middlemen.

Two points against this view may be made briefly . One is that the fish distribution business may be quite competitive, therefore, according to economic theory, any excessive profits by any one group of businessmen are likely to be competed away. The second is that fish distribution entails costs and risks which are borne by the entrepreneurs who conduct it. The difference in prices reflects these costs. It is particularly important that planners should appreciate this latter point. The distribution of fish is a risky and costly business. The risks arise because fish is so perishable, and is lost if it is not sold quickly. The seller will expect compensation for this. Other costs arise because distances are often great, roads are sometimes poor and transport costs are high. For the entrepreneur the sheer time involved in getting fish from one place to another has an opportunity cost. He could be doing something else - perhaps making money in some other way.

6. EXAMPLE OF THE CALCULATION OF THE ELASTICITY OF DEMAND

Table 4: The Price Elasticity of Demand for Fish

Price $/kg	Quantity Demanded per period kg	Elasticity	Revenue (Price *x* Quantity) $
12.50	0	Infinity	0
10.00	20	-4	200
7.50	40	-1.5	300
5.00	60	-0.67	300
2.50	80	-2.5	200
0.00	100	0	0

The application of the formula for the elasticity of demand for fish gives the results given in Table 4. In this example, the percentage change in quantity demanded between "20 kg per period" and 40 kg per period" is 100 percent ((40-20)/20 *x* 100). The percentage change in price over the same interval, from "$10 per kg" to "$7.50 per kg", is minus 25 percent ((10-7.5)/10 *x* 100). The minus sign is because the price is falling over this interval. Dividing the percentage change in price into the percentage change in quantity (100 percent divided by minus 25 percent) equals -4.

Note in Table 4 that a price elasticity of demand of more than (the absolute value of) 1 implies that total revenue falls as price rises. The intuition behind this is that if the elasticity is high, the quantity demanded falls more rapidly than the price. This results in a fall in total revenue as price rises. Similarly, if demand is elastic (value greater than the absolute value of 1) and price falls, total revenue increases as price falls. The intuitive explanation is the same. A price fall induces a greater proportionate increase in quantity demanded, thus the increase in quantity purchased outweighs the fall in price.

The converse also applies. In the inelastic range of the demand curve (where the elasticity of demand is less than the absolute value of 1), price rises are accompanied by a less than proportionate change in quantity demanded. This results in an increase in total revenue. Similarly, price falls along the inelastic range of the demand curve result in a decline in total revenue because quantity demanded does not increase enough to compensate for the fall in price.

This information can be extremely useful to management. If they have an indication of the price elasticity of demand for their output, they have an indication of whether an increase in price will be associated with a fall or an increase in revenue.

Using calculus it is possible to estimate the "spot" (as opposed to "arc") elasticity of demand. The way to do this is first to express the demand curve as an equation. Quantity is to be expressed as a function of price so according to the usual conventions of mathematics it would be drawn on the vertical axis of a diagram. This is done in Figure 6 below.

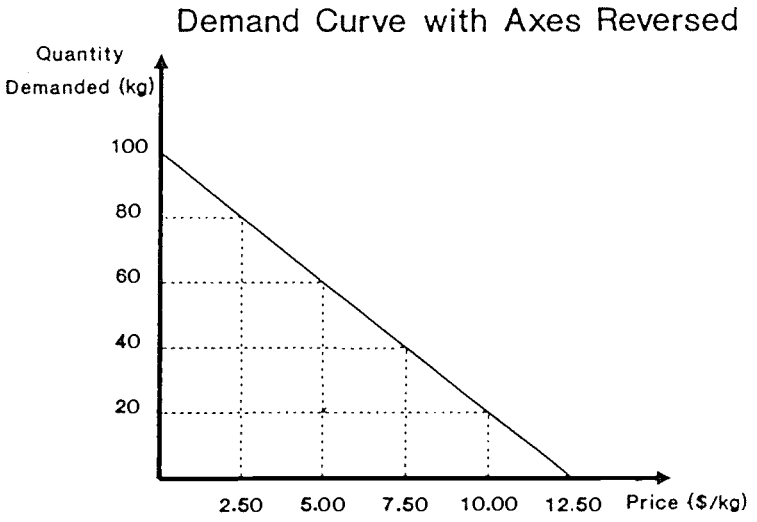


Figure 6

With this visual aid it can be seen that the gradient of the curve is -100/12.5 (=-8) and that the intercept, that is the value of Q when P = zero, is 100. This is all we need to derive the equation corresponding to the demand curve illustrated.

$$Q = 100 - 8\,p$$

The formula for the spot elasticity is:

$$(dQ/Q) \,/\, (dP/P)$$

$$\text{therefore } e = \frac{dQ}{dP} \times \frac{P}{Q}$$

For example, when the price is $5/kg, the quantity purchased is 60 kg. The spot elasticity is therefore (dQ/dP) x (P/Q) or -8 x 5/60. This is equal to - 0.66666. The reader may like to calculate the elasticity of demand when the price is $6.25/kg.

In the Appendix some examples of demand curves are estimated by econometric methods. However, in the first Appendix example, instead of quantity demanded being analysed as a function of price, price is analysed as a function of quantity. The model assumes that the quantity of fish supplied is an independent explanatory variable (or exogenous), a more realistic scenario for some fisheries cases. In this case the analyst is interested in the response (or elasticity) of price with respect to quantity changes and would therefore calculate the percentage change in price divided by the percentage change in quantity. To distinguish the idea of price responses with respect to quantity changes from the usual elasticity concept of quantity changes with respect to price changes, economists have coined the word "flexibility". The elasticity of price with respect to quantity changes is known as the flexibility as it measures how flexible prices are in response to changed quantities.

7. THE DEMAND FUNCTION AND THE DEMAND CURVE

The demand curve for fish plots the relationship between the price of fish and the quantity demanded when all other factors are held constant. The market analysis of demand usually requires a more advanced analysis to take account of the various other factors, in addition to its own price, which influence the quantity demanded of fish or a fish product. The relationship between the quantity demanded and all the other significant factors is known as the demand function.

What are the factors which may influence the quantity of fish demanded? They are discussed in turn below.

7.1 Price

The relationship of the quantity demanded of fish to its price has already been described. This is the demand curve.

7.2 The Price of Substitutes

Some products, such as meat, compete with fish. If the price of meat falls then some people may buy less fish and more meat so the price of fish will also fall. If the price of meat increases some people may buy less meat and more fish, thus pushing the price of fish up. They are induced by a price change to substitute from one product to another, and this generates further price effects. One of the most celebrated examples of this is the effect of the declining real price of chicken and red meat in the USA on the price of tuna, widely perceived as a substitute for these products.

In demand analysis the price of substitutes is usually a very important influence on the price of the commodity in question. For example, if there is downward pressure on the price of popular meat products, then fish prices will also be forced down. The influence of the price of substitutes can be seen most strongly within the fish product range. If the landings of one species increases, its price tends to fall, and this drags down the prices of other similar species.

7.3 The Price of Complements

Complementary goods are those which are consumed with the product in question, not instead of it. Complementarity is important for some commodity markets but is rarely of anything like the significance of substitution. In the UK market fish and potatoes (through the fish and chip market) are complements, and if the price of potatoes rose substantially, thus forcing up the price of chips, the quantity demanded of fish (with chips) would fall, putting downward pressure on fish prices. So in the case of complementary goods, prices are inversely related (unlike the case of substitutes when the prices move together).

7.4 Advertising and Promotion

Advertising and promotional efforts are designed to influence taste and preference patterns of consumers. Successful promotion of fish (or fish products) pushes its demand curve to the right and thus increases the price, all other things being equal.

The most socially useful advertising and promotion is the provision of information about the product to the consumer. For fish and fish products this may be information about its nutritional value, where it is available and how it is prepared for best results. It can readily be seen that consumers who are better informed about fish may wish to buy more, thus moving the aggregate demand curve to the right.

For developing countries fish promotion through appropriate campaigns (such as leaflets pointing to the nutritional benefits) are clearly an important means by which planners and managers can assert some control over the demand for the product. Planners may also consider the promotion of new products derived from the fish at their disposal.

7.5 Product Quality

The perishability of fish ensures that product quality has a major influence on demand. In some developing country markets there is no great enthusiasm for extremely fresh fish, especially if it costs more than offerings which have been around a little longer. Nevertheless, freshness may still command a premium if it gives the fish distributor or consumer more flexibility. When the wholesaler buys fresh fish from the producer he has a wide choice about what he does with it- sell whole fresh, hold it for a few hours, or days if ice is available, fillet, freeze, or process in some other way. Poorer quality fish immediately begins to reduce his various options. For example, the quality of the fish may be too poor to freeze it whole, so he has to fillet it and hope that he sells it quickly. Fresh fish is worth a lot more to fish merchants as well as to consumers.

7.6 Distribution Outlets

The number and size of distribution outlets can influence the demand for fish. A larger number of fish retailers gives consumers more opportunities for purchasing fish.

In developing countries the conditions for the sale of fish can be improved in quite simple ways, thus stimulating the demand for fish. For example, it will often be possible to provide cleaner and more secure places for fish to be sold by quite simple improvements. Fish selling areas may be fenced in and provided with washing facilities. Fish sellers may be required to use proper stalls for the sale of fish. These measures may help to push the demand curve to the right.

7.7 Consumer Incomes

The responsiveness of quantity demanded to income changes is known as the "income elasticity of demand".

> Income elasticity of demand
>
> Percentage change in quantity demanded divided by the percentage change in income that brought it about.

There are some goods for which the income elasticity of demand is negative. This means that as income increases, quantity demanded declines. This is sometimes the case for traditional staple crops, such as millet or potatoes. But the income elasticity of demand for fish, along with most animal protein products, is usually positive - as people become richer they want to eat more of it. Two exceptions may be the demand for pickled herring in Europe and possibly for dried fish in some countries; in these cases as incomes rise the quantity demanded by consumers may fall. It is useful to be aware of income elasticities when export drives for fish or fish products is being considered. If incomes are rising in the country to which it is planned to export, they may have a long term positive influence on the real prices of many species of fish.

7.8 Consumer Tastes and Preferences

Consumer tastes and preferences are changing all the time. For example, in developed country markets preferences have swung towards healthy food products, a development which is thought to have increased the demand for fish and fish products.

7.9 Expectations

The role of expectations may influence prices, particularly within the distribution chain. For example, if fish distributors expect fish prices to decline, they may choose to delay purchasing in anticipation of lower prices in the future. Conversely, if prices are expected to rise then it may make sense to buy now rather than later to escape the full force of the increase. Expectations may, therefore, be self-fulfilling prophesies. Remember, however, that speculators can be wrong and if they are, they "have their fingers burned" -being forced to buy quickly on a rising market, or having paid more than they need on a falling market.

The market for fresh fish provides frequent examples of this. If the weather is expected to change in the near future, despite heavy supplies fish prices may rise.

7.10 Other Factors

Fish sales from developing countries can also be influenced by various other factors. Some examples are changes in health regulations or tariffs in export markets. Fish product exports may sometimes be affected by a "scare" about a product from a particular source.

8. MARKETING MANAGEMENT AND THE DEMAND FUNCTION

Some of the ideas put forward so far may be summarised in the following way. The demand function may be expressed as an equation as follows:

$$
\begin{aligned}
Q(x) = f(&P(x), A(x), D(x), O(x), && \text{(strategic variables)}\\
&Y(c), T(c), E(c), && \text{(consumer variables)}\\
&P(y), A(y), D(y), O(y), && \text{(competitor variables)}\\
&G) && \text{(other factors)}
\end{aligned}
$$

Q(x) = quantity demanded of own product (fish or fish products)
P(x) = own product price (fish or fish product)
A(x) = advertising and promotion expenditure
D(x) = product quality variable
O(x) = number of outlets
Y(c) = consumer incomes
T(c) = consumer tastes
E(c) = consumer expectations
P(y) = price of competing good (s)
A(y) = promotion of competitors
D(y) = quality of competing goods
O(y) = outlets for other competing goods
G = other factors, such as government policy

The letters in brackets are identifying subscripts of the variables (adapted from Douglas, 1987).

The above equation states that the quantity demanded is a function of (i.e. causally related in some reasonably systematic way) to all those other variable listed. Now clearly some are likely to be much more important than others. However, summarising the discussion so far in this way helps to focus on those variables which the planner and manager can influence. These are defined above as the strategic variables. There will, of course, be an inter-relationship between these and other variables. For example, promotion expenditure (A(x)) is designed to influence consumer tastes. However, it is in relation to the first four that the planner can really begin to consider how he might improve the price or volume of fish sales.

9. THE THEORY OF THE CONSUMER UNDERLYING THE SUPPLY AND DEMAND MODEL

Economic science is a very logical subject and the ideas in it are built up from first principles. Underlying the supply and demand model are models of the firm (supply) and the consumer (demand). Thus the idea that in general businesses will respond to higher prices by producing more is based on a theory concerning the characteristics of the constituent units ("firms") in an industry. The theory asserts that firms are profit maximising. Similarly underlying the concept of the market demand curve is a theory that the market for commodities consists of consumers who maximise their "utility" or satisfaction subject to an income constraint. Maximization of utility or satisfaction implies that consumers make the best of, from their own point of view, the income they have, whether it is a lot or a little.

Many additional insights into consumer behaviour can be inferred from the model of the utility maximising consumer. For example, it says that if you want consumers to eat more fish, it really must offer better value or be more attractive than what they are getting at the moment. The consumer must be persuaded to reduce his spending on other goods and spend this money on fish or fish products. For the poor consumer, who must be extremely careful about how he or she allocates a very restricted budget, this is bound to be a difficult choice and often places limits on the amount of fish that can be sold.

The model helps us to analyse in more depth what happens when the production of fish is increased. The increased consumption following lower prices results from an income effect and a substitution effect. The first arises because a lower price of fish leaves more money in people's purses, so they are able to afford more fish (although some of the money saved may also be spent

on other commodities). In addition the lower price encourages substitution from other commodities into fish.

The model helps us to see that the common assumption that prices will remain constant when supplies are increased is only credible when the extra production is a very small proportion of total supplies. Thus if extra fish production from a project is sold onto a world market, or a large domestic market, then it can probably be assumed that prices will not be significantly affected by the new supplies. However it is not realistic or consistent with the basic theory, to assume that substantial extra volumes of fish into a small market will leave prices unchanged. To coax people who already allocate their current income in ways which satisfy them to buy more fish requires price reductions because only then will current non- buyers be induced to substitute from current purchases into fish and current buyers be induced to buy more fish (and less of something else).

Sometimes reality does not fit the theory. The example of advertising has already been mentioned (Section 6.2.3). Sometimes advertising induces a pattern of consumption which most observers would judge to be sub-optimal. In these cases it seems that the consumer is not sovereign and does not make the best of the household income.

10. FORECASTING IN THE REAL WORLD

A number of texts cover this topic. For an approachable introduction see Clifton, P.H.. Nguyen and S.Nutt (1985).

10.1 Informal Forecasts Based on Market Understanding

In practice a great deal of forecasting of variables of interest to market planners is based on a good, and often intuitive, understanding of the dynamics underlying the changes in fish sales or prices. Such forecasts often out-perform statistically based forecasts. For example, in the current world shrimp market an experienced analyst will predict some decline in the real price of shrimp. This is because he is aware that although demand is expected to continue to grow, the steady increase in farmed supplies will put downward pressure on prices. He would then estimate the order of magnitude of the downward drift in the price. Note, however, that his prediction depends on having a supply and demand model at the back of his mind and on having access to data of past and current supplies and prices.

10.2 Percentage Change

The method is to assume that past changes (growth, decline or stability) will continue in the future. In general forecasters will take the change over a number of years and project the data into the future. Unless this approach is qualified by a good understanding of the dynamics of supply and demand in fisheries, it is very likely to produce incorrect results. For example, the growth in supplies of fish from capture fisheries will, inevitably, run up against biological resource constraints and cannot be predicted to go on for ever. A second example concerns prices. Increases in retail fish prices cannot go on indefinitely because consumers will increasingly switch out of fish to other foods.

10.3 Extrapolation

Past data can be used to generate a trend line, and this can be extrapolated into the future. This sounds very similar to the "percentage change" approach noted under 9.2, but this is not entirely so because extrapolation is not simply the extension of a straight line, but can also incorporate curves. Some simple examples are reproduced in Figure 7. The example is sales data in tonnes from an imaginary fish wholesale outlet. The implied forecast level of sales are those shown from 1990 onwards.

Figure A shows the results of a straightforward visual projection of sales returns which conform closely to an arithmetic growth pattern. Figure B, showing a sales pattern of early rapid growth, followed by a levelling out, resembles a logarithmic growth pattern. Figure C showing initially sluggish sales, which then take off, approximates to an exponential growth performance.

These examples illustrate three points:

(a) Plotting a curve on graph paper can sometimes produce results which are just as plausible as more complex statistical methods.

(b) Nevertheless, if there is a more complex and statistically amenable relationship underlying the pattern of sales, such as if the sales of fish were following a biological yield curve, it may be worth attempting to deepen the analysis by using a mathematical model to explain what is taking place.

(c) A plot of points on a curve (or a statistical relationship) is meaningless unless it is backed up by some plausible hypothesis as to why sales should take that particular shape. For example, referring to Figure 6 C, although sales may have shown exponential growth in the early years to justify an assertion that the pattern would continue for the foreseeable future would require some very careful analysis in addition to the plotted curve.

10.4 Statistical Techniques

Statistical techniques can be used to improve upon the visual method described. Regression analysis can be used for projections of dependent variables, such as the sales forecasts described above. It can also be used for the estimation of demand functions. The basic approach and some of the attendant problems are sketched under Section 11.

Carefully applied statistical and econometric analysis can make very useful contributions to our understanding of markets. If judgements about the characteristics of demand are supported by a statistical analysis they are more well-founded and convincing. This is the route through which the social science of economics becomes more objective and scientific.

Figure 7. Examples of visual extrapolation

Figure 7A

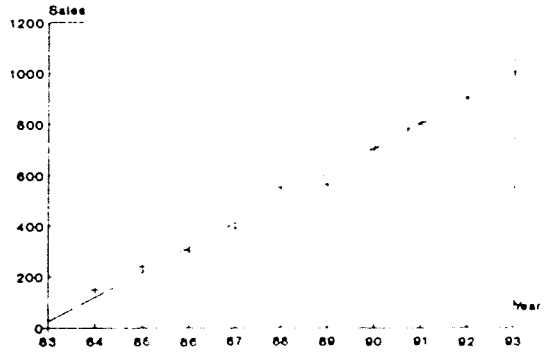


Figure 7B

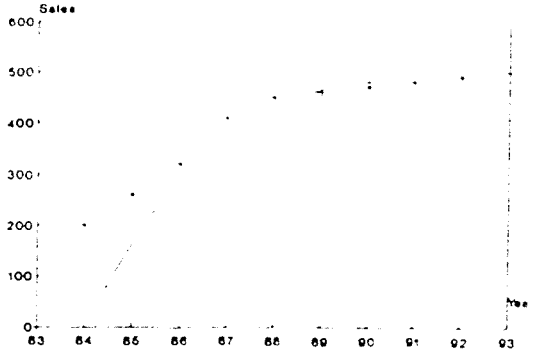
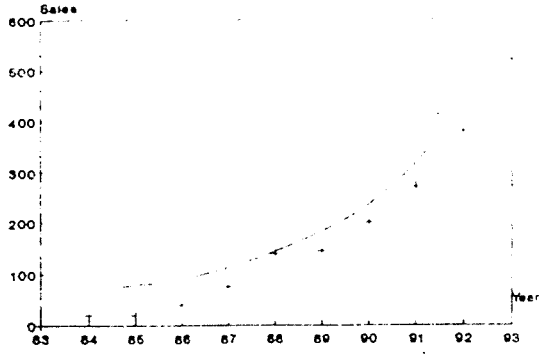


Figure 7C



11. THE USES OF ECONOMETRICS

Econometrics is a branch of applied statistics. It seeks to provide statistical support for economic theory, a point which deserves emphasis because its application to real world problems depends on getting the statistics correct. The statistical technique used for estimating a demand function is known as regression analysis.

To illustrate, suppose we wish to conduct regression analysis for the estimation of a demand function. (For more detailed examples see Douglas, (1987). Assume that a demand function for fish can be expressed in the form:

$$Q = a + bP$$

where Q = quantity of fish demanded
P = price of fish
a is the intercept and b the slope of the function.

This model states that the quantity of fish demanded is a function of its own price so it is an example of demand curve expressed in functional form. When the price is zero the quantity demanded is equal to a. The gradient, or slope, of the curve is b.

To derive the values of the parameters, a and b, we need a number of paired observations of prices (Ps) and quantities (Qs). From the observations of Q and P we can arrive at estimates of a and b. With the estimates of a and b we have an equation which can then be used for forecasting the quantity demanded at different prices.

In this example there is only one independent variable, the price, and so this method of analysis is known as "simple regression analysis". The analysis can be conducted with a number of independent variables, in which case it is known as "multiple regression analysis". The appendix illustrates a case where the independent variable is the quantity demanded. For many fisheries situations this is a more realistic scenario because fish supplies are often believed to be not much influenced by the price received for them.

The statistical technique used for regression analysis is known as the "method of least squares". The method chooses estimates of a and b such that the sum of the squared values of the deviations from the implied demand curve are minimised. Some computer programmes and also some of the more advanced hand calculators can obtain regression equations (the values of a and b in the above model), nevertheless the technique is inadvisable without some grounding in statistical method.

Some of the major pitfalls of regression analysis are as follows. For further details see Douglas (1987).

11.1 Incorrect Specification of the Model

The basic problem (known as "specification errors") under this heading is that the initial model can easily be incorrect. Suppose in the case noted above the relationship between the quantity of fish demanded and its price is a curve rather than a straight line. To solve a problem like this we must change the way the model is written and specify it in power form so that logs can be taken. This complicates the model and requires that its users should be familiar with the mathematics of powers and logarithms.

A second possible specification error is that the real world is much more complicated than the model suggests. Perhaps there are a number of other important independent explanatory variables which have been omitted from the model. The complications of a regression analysis with more independent variables is then only one of the subsequent problems. It is much more difficult, especially in developing countries, to find good, consistent data to stand for the additional independent variables.

11.2 Data Errors

Data which do not stand up to the analytical demands imposed upon them can be a major obstacle to the use of econometric analysis in developing countries. It can be quite difficult to establish consistent and representative examples of prices and quantities, let alone the values of any other possible independent explanatory variables. Even if data have been collected over a number of years they frequently do not measure in sufficient depth or with the required accuracy or consistency the variables necessary for the analysis.

11.3 Other Statistical Problems

A number of other statistical problems can arise and readers must refer to a statistical text for further details (for example, Gujerati, 1988; Mills,1977).

12. MARKET MONITORING

There are five main reasons for monitoring the market for fish.

Published market data, especially representative prices, but also volumes of the most important species, increase the flow of information to consumers and help them to notice if they are charged excessive prices. Consumers are also informed about species which are plentiful and may be relatively cheap.

Published data also increases the transparency of the market for fish processors. They enable the processors to judge their competitive position in the market, to see if their own prices are reasonable and allow them to take a view on whether reductions or increases in prices are advisable. They tell them if particular species are in short or plentiful supply.

For developing countries market data are also useful for project planners. The credibility of project plans is enhanced if the prices used for the valuation of inputs or outputs are predicted from authoritative survey data rather than from rapid surveys undertaken during project preparation.

Market data may also be a useful input in project monitoring. For example, a project plan may predict a neutral or negative impact on fish prices. Market data systematically collected over time may help planners to assess if the project impact is as predicted.

It will be important for fisheries planners to establish the flows of fish. For example, if water bodies are shared serious misreading of the fisheries bio-economics and failure to appreciate the true social and economic significance of the fishery can arise if some of the product flows are ignored. This can easily happen especially if the fish is absorbed by another country.

A market monitoring system is generally a sample study of fish prices and volumes at selected markets for fish. A selection of retail markets may be sampled at intervals sufficiently frequent to reflect the retail price of the major fish species. Inland and port wholesale markets also merit close monitoring. In these cases, much information may be available from the market authorities who will wish to maintain a record of volumes and values to ensure that business is properly conducted and that market regulations are observed.

A market monitoring system will also include a systematic review of product flows. The quantitative information noted above should be supplemented by detailed study of where the fish is going.

13. SOME EXAMPLES OF PRACTICAL MARKETING PROBLEMS

This section outlines some topical examples of marketing problems in developing countries. No solutions are offered as the examples may echo the experience of readers and serve as a stimulus to discussion.

13.2 High Production and Distribution Costs

Some fisheries throughout the world are still under-exploited. (One example is some of the fisheries in the Amazon River Basin, in South America). One of the main obstacles is the enormous distances between fish landing places and the centres of population where the main markets for fish are located. The costs of catching fish and transport costs are currently quite high. As a result the prices are higher than the prices of many other sources of animal protein. The challenge for fisheries planners and managers is to develop ways of reducing the costs of distribution. This may entail the construction of fish storage facilities and obtaining better transport, but other options are possible.

13.3 Fish Losses Through Poor Handling

There are numerous examples throughout the world of fish losses arising from poor handling practices. The problems are that fish is badly handled at source and during transport. The result is that fish losses are higher than they would be if fish were more carefully treated.

The case raises some interesting issues. Would the fish distributors (owners or renters of the trucks) be better off if their fish handling practices were improved? If so, why do they not improve practices themselves? Is it possible to prove that their financial returns would improve and also to demonstrate this to the distributors? Are there any other policy initiatives, such as extension and training in fish handling or a greater degree of official regulation which might be appropriate?

13.4 Fish Losses Trough Insect Infestation

A widely recognised problem in Africa is the losses of sun dryied fish through blowfly larvae. In Malawi the Fisheries Department, in cooperation with the Overseas Development Natural Resource Institute, developed a dipping treatment for sun dryied fish with the insecticide "Actellic". Actellic is now distributed to fish processors commercially and is widely used.

This is a good example of an appropriate policy initiative by the public sector. The problem was recognised and a research policy carefully focused on it was developed.

13.5 The Public Provision of Fish Markets

There are sound economic arguments for saying that there should be public provision of fish wholesale markets. Fish wholesaling generates external costs which are most easily regulated and controlled in an organized fish market. For example, fish wholesaling concentrated in one location ensures that hygiene standards can be enforced and congestion of roads by buyers and sellers is confined to one area, and also probably only during pre-determined times of the day.

There may also be other benefits from the organisation of a single wholesale market. The transparency of the market, the concentration of buying power and the presentation of the product may be improved in the competitive environment of the regulated market. These advantages would not necessarily accrue to any single wholesaler individually and he probably would see no advantage in implementing them himself. Thus competition alone is insufficient to produce the optimal result as it depends on cooperation between commercial operators.

For the gains to be achieved, the costs to be controlled and the administrative costs to be met, the markets must be subject to official regulation. Otherwise some wholesalers will "free-ride", taking advantage of what the market offers by way of increased demand, but not paying the price of the necessary regulations. For example, they might locate their stalls just outside the entrance to the market, to catch buyers as they enter, or to purchase the best of the fish from potential sellers.

14. COMMERCIAL AND ECONOMIC BENEFITS FROM FISH PRODUCTION AND DISTRIBUTION

The flow of commercial profits and wages to private sector businesses may or may not coincide with national economic benefits. For example, if a fisheries development project to improve the marketing of fish for small- scale fishermen results in higher incomes for them, there is not much doubt that the extra flow of benefits to the fishermen is also a net increment to national income (although a careful economic planner may dispute the exact correspondence).

However, fish processing projects may sometimes actually reduce national income. For example, suppose that a project were established to manufacture fish meal from a pelagic fish stock. It increases the demand for pelagic fish and the resource becomes depleted. Inshore fishermen, catching the fish for human consumption and dependent upon it for their livelihoods now find that their catch rates fall and it is no longer profitable to fish. The net loss of income for the inshore fishermen, who used to have higher earnings from selling higher valued fish, is a cost which must be offset against the gains resulting from the fish meal plant (quite apart from the costs of adverse effects on the distribution of income).

15. CONCLUSION

The key to satisfactory market planning and management is a sound understanding of the economics of supply and demand. Project plans are littered with errors of judgement concerning the capacity of markets to absorb fish and fish products and expected prices for output because the precaution of putting the project's output within the framework of a supply and demand model has not been taken.

Marketing management is essentially the management of demand. The *raison d'être* for the planned management of fish marketing is the search for improvements to the system by increasing the satisfaction of the customers and adding to the economic profitability of the components of the system. Planners and managers may never reach perfection, but they should never give up.

16. REFERENCES

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Douglas, Evan J (1987) Managerial Economics: Analysis and Strategy (Third Edition) London: Prentice-Hall International

Mills, Richard L. (1977) Statistics for Applied Economics and Business Tokyo: McGraw-Hill Kogakusha

APPENDIX

A Note on Econometric Tests

A precondition for undertaking econometric analysis is the study of a basic text. A simple introduction is included in Douglas (1987). Gujerati (1988) is an excellent clear basic textbook on the topic.

However, to illustrate the technique two simple examples are given of econometric models using the technique of ordinary least squares follow. Both are intended to illustrate two aspects of the technique. The first example demonstrates how data may be built up from market monitoring data. This is then used to undertake an analysis of demand, but with only one explanatory variable. The second example shows how the results of a regression may be improved by increasing the number of explanatory variables.

2. Example 1.

Market monitoring data have been collected on the following basis.

Market monitoring data (fish prices and fish quantities supplied and sold have been collected from two markets over a period of twelve months. Data from a longer period might have improved the statistical basis of the study, but various complications, such as the influences of income and population change might have added to the complexity of the analysis.

Two retail markets were selected for the study. One serves a population of 10,000 and the other, 1,000. The social characteristics of the two populations are very similar. It was possible, therefore, to standardize the data into "per capita" form, thus helping to reduce the complications of the exercise.

It could be assumed that only one species was being studied. But, to be a little more realistic, let us assume that a number of species are included in the analysis, but the cross elasticity of demand between them, that is the responsiveness of the quantity demanded of one relative to price changes in others, is high. The species are, therefore, close enough as substitutes for one another to be treated as a single commodity. In practice, if data were available, it would be valuable to test this by calculating the demand function for each species separately, and then observing if the statistical significance were improved by aggregated analysis.

In this case the assumption is that all the data on prices and quantities were collected from the two markets. Although the data concern all fish sales over the twelve month period in question is consistent with some market monitoring practice. Although the data recorded all fish sales over the welve month period, they should still be regarded as a sample on the basis of which more general conclusions (for example, over time) about the demand for fish may be drawn.

The data are aggregated on a monthly basis. The way in which data are handled depends very much on the hypothesis that the researcher is attempting to prove or challenge. In this case the implicit assumption is that there is a stable annual demand function reflected in the relationship between the monthly per capita fish supplies and the price households are willing to pay for the fish. It should be noted that the example treats fish supplies as exogeneous (see 6.9). A possible justification for the use of data aggregated over a month rather than as shorter interval is that more frequent data would introduce fluctuations into the data set without adding to the explanatory power of the model. Nevertheless, researchers are advised to examine the data set carefully to see if a model can be developed to yield greater insight.

2.2 The Regression

The Data

Table A1: Quantities Supplied (kg), Monthly Average Prices, and Estimated Per Capita Supply (PCS (kg) at two Representative Markets.

Site 1			Site 2			Site 3		
Quantity	Price	PCGS	Quantity	Price	PCGS	Quantity	Price	PCGS
17,000	9.40	1.70	2,100	9.40	2.10	19,100	9.40	1.74
24,000	8.20	2.40	2,800	8.20	2.80	26,800	8.20	2.44
1,000	15.00	0.10	1,000	10.00	1.00	2,000	12.50	0.18
21,000	9.00	2.10	2,200	9.00	2.20	23,200	9.00	2.11
31,000	7.00	3.10	4,400	7.00	4.40	35,400	7.00	3.22
43,000	6.20	4.30	4,300	6.20	4.30	47,300	6.20	4.30
60,000	4.30	6.00	5,600	4.30	5.60	65,600	4.30	5.96
52,000	5.00	5.20	4,800	5.00	4.80	56,800	5.00	5.16
500	16.00	0.05	100	16.00	0.10	600	16.00	0.05
82,000	2.67	8.20	6,900	3.50	6.90	88,900	2.73	8.08
69,000	3.80	6.90	8,200	3.80	8.20	77,200	3.80	7.02
43,000	6.40	4.30	4,300	6.40	6.40	47,300	6.40	4.30

The Models

In the following models per capita fish supply (PCS) is treated as the explanatory variable. It is assumed that the quantity available is not much influenced by price, that is the supply is perfectly inelastic. If drawn on a conventional supply and demand diagram, with price on the vertical axis, the vertical supply curve would move across the paper identifying the price associated with each monthly quantity and thus tracing out the shape of the demand curve. P denotes the price and PCS denotes the *per capita* quantity supplied at each of the two representative markets (1) and (2). The subscript (3) refers to the aggregated market data.

Market 1 P(1) = 13.316 - 1.507 Q(1)
(Se 0.797) (Se 0.179)
(t 16.710) (t -8.412)
Standard error of estimate 1.537
R squared = 0.876

Market 2 P(2) = 12.621 - 1.342 Q(2)
(Se 0.860) (Se O.191)
(t 14.676) (t -7.030)
Standard error of estimate 1.502
R squared = 0.832

Market 1+2 P(3) = 12.740 - 1.399 Q(3)
(Se 0.713) (Se 0.160)
(t 17.865) (t -8.730)
Standard error of estimate 1.361
R squared = 0.884

The terms

A brief summary of the meaning of the statistics reproduced above follows. However, users of econometric techniques are strongly recommended to study a text book (for example Gujerati, 1988) on the topic before using them for professional purposes.

Se is the Standard Error of the Coefficient. It enables the researcher to construct confidence intervals for the coefficients in the models. For example in the case of the third model one can

assert that there is a 95 percent probability that the true value of the slope coefficient lies plus or minus 2 standard errors of the actual coefficient. Thus there is a 95 percent probability that the true value of the slope coefficient (estimated as -1.399) lies within the range -1.079 to -1.719.

A simple rule of thumb sometimes used by analysts is to take twice the value of the standard error of the coefficient and compare it with the estimated regression coefficient. If the regression coefficient exceeds twice its standard error we can be 95 percent confident that the estimated coefficient is significantly different from zero and that there is a statistically significant relationship between the variables.

The t Statistic enables the researcher to make use of the properties of the "Students t distribution". A common approach is to hypothesise that the slope coefficient is zero (not -1.399 as estimated). If the absolute value of the t statistic exceeds the appropriate value of t in the t distribution, the null hypothesis (that the slope coefficient is zero) is rejected. In this case, with 10 degrees of freedom, there is a 95 percent probability that the value of the slope coefficient is not equal to zero because the t statistic exceeds the relevant tabular value of 2.228. Again we have a rule of thumb relevant to a reasonably large number of observations. If there are over 20 degrees of freedom and the t statistic is over 2, there is a 95 percent probability that the null hypothesis can be rejected.

The Standard Error of Estimate is the measure of the dispersion of the data points from the line of best fit. It permits the construction of a confidence interval (say 95 percent) around the values of the dependent variable (in this case P). The case is exactly analogous to the standard error of the coefficient noted above.

The R-squared is the coefficient of Determination and is a measure of the "goodness of fit". It shows the proportion of the variation in the dependent variables explained by the variation in the explanatory variables. In the above case aggregation of the data from the two individual markets has enabled us to improve the R-squared. The final model enables us to say that 88.4 percent of the variation in P(3) is explained by variations in PCS (3).

2.4: A Second Example

This is a conventional demand model as it places the quantity demanded as a function of price and other variables. It might, for example, be relevant to apply this type of model to a processed fish product (such as fishmeal or canned fish) where the quantity demanded might be related to price rather than the other way round.

Suppose annual per capita consumption data were collected as follows. To eliminate the influence of inflation prices are deflated by an appropriate index and thus expressed in real terms. Population effects are removed by treating per capita, rather than total, consumption as the dependent variable.

Table A2: Annual Per Capita Consumption of Canned Species Y In Country X

Year	Q(1) kg/capita	Price $/kg	Price Substitute $/kg
1	1.20	10.70	3.02
2	3.00	10.70	4.80
3	4.02	9.10	5.30
4	2.125	8.50	1.80
5	4.48	8.10	4.12
6	4.65	7.80	4.00
7	4.50	6.60	3.89
8	3.125	6.50	3.50
9	6.00	5.20	7.00
10	7.20	5.20	7.50
11	6.20	3.70	4.90
12	7.30	3.60	5.00

First estimating a relationship between own price and quantity sold produces the following result.

$$Q = 9.3412 - 0.6802\ P$$
(Se 0.9826) (Se 0.1308)

(t 9.5068) (t -5.1999)
Standard error of estimate = 1.0546
R squared = 0.73

We can, however, improve the fit (note the higher value of R squared in the second model) by including a second term among the explanatory variables. This might be the price of a close substitute commodity (perhaps canned meat) the price of which one might expect to be closely positively correlated with the consumption of the canned fish -as the price of canned meat rises, consumers purchase less and shift to canned fish, thus pushing up canned fish sales. The annual prices of the substitute commodity are listed in the third column of Table A2.

Thus:
Q = 5.5099 - 0.5069 P(1) + 0.5676 P(2)
(Se 1.1789) (Se 0.0958) (Se 0.1471)
(t 4.6740) (t -5.2905) (t 3.8592)
Standard error of estimate = 0.6822
R squared = 0.90

Calculation of Spot Elasticities

The text notes that it is possible to calculate spot elasticities from estimated equations. For example, the second of the simple models illustrated above is:

Q = 5.5099 - 0. 5069 P(1) + 0. 5676 P(2)

Inserting P(1) = 6.6 and P(2) = 3.89 into this gives an estimated value for Q of 4.372. The elasticity of demand at this point can then be estimated by applying the formula:

$$e = \frac{dQ}{dP(1)} \times \frac{P(1)}{Q}$$

(Where dQ/dP(1) is the partial derivative with respect to P(1) (own price) and taken as the slope coefficient of P(1)).

e = -0.5069 x 6.6/4.372 = -0.76

The formula for the spot price elasticity of demand is basically the same concept as the arc elasticity except that the percentage change of the arc elasticity becomes and infinitesimal change for point elasticity. One of the advantages in estimating the equation in log form is that the constant elasticities are the coefficients of the model. Readers must refer to an econometric text to study the methodology.

AN INTRODUCTION TO SECTORAL PLANNING IN FISHERIES:

by

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ABSTRACT

This paper offers guidelines and elements of a methodology for fisheries development planning. It describes the different stages and introduces key concepts in reference to the preparation of a medium-term plan. The paper emphasizes strategic planning and underlines its importance in the overall planning process.

1. INTRODUCTION

Planning refers to the process of working out how to 'best' achieve an objective, given available or expected development resources, and a range of opportunities and constraints. For developing countries, development planning at national and sectoral levels is especially important due to the scarcity of development resources and to the fact that a large proportion of these resources is managed directly or indirectly by the governments and administrations concerned. These two factors are and will remain important even if direct governmental intervention is reduced as development occurs.

1.1 Emphasis on Strategic Planning

This introductory paper on sectoral planning in fisheries focuses on strategic planning as opposed to tactical or organizational planning. Strategic planning can be described as a process for determining the broad framework in which objectives and targets are to be achieved through the implementation of specific strategies, policy measures and programmes. As such it constitutes a basic step in the preparation of sectoral plans and provides the essential background for the proper and coordinated design of programmes and projects (tactical planning) and for working out the details of their implementation (organizational planning).

The emphasis put on strategic sectoral planning also stems from the role which this process plays in translating national strategies and policies as well as regional priorities into specific projects and policies to be implemented at the sectoral or sub-sectoral level.

Strategic planning is required not only to harmonize the proposed actions of the government at the sectoral level, but also: (a) to ensure the complementarity of policy measures, projects and programmes; (b) to assist with the mobilisation of international aid and assistance; and (c) to provide the operators of the fishery sector with information concerning the government's medium- and long-term strategies for the development of the sector, thus providing for a less uncertain investment climate. This is especially important if planning is indicative rather than directive in nature.

1.2 Weaknesses Observed in Plans and Programmes

Major weaknesses observed in the preparation and implementation of plans and programmes for the development and management of fisheries in Africa also point to the fact that fisheries administrations pay insufficient attention to strategic sectoral planning. Among these weaknesses are :

(a) The lack of carefully established priorities with too many plans attempting to achieve all the common long- and short-term objectives (increased production, increased employment, increased fish and protein supply, etc.) without any indication of priorities, even if the programmes will contribute only marginally to some of these objectives. Similarly, programmes and programme elements are seldom ranked in order of priority. As far as recurrent expenditures are concerned, one also notes that existing programmes are seldom assessed and that funds are not regularly reallocated based on priorities and performance. In other words regular streamlining of existing programmes is rarely undertaken.

(b) The inadequacy of the information base and related analyses : generally, information and analysis seldom serve the decision-making process and lack the focus and pluridisciplinarity required to allow for periodic sector-wide assessments. This inadequacy reflects deficiencies in fisheries statistics; too much reliance on these statistics for the provision of information (e.g. complementary surveys, field and mission reports are unavailable); limited comprehensive analyses done at thematic, sub-sectoral or sectoral levels; and an insufficient linkage between research and decision making.

(c) Insufficient links between plans and projects : Symptomatic of this problem is the fact that planning is often limited to a series of uncoordinated and unharmonized projects, thus showing that attention is essentially limited to tactical planning. In the absence of a broader view of how the concrete interventions of the government will fit together, the programmes and projects which are implemented will generally be inadequate. A major reason for this state of affairs is that developing countries are too often too dependent on outside funding for the financing of their development programmes. As donors often have their own priorities, planning in such a context could be a frustrating experience. However, donors could be made to support the implementation of a sectoral plan if sectoral planning does provide for a rigorous framework for intervention.

(d) Insufficient assessment of policy measures : This is indeed one of the most serious flaws of present planning practices, and certainly the consequence of over-emphasis on projects to achieve development goals. Very often it is not projects but good policies which are required for the development of fisheries. There are, at this level, numerous examples of projects which are doomed to fail, not only because of lack of appropriate accompanying policy measures but because they are in direct contradiction with the existing policy measures e.g. a small-scale fisheries development project and the absence of law or enforcement to protect small-scale fisheries from infringements by industrial vessels; projects aimed at providing gear or fishing equipment which compete with existing national companies often unable to operate adequately because of import limitations; projects aimed at developing fisheries in the presence of price-fixing policies (low prices to consumers should be the result of development and are certainly a counter-productive ingredient to development at its initial stages), etc. Furthermore, major policy measures such as subsidies on inputs and capital are often adopted without proper assessment (even if they often prove a useful tool), are poorly monitored and too often continued even when no longer required.

1.3 Some Of The Consequences of Poor Sectoral Planning

If insufficient attention is paid to sectoral planning, this will generally lead to the ad-hoc or arbitrary identification and selection of programmes (i.e. projects, policy instruments such as credit, or a combination of both). This may have fairly detrimental consequences, such as :

- The fact that there is unlikely to be any machinery for identifying and resolving critical policy issues;

- Projects will often be chosen which are highly visible and which, perhaps, create the perception of meeting important social needs but which, in fact, dissipate national resources by not responding to real needs;

- There is often a scarcity of well prepared projects which the government and donors would like to be able to fund, i.e., the problem is not one of ranking projects in relation to a given budget but one of project scarcity; this provides an incentive to donors to "identify" projects unilaterally or to direct their efforts to other sectors where there are good development plans;

- Projects may be implemented which are in conflict with, or contradictory to each other, or to other activities in other sectors;

- As a result of project scarcity, projects may be presented without being adequately prepared and without adequate analysis of their impact on the economy. Frequently, all options for meeting the project's stated objectives are not considered and other project designs are given little or no attention;

- There is no indication of the resources to be allocated to each project. Fisheries departments may accept donor-financed projects because of their short-term advantages to hard-pressed departmental budgets but in the longer term do not have the resources to sustain them, leading to charges by the donor of lack of government commitment.

1.4 Linking National and Sectoral Planning

Most professionals in sectoral planning dislike programming prepared outside the framework of the national plan as is sometimes necessary. They tend to take the position that such programming must be done within the framework of development planning for the whole economy, or some similar reasoning.

There is no doubt that optimal allocations of resources to economic sectors, and to projects within each sector, can only be made within the framework of a plan for the whole economy. The arguments for this point of view are forceful. Development in fisheries and in other sectors is clearly interdependent and mutually supporting. Some kind of balance is required in inter-sectoral growth if the allocation of scarce resources among these sectors is to be accomplished efficiently and if fisheries goals are to conform to national goals or sub-sectoral goals (e.g. agriculture).

But the record shows that many professionals in sectoral planning appear willing to forgo such an ideal situation, since they do their work outside an aggregative framework, either where existing national plans are not operational, or where it is not considered feasible to prepare national plans which have a reasonable chance of being put into practice.

The viewpoint here is that while sectoral planning carried out independently to national planning may be a second-best option, in practice it is possible to achieve considerable success when planning is confined to individual sectors. However, even in this situation there should be a relationship between the planning processes at the national and sectoral levels. In most countries, the broad objectives for the sector can be made consistent with national objectives. For example, where a government decides to give priority to improving the living standards of the rural poor, this is likely to influence fishery sector objectives.

When no general framework exists, sectoral planning should also be based, implicitly if not openly, on assumptions regarding the performance of the whole economy, with parameters and patterns for: expected population growth; national food and protein production and consumption; foreign trade; investment; input supplies; and so on. Even if the quality of the methodology of forecasting economic change is still uncertain, a knowledge of basic trends at national level is required.

The linkages between national and sector plans will vary widely from one country to another. In most countries, national objectives will be taken up at the sectoral level and in some countries the setting of national policies will be influenced by the fishery sector. In such countries, where the fishery sector is of considerable economic importance, it is likely that planners for the sector will be able to strongly influence national economic policies. In most countries, however, where the fishery sector is relatively small, the sector planners will have to work within the parameters of national economic policy measures such as fiscal and monetary policies, exchange rate policy, wage and trade policies, and so on.

1.5 Time horizons of plans

Since the sectoral plans of most countries are linked, at least in the way described above, to their medium-term national plans, they are prepared for the same time frame of up to 5 years. This time horizon is generally too short for bringing about fundamental, long-term changes in the sector. Consequently, planners also need to look ahead, adopting a perspective of 10 to 15 years depending on the changes required and the specifications of the sector.

The preparation of such a long-term or 'prospective' plan is constrained by the shortage of basic data required for long-term forecasting, the intrinsic uncertainty which characterizes fisheries in general, and the many unforeseeable changes likely to occur over such a long period. That is why planners recommend that such plans provide only broad, indicative lines of desirable sectoral development.

Such a prospective plan should only provide a basic framework for medium-term planning work in terms of a periodically revised strategy of sectoral development elaborated in reference to national requirements, resource availability, technical possibilities, objectives and priorities.

This framework should be used as a reference or guide for more detailed planning by the government. A more detailed strategy and issues related to specific programmes, projects and policies would generally be elaborated in the context of medium-term sectoral plans.

To take into account unforeseen development or changes brought about by domestic and external events as well as the results of plan implementation, both the prospective and medium-term plan need to be reviewed periodically and adjusted. A review of the prospective plan can be made every few years in relation to the periodicity of the medium-term plan (e.g. every 3 years in connection with a 5 year medium-term plan). For medium-term plans, this is usually done on an annual basis and may be done in one of several ways :

One method is to revise the entire medium-term sectoral plan every year for the remainder of the plan period. This is both difficult and time consuming because it requires numbers of trained personnel which few poor countries possess. A second way is to prepare annual plans which take into account progress made to date, allocate available resources to projects as a basis for budgetary appropriations, and set out specific instruments of policy and other measures for achieving development objectives. While this is an easier way of adjusting to unforeseen changes, it has a serious defect. As the years pass, annual plans tend to deviate so substantially from the medium-term plan that the latter no longer provides much guidance for their preparation. A third way, which avoids this difficulty is the introduction of a so called 'rolling plan' where an additional year is added to the length of the medium-term plan at the end of each year, after making appropriate adjustments due to changed circumstances in the year just passed. This approach has the added advantage of providing a medium-term plan with up-to-date benchmarks for annual plans, which have to be prepared anyway to make the medium-term plan operational. If the 'rolling forward' technique is applied every few years to the prospective plan, the latter can also be updated to provide guidelines for rolling the medium-term programme forward each year.

Using perspective, medium-term and annual plans is an ideal solution to the time-horizon problem. The perspective plan permits a look far enough ahead to identify in broad outline the main directions of sectoral development. The medium-term plan spells out in greater detail than the perspective plan interim goals which must be achieved in the medium-term in order to attain the longer-run targets. And the annual plans make the medium-term plan operational by (a) reducing medium-term targets (which are usually stated in terms of the end of the medium-term plan period) to annual targets, so as to allow allocations required for their achievement to be incorporated in annual budgets, and (b) enumerating in sufficient detail the measures which will be adopted to achieve the plan's objectives.

This approach to sectoral planning is largely associated with conventional macroeconomic planning which most authorities now agree requires the preparation of overall perspective, medium-term and annual development plans. For sectoral planning in low income countries, it will generally suffice to: (a) prepare a medium-term plan according to the relevant periodicity, inclusive of a section on long-term perspectives; (b) amend the medium-term plan at mid-cycle, with focus on key elements; and (c) make this plan operational with annual plans closely linked with government budgets.

1.6 Scope of sectoral plans

In many countries, plans for the fisheries sub-sector are included in a comprehensive sector plan for agriculture. In such a case the fisheries sub-sector is likely to receive far less attention than other subsectors like crops, livestock and forestry. On the other hand, there are plans for the agriculture sector as a whole which make little attempt at wide coverage and focus on key sub-sectors. In this case, the fisheries sector may or may not be covered. The approach will generally be similar if fisheries are under a ministry other than agriculture. While national or ministerial planning procedures have to be followed, it is generally advisable for fisheries planners to prepare an expanded or more relevant version of the plan, especially if the importance of the sector is not adequately recognized. Contributions to national or macro-sector plans can be prepared subsequently on this basis. The advantage of this approach is to make planning less bureaucratic and more tutorial, further providing the fisheries authorities (and the donors) with a rather comprehensive framework for intervention.

Partial planning would generally be relevant to the fishery sub-sector as it is only partially related to agriculture and other land use. There are important linkages to be addressed, however, such as joint employment in the fisheries and crop sub-sectors, and their use of infrastructure. For the aquaculture sub-sector linkages, with other land and water uses are bound to be more important and therefore require a more comprehensive approach.

Concerning the fisheries sector itself, it is *a priori* desirable to deal with the whole sector but limitations of planning data, trained manpower, finance and time may make partial coverage inevitable. Although main linkages need to be stressed, it is well to be selective in emphasizing one sub-sector or component over another, especially if development resources are limited.

Classification among and within sectors and sub-sectors is another important consideration for the purpose of planning as it determines how the information will be collected and processed. Fisheries and fishculture can be approached as sub-sectors, each to be divided into appropriate components.

This can be done on the basis of a number of criteria such as employment, size and type of business (or holdings for aquaculture), kind of economic activity or output. Each has its limits but the use of multiple criteria for classifying sub-components of a sector would lead to overlapping. For example, one can opt for a classification based on the type and size of business:

Sub-sector 12 : Fishing

Division 121 Ocean and Coastal Fishing

Sub-Division 1211 Industrial

Sub-Division 1212 Artisanal

Sub-Division 1213 Subsistence

Division 122 Inland Fisheries and Aquaculture

Using the same divisions, a sub-division can also be divided by the output of its various commodities e.g. finfishes, crustaceans, molluscs, etc. Alternatively, the type of output can serve as a basis for differentiating main divisions while the kind of business/holding serves to differentiate sub-divisions.

The classification system that would be adopted by any country would generally be determined by the structure of the industry, its stage of development, and by national/sectoral objectives. Accordingly one might emphasize a distinction between export-and domestic-oriented activities; distinction based on technology, water bodies, etc.

Each classification required would therefore be adapted to sectoral characteristics and priorities. This also requires precise definition so as to allow straightforward inclusion into a category (e.g. with respect to industrial vs artisanal; ocean vs coastal; inland fishing vs aquaculture; etc). In deciding which classification to use, much also depends on the quality and coverage of a country's

statistical service. However one should not forget that statistics should conform as much as possible to the needs of planning and not the other way around.

1.7 The Need For Regional Planning

A national fishery or aquaculture plan should take into account the varying ecological and socio-economic requirements of various areas of the country. In practice this is a difficult task, but growing political awareness in less-favoured regions and of the consequences of unbalanced regional development in general has led many countries to put added emphasis on regional planning in recent years. The African experience with regional planning has been mixed: regional planning conducted by central authorities has allowed for some top-down consultation and a better realization of regional requirements, but decentralized planning structures have often suffered from the lack of skills, expertise and coordination. The lack of regional information, and problems connected to the definition of a region are other constraints to regional planning 'from the bottom up'.

2. PREPARING A PLAN FOR FISHERIES DEVELOPMENT

2.1 Components Of A Plan

The development planning system involves many tasks and phases which must be carefully coordinated. The following list summarizes 12 major components of a sector plan of which the first five deal with strategic planning and the remaining with tactical planning:

1. Development objectives for the sector;
2. A stock-taking and diagnostic survey;
3. A set of targets;
4. Selection of a limited set of strategies from among available alternatives;
5. Policies and policy instruments for achieving programme objectives and targets;
6. Policy measures and projects (preferably organized in programmes) to be carried out in fisheries, as well as in related sectors, to achieve the plan's objectives and targets;
7. Research and studies to obtain the technical information needed for further elaboration of development/management programmes;
8. A programme of public expenditure for financing each year of the plan period including the source of financing;
9. A programme of manpower training;
10. Improvements and reforms needed in organizations, institutions and administrations;
11. Consultancy services/technical assistance required;
12. A system of plan evaluation, monitoring and control.

2.2 Planning Sequence

The sequence in which the 12 components are given has significance and follows a definite logic. Obviously, some elements should be carried out before others, even if only tentatively. For example, setting development objectives, and the stock-taking and diagnostic survey should precede target fixing since targets are really quantified objectives as specified through a careful assessment of constraints, opportunities and available development resources (natural, human and

financial). Similarly, economic policies and measures should be adopted in reference to the requirements for achieving targets and to an assessment of their relative expected efficiency.

Although some aspects of planning precede others, it would be a mistake to suppose that no deviation is permitted from the suggested sequence, and that each component must be dealt with consecutively in the order given, one at a time (see Figure 1). Work on some components low on the list may have to begin before work on others higher up. Such is the nature of the planning process. Project identification and preparation, for example, may take two or three times as long as the preparation of the entire fisheries development plan.

Usually, work must proceed simultaneously on two or more components, with the emphasis changing from one component to another. This is because sector planning is a continuous process, with interrelated and mutually interacting elements. Each component must be coordinated with the others if the plan is to be consistent. Targets may have to be altered as planning proceeds if, for example, the strategy or policies required to achieve them become politically or socially unfeasible. Projects may have to be reduced in number and size. Strategy may have to be modified in the light of rates of return realizable from available projects, and even objectives revised or discarded if, for example, investment funds prove to be insufficient. Conversely, additional funds may have to be found to permit retention of objectives and projects which are considered of the utmost priority.

In short, planning starts with assumptions and speculations which may turn out to be untenable and, by iteration or successive approximation, moves towards what is possible.

2.3 Discrete Stages For Plan Preparation

In practice much planning is done on a continuous and partial basis *viz* specific fisheries, regions, programmes, projects and activities aimed at solving immediate problems. The act of committing a medium-term plan to paper can therefore be seen as a series of successive adjustments of major plan components for which partial planning has already taken place. Generally partial planning would focus on tactical and operational planning, often but regrettably not always in relation to priorities indicated in the previous plan or to those *a priori* dictated by the more recent evolution of the sector.

Medium-term plans aim fundamentally at periodically and comprehensively appraising the consistency and realism of partial planning conducted prior to plan preparation *per se*, and at providing an updated strategic background for future partial planning activities. Key words here are comprehensiveness, realism, consistency and perspective.

The role of planners is to facilitate the decision-making process by providing background information and analysis; assessing alternative strategies, policies and programmes, further specifying expected requirements and expected outcome. However, the determination of objectives and targets, and the selection of key elements such as policy instruments and programmes remain the prerogative of decision-makers. Extensive consultation in general and with decision-makers in particular, is therefore an essential part of plan preparation, especially at the strategic level.

To allow for extensive consultation and a gradual determination of priorities, planners should break the plan preparation process into discrete stages corresponding to the preparation of partial drafts to be followed by extensive consultations. The first draft may focus for example on objectives, diagnostic survey and the identification of possible strategies; further providing indications of the relevance of on-going or recently elaborated programmes/policy instruments/projects to these strategies. With the third or fourth draft, plan elements corresponding to strategic planning *per se* could be fully elaborated with a summary presentation of plan components related to implementation.

2.4 Planning For Plan Preparation

It is quite critical for planners to organize carefully the progressive formulation of the plan. Aside from "pre-planning" activities related to information gathering, analysis and evaluation, the preparation of the plan may take from 3 to 12 months depending upon the recent evolution of the sector, the outcome of partial planning activities and its relevance to the strategic planning framework, and other factors such as major changes in national policies.

As seen above, plan preparation implies essentially a series of successive adjustments of plan elements aiming at both internal consistency and realism. The first stage in plan preparation is to roughly assemble existing information on the various plan components. On this basis the overall time frame of plan preparation can be determined viz the expected difficulty in achieving internal consistency and the foreseen need for short complementary investigations. It is recommended that this review/assessment takes place quite early in the process - e.g., 9 to 12 months prior to the plan completion deadline.

Once the overall time frame of plan preparation is determined, it is essential that a precise schedule be adopted, preferably along a number of stages as discussed earlier in this paper. Proper organization of plan preparation should further allow for a precise identification of tasks, their allocation and the adoption of a timetable for delivery of plan elements (drafts) and related working papers.

The importance of committing to paper at different stages the adjustments made and the supporting analysis should be stressed. Above all it allows planners to put together the results of their investigations in an iterative way and to organize consultation/discussions on a concrete basis. Planners are advised at this level to present the results of their analyses and complementary investigations in a series of working papers while preparing short and synthetic drafts of major plan elements for the purpose of consulting with decision-makers and other concerned parties.

The responsibility of strategic planning lies with senior management of the Fisheries Department. A small multidisciplinary team should be appointed for this purpose with the team members working under the general guidance of a fishery economist/planner. On the other hand primary responsibility for working out how to achieve the goals of the strategic plan in the short-to medium-term rests with middle management at both headquarters and regional levels with lower-level field staff assisting with operational aspects. Because information and planning are very much interrelated, it would generally be sensible that these tasks be assumed by a specific service whose role will be to assist with overall planning activities. It is to be emphasized that the role of a service is not to plan but to support planning activities through the systematic processing and analysis of related information.

The above division of responsibilities in planning should not be interpreted as meaning that effective planning requires a rigid hierarchical system in which plan prescriptions are imposed from above. It follows from the need to ensure that senior managers do not engage in tactical or operational work to the neglect of establishing the guidelines that can only be established at this level.

3. SPECIFYING KEY ELEMENTS OF STRATEGIC PLANS

3.1 Formulating Objectives

It is possible to identify a wide range of functions through which the fisheries sector might contribute to meeting national objectives of rapid economic growth, better distribution of income, improved balance of payment position, reduced unemployment and so on. These functions may include :

- a source of capital;
- a renewable source of food and of animal protein;
- increased production and income;
- a basis for industrialization;
- earning and saving of foreign exchange;
- the creation of employment opportunities in rural areas;
- a complement to agricultural production;
- a wildlife base; etc.

It is common, therefore, to find sectoral plans with an abundance of objectives, some of which quite plainly are contradictory. A long list of objectives is generally harder to achieve than a short one because of the scarcity of resources. Priority becomes harder to determine. Since the

problem is more often one of too many objectives than too few, one precept worth bearing in mind is to have as few objectives as possible.

A related principle is that ends, or objectives, should be clearly distinguished from the means to achieve them. There is often confusion on this point. For example, where self-sufficiency in fish supplies is the objective (end), a framework focusing on improving fish distribution and quality may be the strategy (way), and the use of government subsidies and the rehabilitation of infrastructure the major policy instruments (means). Figure 4 illustrates this relationship between end, way and means.

Precision and consistency are required for the definition of objectives. Typical government statements such as "managing the fisheries resources to the greatest benefit of the country as a whole" need to be translated into more specific objectives which in due course must be quantified (even if the plan is fundamentally indicative rather than directive).

Specific objectives can further be specified as medium or long term with high or low priority. For example, the long-term objectives of a plan may be to achieve a certain level of *per capita* consumption while simultaneously raising foreign exchange earning (these may or may not be conflicting depending upon the products and markets concerned, e.g. shrimps may not have a local market). These objectives can be ranked in that order of priorities and quantified after further analysis. In the medium-term, priority objectives can be similarly specified but with greater emphasis on developing the internal market, especially with respect to some water bodies or regions.

An obvious starting point in the identification and ranking of objectives is the stated objectives of the past fisheries plan and their actual relation to on-going and recently elaborated programmes. They may or may not be consistent; if not, one may try to reconstruct what have actually been the objectives and priorities of the last plan. A next step is to analyze the relevance of changes in national priorities and policies to future sectoral orientations, further considering the recent and expected evolution of the sector. It is likely that the identification of major objectives will be an easier task than their ranking as the latter requires a further consideration of sectoral requirement and of strategies which may be considered to achieve these objectives.

Conflicts will likely arise in connection with the pursuit of several objectives. Programmes aiming at the creation of new jobs may be expected to clash with programmes seeking to increase earnings of established fisherfolk; programmes promoting export market expansion may reduce domestic supplies; short-term expansion of production may, for some fisheries, result in lower production in the longer-term, etc.

In general the size of the two sub-sectors (fisheries and aquaculture) would not justify a complex range of objectives. Determining for each sub-sector a main and eventually a secondary objective will generally be appropriate. This implies that priorities be carefully established and reduces possible conflicts among objectives and related strategies.

3.2 Stock Taking And Diagnostic Surveys

A stock-taking and diagnostic survey is needed early in the planning process to provide information about the wide range of factors influencing fisheries performance. The scope of the survey should be limited and closely linked to presumed plan objectives. Stock-taking depends very much on the data collection, monitoring and information system in place. Indeed, the survey is different from basic research and short-term fact-finding surveys or ad hoc studies. Although these could be complementary, a stock-taking and diagnostic survey should be, as its name implies, a broad-range inventory and an assessment of largely existing information about the fishery sector.

The following classification is proposed as one possibility:

(i) Basic data, e.g., on production, prices, international trade, inputs, means of production, etc.

(ii) Inventory of fisheries development resources, providing an indication of their availability. This would include fish stocks and other relevant natural resources (e.g., water level/quality); capital resources with focus on investment and working

capital; institutional resources including the role, function and effectiveness of entities such as research and training institutions, marketing boards, cooperatives; human resources (labour supply and demand, qualifications, extension work).

(iii) The role of the fishery sector in the economy, (key indicators such as production, value added, net contribution to foreign exchange and nutrition, etc.). This analysis can be undertaken in reference to the whole economy but it is likely that reference to the agricultural sector (food production) will be more relevant.

(iv) Present state and potentialities of fisheries, summary analysis of: development opportunities, needs and constraints; impact and adequacy of ongoing or recently completed interventions by the public sector. This summary has to be based on ample consultations with the industry and relevant authorities at the decentralized/field levels.

(v) Analysis of special survey of key relevance to the sector: occasional or periodic surveys of key issues or aspects of the sector which require special assessment, preferably on a periodic basis. At a certain stage of fisheries development, likely issues will be the supply of fishing equipment or the development of new technologies. At a further stage a major issue might be the rational control of fishing effort and related management issues, or the reduction of post-harvest losses.

(vi) Trends, demand and supply projections of fisheries products involve the use of methodological techniques of some complexity, especially because of the special relationship linking the two major determinants of supply: the fish resources and the fishing effort. One aspect is to project demand and supply; another is to reconcile them through some sort of commodity balance sheet constructed as a basis for determining what adjustments may be required to achieve the targets.

(vii) Information gaps, During this first review, focus should be placed on immediate information gaps. Later on, in the plan preparation process, information gaps will be identified which require action during the plan implementation timeframe.

3.3 Formulation of Development Strategies

To facilitate the identification of relevant policy alternatives, and the choice of those likely to be most effective, a frame of reference is required. This is what a development strategy provides. By laying out the broad approach, or general direction, to be taken to achieve a specific objective or target, a strategy allows planners to choose from a variety of potentially usable policies, projects, programmes and other measures, those which are best suited to that approach, and to relate them to each other in an integrated way.

A strategy is a convenient way (because it is intermediate between an objective and the means required to achieve it) for testing whether all the policies, programmes, etc. needed to realize an objective are being or can be adopted.

A strategy can also be considered as a means of selecting elements, or factors, on which to concentrate in developing the sector. This involves choosing among different technologies, spatial arrangements, time horizons, production mixes and among producer/consumer groups, etc; as well as deciding on the emphasis to be given to each element in achieving a given objective or target.

A development strategy may thus be seen as a framework for a consistent set of policies, measures and activities, within defined constraints, which together constitute an organised attempt towards fulfilling a particular objective or target. However, the adoption of a strategy to achieve a given objective or target does not imply that everything outside the strategy will be ignored - only that the strategy will be emphasised. Thus, adoption of a strategy to improve self-sufficiency in fish production does not mean that export expansion would get little or no attention, but that self-sufficiency would get greater attention.

This is so at least in theory. In practice, one frequently finds policies in effect without reference to a clearly defined development strategy, in national as well as in aquaculture planning. In fact, the total absence of a policy frame is the most conspicuous feature of many fisheries plans. Even

if such a strategy exists, planning is still often carried out without prior knowledge of the manpower and resources which the government is willing to invest. Production targets are often set with little indication of how the necessary inputs and infrastructure were provided. Also noted is a preoccupation among 'planners' with what is technically possible rather than with what is economically possible and socially acceptable. These weaknesses are made worse by the common tendency not to modify the plan (or strategy) in the light of changes in the availability of resources.

Part of the problem is the failure to distinguish between objectives, strategies and policies. This has already been mentioned earlier. The point worth noting here is that when an objective is taken to be the same as a strategy, the need for a unifying framework for the policies is likely to be overlooked; and when a policy is taken as a strategy, it is likely to be too narrowly defined to provide that unifying system.

A well-defined strategy allows resources to be combined in specific ways to achieve an objective or target. Clear definition is important because different strategies use resources in different ways, such as one which relies on a discrete technological jump, compared to another based on gradual improvements with traditional inputs, for instance.

Strategies for the development of the fisheries sector would generally be developed in relation to one or two objectives and in light of the individual circumstances reflected by the stock-taking and diagnostic survey. Strategic planning rests on the end-way-means model already described, and alternative strategies will have to be developed and assessed in this context.

The elaboration of a strategy can first be described as a process of selecting among main options for each key component of the industry. Assuming a fairly common objective such as the improvement of food security, choices may have to be made with respect to the priority/emphasis to be given to :

- alternative modes of production and related target groups (small-scale, advanced-artisanal, semi-industrial, industrial);
- alternative regions, water bodies, fisheries;
- alternative markets to be supplied;
- alternative products to be supplied;- alternative sub-sectors to be strengthened (harvesting, processing, marketing, input supply);

This approach would give planners a first set of possible strategies. One such strategy could be to give the highest priority to increasing the production of the small scale fisheries sub-sector by:

(i) increasing catch, product quality and range of distribution of fish from (isolated) Lake X and marine region Y;

(ii) intensifying the exploitation of pelagic resources of Lake Z (now largely under-exploited);

(iii) improving the supply of fishing gear;

(iv) improving extension services provided in zones A,B,C.

Now choices also have to be made for each main element of this strategy with respect to production factors. For example, element (i) might be approached in a number of ways in reference to labor and capital intensity, technologies, service support, training, input supply, infrastructure, etc. With respect to (i) a possible strategy might be to focus on market expansion through the development of appropriate processing technologies and the provision of basic infrastructure like access roads and storage facilities. In turn the development of appropriate processing technologies may require the use of alternative policy instruments such as a research programme, extension work, the provision of credit, etc.

3.4 Selected Issues In The Formulation of Strategies

While there are no magic formulas for the formulation of strategies, the process of identifying and selecting among strategies raises a number of issues.

Concentration versus dispersal: Because of the scarcity of development resources, one may consider that their dispersal over many activities could lead to limited results. At the other extreme a strategy which concentrates resources may carry a high social cost because it will generally imply focus on a limited social group, and because of the risk involved in case of failure. Given the limited information base on which strategies are generally based, the rate of failure is often high. The choice between the two approaches also relates to the issue of absorption capacity. Because of the numerous constraints which affect any sector in a developing economy, the concentration of development resources may lead to much slower results than expected, especially if the strategy is not revised periodically. Strategies which have concentrated resources for the development of industrial fisheries are a case in point. At the other extreme, an excessive dispersion of scarce development resources may have a much diluted impact. Clearly, a balance has to be found.

Strategic leaps versus incremental improvement: To a large extent this issue is related to the above as a strategic leaps approach often requires the concentration of development resources and the inverse for a strategy of incremental improvement. Basically the first approach would favour discontinued development through a series of major strategic leaps which may take a variety of forms: major fleet expansion programme; large- scale infrastructure development; adoption of new technologies and large- scale support programmes, etc. At the opposite extreme a strategy of incremental improvements would favor a series of small steps whose cumulative impact could be just as great, but in a more continuous and less disruptive way.

Experience indeed suggests that a more gradual approach to development is more reliable and efficient although it may not be quickest. The large number of so-called 'white elephants' which have characterized fisheries development in many countries of Africa point out the risk involved in adopting a strategic leaps approach. Such an approach ignores absorption capacity limitations, high-level expertise and management requirements and generally leads to an inappropriate concentration of scarce financial resources.

Lead Time: Some strategies require a longer time to carry out than others. It is therefore, desirable to determine how long a given strategy will take to produce results. For short- term results, one should avoid a strategy which relies on major changes in technology, administration or organisation. Long lead times are typical in aquaculture so that careful evaluation of possible strategies is needed to separate those with mainly short- or long-term effects. If both strategies are attempted at the same time, they may be found to conflict with each other.

Diversification or expansion versus intensification: This issue is basic to the formulation of strategies for agricultural development. In the aquaculture sector it similarly relates to key options: intensification of production by existing farmers using more performing technologies vs bringing new land/water resources into fish production vs introduction of new species, etc. Aquaculture development may also be part of a strategy of agricultural diversification. For the fisheries sector many choices are also made in this context: intensification in existing fisheries vs the development of new fisheries, new products, or new technologies; expansion of existing programmes vs initiation of new ones, etc. Choices should at this level be based on the careful assessment of past programmes and the cost-benefit analysis of these programmes vs new ones. It should normally be an easier task to assess existing programmes but, in practice, the absence of careful monitoring often implies that past performance of existing programmes is even more difficult to assess than expected performance from new ones.

Import Substitution: Strategies based on import substitution were the panacea of development in the 1960's and 1970's. These often led to mixed if not poor results because of the implied inefficiencies resulting from excessive protection from external as well as internal competition. In the fisheries sector, import substitution strategies have been followed especially for gear production as far as equipment is concerned, and for fish meal as far as products are concerned. The results have often been poor. However, some countries have followed (explicitly or implicitly) a strategy aiming at maximum use of local inputs with good results.

Management vs Development: This is a critical issue when discussing fisheries development strategies as more and more stocks are becoming fully or over-exploited in Africa. Because of the nature of fisheries resources, greater sustainable yields can be achieved by proper management of heavily exploited resources than by the development of new resources or by intensifying the exploitation of less exploited resources. For a number of reasons, often of a political and social

nature, management-oriented strategies have so far received little attention. While this is understandable in the early stages of sectoral development, many countries in Africa have reached a point where added benefits can hardly be achieved without a strong emphasis on fisheries management.

Entrepreneurship and government policies: A number of development strategies are based on the myth that developing countries are lacking entrepreneurship or that entrepreneurship is constrained by the lack of skills, e.g. in relation to the adoption of technologies, technical or management capabilities, as well as by the lack of financing. Actually, this is only partly the case as entrepreneurship would be equally influenced by the actual opportunity of gaining an advantage, as by the risks involved. Both are related to the prevailing economic and business climate which in turn is greatly influenced by government policies. Excessive price controls, limited access to foreign exchange and credit, excessive taxation and regulation, bureaucratic red-tape, etc. are likely to discourage even the most entrepreneurial entrepreneurs. Although such policies are mostly determined at the national level, sectoral strategies can either strengthen or lessen these constraints.

3.5 Constraints on the Choice of Strategy

A strategy for sectoral development must aim not only at an acceptable compromise between conflicting social and economic objectives, but also seek to obtain efficient use of scarce development resources. This provides the basis for systematic policy analysis of nationwide conflict for use of primary and financial resources among sectors and sub-sectors. Indeed there is also the interface between sub-sectors to be examined, such as complementary or conflicting relationships which might exist between fisheries and agriculture, between large--scale and small-scale fisheries, between the sector as a whole and the natural environment, etc.

A good analysis of strategies requires the collecting and analysis of as much information as possible about the cost and benefits, advantages and disadvantages of each alternative with emphasis on major linkages to other components of the sector and of the economy, as well as on resource requirements.

While the benefits and advantages of a possible strategy are generally easy to assess, its full costs and disadvantages are frequently less apparent. One reason is that the nature of the constraints for a given strategy may vary greatly from one country to another, or one region to another. A second reason is that it is necessary to adjust a strategy to the special situation in a country before all the costs and disadvantages can be determined. Planners frequently fail to recognise that substantial differences in constraints from one country or region to another make it essential to identify them in specific environments, rather than to look for a strategy that will be suitable in a wide range of conditions.

Resource Constraints: Recognition of resource constraints influencing the choice of fisheries and aquaculture strategies may spell the difference between success and failure in achieving targets and objectives. One of these is imposed by the natural conditions in a country. Soils, climate, endemic disease and scarcity or abundance of water are examples of natural conditions which set limits on aquaculture strategies. As for fisheries development much emphasis should obviously be put on periodically assessing the state of key stocks. Planners must therefore look ahead and try to estimate which resources are likely to become scarcer and which more plentiful. New technology is likely to influence this situation.

A second constraint is a country's stage of development. Clearly, in its early stages of development, a country should not normally select a strategy which, like mechanization, requires skills, foreign exchange and other resources which it lacks; any more than a country at an advanced stage should adopt a strategy which emphasizes labour-intensive techniques. Nor should a strategy be selected which is otherwise inappropriate to the actual situation in a country.

A nation's social, political and economic institutions and beliefs is a third determinant of strategies. At the international level, they are likely to embody a country's attitudes towards the role of foreign trade, aid, and private investment, the importance of international regional cooperation, desirability of attaining economic independence, etc. At the national level, they will reflect public attitude toward the roles of the private and public sectors, regional development, family planning, unemployment, (and, therefore, among other things, the choice of technology for

public investment projects), the pattern of income distribution, levels of consumption, retention of traditional ways and forms, institutional reform and so forth.

Some constraints are self-imposed, like a government's attitude toward the private sector, or its price policy for foodstuffs which may benefit urban workers but actually discourage production. Some are not, but occasionally the line between the two is thin. For example, foreign exchange constraints are influenced both by international factors and by some national policies (e.g. viz public investment, foreign aid, etc.).

Planners may sometimes wish they had the power to change a government's self-imposed constraints. They may not always be able to do this. But for planning purposes, they should determine the extent to which they must accept, as given, existing attitudinal and institutional constraints on the choice of strategies and the extent to which the constraints are subject to revision. Only a good understanding of the political leadership's thinking can make it possible for planners to help select an appropriate strategy.

In many countries, the state of public administration is a serious constraint to fisheries development. Failure to recognise this has led to the adoption of strategies which make demands on public administration which it is unable to satisfy. A government administration is often called upon to carry out more projects, or to intervene more frequently, than it can manage effectively.

In choosing a strategy, it is important to distinguish between constraints at the national, sectoral and enterprise levels. Lack of investment resources may be a constraint at the level of the fisheries/aquacultre sector but not at the national level where a government has decided to concentrate available resources on industrial development. And just as constraints may differ between the national and sectoral levels, they may differ between those at either of these levels and at the enterprise level. Thus, where the availability of inputs may not appear as a constraint at the sector level, unreliable deliveries at the enterprise level may prove to be a serious problem, and while skilled manpower may be a limiting factor at the national level, fishermen and fish farmers may have all the knowledge required to produce more than they do, if only deliveries of e.g. inputs could be improved. Since the constraints faced by the producers are the ones which actually retard development at any given time, assumptions must fit the difficulties which they face if effective strategies are to be selected. Too often, they turn out to be answers to the wrong questions because they are based on assumptions which are applicable to constraints at national or sectoral levels instead of those at the local level. A strategy must be designed to ensure that the producer sees the actions taken under it as contributing to the solution of his problems and the achievement of his objectives.

Sometimes, a single strategy will not be enough. This is true, for example, where improvement of both commercial and subsistence fishing is attempted. Since the problems and the constraints of commercial and subsistence fishermen differ, two strategies, or two distinct components of an overall strategy, have to be identified: one dealing with the commercial side and the other with the usually more pervasive and complex issues of subsistence fishing. In some countries, a single strategy may not be possible for other reasons, e.g. in a country with diverse ecological, climatological, or economic regions. In Brazil, for example, great regional diversity and a tradition of regional autonomy in matters of development make the formulation and execution of a unified agricultural strategy impracticable.

The best strategy is one which is least bound by constraints. Thus in a country with a foreign exchange constraint, a strategy which makes maximum use of domestic resources like labour is better than one like mechanization, which requires costly imports. Implicit in strategy selection is the requirement that the greatest use be made of a country's abundant resources. While constraints impose limitations on the choice of strategy, they can be dealt with either by sidestepping them or by devising a strategy with elements which fit the constraints.

Implications of a Strategy

Before selecting a strategy, its possible repercussions should be explored with care. Sometimes, it may easily be seen that a certain strategy will not achieve its objective. For example, a strategy which emphasizes sophisticated and capital-intensive production techniques is unlikely to raise the incomes of poor fisherfolk. Sometimes, even if it is clear that a strategy will succeed, there may be side effects which need to be considered. The process by which a strategy is selected from

among available alternatives should therefore include careful consideration of its possible negative effects. Some such effects may be foreseen and provided for with contingency measures if a more systematic analysis of the strategy is made prior to its adoption.

Finally, it is vital that those who will be closely affected by a strategy are kept fully informed about its nature and implications. Too often the one certain quality of a strategy is its lack of clarity. Even if this is not a problem, it does not draw forth much response because of failure to keep producers and local officials fully informed about it.

4. STRATEGIES AND GOALS IN REFERENCE TO SECTOR ANALYSIS

Sector analysis seeks to establish a quantitative basis for assessing what goals/targets are feasible, what contribution the sector can make to meeting national and sectoral objectives by pursuing particular goals within the sector, and the framework with which to identify policies, projects and activities to effect this contribution. This is achieved through analysis of major relationships, both within the sector and also between the sector and the rest of the economy (viz demand and supply of inputs and outputs).

The scope of activity within the fishery sector is subject to various constraints and opportunities, and conditioned by the interrelationships which exist between the different components making up the sector. A basic purpose of sector analysis is consequently to establish the limits within which planning of development in the sector can take place, and thus to identify how best to manage the sector within these limits. As there will seldom, if ever, be only one way of developing and managing fisheries in a given situation, sector analysis in practice involves identifying and analysing a range of alternative options or strategies that are available to decision-makers.

If the sectoral objectives and the criteria for measuring the worth of fisheries development options in terms of these objectives are clear-cut, the subsequent choice between the alternatives can be made at the executive level.

However, as pointed out earlier, several objectives or contributions may well conflict with each other and be measured by different criteria. In this case, no single measure of what is best exists, and policy decisions must be made at a higher level. Actually, and because of the iterative nature of the plan preparation process, sector analysis can also provide an important aid towards further specifying and ranking objectives themselves (quantified as goals/targets), by clarifying for the policy makers what feasible options (broad strategies/policies) are actually available.

In order to provide the necessary basis for decision, sector analysis needs to be policy-oriented. The alternatives analyzed need to be assessed in terms of their contribution to national income, redistribution of income, creation of employment, earning or saving foreign exchange, or whatever other criteria reflect the national and sectoral priorities. The analysis should shed as much light as possible on those policies within the sector which will best achieve a given goal or goals, and what would be the effects of applying particular policies. It will generally involve:

(1) Modeling the sector and quantification of the interrelationships or flows linking major components;

(2) Estimation of major trends especially viz supply and demand for goods and services and identification of gaps;

(3) Estimation of the quantities of goods and services that the sector could provide in the future under alternative supply and demand assumptions;

(4) Assessment of the feasibility and efficiency of the different future supply and demand scenarios;

(5) Analysis of the contributions of each of the alternatives to meeting national and sectoral objectives and presentation of the resulting information to the decision makers.

Actually sector analysis is very much a systematic follow-up of a stock taking and diagnostic survey. Drawing from system analysis, sector analysis allows for a quantitative or semi-quantitative

representation (model) of the sector, and its simulation under different scenarios. Although the uncertainty characterizing the resource base is a key constraint to fisheries planning in general, simple models can be used to identify and quantify major inputs and outputs, specifying their origin and destination, and linking those with simple relationships and basic constraints such as estimated maximum production. Basic sets of accounts may be built into such models to relate consumption, trade, harvesting and production requirements within the sector and to measure these in terms of requirements of capital, labour, foreign exchange and inputs from other sectors of the economy and in terms of contribution to national production, foreign exchange earned, employment, etc. If much work remains to be done to develop widely applicable models of this type for the fishery sector, *ad hoc* approaches involving basic calculations for alternative scenarios are seen as appropriate and required for proper planning.

Such a model would generally and rightly put emphasis on the reconciliation of supply and demand. Indeed planning is very much related to ways and means of closing an expected gap if the comparison of supply and demand shows a prospective short fall in supply, or to ways and means of disposing of a prospective domestic surplus. This situation may apply to the sector as a whole or to some of its components. The determination of policies and strategies would generally be linked to the result of such reconciliation exercises. For example, the major steps which may be taken to reduce an expected shortfall in supply may include:

- raising domestic fisheries production;
- developing fish culture production;
- reducing post-harvest losses (if important);
- increasing imports;
- reducing exports;
- reducing industrial use (e.g. fish meal).

Of course, more than one of the above goals (specific objectives) and related strategies can be sought simultaneously and further iterative analysis of requirements and likely benefits are required to quantify these goals into targets. For example, in reference to the broader objective of increasing *per capita* consumption, an option may be to raise domestic fisheries production through a number of alternative strategies (intensification of small-scale fisheries on such and such water bodies/fisheries; development of new fisheries; management of largely over-exploited stocks, etc.) and to reduce post-harvest losses (through improved conservation methods, greater availability of ice and cold storage, etc.).

A first level of analysis should enable planners to identify the range of alternative goals and related strategies which are *a priori* consistent with the size and nature of the future market and fisheries resources, the likely cost of making the latter available, and the likely price prevailing in the market. As seen above, a simple sector model can be used to evaluate the likely impact of alternative demand/supply schemes in reference to possible goals/srategies. Depending upon major national and sectoral objectives, the contribution of alternative goals/strategies may be measured in terms of economic growth (value added, i.e., the difference between total revenue and the cost of raw materials, services and components), return to capital, employment (e.g., total employment, investment cost per new job created, net value added, productivity by worker, location of jobs, etc.), foreign exchange, fish and animal protein consumption *per caput*, etc. Trade-offs between criteria which are not easily quantifiable would generally be a difficult question, even if objectives are ranked. Alternatives would thus have been presented to decision makers.

This first level of analysis should preferably be done on the basis of a semi-quantitative sector model assessing the feasibility of alternative goals and selected broad strategies. Further assessment of alternative strategies needs to be extended to encompass two further factors:

(1) The availability of sufficient capital, fisheries resources, manpower, technologies, skills and other inputs needed to, for example, raise the domestic production of specific fisheries (broad strategy) by a certain level (goal and target)

(2) The adequacy of the institutional framework which exists and that which should be created in the time available to bring about the changes needed to raise production to the required level.

In reference to physical inputs such as labour or capital, these need to be broken down to recognize the likely diversity of these inputs. For example, per unit capital requirements can be assessed viz a number of sub-sectors and activities. Foreign exchange outlays can be identified in a similar way. A balance sheet of requirements and availability of the basic categories of skilled manpower will further reveal whether, for a given option, there are major in-balances in the demand and supply of trained personnel. This information will either show that alternative goals-strategies must be selected or that the strategy should comprise an important training component.

Alternative targets and selected broad strategies will require different policies if these are to be attained. A final stage of sector analysis is therefore concerned with assessing what policy instruments are available, the nature of their impact and the extent to which they can be applied and made effective, in practice.

5. ASSESSING POLICY INSTRUMENTS

The availability of policy instruments depends very much on political factors and budgets, while effective application of available instruments depends on a host of institutional factors, including the organization of government services. The availability and appropriateness of policy measures or instruments will differ according to the degree of government control; clearly, something quite different is possible, and needed, where the state can do no more than induce change in a particular direction through the provision of relevant incentives, and where it can intervene through the issue of directives. The choice of policy measures will also differ according to whether or not control can be exerted on the resource (viz jurisdiction/shared stocks).

There are three generally recognized categories of policy instruments relevant for fisheries: public investment; regulations; incentives and disincentives;

Government can manipulate change by investing directly in projects in the sector and so control, or influence, their management. Incentives or disincentives to private enterprises to act in the way desired by government are created by giving subsidies or imposing taxes which respectively make desirable activities more attractive, and undesirable activities less attractive, in terms of profitability and other private sector criteria. While disincentive policies say " you may do such and such, but you will have to pay an additional tax of so many dollars", regulations say "you may not do such and such". A classic example of the difference is the distinction between an outright export embargo and a tax on export of certain species. Regulations tend to be easier to apply, more certain and less complicated, but less flexible, and often less acceptable, than incentives and disincentives.

There are various general policy instruments, such as minimum wage rates, tariffs, income or corporate taxes which affect the fishery sector but which are administered not by the fisheries authorities but by other branches of government. Though these can consequently seldom be manipulated specifically to bring about change in the fisheries sector, it is necessary for the fishery sector analyst to be aware of such exogenous policy factors, and to recognize what their impact on the sector will be. For example, it will be difficult for the fisheries sector to encourage capital intensive fishing and processing technology within the sector at a time when the country's fiscal and monetary policy measures undervalue the national currency in terms of foreign exchange, as this will mean expensive imports, including imported machinery, which will encourage the private sector to move towards more labour-intensive rather than more capital-intensive options.

Figure 5 lists the major categories of policy instruments available to the sectoral authorities in fisheries, some specific examples from each category of instruments which are actually being used in fisheries development programmes, and some examples of the types of objectives to which the instruments apply. They include such familiar tools as management regulations and fiscal incentive. From an analytical point of view, and in terms of defining the costs and benefits involved in different alternatives, we need to dissect these familiar tools since, in general, they contain more than one type of policy instrument which will affect objectives. For example, most management schemes contain a combination of regulations and incentives. Development programmes also tend to be a "package" of different types of instruments, including both regulations and incentive and

disincentive provisions. Unless we have some idea of the specific instruments involved, we cannot adequately analyse and evaluate the effects of applying the tools and the workability of alternative courses of development presented in the sector analysis.

Most of these measures are well known. However, it is also well known that their application in practice has all too often resulted in developments that have been quite other than what was desired and planned. To cite but a few cases: legislation has often proved to be an obstacle rather than an incentive to sustained development because of the emphasis on deterrent and punitive aspects. Attempts to develop industrial fisheries have sometimes led to destruction or downgrading of the resource with very little benefit to the country concerned. Tax incentives and subsidies to induce development of specific activities by the private sector have on occasion led to dissemination with little impact or target groups. And tariff protection which has often inhibited the growth of the fishing industry, and hindered the expansion of the other related sectors.

There are a number of criteria by which the suitability of policy instruments may be judged:

(a) Workability: administrative complexity, suitability of the administering agency;

(b) Efficiency: the relationship between results and cost of administration;

(c) Degree of certainty: does the level of subsidy or the strength of a regulation have the desired result or target group?

(d) Flexibility: to what extent is the Government committed? How much recurrent as opposed to once and for all expenditure? What legal obligations are created?

(e) Consistency: social aspects, welfare, equity, integration with other agencies, external effects on, for example, land costs, social effects.

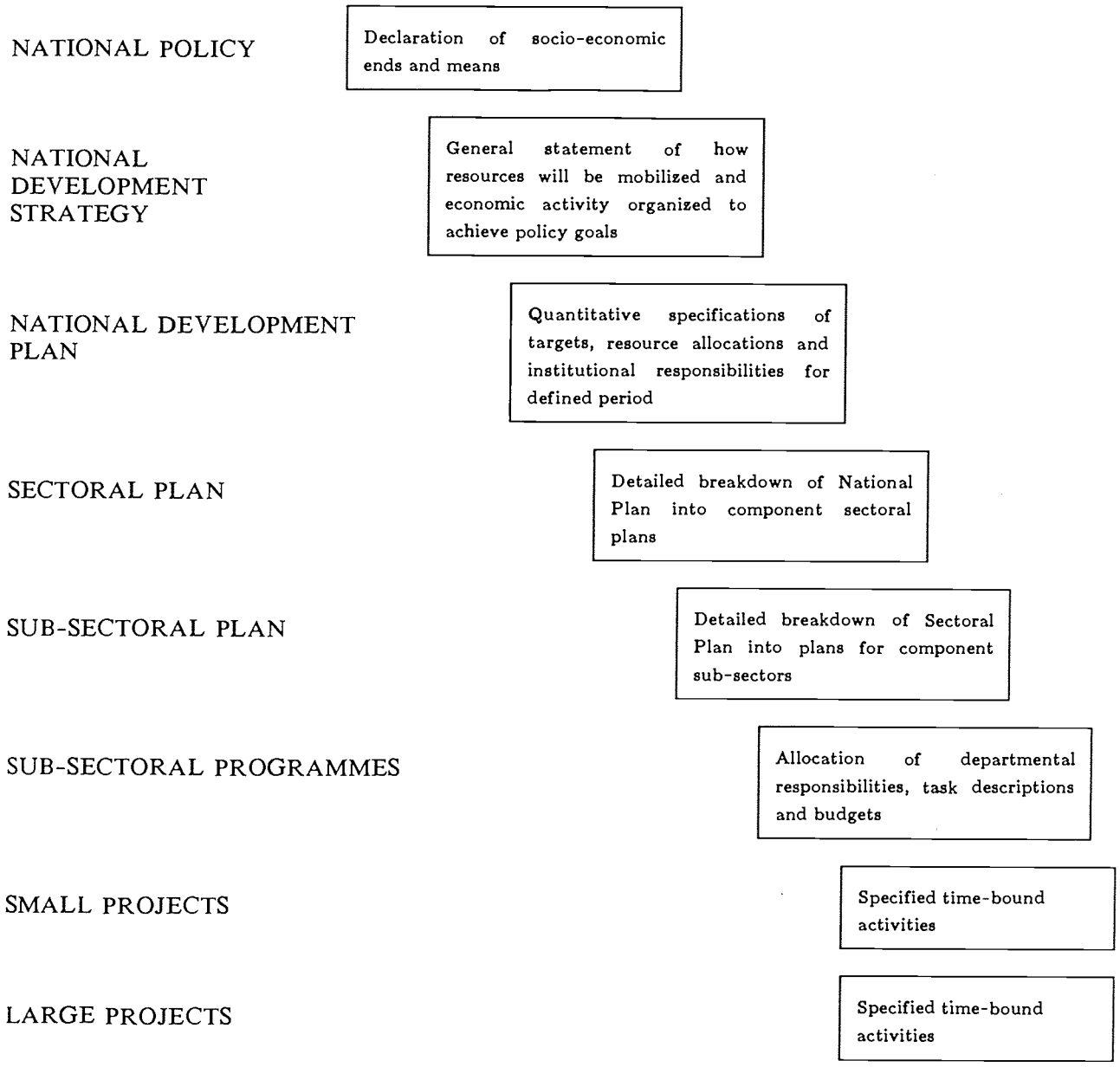
(f) Timing: are the instruments being introduced at the best time?

Failures to correctly assess the institutional feasibility of a given course of action are usually twofold. The first is failure to fully understand the nature, or magnitude, of the relationship between a policy measure and the response to that measure, so that the wrong policy instrument is chosen for a particular situation. For example, an "infant" industry might in some circumstances be better established by means of a subsidy to cover its operating losses while it builds up to full efficiency rather than by a protective tariff, which by increasing the price of the product that industry has to sell, can inhibit, and even reverse, the growth of the market on which the industry depends for viable operation.

The second common area of failure is in the workability of the instrument. Regulations will not be effective if the agency responsible for implementing them is not capable of doing so. Taxes will not be effective if they can be evaded, etc. Such institutional weaknesses constitute a major impediment to sound fisheries sector development in most developing countries. In assessing what can be achieved in a given period, a realistic view must be taken of the institutional constraints that exist.

Again, an assessment of key policy instruments is required which should relate both to the aforementioned criteria and to the more general objectives/criteria of the plan. The need to carefully elaborate a strategic framework and to systematically assess policy instruments should be considered as the very basis of proper planning.

Figure 1: Schematic Representation of the Planning Hierarchy



Source: FAO (1986) Guide for training in the Formulation of Agricultural and Rural Investment Projects. Introduction to the Guide. Development Policy Studies and Training Service, Policy Analysis Division. Rome: FAO.

Figure 2: The Sector study within the sectoral planning process

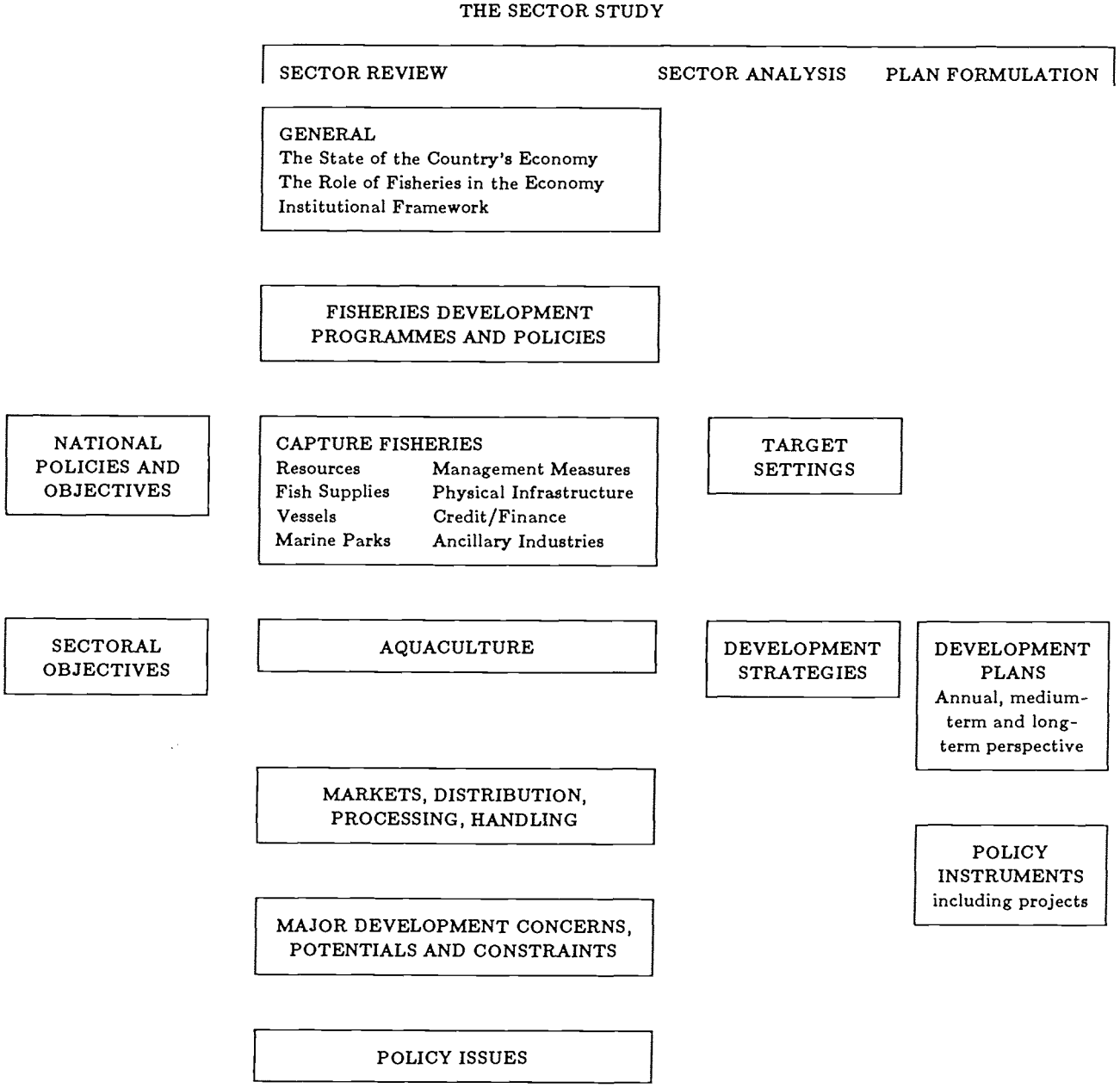


Figure 3: Factors affecting the fisheries sector

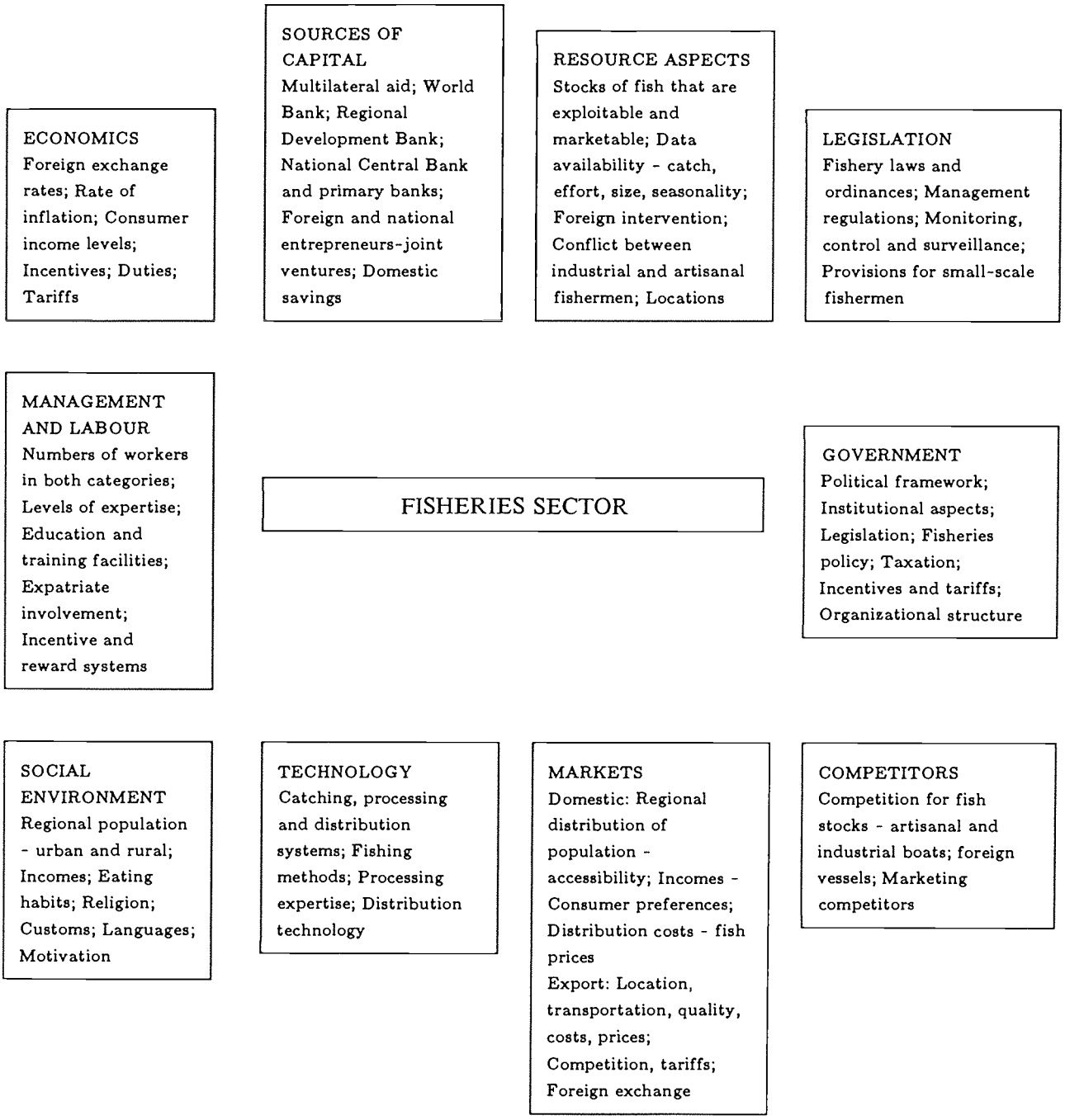


Figure 4: The End-Way-Means framework

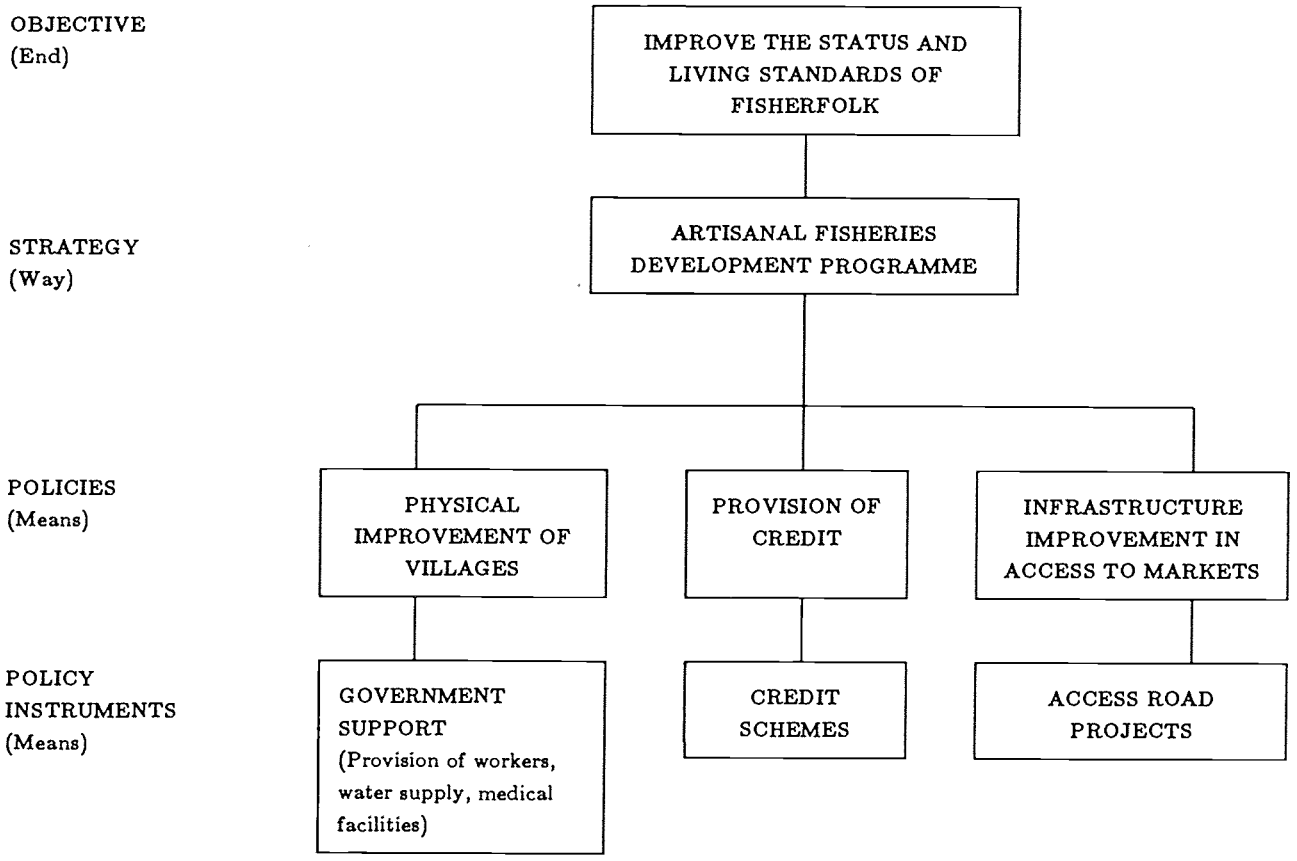


Figure 5: POLICY INSTRUMENTS FOR FISHERIES DEVELOPMENT

Category	Examples of Instruments	Examples of Objectives
I. Direct public investment and management	Public fishing and/or processing corporations of various kinds	Develop a relatively untapped fishery resource where private development is not readily available
II. Regulation of private sector activity	Export embargoes (certain species)	to encourage domestic processing
	Import quotas	to encourage import substitution
	Quality standards (eg. on exports)	to promote and secure export markets
	Utilization standards	to promote higher efficiency and possible consumption
	Labour laws	to protect labour and provide fair pay
	Price controls	to control inflation, protect industry, etc
	Stimulation of competition	to promote efficiency
III. Incentives for private sector 2.		
A. Direct price incentive	Exemption, remission or deferred payment of all kinds of taxes (eg. property, income, sales, export and import taxes)	to encourage various types of private development which are socially desirable but which would not take place without incentives
1. Fiscal		
2. Non-fiscal	Subsidization of inputs through low-cost credit, outright subsidies, price supports, insurance schemes, export performance awards, etc.	to achieve generally the same purposes as above (choice fiscal and non-fiscal depends on institutional and other particular circumstances)
3. Indirect price incentives	Government research support, training programmes, technical assistance, marketing services, export promotion, etc.	to overcome lack of economic and technical knowledge, reduce investment risk, etc.

Notes: 1/ These are specific instruments which may be combined in various workable ways.

2/ The opposite of incentives is disincentives: e.g., instead of tax exemptions, we impose taxes, or instead of an uniform tax rate, we have discriminatory taxes (which amounts to the same thing as an incentive to the sector having the lower tax rate).

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I. TECHNICAL DOCUMENTS / DOCUMENTS TECHNIQUES

Gréboval 1989 D., A. Bonzon, M. Giudicelli and E. Chondoma, Baseline Survey Report (1987) on inland fisheries planning, development and management in Eastern/Central/Southern Africa. UNDP/FAO Regional Project for Inland Fisheries Planning (IFIP). RAF/87/099-**TD/01/89 (En)**: 104p.

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II. WORKING PAPERS / DOCUMENTS DE TRAVAIL

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