The use of Multiple Criteria Decision Analysis for the Development of Adaptive Fishery Management Strategies: the case of the Danube Delta Biosphere Reserve

by

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Abstract

Fishery managers face two problems that are endemic to all renewable resource management: how much of the resource should be extracted, and how should resource users be managed to ensure efficiency and fairness? The predominant fishery management approach addresses these problems through fish stock assessment and resource economics. However, my review of the literature and analysis of the situation in the Danube Delta Biosphere Reserve show that both methodologies face serious difficulties: they deal inadequately with uncertainties about the causes of observed behaviour and the likely effects of different policies; they are too focused on readily measurable objectives; and they do not address the effects of the institutional context on management.

In Chapter 3, I examine previous applications of Multiple Criteria Decision Analysis (MCDA) with a view to see if they can be applied to fishery management. My analysis shows that until now MCDA has been used to address only the first two sets of fishery management problems: systematically incorporating uncertainty and multiple objectives into policy development. I also argue that existing proposals for the use of Decision Analysis can be classified as variations of one version of MCDA, namely Multiple Stakeholder Decision Analysis (MSDA). The main problems that remain to be resolved relate to the interaction between experts, stakeholders, and managers when there are conflicting interpretations of evidence, and situations of high institutional inertia.

In Chapter 4, I examine these problems within the context of ecological management experience and New Institutional Economics. I argue that for complex problems, such as those in the Danube Delta, management that aims to attain narrowly defined optimal fishing yields through command and control measures is unfeasable and undesirable. A more promising approach would seek to strengthen resilience, promote organisational variety, and increase the leverage of stakeholders over those who provide services for them. When one seeks to achieve such a transformation of management, I argue that the intervention needs to take into account the specific institutional circumstances of the client. In Chapter 5, I show how management procedures, problem perception, and strategy development are influenced by organisational structure and the hierarchical position of managers. That is why decision analysis interventions must address both technical as well as institutional needs of clients.

In Chapter 6, I discuss Decision Conferencing, an alternative MCDA approach, and argue that it is more suitable for dealing with management problems such as those of

the Danube Delta Biosphere Reserve. Decision Conferences can provide a structure for expert, manager, and stakeholder interaction and can lead to the transformation of social realities. In Chapters 7 and 8, I review the context and concrete environmental and institutional problems that led to the first Decision Conference on an environmental management problem. I report the processes of the Decision Conference, the agreements reached, and anlyse both the short and medium term effects of the intervention. On the basis of that evidence I make claims about the general utility of the approach. The thesis concludes with proposals to improve Decision Conferencing through a framework that provides guidance for context specific process management and helps to ensure that a requisite variety of viewpoints are incorporated into management strategy development.

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Abbreviations

AEMA	Adaptive Environmental Management and Assessment
DA	Decision Analysis
DC	Decision Conferencing
DDBRA	Danube Delta Biosphere Reserve Authority
DDI	Danube Delta Institute
EBRD	European Bank for Reconstruction and Development
GEF	Global Environmental Facility
IUCN	World Conservation Union
LSE	London School of Economics and Political Science
MAB	Man and Biosphere Programme
MCDA	Multiple Criteria Decision Analysis
MSDA	Multiple Stakeholder Decision Analysis
MSY	Maximum Sustainable Yield
MAUT	Multi-Attribute Utility Theory
MWFEP	Ministry for Water, Forests, and Environmental Protection
NIE	New Institutional Economics
SCA	Strategic Choice Approach
TAC	Total Allowable Catch
UNESCO	United Nations Education and Science Commission
VPA	Virtual Population Analysis

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Chapter 1 Introduction

The question of how to handle the uncertainty and trade-offs among competing objectives associated with renewable resource management has been identified as crucial in the endeavour to make management more successful (Gulland, 1983; Holling, 1978; Thompson, 1993; Walters, 1986). Decision theory is the normative theory of how the relative probabilities and desirability of different decision options ought to be combined if a decision maker wants his decision to be logically consistent and to conform to certain axioms of rationality (Phillips, 1988). Decision analysis is the technology that has developed from decision theory for practical applications. It gives advice on how to deconstruct problems, on how to analyse the value and probability components of the problem, and then on how to re-aggregate both by using explicitly stated and logical principles of probability and utility theory (von Winterfeldt, 1992).

The aim of this thesis is to analyse how decision analysis can be used to develop a fishery management strategy in the Danube Delta Biosphere Reserve (DDBR). There are two sets of reasons that warrant this work:

On the practical side, the fishery sector in the Romanian part of the Danube Delta is of great national and international importance, but was not managed sustainably. Until now, there have been very few applications of decision analysis to renewable resource management problems. When this research was started there were only three hypothetical studies (DiNardo, Levy, and Golden, 1989; Maguire, 1986; Norton and Walker, 1985), and since then there have been two *actual* applications (Gregory and Keeney, 1994; McDaniels, 1995) and a few hypothetical ones. This increase in applications of decision analysis to renewable resource management problems suggests that there is interest and it has the potential to assist decision-makers, such as managers of the DDBRA, to deal coherently with important management problems. At the same time, it is still very surprising that there have been so few applications of decision analysis in a field in which uncertainty and multiple objectives are considered by many to be an important source of the problems encountered (Gulland, 1983; Walters, 1986; Pearse, 1992; Gunderson, 1995).

On the theoretical side, there are several decision analysis approaches which differ in the rationales, methods, and processes used. In the current literature on the application of decision analysis to renewable resource management (or even environmental management more generally) there are no comparative analyses of the strengths and weaknesses of the different approaches. As a result, there is no guidance on which approach to use when. Another shortcoming of the existing literature on the use of decision analysis to environmental management is that it has not dealt with a number of criticisms that have been levied against its use.

This thesis contains an analysis of the existing literature in the fields of Multi Criteria Decision Analysis, fishery management using the Bio-Economic Equilibrium model and Total Allowable Catch quotas, New Institutional Economics, Adaptive Environmental Management and Assessment, Cultural Theory, and some elements of the Organisational Theory, and the Strategic Choice Approach.

I also report the results of my extensive fieldwork in the Danube Delta Biosphere Reserve (Romania), as well as the processes and outcomes of the first Decision Conference concerned with environmental management. On the basis of this research, I provide working hypotheses about the appropriateness of different decision analysis approaches for renewable resource management, deal with the questions posed about their use in resource management, and provide a framework for using the Decision Conferencing approach.

In this chapter, I introduce the Danube Delta Biosphere Reserve (DDBR) fishery and show that managers there were faced with difficult problems. The theories, methods, and processes they were using did not enable them to develop a coherent fishery management strategy. I argue that the problems faced can be grouped into three categories:

- problems relating to the handling of uncertainty;
- problems relating to making trade-offs between competing objectives;
- problems relating to the institutional context within which management takes place.

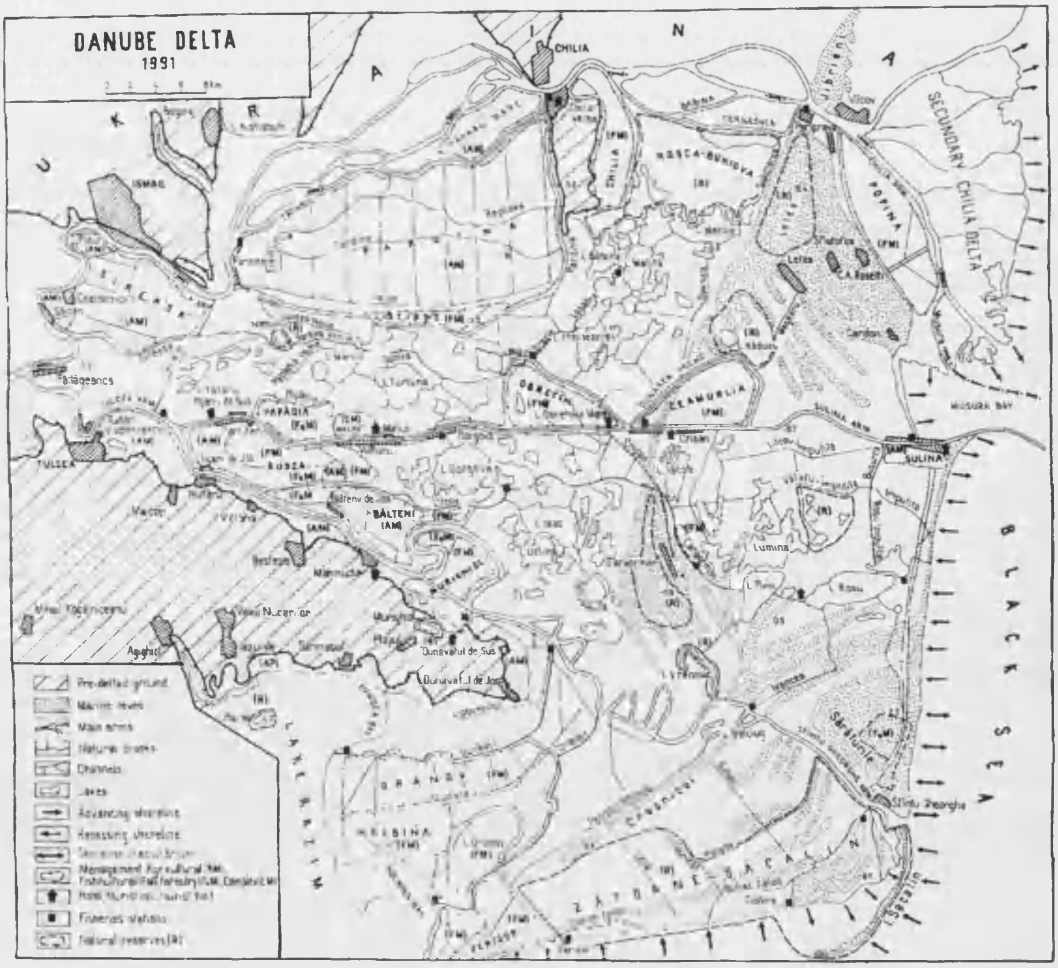
I then introduce Multiple Criteria Decision Analysis and argue that although existing proposals hold great expectations from the application of decision analysis to environmental management problems, at present only the first two of the three problem categories encountered in resource management are addressed: systematically incorporating uncertainty and multiple objectives into policy development. Core problems relating to the interaction between experts, stakeholders and managers, and those dealing with institutional inertia remain unresolved.

I propose to address these issues by using Decision Conferencing, a Multiple Criteria Decision Analysis approach that has not been suggested, applied, or assessed before in relation to environmental management problems. The essence of this thesis is a discussion and partial resolution of the theoretical and practical problems of choosing between different decision analysis approaches, applying the Decision Conferencing approach to environmental management for the first time, and drawing lessons from this application.

1.1 Background

The Danube Delta, shown in Figure 1-1, is Europe's largest (5,800 km^2) and least developed wetland (EBRD, Euroconsult, and IUCN, 1993). It is a heritage site of national and international importance. Its fishery is important because it harbours a great diversity of different fish species, it contributes to the livelihood of the population living in and around the Delta, and as a part of the Danube Delta as a whole is of national and international importance.

Figure 1-1 The Danube Delta



Gastescu (1993:59)

Fishing in the Danube Delta has been practised for many centuries. Historical records show that organised fishing took place as far back as the Roman period. In the early 1920s, 4,000 - 5,000 fishermen were active in the Danube Delta and fish catches were as high as 14,000 tonnes (de Graaf, 1994:5, Staras, 1994). Today, the number of fishermen is reduced to 600 - 1,000 and the reported catch is less than 6,000 tonnes.

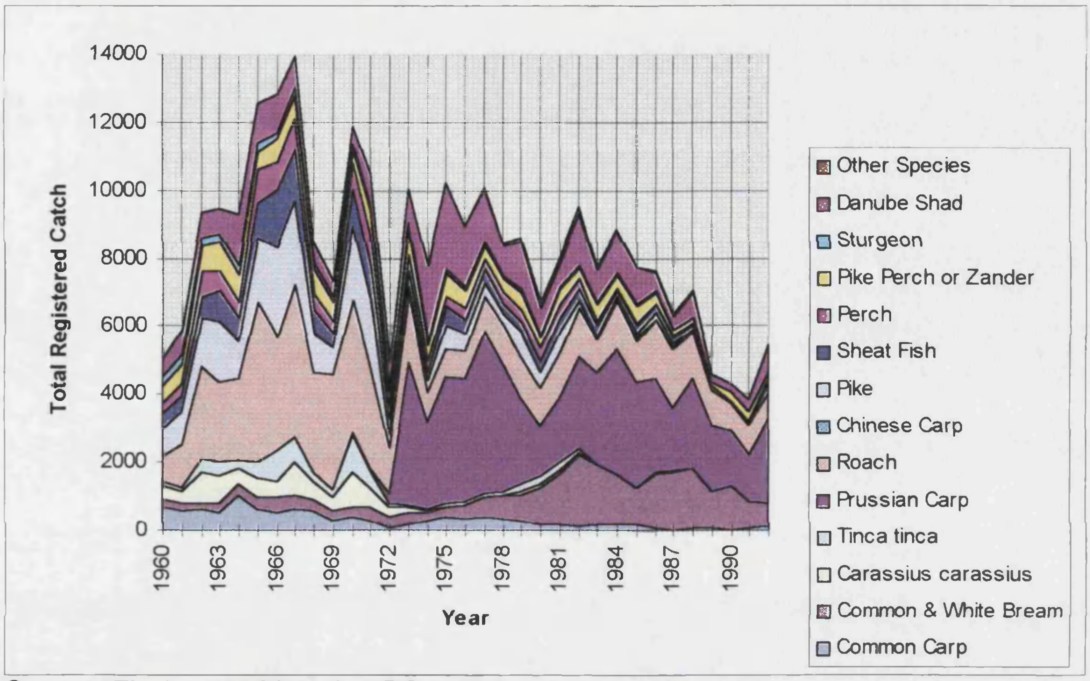
Since the 19th Century there have been repeated attempts to increase the contribution of the fishery to the welfare of Romania through "rational management" of the Delta. At the turn of the century Grigore Antipa, who was the Administrator for the Lower Danube Region, conducted detailed studies on the biological and hydrological conditions of the fishery, as well as on the way it was organised in this area (Antipa, 1895, 1905, 1911, 1914, 1916, 1935). On the basis of these studies he made a number of recommendations on how to increase the proportion of the most valuable fish species in the total catch and how to organise the fishing industry so that the catch would be of the greatest benefit to Romania. His studies are considered to hold many important lessons for the fishery today (Staras, 1994).

At the heart of Antipa's proposals for "rational management" were identification and enhancement of the breeding and living locations and conditions of the different species, and a more systematic and efficient organisation of the fishery. A number of his suggestions and policies were implemented and records (Antipa, 1916; Antipa, 1935) indicate that the quantity of fish caught increased and distant markets were reached.

The era of Antipa (approximately 1895-1940) came to end after the Second World War, when the Communist Regime took power in Romania. Since then, there have been systematic attempts to exploit intensively other natural resources of the Danube Delta as well. Researchers at the Danube Delta Research Institute (DDI) have identified three distinct phases: "the reed production programme, 1950-1960", "the fish production programme, 1960-1970", and "Complex Plan for the Exploitation of the Danube Delta, 1982-1989" (Savulescu and Volcov, 1993:1). None of these "programmes" are considered to have been successful but instead they are viewed has having damaged the ecological balance of the Danube Delta. For example, reed beds have been destroyed through the use of heavy harvesting machinery which damaged the rhizomes, and "empoldering" (the construction of dams around areas which would normally be flooded in the spring, for the purpose of agricultural or fish farming) led to a loss in biodiversity.

During this period, dramatic changes in the fish population took place. Figure 1-2 shows that the overall catch decreased from almost 14,000 tonnes per year in 1967 to less then half of that in the 1990s. Furthermore, the composition of the catch changed from one that was characterised by a variety of species to one dominated by Prussian carp and bream.

Figure 1-2: Changes in total catch and composition of fish in DDBR, 1960-1993



Source: Fischer (1993) using DDI data.

In addition to ecological damage, the policies pursued by the Ceausescu Regime (1967-1989) also affected the population of the Delta negatively. For example, traditionally households relied on a wide variety of income and subsistence activities (fishing, agriculture, horticulture, animal rearing), whereas now many are more vulnerable because they are employees of either agricultural or fishing companies. After the revolution of 1989, when many of the subsidised services, such as food and transport, were cut back and employment opportunities decreased, the younger generation started to migrate to the cities.

Since the 1970s commercial exploitation of the natural resources in the Delta has been assisted through research and planning by a number of Romanian research and design institutions. One of these, the Danube Delta Research Institute (DDI) is located in Tulcea - the capital of the Judet (county) and the biggest city on the border to the DDBR. These organisations prepared the plans for polders, identified areas for reed harvesting, tested and developed farming methods (agricultural and fish), monitored and advised on fish catch, studied the hydrological regime, etc. Their programmes and research aims were largely dictated by the Communist Regime and they had little room to bring their concerns to bear. For example, even though they knew that shallow and flooded areas were important fish breeding grounds, they still had to build polders in accordance with central plans for agricultural surface area increases or fish farming.

During the 1980s all economic activities in the Danube Delta were conducted through the "Centrala Delta Dunarii", a centralised and state-owned company. Immediately after the Revolution, this holding company was broken up into 21 separate, state-owned, companies along lines of activity and geographical concentrations. As part of their endowment they received building, equipment, polders, and access to different fishing grounds. The future of these companies was uncertain. There is evidence that some were able to operate with profit while others reduced activities (Fischer, 1993). They were under the control of the Prefecture of the Judet and were going to be privatised in the future. During the course of this research private fishing companies operating the Danube Delta also emerged but fishermen associations were not allowed to harvest resources.

In December 1989 the Ceausescu dictatorship was overthrown and in the immediate aftermath, Romania, like the other Eastern European countries that had rid themselves of their Communist rulers, strove for a renewal - a break and cleansing from the past excesses. This hoped-for renewal encompassed the political, moral, social, and environmental spheres (Fischer, 1992).

New leaders took over the government and they quickly moved to halt some of the earlier excesses. Among the first actions was the halting of the "Complex Plan for the Exploitation of the Danube Delta". The new Minister of the Environment, a Professor of Ecology from the University of Bucharest who had been engaged in research on the Danube Delta and the upstream floodplains, was primarily concerned with the conservation of the Danube Delta.

As a result of these endeavours, the Danube Delta was declared a Biosphere Reserve in August 1990 (Government Decision Nr 983 of 27 August), with its own Administration: the Danube Delta Biosphere Reserve Authority (DDBRA). The Danube Delta was also declared a Wetland of International Importance in May 1991 (by the Ramsar Convention Bureau), and parts of Delta were put on the UNESCO World Heritage List in December 1991.

1.1.1 The Danube Delta Biosphere Reserve

The first nature reserves with limited protection in the Danube Delta were the marine levees of Letea and Rosca-Buhovina in 1940 (Gastescu, 1993:65). Between 1956 and 1970, five additional reserves were created (reaching a total of 41,511 ha), and an additional 600 ha were seasonally protected (Kiss, 1988:233).

Four birds species (*egretta alba, egretta garzetta, pelicanus crispus*) have been protected from 1933 onwards and a further four (*tadoma tadoma, tadoma ferruginea, platalea leucordia, himantopus himantopus*) since 1955 (Kiss, 1988:233).

On August 27, 1990 through Article 5 Governmental Decree 983 the Danube Delta Biosphere Reserve was created. It includes the whole delta and the adjacent Razim and Sinoie Lagoon Complex, as well as a management and wardening authority (the DDBRA). Initially the DDBRA incorporated a research organisation, the Danube Delta Research Institute (DDI), that already existed before the Revolution and which at that time executed most of the research and planning work for the State-owned companies. The DDI separated again from the DDBRA but they still work together closely. In fact, currently most of the research work of the DDBRA is contracted out to the DDI.

The DDBR can be divided into six discrete geographic units according to their morphological and biological characteristics: (i) the delta itself (including the three main river branches of the Chilia, Sulina, and Sf. Gheorghe channels, totalling 4172 km2)[1]; (ii) the Razim-Sinoie lagoon complex; (iii) the Black Sea coast out to 20m depth; (iv) the undivided River Danube eastwards to Cotu Pisicii; (i) the Isaccea-Tulcea flood plain; and (vi) the Murighiol-Plopul saline plains (Baboianu and Goriup, 1995:6).

1.1.2 Rationale of Biosphere Reserves

Due to the increased concern for the global environment as a whole, UNESCO launched the Man and Biosphere (MAB) Programme in 1971 to describe the characteristics of the global ecosystem and monitor its evolution and responses to human intervention. In 1974 a Task Force of the MAB Programme originated the concept of a Biosphere Reserve. Since the launch of the Biosphere Reserve Network in 1976, it has grown to include 324 reserves in 83 countries by March 1995.

> *"This network is a key component in MAB's objective of achieving a sustainable balance between the sometimes conflicting goals of conserving biological diversity, promoting economic development, and maintaining associated cultural values. Biosphere reserves are sites where this objective is tested, refined, demonstrated and implemented" (UNESCO, 1990).*

Biosphere reserves are terrestrial and/or coastal/marine ecosystem areas that are internationally recognised within the UNESCO MAB framework. They are nominated

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[1] 82%, or 3446 km^2 are situated within Romania, the rest, including a smaller secondary delta, is in the Ukraine.

by national governments and must meet a set of minimal criteria and adhere to a set of conditions. Like all other Biosphere Reserves, the Danube Delta Biosphere Reserve (DDBR) is intended to fulfil the following three functions:

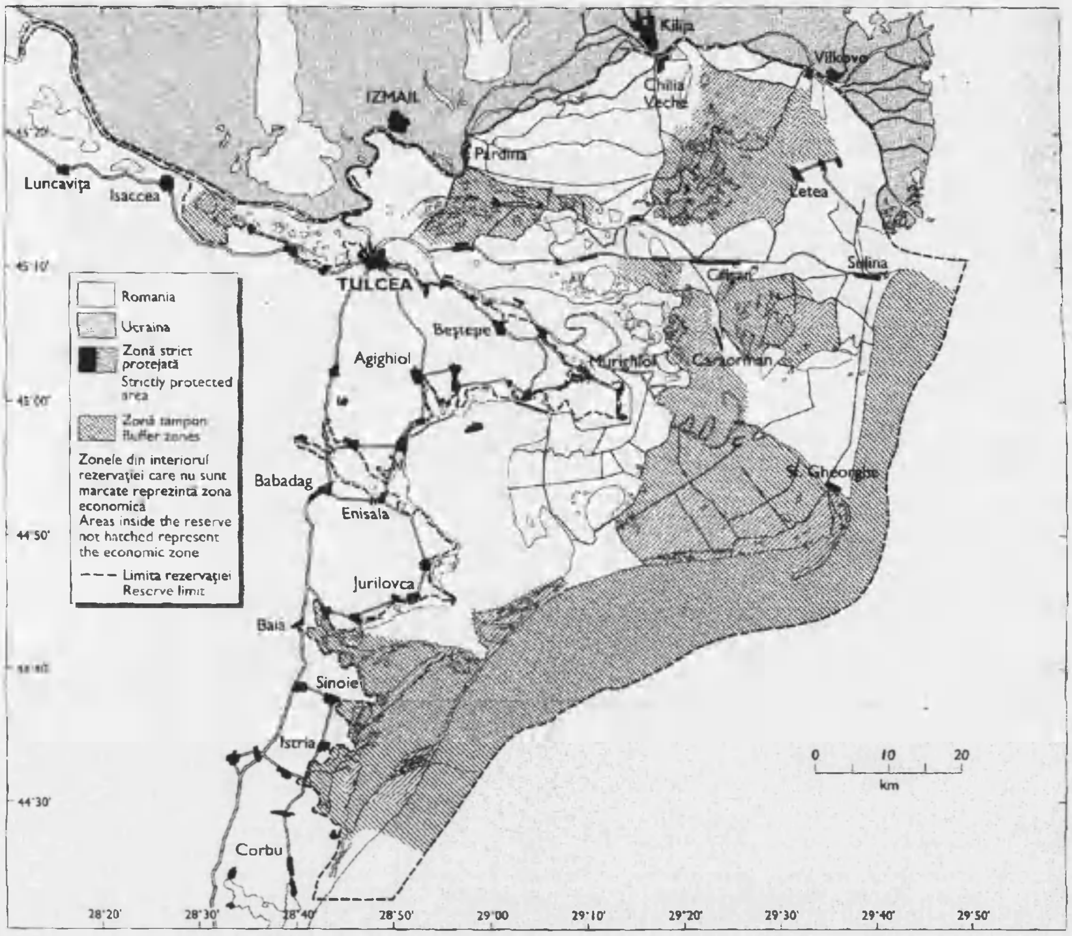
1. preserve genetic resource, species, ecosystems, and landscapes;
2. foster sustainable economic and human development;
3. support demonstration projects, environmental education, training, research and monitoring related to local, national and global issues of conservation and sustainable development. (UNESCO, 1990)

There is therefore an explicit recognition and emphasis on the relationship between society and nature. In the case of the Danube Delta Biosphere Reserve, the overall aim is: "to ensure conservation and protection of existing natural heritage and promote ecologically sustainable use of these natural resources" (Baboianu and Goriup, 1995:45).

All Biosphere Reserves contain areas of three different levels of protection (see Figure 1-3):

1. Core areas: these are securely protected sites for conserving biological diversity, monitoring of minimally disturbed ecosystems, and the undertaking of non-destructive research and other low-impact uses (e.g. education);
2. Buffer zones: these are clearly identified areas surrounding or adjoining the core areas to be used for co-operative activities compatible with sound ecological practices (e.g. education, recreation, eco-tourism, applied and basic research)
3. Transition or co-operation areas: these are flexible areas which may contain a variety of agricultural activities, settlements and other uses and in which local communities, management agencies, scientists, non-governmental organisations, cultural groups, economic interests and other stakeholders work together to manage and sustainably develop the area's resources. (UNESCO, 1990)

Figure 1-3: Map showing the three levels of protection in the DDBR



Source: Baboianu and Goriup (1995:23).

"Biosphere reserves are intended to become models of how we should live with nature. They are multipurpose protected areas established to conserve species and natural communities, and to find ways to use environments without degrading them. Research and monitoring in biosphere reserves will tell us much that we need to know about how ecosystems work, how we are changing them, and how we should adapt our practices to keep those ecosystems, and the societies that depend on them, healthy." (UNESCO, 1990)

1.1.3 The EBRD Technical Assistance Project

Along with this increased international recognition a number of international technical co-operation projects were started. Among these was a major two-year technical assistance project for the DDBRA that began in 1993. It was administered by the European Bank for Reconstruction and Development (EBRD) and implemented by EUROCONSULT, a Dutch consultancy, and IUCN (The World Conservation Union). The main beneficiary of this project was the Danube Delta Biosphere Reserve Authority (DDBRA). The overall aim of the EBRD project was "to develop the capabilities of the DDBRA so that it can produce the first integrated environmental management plan for the DDBR" (DDBRA and Douse, 1993:iii).

The objectives that this project was to achieve by assisting the DDBRA to develop the "integrated management plan" were determined in 1991 at a seminar held at Uzlina (a former residence of Ceausescu inside the Delta and now used as a conference and information centre by the DDBRA). The attendees (international and local experts[2], local political representatives, and staff of the new administration) set the following objectives:

1. *Provide a legal framework to secure the aims and governance of the Biosphere Reserve over the long term.*
2. *Establish appropriate qualitative and quantitative management capacity for meeting the Biosphere Reserve objectives.*
3. *Establish management procedures and planning processes.*
4. *Ensure that the local population is aware of the aims, goals and operations of the DDBR and their representatives actively and fully participate in planning and decision-making.*
5. *a) Ensure wise use of the natural resources of the Delta.*
   b) Protect populations of rare, endangered and typical species, their communities and habitats.
   c) Support recolonisation and re-establishment of species now extinct in the Delta.
6. *Ensure that all economic activity is ecologically sustainable.*
7. *Arrest the decline in local population levels.*
8. *Maintain the cultural heritage of the local population.*
9. *Maintain or restore the natural operations and functions of the Delta ecosystem.*
10. *a) Create an integrated monitoring system.*
    b) Evaluate and analyse trends in support of management.
    c) Integrate research initiatives and strengthen and link institutions engaged on research and monitoring." (IUCN, 1991)

In early 1993 I had started to look for a suitable place to do my research. As I was born in Romania, speak Romanian, and because of the knowledge that I had gained through my M.Sc. dissertation on "The environment in Romania's economic transition", I contacted the EBRD to explore the possibility of organising my PhD field work in Eastern Europe. On their advice, I contacted the project managers who had already started their work in the DDBR, and was invited to join their team as a researcher and trainer. The Terms of Reference of my involvement are detailed in Section 10.2 (Appendix). I was asked to work closely with the Resident Advisor and

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[2] The experts constituted the "International Steering Committe for Conservation of the Danube Delta" and comprised the following organizations: IUCN - The World Conservation Union, Birdlife International, International Waterfowl and Wetlands Research Bureau, World Wide Fund for Nature (WWF), Foundation for International Nature Protection, UNSCO - World Heritage Secretariat, and the Bureau of the Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat. See also EBRD, Euroconsult, and IUCN (1993:19) and IUCN (1991).

other members of the technical assistance programme and "to transfer expertise to appropriate staff of the newly formed DDBRA, Planning, and Investment Department" (my Terms of Reference).

My Terms of Reference also specified that I was to organise a Decision Conference on one of the natural resource sectors that I was required to investigate. Although the Decision Analysis approaches that I proposed to evaluate could have been used for dealing with a number of resource management questions faced in the DDBR, I finally chose to apply it to the fishery for three reasons. First, the fishery management problems were considered by all to be important and difficult. They included multiple competing objectives (for example, conservation vs. sustainable use), and they involved many uncertain elements (e.g., what was the real state of the fish stock and what caused the observed changes, how many fishermen are there, what gear do they employ, what management interventions are most likely to succeed, etc.). These characteristics meant that decision analysis would be the appropriate technology to assist and guide the development of internally consistent management strategies.

Secondly, since the fishery is considered to be one of the most important resources of the DDBR, any headway one could make (in terms of making its management more consistent with the objectives for the DDBR) would be of great benefit to the local population and at the same time contribute to biodiversity conservation. The third reason for choosing the fishery sector relates to the feasibility of drawing important local and internationally relevant lessons for management of complex natural resource systems. There is a very large literature on fishery management and that made it possible to build on the knowledge and experience gained in other parts of the world.

1.2 Development of Fishery Management Strategies

An outline of current fishery management practice and examples in support of my argument that the methodologies employed face three kinds of difficulties is presented below. The difficulties are that they deal inadequately with uncertainties about the causes of observed behaviour and the likely effects of different policies; they are too focused on readily measurable objectives; and they do not address the effects of the institutional context on management.

1.2.1 The basis of current fishery management practice

Modern fish management, like that practised in the DDBR, which uses quotas determined by the study of fish population dynamics to regulate fishing intensity, has been developed only this century (Rettig, Berkes, and Pinkerton, 1989). It consists of two main elements: (i) a scientifically established maximum quantity of fish that can be harvested which leaves enough fish in the water so that the stock can regenerate itself for the next season (this is called the Maximum Sustainable Yield (MSY)), and (ii) a set of rules (or property rights regime), which are incentive and enforcement mechanisms aimed at ensuring that fishermen harvest fish sustainably.

The concept of MSY was developed by biologists on the premise that fish populations tend to develop to a maximum size within any given ecosystem (this is called the "carrying capacity") and that populations below carrying capacity generate a certain harvestable surplus. If fishing was stopped, the surplus would lead to the growth of the biomass and the fish stock would return to its carrying capacity size. Therefore, if one was fishing only this surplus, a given stock size of fish could be maintained, together with a sustainable yield.

To calculate such a sustainable yield, four variables need to be considered: (i) the natural rates of growth of the fish, (ii) the rate of reproduction of fish (called "recruitment"), (iii) actual intensity of fishing (called "fishing effort"), and (iv) the natural mortality of the fish. All of these variables are usually uncertain because they are affected by many factors about which fishery scientists need to make assumptions. The results or recommendations about how much fish may be sustainably harvested are always associated with uncertainty. However, one of the main complaints in the literature is that very often the recommendations by scientists, such as those in the Danube Delta, do not include indications of this uncertainty (Gulland, 1983; Walters, 1986; Pearse, 1992; Gunderson, 1995).

From the economists' perspective, fishing is valuable insofar as it is "capable of yielding harvests of a value greater than the costs of harvesting. This surplus or net value is referred to as resource rent" (Pearse, 1980:13). As long as marginal costs are smaller than marginal revenue it is economically worthwhile to increase effort and to catch more. Where access to the fishery is open and people cannot be excluded from fishing, the result is that the quality and/or quantity of fish caught decreases to the point where the fishery collapses because there are not enough fish left over to regenerate the stock. To avoid this, rules have been devised to govern the extraction of fish.

Such rules can be based on traditional knowledge, or may be scientifically determined, and they can be formal or informal. However, they always need to address the following issues: how much to extract, how to extract, who is to extract, how benefits are to be shared, and how to enforce these rules. The rules governing a fishery must also take into account the characteristics of the resource (how quickly it grows, how it interacts with other species and other environmental factors, minimal stock levels for reproduction, where and how it reproduces).

Restrictions on fishing have not changed much over time. They have always included a variety of restrictions on gear, time and areas for fishing, incentives for sustainable fishing practices, quotas, and methods for revenue redistribution.

In the Danube Delta Biosphere Reserve the DDBRA is responsible for managing the fishery. From the time that they were given this mandate they sought to re-design the existing management regime to one that protected the fish stocks from overexploitation and reversed the decline of fish landings experienced over the past years. The DDBRA started this reform process by contracting the DDI to conduct fish stock assessments and to make proposals for how the fishery could be managed sustainably.

Although there was no written account of the management system the DDBRA was seeking, my interviews with staff of the Authority and the fishery scientists of the DDI indicated that they sought to establish the state of the fish stocks in the different parts of the Danube Delta, then issue Total Allowable Catch quotas to the fishing companies, and then make sure (through a combination of policing and awareness raising) that fishermen did not fish more than what they were supposed to. In spite of the apparent simplicity of this approach, the DDBRA and DDI encountered a number of problems. The problems can be grouped into three categories: difficulties in dealing with uncertainty, multiple objectives, and the institutional context within which the fishery management strategy process took place.

In the following three sections I briefly present some evidence for these problems, giving first some examples from the Danube Delta and then summarising the general problem.

1.2.2 Dealing with Uncertainty

The first difficulty with the prevailing approach to fishery management was that the studies that were conducted and the envisioned management approach did not deal with the uncertainty of fishery management satisfactorily. Although the DDI scientists and DDBRA managers were unable to establish the causes for many of the phenomena they observed, due "insufficient data", and even though they were unsure of what the effects of different management measures would be, the findings they presented in their reports did not include any reference to uncertainty. Instead, they produced some spuriously exact figures for how much fishing yields would change if fishing was done with fishing gear with different characteristics.

Two examples are sufficient to illustrate this point. The first relates to the fact that even though reports only briefly refer to the problem of poaching and under-reporting of landed catch, researchers, managers, and fishermen all acknowledge in private conversations that as much as 30-50% of the real catch does not appear in the official records. Instead of incorporating this knowledge in their analysis, the fishery studies and the management proposals make recommendations only on the basis of the officially reported data that is known to be very inaccurate.

A second example relates to the implications of the Danube Delta being a complex ecosystem, which is very dynamic and subject to strong seasonal variations. In the Inception Report of the EBRD Technical Assistance Project, Paul Goriup, an ecologist appointed by IUCN to be the resident advisor for the project, characterised the DDBR ecosystems thus:

> *"Even under entirely undisturbed, natural conditions a delta ecosystem is highly dynamic. The fundamental physical processes of water flow and sedimentation transport can vary enormously from season to season, and from year to year. Aquatic and terrestrial habitats associated with the delta can arise and disappear with a single flood. Over long periods of time (measured in centuries) a certain degree of stability may be attained, but any sudden changes in the ecosystem (whether due to local or upstream events) can have rapid and far-reaching consequences, causing a major and permanent shift in ecosystem characteristics." (EBRD, Euroconsult, and IUCN, 1993:11)*

Under such dynamic ecosystem conditions, leaving the dynamics of the social systems in a time of transition from the communist to a free market regime aside for the moment, it is very difficult, if not impossible, to determine precise and enforceable Total Allowable Catch quotas. This assertion is born out of the fact that even though fishing companies have stated in their official reports to the authorities that they have fished more than their allocated quota, the DDBRA and the DDI were not able to conclude that they were over-fishing because they had to admit that there may have been natural factors at work that produced unexpected high fish stocks that year (Navodaru *et al.*, 1993:21).[3]

In spite of these circumstances, the DDBRA adopted a fishery management approach that sought to determine optimum levels of fishing intensity for different zones of the DDBR. This choice also meant that they needed accurate information

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[3] For example, one can see in Figure 1-2 that the proportion of Prussian Carp suddenly increased around 1973. It is not clear what caused this. Scientists assume that an unexplained change in environmental conditions - maybe the extraordinarily severe flood of 1970 - brought these changes. How exactly this relates to the increase of that species is not clear.

on the number of fishermen and the gear with which the fish were being caught. However, the quality of that information was even worse than that of the landed catch, but again, the implications of that were only discussed verbally but they were not reflected in the written recommendations.

These examples highlight two problems: first, from a technical perspective there is the question of how one can incorporate uncertainty into the analysis; and secondly, from a process perspective, it shows that there is also the problem of managing interdisciplinary and collaborative work, since neither the DDBRA manager, nor the DDI scientists, nor the fishermen were in a position to overcome these problems on their own. Instead, all these stakeholders needed to collaborate and bring their expertise and knowledge to bear in the development of a management strategy that was sustainable (for evidence that this situation is not unique to Romania, see for example Gulland (1983), Pearse and Walters (1992), McDaniels (1995), or Walters (1986)).

1.2.3 Dealing with conflicting objectives

All fishery management must deal with conflicting objectives. Whenever there is more than one objective then there are trade-offs because not all objectives can be maximised at the same time. The most basic trade-off in fishery management is about the short-term intensity of fishing and longer-term conservation (leaving enough fish in the water for the fish stock to survive).

Another example of conflicting objectives in fishery management concerns the advantages and disadvantages of Total Allowable Catch (TAC) management. The advantages relate to fact that it is widely used, it is easy to understand, and it often works quite well when there is sufficient reliable data. However, TAC management also has disadvantages because fishermen are often not willing to declare true amount of fish that they caught, fearing that this might have negative repercussions on the quota they get in the following year. When choosing a management approach, fishery managers need to make judgements about whether the advantages or disadvantages are bigger. These judgements are often made very difficult because there are a many stakeholders, alternatives, and objectives to consider. In addition to that, I have indicated in the previous section, the data about all these elements is usually uncertainty.

A second example from the DDBR shows some more aspects of the difficulties involved in handling conflicting objectives: Biosphere Reserves are supposed to conserve important resource and provide lessons for how we should interact with nature. One of the most visible aspects of the environment that the Ceausescu

Regime has produced is the polders created for agriculture and fish farming. They do not look natural because they run mostly in straight lines, the dams are elevated The vegetation in them is usually very domesticated and typical of dry areas, not as one expects in flood prone area such as a Delta.

The DDBRA and DDI would like to break these embankments down and let the Danube flood those areas naturally. Ironically, one of the problems encountered in the management planning work of the EBRD technical assistance project was that the water in the polders and canals of the Delta which were cut off from the Danube river was cleaner and probably the last refuge of the most threatened fresh water fish species. When this conflict and trade-off was pointed out by the EBRD project consultant, it sparked quite a debate not only among the staff of the DDBRA and DDI, but also among politicians, laymen, fishermen, members of the Romanian Academy of the Sciences, and others.

For most of the people who took part in these discussions the issues I raised in these examples were not surprising because they had experienced them, but none of the many reports that were prepared over the previous years mentioned them. This, I argue, is further evidence for my hypothesis that the methods they were using were falling short of what was required of them.

In addition to the measurement, comparison, and process difficulties that I have already mentioned in relation to dealing with conflicting objectives, another factor that probably affected the choices made in the DDBRA's approach for dealing with these problems was the long communist history and the associated command and control management. Under communism, management objectives were much narrower than those of the Biosphere Reserve, focusing primarily on maximising the quantity of fish produced. In some ways the choice of the DDBRA to focus exclusively on the improvement of fish stock and the monitoring of fishing activity with the aim of putting management on a 'rational basis' can be seen as a continuation of the traditional narrow focus - though the specific objective sought to be maximised was replaced.

1.2.4 The Effects of the Institutional Context

Until now the MCDA literature has not taken the institutional context into consideration. The existing literature either ignores the issue alltogether or it considers it only from a behavioural standpoint.

The first reason for taking the institutional context into consideration is that it affects the process by which management policy is formulated. For example, part of the reason why collaboration between DDI scientists and DDBRA managers, or between departments of the same organisation was difficult, was that both were highly specialised organisations in which communication was very formal. Both had elaborate administrative structures, and the power of decision making in both was very centralised. These institutional characteristics also made interaction with stakeholders, such as fishermen, very strenuous. One of the effects of this was that in the preparation of fishery management policy between 1991 and 1994, stakeholders were not consulted and as a result, when the DDBRA presented a new fishery licensing framework to the public in early 1994, they were faced with much criticism from fishing companies, the media, as well as individual fishermen who went to protest against it at the DDBRA headquarters.

The following quote from Walters (1986), who is fishery management scientist, captures many of the issues that I have raised in the last three sections well:

> *"So throw together some hatchery managers, law enforcement officers, ecological biologists, administrative personnel, and perhaps quite a few others. Call this a management agency. Now 'interface' it somehow with its constituents, ranging from politicians worrying about the next election, to concerned conservationists, to careful business entrepreneurs, to 'cowboys' out to take the biggest catch this year. Be sure to throw in a few characters with complex motives, like an operator of sport fishing charters who loudly opposes fishing regulations that would make it easier to catch fish without his help. Finally, consider the resource itself, a complex ecological system that is too expensive to monitor thoroughly, changes unpredictably in response to environmental factors, and generally offers all sorts of conflicting signals that are open to every interpretation from imminent disaster to grand opportunity. There you have your modern management situation. It is little wonder that progress appears to be almost non-existent, that only major crises seem to elicit concerted response, and that resource managers are often branded as cynics with little concern for resource husbandry." (Walters, 1986:30)*

1.3 Decision Analysis and Environmental Management

Decision Theory on which Decision Analysis (DA) is based, has at its core the principle of coherence: "people strive to make decisions that at a point in time fit together, are consistent, and do not contradict each other" (Phillips, 1986).

In 1968 the term "Decision Analysis" was created by Ronald Howard of Stanford University through the combination of Decision Theory with Systems Analysis (Howard, 1966). The first full exposition of DA was then provided by (Raiffa, 1968).

Up to that point the theory applied only to the comparison of uncertain decisions which differed only in one respect. Through the work of Keeney and Raiffa (1976) decision theory was extended to cover those cases where the consequences of decisions differed in more than one way. They showed that the overall expected utility of such a decision can be calculated by assigning importance weights to each of the utilities for the different dimensions of the decision consequence and then, in the simplest model, adding these all up to give the overall utility.

The methodology of decision analysis consists of decomposing a decision problem into its factual and value parts, analysing the factual parts as probability problems, analysing the value parts as utility problems, and re-aggregating both by using explicitly stated and logical principles of probability and utility theory (von Winterfeldt, 1992:321).

Over the past thirty years Multiple Criteria Decision Analysis (MCDA) has benefited from the contributions of many disciplines: operational research, management science, psychology, economics, and many others. The traditional intellectual home of DA is in the USA. The early developers of DA were based at Stanford (R. Howard), Harvard (Howard Raiffa, and Ralph Keeney in the 1970's) and at the University of Southern California (Ward Edwards, Detlof von Winterfeldt, and since the 1980's Ralph Keeney). In Europe the leading Decision Analysts were based at the London School of Economics (Lawrence Phillips), London Business School (Bunn, Moore), and Cambridge University (Watson). Today decision analysis is being taught and practised in many different countries. The field is still characterised by a close connection to academia and by a strong influence of different disciplines.

A number of different schools have developed within the decision analysis field and a number of different groupings have been proposed over time in the literature (for example Merkhofer (1987), Phillips (1989), and Watson and Buede (1987)). In this thesis I argue that with respect to the use of decision analysis in the renewable resource management field, existing applications can be classified as variations of only one major decision analysis approach: Multiple Stakeholder Decision Analysis (best summarized in Winterfeldt, 1992).

1.3.1 Existing Applications: The Multiple-Stakeholder Approach to DA (MSDA)

Considering the fact that fishery managers continuously grapple with uncertainty and multiple objectives, it is very surprising to find only the following few Decision Analysis papers where decision analysis is being used specifically for fishery management Keeney (1977); Walker, Rettig, and Hilborn (1983); McDaniels (1995); McDaniels, Healey, and Paisley (1994).

Of these, only Keeney (1977) and McDaniels, Healey, and Paisley (1994) report actual applications, the others are hypothetical case studies. The main arguments made in these publications is, as I will discuss in detail in Chapter 3, that Decision Analysis can help decision makers analyse problems by aiding them to decompose the problem into a value part (which may be analysed through value or utility functions), and a factual part (which is analysed through probabilities). The Subjective Expected Utility (SEU) Theorem is then used to bring the two components together again.

I will argue in Chapter 3 that it is useful to take von Winterfeldt (1992) as the key reference for the existing applications of Decision Analysis to environmental issues (even if it does not deal with fishery management) because it contains the most comprehensive methodological summary and the other decision analyses referred to above can be seen as elaborations of various aspects of the approach presented in von Winterfeldt (1992). Von Winterfeldt (1992) calls that approach the Multiple Stakeholder Approach to Decision Analysis (MSDA). It is characterised by "division of labour" between technical experts who provide estimates on consequences, and other stakeholders who provide the value judgements regarding the consequences in the form of utility judgements. The justification given for employing this approach is that it resolves the dilemma that: "Experts should not control technological choices but the public and political representatives are not sufficiently informed to assume complete control themselves" (von Winterfeldt, 1992). The techniques used are quite formal probability and utility elicitation methods, the approach uses multiple stakeholders and expert inputs, and the key advantages are broad input, assistance to stakeholders to solve common problem in co-operative way, and to assist experts in their analysis.

Another important paper is Gregory and Keeney (1994). They report on workshops held with stakeholders, where an environmental management problem (in their case a proposed coal mining development in a biodiversity rich location in Malaysia) is structured in a decision theoretic way. Through work with stakeholders on a precise articulation of their values the basis for an improved set of policy options is created. This, Gregory and Keeney (1994) argue, "assists governments to make wise and defensible decisions which are in the long-term interest of the people". Some of the advantages referred to in the paper include: "Consensus" and "constructed balanced compromises" which avoid polarised views. Other published applications which could be classified under this approach include (Keeney, 1988; Keeney, von Winterfeldt, and Eppel, 1990) which are concerned with the clarification of public values for making public policy decisions in the energy field in Germany, and alternatives in the shipment of spent nuclear fuel from power plants to a repository respectively.

An example of the application of Multiple-Criteria Decision Analysis in a more traditional form (working with only one set of stakeholders, following Keeney and Raiffa, (1976)) in a hypothetical fishery management case is McDaniels (1995). The key argument is that the mathematical modelling and simulation through which experts and managers try to understand the fishery better does not pay enough attention to the key judgements that need to be made. As in the Multiple-Stakeholder Approach the separation of judgements (by stakeholders) on values and experts (on technical judgements) is also made. However, the emphasis is then on the work with the experts and decision-makers as they deal with conflicting objectives, biological uncertainties, structural complexity, compressed time frame, and potentially high stakes. The stated key advantages are guidance on the avoidance of biases in judgement and enhanced resource modelling.

Within the MSDA literature there are also questions about use and possible limitations. Von Winterfeldt (1992:339-342) raises the following questions regarding the appropriateness of the MSDA approach:

- If you have multiple stakeholders and multiple experts under what conditions can you still use DA, which is really a theory for how an individual decision maker ought to make decisions if he wants his preference to be coherent?
- The approach relies heavily on the distinction between the value and fact dimension. The question therefore becomes: how far should you take this analysis if you acknowledge that values and facts shape each other, as well as problem formulation, etc.?
- The approach is "silent" about process issues, even though "in many cases the process is at least as important as the methodology itself". He considers that the following process issues have not been resolved satisfactorily: when should stakeholders meet? What forms should the meetings take? How long should stakeholders and experts interact? Should experts be encouraged to develop consensus opinions, and how could this be achieved? How could the role and influence of the analyst be limited?

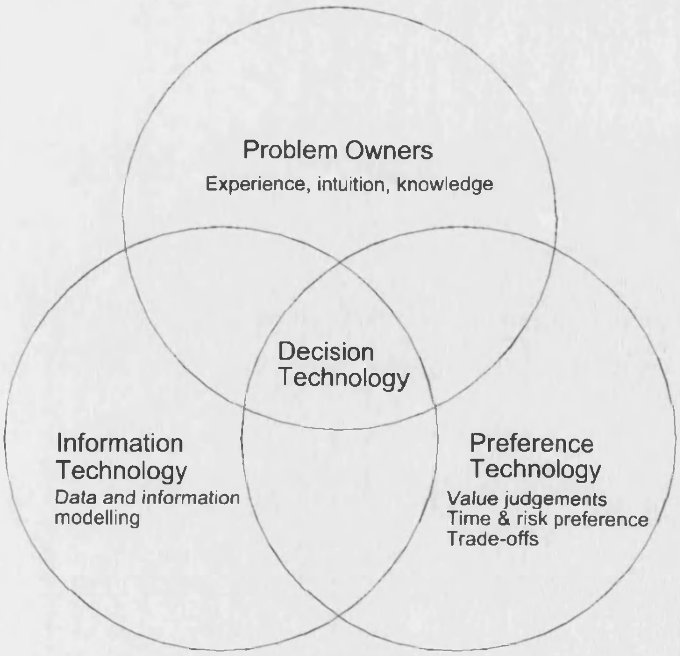
1.3.2 Decision Conferencing

Decision Conferencing is an alternative Decision Analysis approach. The most notable difference to MSDA is that much of the analysis is being conducted in a workshop setting where stakeholders, experts, decision makers interact with a trained the facilitator and a decision analyst. Most of the analysis is conducted on-the-spot, while with MSDA most of the analysis is done away from the client.

Decision Conferencing (DC) is best captured in Phillips (1984) and Phillips, (1988). His rationale for developing and using DC is based on Jaques' (1976; 1996) definition of human work: "exercising discretion within prescribed limits". Exercising discretion means "considering uncertainty, forming preferences, and taking decisions". In a complex environment, where the likelihood of events and preferences is unclear, decision theory can be used to ensure that preferences are coherent. Using Jaques' Stratified System Theory, he argues that the "prescribed limits" are set by the organisational context and with higher management levels the complexity becomes greater. In organisations it is always individual managers who are accountable for decisions, even if responsibility for implementation can be delegated to others, and much of managerial work takes place within a managerial team setting. His work is therefore directed towards helping groups of people exercise discretion, in the sense of forming preferences, making judgements, and taking decisions within complex environments such that their preferences are coherent.

DC is characterised by an interactive, consultative process between problem owners and specialists (analysts), where decision theory is used more as a framework than a mathematical technique. Data are handled quantitatively as well as in a 'soft', qualitative way. In his 1988 paper Phillips summarised DC as integrating three elements (see also Figure 1-4): (i) Decision Theory (ii) trained facilitators who are aware of the effects of group processes on the effectiveness of the work of individuals in groups, and (iii) Information Technology for the purpose of processing data efficiently and effectively and displaying results in interactive sessions.

Figure 1-4: Elements of decision technology



Source: Phillips (1986)

Phillips argues that the key advantages of this approach are that it leads to a shared understanding of a problem, encourages creative thinking, builds commitment in a group, generates action plans, captures all perspectives on a problem, and it reveals assumptions made by people in a useful way.

Decision Conferencing (DC) has not yet been applied to environment related problems in a form that is compatible with Phillips' rationale and methods. Examples of applications which differ significantly from Phillips would be Reagan-Cicerone *et al.*, (1991) who apply, characteristically for all Decision Conferences, a facilitated workshop approach with the use of information technology, but instead of using decision analysis to model participants perception of the problems, they used systems simulation models and other techniques; or Hamalainen and Leikola, (forthcoming) who worked with Finnish parliamentarians on their judgements about energy policies for Finland.

There have been a number of explanations offered for why divisions or differentiation exist within DA. Some argue that some approaches are simply wrong - or at least do not apply real DA. Others relate it more to marketing different brands of a similar product (Keeney, 1994). Keeney, for example, argues that there is competition between the different schools, and the academics around which the different models have developed, and that the strategy adopted is to concentrate on a particular field of application (military, technological choice, nuclear or electricity field, medicine, pharmaceuticals, etc.). Phillips, on the other hand, argues that the approaches differ in a number of respects:

> *"The schools differ in their emphasis on modelling uncertainty, modelling multiple criteria, modelling the environment or the individual's view of it, the role of information, the focus on value or utility, the degree to which model building is seen as an iterative activity with full involvement of the client, and the focus on individuals or groups" (Phillips, 1989:86).*

Later Phillips (unpublished) argues that there is also a deeper dichotomy, which he locates in the positivism-empiricism versus social constructivism (naturalism) debate. A positivist-empiricist worldview assumes "a single, existing reality that can be studied in a value-free inquiry by an independent observer who examines the effect of independent variables on dependent variables and arrives at time- and context-free generalisations. On the other hand, naturalism assumes that reality is multiple and constructed, to be studied holistically in value-bound inquiries by an investigator who is part of the reality and who examines the mutual simultaneous shaping of systems, leading to time- and context-bound working hypotheses" (Phillips, unpublished:2). The implication of these two metatheoretical assumptions for research in Decision Analysis is that a positivist "seeks to understand and predict behaviour, and our belief in reductionism leads us to the laboratory so we can exercise control in experimental settings over extraneous and unwanted influences. As social constructivists, we seek understanding both about what is and what could be, and we are more concerned with what could help people than with predicting their behaviour" (Phillips, unpublished:13).

1.4 Study questions

1) Are previous applications of Multiple Criteria Decision Analysis to fishery management satisfactory?

The fact that there have been so few applications of Decision Analysis, the technology derived from the application of Decision Theory (the normative theory of decision making under conditions of uncertainty) to fishery management, which is a field in which uncertainty and multiple objectives are much discussed and problematic issues merits investigation. Is it a case where fishery managers have missed good opportunities to employ a technology that is already sufficiently well developed for their needs?

The hypothesis that I put forward on the basis of an examination of the existing literature in relation to a detailed analysis of the suitability of MCDA in the case of the Danube Delta Biosphere Reserve, is that stakeholder collaboration and participation in decision making, particularly under conditions of sharply differing interpretations of evidence, are not handled well enough. Since these are issues that relate to the interaction between individuals (intra- and inter organisational) I refer to it as the institutional context.

Furthermore, Decision Conferencing has not yet been applied, even though it is a valid approach which, due to the successful application in other fields, should be relevant for cases such as the DDBR as well.

There is also some criticism of DA within the fishery management literature (especially Walters (1986), and Pearse and Walters (1992)) that needs to be addressed.

2) How does the institutional context influence the development of fisheries management strategies?

We need to examine the institutional context within which managers of the DDBRA are operating. Specifically, we first need to examine alternative views of the interaction between the social, economic, and ecological systems that together form the DDBR, and secondly examine the organisational characteristics of the DDBRA and the effects that these have on the work of staff of the DDBRA.

The New Institutional Economics literature argues against centralised command-and-control management because of the high transaction costs. Instead, we need quite a fundamental change in the management approach of the DDBRA towards co-management. The important point here is that the DDBRA need not (and possibly can't) determine all those parameters that it set out to establish. Instead, it must make much more fundamental changes in its management role within the DDBR.

3) Can the Decision Conferencing approach be used to assist the Danube Delta Biosphere Reserve Authority develop an adaptive fishery management strategy?

My analysis will show that theoretically Decision Conferencing is a promising approach for assisting the DDBRA develop an adaptive fishery management strategy. Until now, however, Decision Conferencing has not been applied in practice to natural resource management problems. In order to learn more about the benefits and shortcomings of the approach it is therefore necessary to apply Decision Conferencing in practice.

I will argue that Decision Conferencing is the preferred Decision Analysis approach when the task is one of transforming the shared problem understanding among a diversity of stakeholders, strengthening management capacity, and there is little time available. While DC courts the representation of a diversity of viewpoints in a Decision Conference, the existing approach can be supplemented by a more proactive pursuit of diversity. A possibility that merits further examination is the use of Cultural Theory.

1.5 Research Organization and Methodology

1.5.1 Timing and organization

I started my PhD research on the subject of "operationalizing sustainable development through the use of Bayesian statistics" in the fall of 1992.

The first half year was spent reviewing the literature and refining the research questions and agenda. Within this period two important developments took place: first, I learned about the existence of Decision Analysis and realized that many of the probability and preference assessment aspects necessary for my fieldwork had already been developed within the field of Decision Analysis. Though the applications of Decision Analysis were wide ranging, curiously it had not been applied within the sustainable development field. The second important development was that the review of the literature enabled me to choose a particularly interesting area of the 'sustainable development' field as the focus of my research: common pool resources.

Having decided on common pool resources I started to seek a suitable fieldwork project. I investigated two lines in particular: first, coral reef management and fishery management. In early 1993 I learned about the EBRD financed project in the Danube Delta. I used the background information on the project that I received from the EBRD project manager to develop several possible lines of investigation that would fit with my research interests and be of use for the project. The latter was important because (i) my limited research funding meant that the only way in which I could do a significant amount of fieldwork was if I received some subsistence payment; and (ii) the best way of testing and developing the use of Decision Analysis for renewable resource management was through the application to a real and live problem.

In the summer of 1993 I first met with Paul Goriup, who was the IUCN appointed resident advisor of the EBRD project, in England, and in late August 1993, almost exactly one year after starting my PhD, I first visited the Danube Delta. In the course of the month of my first visit I worked with the project manager to complete the economic survey (Fisher, 1993). I discussed with the resident advisor and the project manager my research agenda explaining the rationale of my research and that illustrated the potential usefulness of my research for a variety of different aspects of protected area management strategy development. My Terms of Reference (see Appedix 10.2) were written on the basis of those discussions.

My TOR show a number of different aspects: first, I was not a regular consultant member of the project team, but instead my status as "researcher" was formally acknowledged (and also reflected in the subsistence pay I received); second, the core of my work related to the intersection between economics and management, and more specifically the analysis of alternatives for situations where there is great uncertainty (objective 1 refered primarily to the fishery since that is the most important economic sector but it was stated vaguely so as to give me sufficient flexibility to focus on what I considered most suitable for my research; objective 2 acknowledged the fact that policy analysis needed to take into account the situation of many different stakeholders which had not been considered up that point; objective 3 refers to road construction projects which were discussed in 1993 but which were not taken any further). Objective 4, "compiling and assessing the extent and quality of existing information pertinent to management planning within the DDBR" formally required me to report on the data and information that I was going to analyse for the purpose of my PhD research. Objective 5, "assist the resident advisor and other members .... and to transfer expertise to appropriate staff of the DDBRA Planning, Policy and Investement Department", clarified my relationship to the project team and, most importantly for the action research that I was conducting, my relationship to the DDBRA. I discuss the organizational specifics of the DDBRA in detail in Chapter 5, but at this point it is important to note that the Department referred to was headed by the Executive Director.

In the first half of 1994 I contucted two more month long visits to the DDBR (one in February, other in April-May). During this time I collected and examined the primary data that I report in Chapters 1, 2 and 5. In addition to the research reports of the DDI which form the core of my analysis with respect to the adequacy of the methodologies used for fishery management I also conducted numerous interviews with DDI, DDBRA, and University of Bucharest researchers (faculties of Biology, Ecology, and Geography), fishing companies, as well as extended visits to the villages in the Delta and surrounding area. The analysis of the data took place mostly in London. During this period I analysed the suitability of the different decision analysis approaches for the problems faced in the DDBR and developed plans to apply both MSDA as well as Decision Conferencing.

The longest visit to the DDBR took place in the summer / fall of 1994. I spent most of the period between August and October in the DDBR, interrupted only by one short visit to London where I finilized the arrangements for Peter Hall's 4 day visit in October (the decision conference facilitator that I arranged through the London School of Economics).

After the Decision Conference of October 1994 that I report in this thesis I had two more occasions to visit the DDBR in first half 2000. These visits were as part of a World Bank project which sought to help the DDBRA incorporate economics into their decision making process on ecological restoration and to conduct economic feasability analyses on the GEF projects executed over the past 3 years – one of these projects (the Pilot fishing association with their own 'cherhana'[4]) is the direct result of the decision conference reported in this thesis. The delays in the completion of my dissertation that came about due to financial and other personal events were unforseen, but they enabled me to examine the far reaching effect that my work has had on fishery management and the wider aspects of protected area management in the DDBR.

[4] Fish collection point.

1.5.2 Methodology and Scope

The choice of the methodological approach in general and the specifc research components in particular were informed by the research questions – as presented in Section 1.4 above.

I limit my examination of the Decision Analysis literature to the Multiple Criteria Decision Analysis field that uses Expected Utility theory and which has reported applications or suggestions for use in the environmental management field. This means that I am not dealing with applications of the Analytic Hierachy Process approach (see for example Saaty (1994) or di Nardo, Levy, and Golden (1989)), or with approach to Decision Analysis developed by the Strategic Decision Group (see for example Howard and Matheson (1989)).

Within this thesis I will be using the terms Multiple Criteria Decision Analysis (MCDA) and Decision Analysis (DA) interchangeably, mostly because otherwise MCDA may be confused with Multiple Stakeholder Decision Analysis (MSDA).

In the following I discuss the research steps associated with each of the hypotheses I am investigating.

1) Are previous applications of Multiple Criteria Decision Analysis to fishery management satisfactory?

To answer this question my method involves the following steps:

(i) Describe and analyse the problems and issues that need to be addressed in fishery mangement. I examine the situation of the fishery in the DDBR using the original research and management reports by the DDI as my primary literature. I also refer to the older literature on the Danube Delta, and wider management literature. One needs both the methods and the immediate context of fishery management. (Chapter 2)

(ii) Determine the extent to which the existing fishery management approach and the methods employed are able to deal with the issues so as to be work out the criteria by which one should judge wether the existing MCDA approaches are satisfactory (Chapter 2)

(iii) Present the previous applications of MCDA which are to be examined. In Chapter 3 I review all published MCDA approaches and analyse how one could use them in order to overcome these three problem types.

(iv) Describe how these approaches could be used in the DDBR

(v) Predict the likely outcomes of applying the MCDA approaches and methods.

(vi) Compare the likely effects of applying MCDA against the criteria developed. Judge how satisfactory the outcomes are.

On that basis I then decide whether or not to apply that approach or to develop ro try to apply new or modified approach.

I conclude that three types of problems remain unsatisfactorily resolved: (i) those relating to conflicting objectives; (ii) those relating to uncertainty; and (iii) the institutional context. The crucial stumbling block is how they are dealing with inter- and intra-organizational issues (i.e. the institutional context). Even though all the existing decision analysis literature that deals with environmental management problems draws attention to the importance of the interaction between stakeholders (even if that is limited to expert risk assessment), none of them incorporate coherent theories for institutional aspects.

2) How does the institutional context influence the development of fisheries management strategies?

Two core issues emerge with respect to the institutional context:

(i) the wider institutional context within which fishery management takes place. Fisheries are common pool resources and the DDBR exhibited many of the features associated with the tragedy of the commons. Trying to determine an MSY and then inforcing it through central regulation was the default position. Addressing this problem was very relevant because if viewed in that light, the main question posed is if MSDA/DA would be able to deal with the uncertainty and the differences in interpretation and the varying objectives, not only in a technical way supporting the bioeconomic fisheries model but also wether it would be able to handle the process.

3 possibilities of applying *existing* MCDA approaches. I do not follow through with that practical case study however, because through close examination of the institutional context and the way it relates to plausible alternative views of the ecosystem (Chapter 4 discusses NIE, and adaptive management literature, and Cultural Theory) I conclude that determining MSY for a fishery such as the DDBR is unfeasible (because there is good reason to believe that there are multiple equilibria) and inappropriate (because variation in fish stock is natural and desirable). But

even if one were to argue that there is room for improvement in the estimates, then the problem of managing the resource - from an organizational & institutional point of view still remains. A review of the common pool resource management literature shows that some form of co-management will be necessary. That is a great departure from the way the fishery was managed at the time.

Since fishing is a very important resource world-wide and management of it has frequently resulted in failure, much has been written about possible ways to improve fishery management. Within the context of this thesis, which is dealing with the situation in the Danube Delta, I have chosen two main strands of the literature that provide alternative and complementary theories to those used in the Danube Delta. In relation to the natural science aspects of renewable resource management I chose to review Adaptive Management and Environmental Assessment (AMEA), and in relation to the social science aspects New Institutional Economics (NIE), particularly the literature relating to co-management of common pool resources.

(ii) the specific organisational characteristics within which fishery management policy is developed also needs to be considered.

Organisational theory is a very large field. I chose to review the implications of Stratified System Theory (SST) (Jaques, 1996) because it is important in the Decision Conferencing literature and presents the strongest case for a differentiation of managerial work, and by implication support requirements, according to managerial hierarchy levels. However, I go further and also deal with Mintzberg's (1989) analysis of organisations because Mintzberg's work presents a very different analysis of organisations compared to that of Stratified Systems Theory and he is particularly concerned with the effects that different organisational configurations have on the strategy development and planning. Cultural Theory and AMEA can also be seen as variants on institutional context, so my work really tries to see some of the implications of the differences brought out in the literature for DC.

3) Can the Decision Conferencing approach be used to assist the Danube Delta Biosphere Reserve Authority develop an adaptive fishery management strategy?

Note that unlike many other decision conferences or decision analyses, the decision conference that I conducted did result in a decision and a number of action steps. This is very useful because I will show that the development of adaptive management strategies does not only require coherent decisions (the principle criterion used in all decision analysis) but also transformation of approach and 'enabling others to work together'. Especially for the 2nd main objective of my intervention, medium to long term evidence is useful for determining the extent to which a transformation has been achieved.

To answer this question, my method involved the following steps:

(i) Analyse the way in which the Decision Conferencing approach seeks to incorporate and address the institutional setting within which problem solving takes place. (Chapter 6)

(ii) Preparation of the intervention - in addition to the wider context that I discuss earlier, needed to take into account the more immediate circumstances (i.e. how the EBRDTechnal Assistance Project had advanced matters).

Choosing the DA approach

Building support for the intervention - hold small conference on a more limited problem problem (Sinoie Lagoon)

Ensure that the Executive Director also attended a personalized training course the LSE with Prof. L.Phillips on Decision Analysis as part of his UK study tour. EBRD project financed his course.

Secured Peter Hall as facilitator for the Decision Conference in the DDBR because I had little experience with actual facilitation. The LSE financed his participation.

Gain agreement with DDBRA and Technical Assistance project staff to conduct decision conference.

(iii) Develop specific intervention objectives that can serve as criteria for judging wether or not the intervention leads to an adaptive fishery management strategy. In the conclusion I use these objectives to frame the general recommendations about the use of MCDA for the development of adaptive fishery management strategies.

(iii) organized 3 preparatory workshops that lead up to the decision conference. Their purpose was to create the motivation and momentum for the Decision Conference. It also led to the specific focus for DC. Data for this analysis are the posters from the sessions supplemented by some transcripts.

(iv) 2-day decision conference and presentation of results. The DC is reported in greater detail than any other existing account of a DC. Particular attention is paid to examing the extent to which the DC facilitated the achievement the coherence, transformation and collaboration objectives necessary for adaptive management strategy development. The process is reported both in aggregate as as well as with the individual participants during the DC. The primary data used for this analysis are the detailed model transcripts from the sessions (Appendix 10.4 and 10.5).

(v) Follow-up analysis of all the points agreed to in the Decision Conference over a period of 4 years, as well as examination of the wider impact on fishery management and ecosystem management in DDBR. The primary data used for this analysis are the government decisions passed, concrete changes in management approach as brought into evidence about how and what licences are issued, what is monitored, what data is reported, how and to whom, commitments and projects resulting directly from the Decision Conference being implemented.

I am examining the interface between MSDA and DC within the context of fishery management and analyse how they can be used (not only theoretically, but practically). My focus for analysis is on the use of these approaches as tools for intervention and I am not examining questions relating to the systemic integration of Decision Analysis as a decision making technique by organisations, nor am I examining how Decision Analysis could be integrated into fishery management science.

Chapter 2 Management Problems of the DDBR Fishery Sector

This Chapter sets out the context of my fieldwork, outlines the methodologies used in fisheries management, and argues that the existing approaches to fishery management dealt unsatisfactorily with three problems: integrating uncertainty and multiple objectives into analysis, and addressing the effects of the institutional context on management.

2.1 The Danube Delta Biosphere Reserve Setting

2.1.1 The Ecological and Social Importance of the Danube Delta

The Danube is Europe's second largest river, draining an area of 805,300 sq. km through a system of streams including 120 important tributaries. Excluding the delta itself, it is 2,860 km long (Gastescu, 1993:57). "Today, 76 million people from ten nations live in the basin of the river, whose main waterway passes through ten cities of over 100,000 inhabitants" (Cousteau, 1993:1). According to IUCN (The World Conservation Union) (IUCN, 1993:5) the role of the Danube river and delta are "inestimably" important in the preservation of world biodiversity as it is one of only two active deltas in Europe (the other being the Volga in Russia).

Because of the Delta's geographic position (it is half-way between the North Pole and the Equator) and because it is a wetland, the Delta has a great influence on the migratory pathways of birds (Baboianu and Goriup, 1995:5). The total bird population of the Delta exceeds two million. Globally threatened bird species have their habitat there, including the majority of pygmy cormorants, red-breasted geese, four species of herons, 5% of the world breeding population of Dalmatian pelicans, white tailed eagles, the slender-billed curlews and lesser white-fronted goose occur on migration.

Seventy-five fish species occur in the Danube Delta. Of these, 44 are freshwater species, while the rest are migratory species that travel up from the Black Sea to the Danube Delta and beyond to breed. Important among the latter group are sturgeon, semi-migratory carp, zander, and bream. Important freshwater species include the pike, perch, and roach.

The richness of the natural resources of the Danube Delta, and the remoteness of the area, have attracted people seeking to make a living and fleeing persecution since ancient times. Use of the natural resource over time has led to the development of traditional economic activities and characteristic cultural and social habits.

Today, Cousteau (1993:1) points out, the many users of the river put increasing pressure on this fragile resource through their many competing uses:

> *"Energy production requires dam construction; navigation relies on a steady, concentrated flow through a single channel; the alluvial ecosystem depends on floods and on irregular flows; the diversity of fish species is directly linked to flood levels and to the surface of the alluvial ecosystem; farming necessitates irrigation; industrial production and thermal and nuclear power stations draw on the river for cooling; and, most important, the population needs a healthy, pollution-free supply of drinking water. The conflicting interests are all the more complex to solve because they are not only national but international."*

One of the most important indirect benefits derived from the Danube Delta is its ability to cleanse the waters that flow through it. When deltaic ecosystems function properly, they act like immense filters, trapping many of the agricultural and industrial pollutants borne in the waters of the rivers, before they are discharged into the sea.

The Danube Delta was formed in a gulf when the sea was 50-60 meters above current levels (Gastescu, 1993:58) and the 'initial offshore bar' has been estimated (through carbon 14 dating) to have formed about 12,800 years ago (Baboianu and Goriup, 1995). Over the course of the following 3,300 years successive 'offshore bars' have blocked the mouth of the Danube and thereby gave rise to the delta's formation. Since then, the three branches of the Danube (Sf. Gheorghe, Sulina, and Chilia) successively formed a series of secondary deltas, starting in the south.

The fundamental physical processes by which the Delta is formed and transformed are the water flow and the sediments that are carried and deposited or eroded with them. The sediment load has declined from an average of 67.5 million tonnes per year (1921-1960) to 52.7 million tonnes over the extended period to 1983 as a result of the construction of dams and changes in the river flow (Bondar, 1991) quoted in Gastescu (1993:57). Nevertheless, the delta is still expanding - possibly even at a faster rate because the successive straightening of the river course meant that more sedimentation is carried to the mouth of the river rather than being deposited inside the delta. Evidence of this expansion is that the Chilia sub-delta has advanced by 40-80 meters per year further out into the sea over the last century, and Sahalin island (at the mouth of the Sf. Gheorghe branch) is also growing. The canal which has been dug at the entrance of the Sulina branch from 1894 onwards in order to allow access to deep-sea ships now extends more than 10 km out into the sea and 200 metres are added every year (Gastescu, 1993:61-62).

The deltaic part of the DDBR is a highly dynamic area which derives its shape through the erosion and sedimentation arising from inundations.

2.1.2 The Razim-Sinoie Lagoon Complex

The Razim-Sinoie lagoon complex at the southern part of the DDBR is not strictly a part of the Danube Delta. It extends over a total area of 1,015 km^2, of which 863 km^2 are flood valleys (limans) and lakes. The lakes used to be marine bays (collectively known as Gulf of Halmyris) but over the past 1,500 years (through the sediments that are carried eastwards from the mouths of the Danube and the advance of the delta itself over the past 3,000 years) they became successively isolated from the sea as sand bars and dunes built up. Lakes Agighiol and Babadag are the principal limans (flooded valleys), while Razim, Golgovita, Zmeica, and Sinoie are lagoons (Baboianu and Goriup, 1995: 9).

In this century this lagoon complex has experienced a number of significant human modifications. In the early 1970s the complex was divided into two units: (i) Razim, Babadag, Golgovita and Zmeica lakes were cut off completely from the sea by a sluice built at Gura Portitei and thus transformed from brackish water to a freshwater reservoir into which Danube water from the Sf. Gheorghe branch was diverted through a channel that was cut at the beginning of the century. Thus this part became an irrigation reservoir out of which water was pumped up the surrounding hillsides for irrigation of crops. (ii) The second unit is made up of the Sinoie and Nuntashi lakes. These continue to have a link with the Black Sea through a sluice at Periboina and thus maintain their brackish character. In the period of 1960-1978 the western shores of the Razim and Golgovita lakes were empoldered for fish farming (Baboianu and Goriup, 1995:9).

There has been much intervention by people in the ecosystem. The project preparation team for a Global Environmental Facility project for the Danube Delta (Huntington Technical Services Ltd and Partners, 1993:14) distinguished between six episodes in the development of the Danube Delta, three before World War Two, and three after the War:

1. Human settlement from well before Roman times and the establishment of traditional land use practices.
2. The creation of the European River Danube Commission in 1856 after the Crimean War, and subsequent engineering works to improve navigation.
3. The creation of Protected Areas starting in the 1930's.
4. Proposals to develop the Delta, and the construction of pilot polders in the 1930s and 1940s.

5. The creation of the Danube Delta Company (Centrala Delta Dunarii) in 1979, the adoption of an economic development plan and widespread polder development.

6. The 1989 Revolution in Romania, the creation of the DDBR, and associated DDBRA in 1990 and the end of polder development.

Table 2-1: Chronology of development in the Danube Delta and Upstream, late 19th Century - 1990

Date	Development
	(a) in the Danube Delta
Late 19th Century	Mahmudia and Murighiol pilot polders
1889-1902	Canalisation of Sulina Branch
1903	Canalisation of Dunavat channel between Sulina Branch and Lake Razim
1912	Canalisation of Dranov channel between Sulina Branch and Lake Razim
1938-40	Tatarul Polder (3500 ha)
1944	Canalisation of Litkov channel linking the Rosu Lake complex to Sf. Gheorghe Branch
1948	Canalisation of Peritensca channel between Lake Razim and Black Sea
1950	Maliuc Island embanked for reed
Early 1950s	First fish polders constructed: Matita I (1955), Rusca (1957)
1950-1965	Major canal dredging period Danube Delta (reed production)
1955-1965	Construction of agricultural polders, including Tulcea Nufarul (ca 2500 ha), Victoria-Bestepe-Mahmudia (ca 1000 ha), Popina (3500 ha), and Carasuhat (3300 ha)
1964-65	Construction of Pardina polder (27,000 ha)
1965 - present	Six meander cuts on Sf. Gheorghe Branch, dredging of Crisan-Caraorman canal (for sand transport), and the Tudor Vladimirescu-Pardina channel (linking Chilia and Tulcea Branches of Danube)
1975	Lake Razim cut off from the Black Sea
1979-1989	Construction of agricultural polders: Murighiol-Dunavat (2680 ha), Babina (2000 ha), Cernovca (1500 ha), and Sireasa (7500 ha)
	(b) Upstream of Danube Delta
Early 1960s	Construction of the flood banks along Danube left bank
1969-1989	Construction of irrigation intakes along the Danube
1969-1989	Empoldering of Great Braila Island
1969-1989	Construction of dams on the tributaries to Danube
1978	Construction of Iron Gates Dam on Danube
1990	Completion of Danube-Black Sea Canal

Source: Huntington Technical Services Ltd and Partners (1993:33)

2.1.3 The Population of the Danube Delta

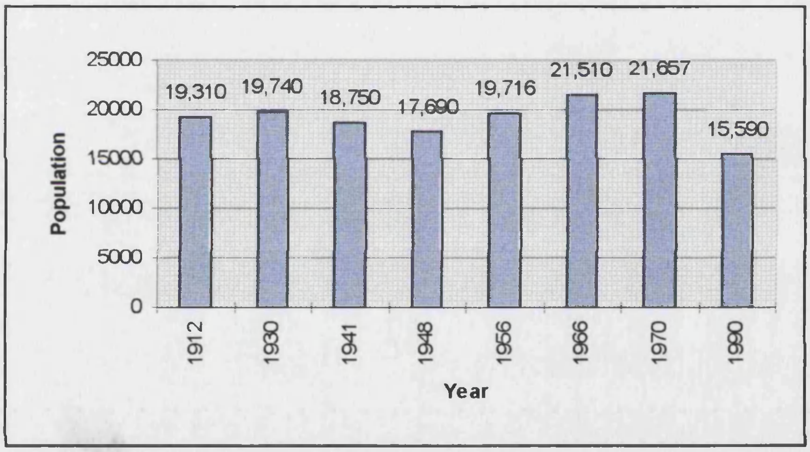
Archaeological, cartographic and documentary evidence show that the eastern coast of Romania, including the Delta, has been settled for thousands of years. The Control over the land changed hands several times in history. For example between 1442 and 1877, the Danube Delta was under Turkish rule. At the same time, the construction works on the Sulina branch for navigational purposes initiated by the European Commission of the Danube in 1856 brought workers and technicians from Moldavia, Wallachia, and abroad into the region and further settlements arose

(Gastescu, 1993:57). One of the effects of these different occupations of Romania and in particular the area around the Danube Delta has experienced is that a unique tapestry of different cultures emerged. More than a dozen of different ethnicities inhabit, live and work together.

5,700 people live in Sulina, and remaining 9,300 residents live in 28 small villages. There are also an unknown number of people living temporarily in the Delta (Fischer, 1993:3).

The distribution of people living within the Delta is shown in Figure 2-1. In 1956, 20,000 people lived in the Danube Delta. Since then, this number has decreased but over the past years it remained at approximately 15,000. There are two factors which presently cause concern: (i) the poor living conditions of the population, and (ii) the changing age structure of the population. In 1977 only 29% were older than 50 years but this number has increased to 56% in 1992.

Figure 2-1: Population Distribution around DDBR

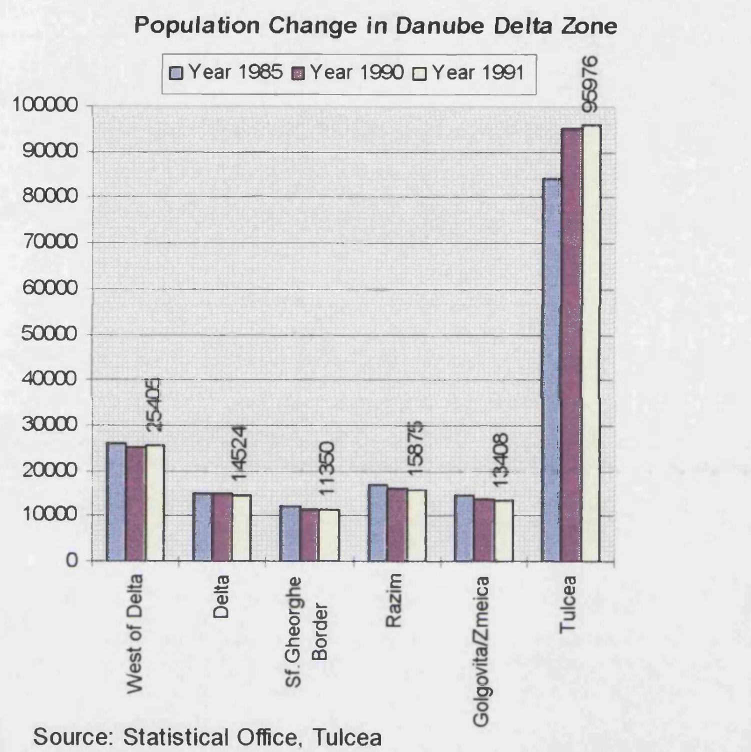


Source: Gastescu (1993:61)

The majority (61%) of the population is of Romanian origin, 13% are Russian Lipovans, and 23% are Ukrainian (Baboianu and Goriup, 1995:21) The 28 settlements in the Delta are divided into 7 communes and one town (Sulina). Social services for these settlements are provided in the largest villages of the respective municipalities. Not all the villages have schools and only Tulcea and Sulina have secondary schools. Four of the villages do not have electricity but all have phone connections. Five of the larger villages have partial drinking water supply systems but all the other ones have none (Baboianu and Goriup, 1995:21).

Two towns are close to the Delta: Tulcea, which is the capital of the Judet and the main entry point to the Delta with 96,000 inhabitants, and Constanta, which is an important shipping port and Black Sea resort with 400,000 inhabitants. A number of villages surrounding Delta are at least partially dependent on the DDBR for resources. Along the Romanian border of the DDBR, there are 37 villages and 3 towns (Tulcea, Isaccea, and Babadag) with an overall population of 170,000 (of which 103,000 are in the urban setting - see also Figure 2-2) (Baboianu and Goriup, 1995:23).

Figure 2-2: Population change in and around Danube Delta 1985-1991



Source: Statistical Office, Tulcea

2.1.4 A profile of economic activity in the Danube Delta

Three aspects of the economic system are important to note within the context of this thesis. First, that fishing is the most important economic activity but that people were actually engaged in a wide variety of economic activities. Secondly, that there were many institutional changes taking place and that meant that the status quo was changing and as a result it was a time of great political and economic uncertainty. Thirdly, institutions (including the DDBRA) were seeking to determine new relationships but the long history of pervasive state involvement and only distant memories of decentralised activities, as well as a weak civil society, meant that transformations were slow and difficult.

Fishing is the single most important activity in the Danube Delta Biosphere Reserve, followed by livestock rearing and agriculture (see Table 2-2). The exact number of fishermen currently active in the DDBR is not known. About 2,400 persons are employed in the nine state companies whose main activity is fishing (while a slightly lower number (2,000) are employed in companies engaged in agriculture and livestock production (see Table 2-3 and Table 2-4). Family income is often supplemented by agriculture, cattle breeding, and vegetable growing in gardens (Fischer, 1993).

Fishing has traditionally been the most important sources of income and subsistence. (Giurescu, 1964) provides much documentary evidence that trade in fresh and salted fish was at the centre of economic activity throughout the centuries.

Today too, fishing (together with reedharvesting) represent "the most extensive and important forms of natural resource use in the DDBR" (Baboianu and Goriup, 1995:19, see also Staras, 1994:1) Together these two activities are being conducted on over 3,306 km2 (57%) of the reserve where there is a natural flooding regime. Fish farming is taking place in endyked areas called 'polders' which occupy about 406 km^2 (7%). Both of these areas are state-owned and exploited by state-owned companies. However, while the open flooding areas are controlled by the DDBRA, the polders are controlled by the Tulcea County Council.

Commercial fishing is undertaken by nine state-owned companies. Most of these companies are engaged in both fish farming and fishing of wild fish. In 1992 the total reported fish catch was 5,445 tonnes. This is approximately the same catch level as the one reported in the early 1960's (5,000 tonnes). The peak catch was recorded in the 1966-68 period (14,000 tonnes). After that fish catch decreased to 10,000 tonnes and remained at that level until 1979. Since then catch has been decreasing.

There are a total of 51,000 ha empoldered areas designated for fish farming, but approximately 14,000 ha have been abandoned by the companies (Fischer, 1993:7). In 1988, approximately 9,000 tonnes of fish were produced but this had fallen to 3,710 tonnes in 1992. With the exception of two fish farming companies (Jurilovca and Ecodelta) yield per hectar is very low (under 100 kg per hectar) and very varied (ranging between 28 and 151 kg per hectar). The primary reason given for these low production levels were insufficient inputs, inappropriateness of the polders (Fischer, 1993:7).

Within the DDBR, agriculture was traditionally restricted to parts of the Caraorman and Letea marine levees and along the river banks (Gastescu, 1993:61). Today, however, agricultural land covers about 696 km^2 (12%) of the DDBR. Most of the arable land (about 58%) was derived mainly from empoldered and drained marshlands, while the remaining agricultural land is natural grassland (42%) that is situated on the higher sandy oils and dry summer pastures (Baboianu and Goriup, 1995).

63% of the agricultural land is state owned under the direct control of the Tulcea Judet and largely used by six state owned companies and some small companies and bodies operated by the County itself. A further 29% is also state owned but under the administration of the local councils represented by majors and only the remaining 8% of the agricultural land is privately owned by the inhabitants of the Danube Delta. About 36% of the total agricultural land is used for animal rearing, a traditional activity in Danube Delta (Baboianu and Goriup, 1995).

As indicated above, the population in the Delta has decreased and especially the young people left the villages because of poor living conditions and few possibilities of earning a living. About 41% of the population in the DDBR is in the labour force. Most of the 8.7% who are registered as unemployed live in larger settlements of Sf. Gheorghe, Chilia Veche, and Sulina.

Until 1990 the state companies listed in Table 2-4 formed part of a single state holding company called *Centrala Delta Dunarii.* Through Law 15/1990 that company was dissolved. The newly independent companies report to the Tulcea County Council through the Bureau for Delta Matters. Their future is uncertain as the Government has plans of privatising them.

Table 2-2: Main non-industrial goods and services produced in the DDBR, 1993/4

Goods and Services	Volume+	Value*
Freshwater fisheries	6,400 t	5,245,400
Coastal fisheries	1,028 t	1,007,500
Sturgeon fisheries (excl. caviar)	6 t	2,650,000
Sturgeon farming	Fillets, fingerlings, caviar	75,000
Reed export	2,700 t	378,000
Cereals		
Maize	3750 t	300,000
Wheat	3214 t	392,000
Barley	1434 t	80,300
Oats	654 t	35,500
Other cash crops		
Flax	55 t	5,500
Oilseeds	2776 t	449,700
Livestock		3,000,000
Beef	890 t	
Mutton	229 t	
Pork	314 t	
Chicken	35,000 birds	
Other agricultural products		
Milk	5,000,000 l	858,000
Eggs	6,000,000	530,000
Honey	6,000 kg	50,000
Wool	100 t	195,000
Timber	28,000 m3	84,000
Tourism	42,500 person days	850,000
+figures based on 1993/1994 data (probably understated for most products) *estimate in US$ at $1 = 2040 Lei		

Source: Baboianu and Goriup (1995:18)

Table 2-3: Employment Profile in DDBR, 1993

Fishing and fish farming	32.5%
Agriculture	31%
Industry, construction, transport	22.5%
Commerce and services	4.4%
Education	3.8%
Tourism	2.1%
Health	1.5%
Local administration	1.2%

Source: Baboianu and Goriup (1995:22)

Table 2-4: The state-owned companies operating in DDBR, 1992

Company Name	Turnover 1992 ('000,000 Lei)	Employees	Area of activity and production
Piscicola Tulcea	180.0	333	Wildfishing, fishfarming
Piscicola Mila 23	55.7	120	Wildfishing, fishfarming
Piscicola Chilia Veche	79.0	130	Wildfishing, fishfarming
Piscicola Sulina	87.6	300	Wildfishing, fishfarming
Piscicola Murighiol	100.8	125	Wildfishing
Fish Farms Murighiol	150.8	168	Fishfarming
Piscicola Jurilovca	553.0	313	Wildfishing, fishfarming, reed harvesting
Piscicola Sf. Gheorghe	143.4	178	Wildfishing
Piscicola Isaccea	49.0	71	Wildfishing, fishfarming
Piscicola Macin	110.4	135	Wildfishing, fishfarming
Ecodelta	1,079.2	544	Fishfarming, reed (19,000 t), canning, procurement, tree cutting
Subtotal	**2,588.5**	**2417**	
Agrodelta Sireasa	115.0	83	Cattle, land cultivation 2564 ha
Agrodelta Pardina	278.5	332	Cattle, cultivation 6,081 ha, dairy farming
Agrodelta Tatanir	170.0	116	Cattle, cultivation 5,484 ha
Agrodelta Chilia Veche	229.1	300	Cattle, cultivation 6,235 ha, dairy farming, milk processing
Agrodelta Sarinasuf	275.0	237	Cattle, land cultivation 2,935 ha
Subtotal	**1,067.6**	**1068**	
SIAJ Tulcea	488.3	585	Ship building and repair
Deltacons Tulcea	542.3	475	Construction
SCUT Tulcea	363.0	450	construction and dredging
Transnav Tulcea	288.7	329	transport
Silvodelta	66.7	146	forestry
Delta System Tulcea	20.0	39	"Water Union"
Sub-Total	**1,769**	**2,024**	
Total	5,425.1	5,509.0	

Source: based on Fischer (1993:4)

2.2 The EBRD Technical Co-operation Project

The beginnings of the EBRD Technical Co-operation Project can be traced back to the Planning Seminar that was held by the International Steering Committee for Conservation of the Danube Delta together with the DDBRA in September of 1991 at Uzlina, in the Danube Delta. At that meeting the overall management objectives for the DDBR were agreed (as described in Chapter 1). After negotiations with the Romanian Government the following mandate for the project was agreed to (DDBRA and Douse, 1993:2):

1. *undertake a review of current legislation and establishing an effective and comprehensive legal framework;*
2. *strengthen the DDBRA, particularly developing planning capacity and establishing a planning process (providing training where appropriate);*
3. *support the development of a work plan and a management plan;*

4. *assist the DDBRA to develop more effective co-ordination of the activities of international organisations in the Delta (e.g. further inputs from the Global Environmental Facility); and*
5. *prepare proposals for investment projects designed to promote sustainable development by the local population.*

The following reasons for the conservation and careful management of the Danube Delta were put forward (EBRD, Euroconsult, and IUCN, 1993:iii):

1. *it is the largest and least damaged example of a delta in Europe, and as such is a unique landscape and model for scientific research and environmental management*
2. *it provides a high degree of water regulation and cleansing function that, if lost, could have an irreversible deleterious effect on the Black Sea*
3. *its natural resources have in the past, and could in the future, provide a basis for sustainable economic development, as well as provide a source of human enjoyment and cultural enrichment.*

The EBRD project started in May of 1993 and lasted until February of 1995. The work was organised such that a core team of foreign experts (a resident advisor, and economist/planning expert, a training expert, and a financial/administrative expert who was to work with a local counterpart) were scheduled to be intermittently in the Danube Delta throughout the project and that in the second half of the project additional experts were brought in on a shorter term basis.

In the first half of the project, work concentrated on the administrative structure of the DDBRA (its human resource capacity was evaluated and recommendations for restructuring were made, the filling of vacant positions were prioritised, the legal framework under which the DDBRA was working was analysed and recommendations were made for amendments). At the same time, basic background research was conducted. The economist, for example, produced a survey of the economic activities conducted in the Reserve (Fischer, 1993). The fieldwork for this thesis began at the end of this first phase. As can be seen from my Terms of Reference as the Economics Researcher (see Section 10.2) my area of work was concerned with socio-economic issues related to management planning.

On the basis of the recommendations of the human resource review a number of training and exchange visits to other protected areas were initiated. Staff of the DDBRA travelled to Switzerland and the UK to visit with IUCN, the Broads Authority, and others. At my recommendation, the Executive Director of the DDBRA also had a three day training course in Decision Analysis with Dr L.D. Phillips at the London School of Economics.

The second half of the project was organised around a series of workshops. Local researchers and experts prepared sectoral background papers in the area of their speciality. Towards the end of their work, a series of short-term consultants came and assisted in the review and analysis of that work. The outputs were then submitted for discussion in a series of management workshops for each of the different parts of the DDBRA.

The specific questions to be addressed by these workshops were outlined in the Inception Report as follows (EBRD, Euroconsult, and IUCN, 1993):

1. *What are the minimum and optimal levels for the various physical, chemical and biological processes in order to maintain ecological balance?*
2. *What are the impacts of human activities upon the environment?*
3. *How does the Delta ecosystem react to changes in the environment?*

The management process that this workshop series was to initiate is illustrated in Figure 2-3: Once an adequate understanding of the site's present conservation status was gained and measured against international standards, objectives were to be set, and management prescriptions (including adequate monitoring systems, pilot studies, field trials and sustainable use of natural resources) were to be carried out using a rigorous scientific approach. Fortunately, there was already a considerable body of information available to permit rapid identification of urgent actions to prevent further degradation of the delta ecosystem. Finally, implementation of the plan itself was to be continuously controlled and evaluated. This feedback was to be incorporated in the planning process and any necessary modifications to the plan made on a regular basis. "Clearly" the Inception Report (EBRD, Euroconsult, and IUCN, 1993:44) noted, "this mechanism can only work properly under the auspices of a single authority, namely the DDBRA."

2.3.1 Historical development of fishery management in DDBR

According to the account of Staras (1994:1-4), between the 15th and the 17th Century the fishery of the Danube Delta was exploited through taxes and agreements between landowners and fishermen. Between 1879 and 1894 the fishery was then regulated mainly through leasing of fishing zones to fishermen, but still without any form of centralised co-ordination.

After the first fishery law was passed in 1895, the state became involved in organising the fishery for "the purpose of generating revenue and incomes for fishermen on a sustainable basis" (Antipa, 1911). For the following 50 years Grigore Antipa[5], a former Director of the Natural History Museum in Bucharest, became the principal regulator and scientific advisor on the Danube for the Romanian Government. Antipa's proposals for the creation of habitats most suitable for valuable fish and the re-organisation of the fishery were far reaching. His studies of hydrology, biology, and commercial exploitation of the Danube Delta were quite detailed and are still considered by many (particularly in the Danube Delta) to be of great relevance to today's problems.

The state only gradually took control of the different fishing areas along the lower Danube. However, by 1928 all of the important fishing areas were under state control and the state collected taxes on the fish landed, and executed maintenance and 'improvement' work throughout the delta (see also Antipa, 1914).

The era of Antipa ended in 1947, when the first Socialist government took power. Already during Antipa's time the first fishermen collectives were formed (according to Staras (1994) in Tulcea Judet the first was formed in 1914). By 1947, 80% of fishermen were organised in co-operatives and in 1953 the first state companies began to replace these co-operatives. The zones that these fishing companies would fish on had to be obtained through auctions. Unfortunately, there is very little information on the circumstances and the events that surrounded these take-overs, or on the effects these changes in regime have had.

From 1961 onwards some of the state companies also started to become active in fish farming (Staras, 1994). In 1974 a nation-wide Fishery Law that regulates the ways in which Romania's fish resource is exploited was passed and has remained in effect into the 1990s.[6] During the 1970s these individual fishing and fish farming

[5] Antipa was not in charge of Government Affairs throughout this period (but instead intermittently).

[6] During the time of this project the fishery law was being revised, but changes had not been agreed to yet and it was not promulgated.

companies were integrated into one holding company: the Centrala Delta Dunarii. During the 1980s this holding company came to control all of the commercial exploitation of natural resources in the Danube Delta.

There is not much documentation beyond the catch and harvest statistics available on natural resource management in the Danube Delta during the communist period. The scientific research on the Danube Delta that was started by Grigore Antipa has been carried on by a number of academic and industrial research institutes. In the 1970s the Danube Delta Research and Design Institute (DDI) was formed and once the Centrala Delta Dunarii was created, it's main task became the design of canals, polders and irrigation schemes and the testing or development of various plant, animal species, or farming methods for the latter. Research on natural resources focused on maximising quantitative outputs, with little regard for social, economic, or conservation values.

2.3.2 The legal mandate of the DDBRA

After the Revolution in Romania (December 1989), the *Centrala Delta Dunarii* holding company was split into 21 independent state companies. Of these companies 11 were engaged in fishing in open waters and fish farming (see Table 2-4 on page 54).

At the same time, in 1990, the Danube Delta was declared a Biosphere Reserve through a Government Decision (after the appropriate applications were made to UNESCO). The Ministry for Water, Forests, and Environmental Protection (MWFEP) set up the DDBRA. However, responsibility for management of natural resources in the DDBR remained unclear.

Finally, in 1993, when the law that governs the DDBR (Law 82/1993) was promulgated, an important part of the confusion was resolved. DDBRA was given the following power and responsibility[7]:

> *"to develop and apply a special management regime for the conservation and protection of the biological diversity of the natural ecosystems of the reserve, for the development of human settlements and the organisation of economic activities in accordance with the carrying capacity of these ecosystems" (Article 5, Annex 2).*

For the fishery this would include the following specific elements:

- *"identification and protection of zones populated by endangered wild species of flora and fauna and of the zones preferred by migratory species; (Art. 6b)*

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[7] The following is my own translation of the law from Romanian.

- *preventing the of capturing, imprisoning, and killing of the wild fauna in periods of prohibition; (Art. 6b)*
- *protection of the breeding, resting, and feeding zones of the fauna (Art. 6b)*
- *preventing the use of unselective catching gear of fauna; (Art. 6b)*
- *developing proposals for the regulation of environmental protection and of the use of the natural resources within the Reserve; (Art. 6d)*
- *proposes for approval by the Tulcea County Council the user fees for economic, tourism, and recreational activities by physical or legal persons, on territory that belongs to the public, private, local, or County domain; (Art. 6r)8*
- *organise, in accordance with the law, the concessioning of the renewable resource use; (Art. 6s)*
- *the Scientific Council of the DDBRA approves the annual levels of use of the renewable resources, the technology through which it is used, and the zones for use;" (Art. 6g)*

2.3.3 Reasons for concern about the state of fishery management in the DDBR

The following two sub-sections outline the two main reasons why the state of fishery management was considered to be unsatisfactory. The first relates to the fish stock, because it showed signs of decline in size and diversity. The second reason relates to the management system in operation, because even though the DDBRA had been given the mandate to manage the fishery sustainably, in practice they had little control over what was going on.

2.3.3.1 Problems with the fish stock

Figure 2-4: illustrates how fish diversity in the DDBR fishery has declined over time. Staras (1994:5) highlights the fact that until 1972-1975 a broad variety of fish were caught. After this period the proportion of pike (*Esox lucius*), perch (*Perca fluvialis*), crucian carp (*carassius carassius*), and tench (*tinca tinca*) caught declined quite sharply. In 1992 almost 60% of the catch was made up of prussian carp (*C. auratus gibelio*).

The decline in total catch has not been uniform throughout the DDBR (see Figure 2-5). While catch in the Danube Delta itself has been declining quite steadily since the mid-1970s, catch in the Razim-Sinoie complex remained relatively steady. On

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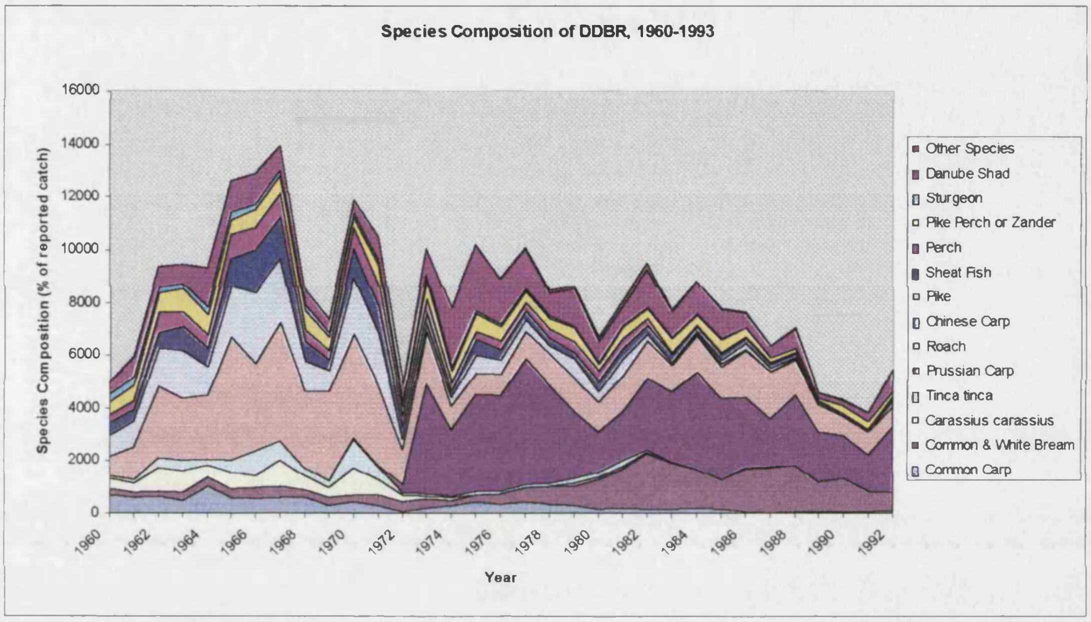
[8] Art 39 provides that "the local population may pursue renewable resource use activities with traditional and non-polluting tools" without the payment of taxes - in the case of fish it is specified that one's own traditional gear must employed and only for the purpose of private consumption.

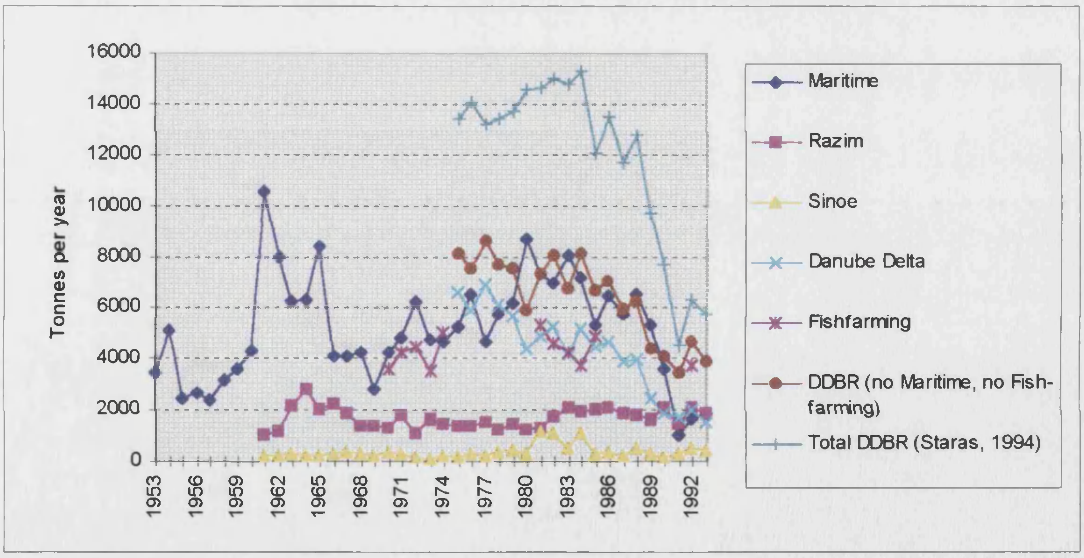
average, only 22 kg/ha where produced in the Danube Delta compared to 38kg/ha in the Razim-Sinoie Complex.

Figure 2-4: Changes in Species Composition in Danube Delta Fishery, 1960-19923



Source: Staras (1994)

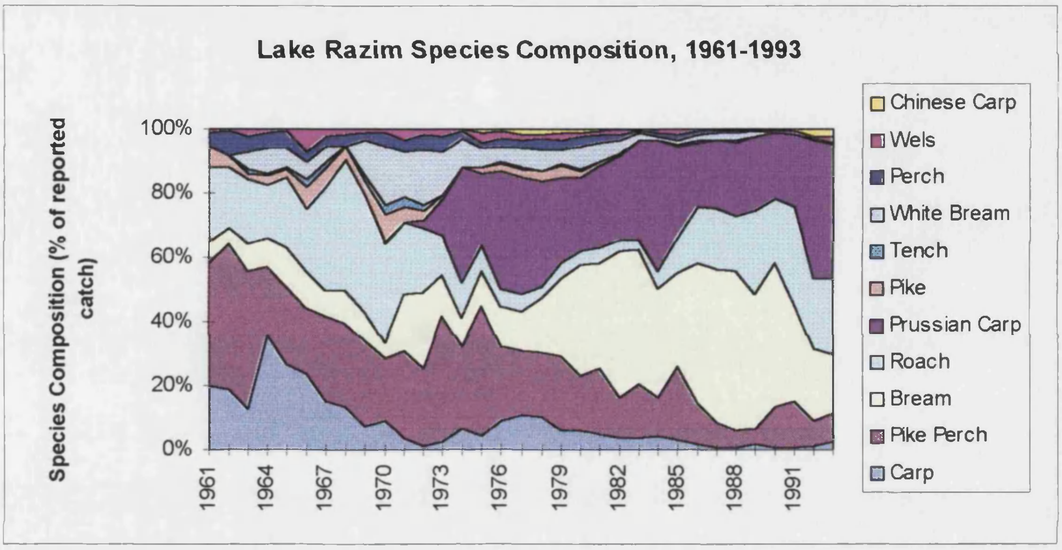
Figure 2-5: Total fish yields in DDBR, 1953-1993



Source: Staras (1994): Razim p.4d, Sinoie 4e, Danube Delta 4c, Fish farming (1970-1985) 19a, DDBR calculated, Total DDBR calculated; Fischer (1993:26) fish farming 1992

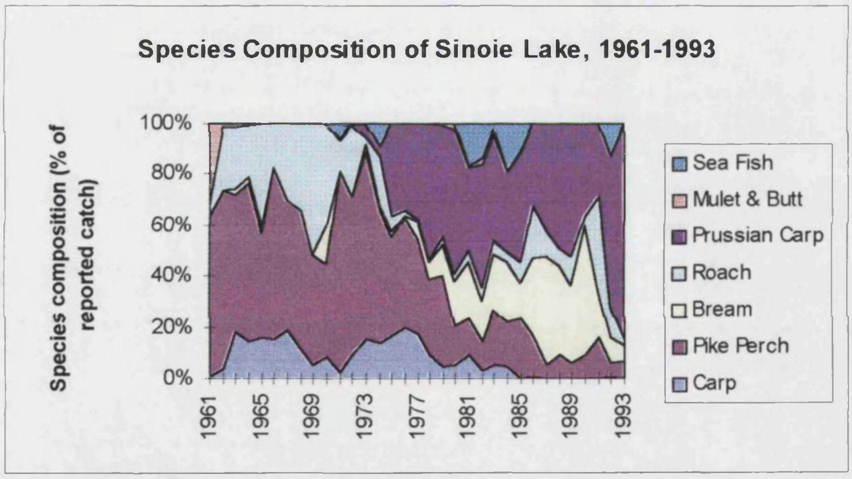
In addition to this different variation in total fish yields, the change in species composition evolved differently in the Razim and Sinoie lakes (compare Figure 2-6 and Figure 2-7). Staras (1994) argues that these differences in evolution patterns can partly explain why total catch has declined less in Razim and Sinoie compared to the Danube Delta: prussian carp, the species that currently represents the proportionally biggest catch, has developed much more vigorously in the Razim and Sinoie lakes than it has in the Danube Delta.

Figure 2-6: Lake Razim Species Composition, 1961-1993



Source: based on Staras (1994:4d)

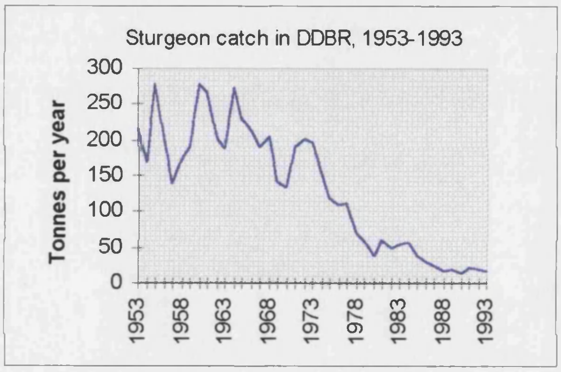
Figure 2-7: Species Composition Lake Sinoie, 1961-1993



Source: based on Staras (1994:4d)

The overall trend, however, has been a continuous decline of the most valuable species (common carp, pike, sheat fish, perch, zander, sturgeon, Danube shad, and tench) (Navodaru *et al.* 1993). According to Navodaru *et al.*'s (1993) analysis, before 1963 these species constituted 68.4% - 75.6% of the total catch (see Figure 2-4:). In the period between 1964 and 1974, especially through the decline of common carp, the economically most valuable group constituted only 35% of the total catch in 1974 (7,823 tonnes). Since then, the most valuable species, especially sturgeon, have declined even more (see Figure 2-8).

Figure 2-8: Sturgeon catch in Danube Delta, 1953-1993



Source: based on Staras (1994:17f)

2.3.3.2 Problems with the management system in operation

The second reason why the state of fishery management in the DDBR was considered unsatisfactory was that since the breakdown of the Communist system, within which only state companies were operating in the Danube Delta and the prime objective was the achievement of ever increasing catch targets, an informal and ineffectual management regime had emerged.

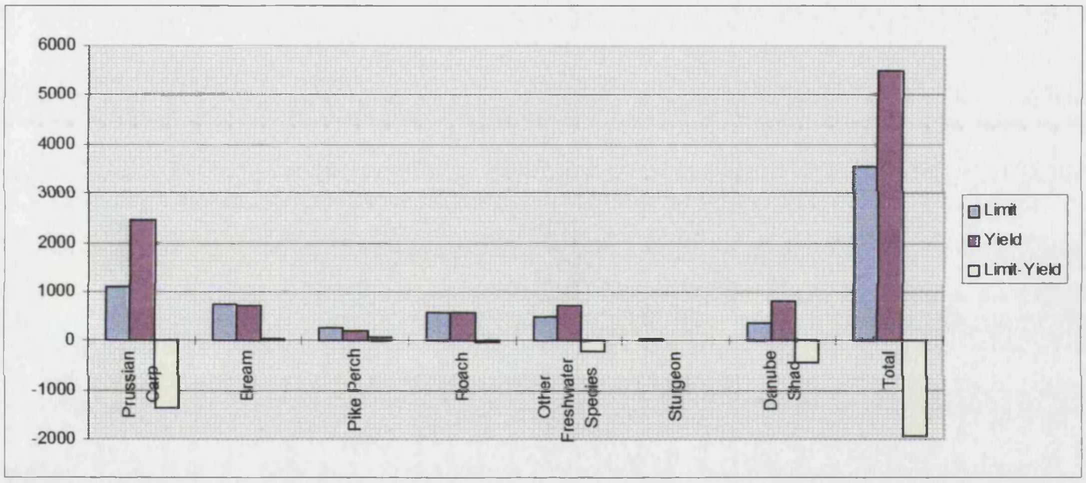
After the Revolution of 1989 the system of control over fishermen, the fishing companies that employ them, and fish merchants had broken down, as companies had become independent and the old control mechanisms were replaced by the DDBRA. At the same time, however, incentives to sell on the black market had increased because other food had become more expensive (the purchasing power of Romanians had decreased, and state subsidies had been removed on many food items). This combination led to a large number of different poaching activities that included under-reporting of the size and type of fish caught, fishing without licences, fishing in the prohibition period, fishing with improper gear, improper use of licences (e.g., leasing them to third parties), or use of fake licences. Fish stock assessment did not take account of poached fish and nobody knew what state of the fish stock really was.

Licences were issued by the DDBRA but they were quite meaningless because they were not based on real analysis of the fish stock or fishing effort. Instead, the nine state companies and two private companies received licenses which specified fishing limits on the basis of the catches declared in the previous season, companies do not pay for them, and an unknown number of fishermen or fishing companies are actually fishing.

Under these conditions enforcement by the DDBRA was poor because not even the DDBRA believed that the quotas they issue were accurate. For example, it was often said that there is over-fishing but evidence for that was inconclusive. Figure 2-9 shows that the overall catch for 1992 was almost 2,000 tonnes greater than the allowed fishing limit. However, the scientists who set that fishing limit, argue that the surplus catch does not necessarily mean over-exploitation but instead that the fishing limit was set too low, as the unexpected fish movements that occurred during that year could not have been predicted (Navodaru *et al.*, 1993:21).

In the case of Prussian carp, scientists argue that unexpected large number migrated to the Danube Delta from further upstream in the large flood of 1991. The other the two fish species that yielded higher catches than the predetermined limit, Danube shad and "other species", either larger than expected migrations, or "unprecedented" rises in the populations were to blame (Navodaru *et al.*, 1993).

Figure 2-9 : Comparison of limits set and fish caught, Selected species, 1992



Source: Fischer (1993:19) using 1992 data from DDI

The DDBRA and DDI were trying to develop new system but that did not work out. In the remainder of this chapter I will argue that the DDBRA and the DDI were unsuccessful in their endeavour because they were unable to deal with the problems related to uncertainty, conflicting objectives, and institutional context within which management took place.

2.4 Shortcomings of the Fishery Management Approach used in the Danube Delta

The purpose of this section is to present the reasons why I argue that the staff of the DDBRA and DDI were not be able to develop the management system outlined above with the techniques, theories, and processes they were using. Since the DDBRA and the DDI were employing widely used fish stock assessment methods, the problems illustrated here faced by the DDI and DDBRA are not unique to the Danube Delta.

The section draws heavily on two publications, both of which are authored by scientists from the Danube Delta Institute (DDI): Navodaru *et al.* (1993) and Staras (1994). Navodaru *et al.* (1993) is the most recent annual report by the Fisheries Research Unit of the (DDI). It forms part of the five-year research programme commissioned by the DDBRA that started in 1991. Staras (1994) is the Fishery sector report that was produced for the purpose of discussion in the Management Planning Workshops of the EBRD project. The objective of that report is to summarise all the research that has been done on the Danube Delta Biosphere Reserve Fishery. There are no other publications that are as recent or detailed as these two publications. Furthermore, the DDI research is the basis for the DDBRA fishery management policy, and that means that it is particularly important in the context of this thesis.

My analysis of the fishstock assessment and the effort restriction approaches are based largely on Jones (1984) the DDI scientists chose to use that text and it appears to be used quite widely. There are alternative texts such as Gulland (1983), which describes methods that are very close to those used in the Danube Delta, or Walters (1986) which describes a number of methods not used in the Danube Delta (but which is based on a fundamentally different view of fishery and ecological management, to be summarised in Chapter 4).

2.4.1 The DDBRA's approach to fishery management

Up to September 1994 (that is three years into the existence of the DDBR), when I conducted the first workshops as part of my fieldwork (see Chapters 8 and 9), there were no written statements on the principles of the existing or future fishery management. Also, there were neither concrete accounts of the system in operation at the time, nor what the management problems were (except for the writing by the DDI fishery scientists which focused on the resource aspects), nor a written statement of what principles or policies the future fisheries management system should be based on. Not even the socio-economic survey by Fischer (1993) was able clarify how the fishery was really managed at the time.

One possible explanation for that lack of clarity could be that the DDBR law was not promulgated until late 1993 and as a result there was no legal basis for the DDBRA to proceed to implement a regime that was likely to provoke resistance from the fishing companies as it interfered with (restricted) their current operations. An alternative explanation for this lack of clarity could be that the scientific information necessary for the establishment of an adequate management regime was not yet available. However, I argue in the following Sections that the persistence of this lack of clarity has also to do with difficulties of applying existing fishery management methods in circumstances such as those encountered in the DDBR.

By integrating the DDBRA's legal mandate (Law 82/1993), the research programme that the DDBRA commissioned, the methods used by the DDI in their research[9], and the interim management procedures that the DDBRA had adopted, I would argue that the DDBRA pursued a management regime with the following structure[10] and rationale:

1. The DDBRA is the manager of the DDBR because it is being held accountable and has been assigned the authority to ensure that the aims of the Biosphere Reserve are achieved.

2. Previous management efforts did not pursue the same aims as those of the DDBR. In fact, the policies of the Ceaucescu regime threatened biodiversity and the cultural heritage because the policies were misguided and politically motivated. Research and science were politically restrained and limited by resources from pursuing what would have been professionally correct.

   New policies should not ignore or go against scientific interests and knowledge. Instead, the new or future management regime would start with a sound scientific understanding of nature. In the case of the fishery, the questions that need to be addressed are as follows:

2.1 What are the important species and what is their current condition? This needs to be established through scientific research. The value of a species is a combination of the price it commands on the market and its rarity (for example, sturgeon is the most valuable fish both because it fetches the highest price and because it is threatened with extinction world wide). There are other fish which are counted as "valuable" such as pike perch because it fetches a relatively high price on the market.

2.2 Can they be commercially exploited? In other words, is the stock large enough to allow additional pressure (besides those affecting 'natural mortality') to be exerted on it through fishing. The most important objective is the maintenance of all the fish stocks.

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[9] I will use Mr Staras' sectoral report (1994) again for this explanation because it provides the best summary of work and thinking from before the fishery workshops that I organized.

Fishery scientists have two approaches for the determination of stock: one is "holistic" and the other "analytical" (Staras, 1994:27). The holistic approach is based on the "production surplus model" (Schaefer, 1954 and 1957). It requires long and accurate time series data on the catch and the amount of effort required to make the catch. Such data are not available for the DDBR fishery. Therefore, the scientists of the DDI use the analytic approach which is based on the analysis of fish samples.

Fish stock assessment of the Danube river fishery cannot be done with the same models as those used for lakes because the exploitable river stocks depend on the migration patterns of semi-migratory fish (those that move between different lakes or hydrogeographical areas) and migratory fish (those marine species that swim into the delta and beyond to reproduce) (Navodaru, 1992; Navodaru *et al.*, 1993). Problems also arise because the same stocks are exploited by several countries, the estimates one would obtain would not be extendible to neighbouring areas, and their validity would be of very short duration while the research effort would be very large (Staras, 1994:28). Instead, it was suggested that a sonar system or a tagging and recapturing system would be appropriate for stock estimation on the Danube River itself. Most stock estimation work attempted to relate Danube shad stocks to the hydrological regime of the Danube (Navodaru, 1992; Navodaru *et al.*, 1993) and frequent reference was made to 10-11 year cyclical variations (which may have links with solar cycles which causes changes in the hydrometereological and especially hydrological regime) (Staras, 1994:22, quoting Ivanov (1985), Leonte (1957), Navodaru (1992), Navodaru *et al.* (1993); Niculescu (1960), Niculescu and Nalbant (1965)). The conclusion was that stock estimation for the Danube can be improved, but that it would also require substantial costs as it would be necessary to do work on a large, international, scale where all the countries that exploit this resource become involved.

3. At the end of this work the DDI is supposed to provide the DDBRA with detailed prescriptions about the Total Allowable Catch Limit (TAC) for the different species and fishing regulations (e.g., what gear to use, restocking of lakes with fingerlings, and maintenance work on breeding grounds) for different fishing zones of the DDBR.

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[10] I have numbered these paragraphs because the structure involves both content and process issues .

This auction/leasing system was expected to produce sufficient income for the state (estimated at about USD 350,000 per year)[11] and allow the DDBRA to undertake the necessary research and investments in the fisheries of the DDBR.

5. Once the leasing contract with the different fishing companies were made, the DDBRA expected that it would be able to get much better fishing effort data. The clarity with which the fishermen would be required to report to the company on where they caught the fish, would enable the DDBRA and DDI to manage the fishery (except for the Danube River and the Black Sea fishery) much more reliably and accurately towards optimal levels because they will be in a position to also determine the optimal effort levels (something that, according to Staras (1994:28-29), is not possible with current data). The TAC were to be reviewed annually for each zone.
6. Better management would result in higher and more stable fish yields, and that prospect would make the fishermen interested in participating in the attainment of the management objectives of the DDBR. The Ecological Guards (wardening) department of the DDBRA would assist to ensure that the fishing companies comply with the agreed conditions.

2.4.2 Problems relating to the handling of uncertainty

There were two main problems with respect to the way in which the DDBRA and the DDI handled uncertainty. First, even though they mentioned occasionally that not all catch was reported, the implications of this problem (and many other sources of uncertainty) were never specified. Secondly, the DDBRA insisted that the DDI was to prescribe exact catch limits and optimal fishing restrictions in spite of overwhelming problems of uncertainty relating to almost all variables of the fishery management.

According to fishery biologists "rational and scientific management of fisheries must depend on a fundamental understanding of fish biology and ecology; that is, what sort of animals fish are, and were and how they live" (Pitcher and Hart, 1982:9). Only in that way can one attempt to answer the question asked by all those involved in fishery management: "how can the harvest of fish biomass be maximised without impairing the prospects of exploiting the fishery in the future?" (Pitcher and Hart, 1982:219) To answer this question fishery scientists seek to estimate how many fish

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[11] 1,000 million Lei at 3,000 Lei per USD (Staras, 1994:30)

there are in the water at a given time and to what extent and how quickly a stock can recover after different amounts of fish have been extracted (Gulland, 1983).

It must be noted that fishery biologists are aware that in fishery management not only the existence of the resource matters, but also the benefits that one can expect to draw from them. They point out, for example, that the Maximum Sustainable Yield (i.e. the maximum amount that can be extracted on a sustainable basis) is seldom also the amount that is most beneficial to extract, as that calculation also needs to take the costs of harvesting into account. That is why biologists do not argue, like the DDBRA's approach suggest, that fishery management is primarily about establishing the Maximum Sustainable Yield as an indication of the carrying capacity of the Danube Delta. Instead, they speak of "optimal control", where the yield determined for allowable extracting each year "reflects as many factors as are necessary for the long-term survival of the fishery"[12] (Pitcher and Hart, 1982:354&356). Or, in the words of Pearse (1980:356): "Fishery management is an exercise in optimal control using appropriately selected models."

However, the reason why the DDBRA is drawn to fishery science is that the following recommendation is common (see also Gulland, 1983:1):

> *"The best policy seems to us to produce a sound purely biological recommendation, decide what regulations might achieve them, and then bring in economic and other considerations as a way of choosing between alternative strategies of gaining the optimal biology, which may of course include conservation aspects as well as fish yields. To run things the other way round seems a path fraught with dangers, since only by putting the stock biology first can we be sure of continuing to use the valuable naturally renewable resources of fisheries" (Pitcher and Hart, 1982:366).*

Such recommendations appear to suggest that the only way that one can start fishery management is through scientific fish stock assessments. The following examples show why the implementation of such an interpretation has proven to be very difficult (in the Danube Delta, as well as elsewhere).

The process of making "biological recommendations" involves two steps: first, scientists seek to determine the state fish stock, and in a second step, they attempt to predict the effects of changes in fishing effort on the fish stocks.

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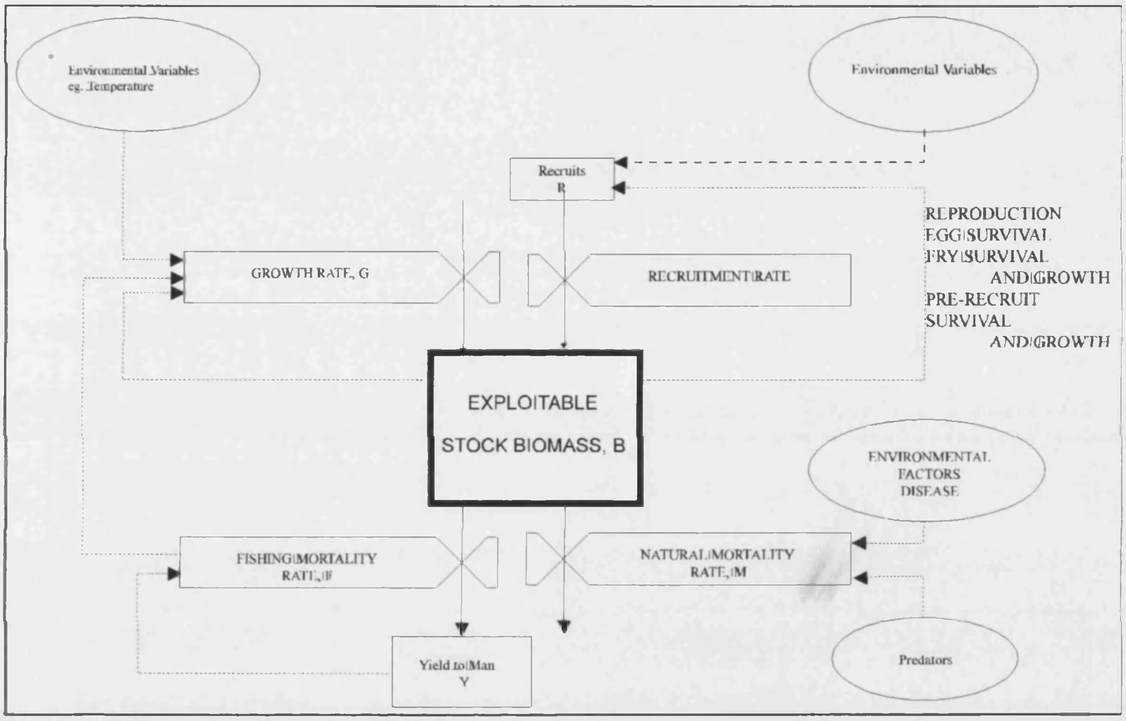
[12] Note that a in the biologists view a "fishery" consists of both the resource as well as the humans exploiting it.

2.4.2.1 Determining the state of the fish stock

Figure 2-10 illustrates that many factors influence fish stocks. Fish stock analysis also has to be repeated for different species and different habitats, as the factors that affect them will differ and change over time.

Figure 2-10: Flow diagramm illustrating variables and sub-systems affecting the expoitable stock biomass



Source: Pitcher and Hart (1982:251)

The methodology for fish stock assessment used by the DDI is the Beverton-Hold method (Jones, 1984). The main idea behind this method is to establish a relationship between the size of the catch on the one hand and growth and mortality of fish on the other through analysing samples of the fish landed. One of the greatest advantages of this method is that when sufficient accurate data is available as little as two years data may be required for a preliminary assessment.

The Beverton-Holt model (Beverton and Holt, 1957) is based on the assumption that in the long-term fish stocks is constant. Such constancy is only achieved when the rate at which new fish are added to the population (called "recruits") equals the total number of fish dying (both from natural causes and fishing). By dividing the fish population into different age groups, and by predicting the weight of fish in each age group (e.g. average from past catch, together with assumptions about growth etc.), the total yield of fish through fishing can be calculated for different intensities of extraction and age of first capture (which is determined by the mesh size).

To implement this model Danube Delta Institute (DDI) scientists have taken random samples from commercial fish collection points in nine hydrographical zones of the Danube Delta and the Razim-Sinoie complex since 1989 (there is no stock estimation for the Danube River fishery - because of technical and methodological difficulties). The months of October and November were chosen for this sampling, since it is during this period that fish congregate in preparation for the winter months. The length and weight for 1000 fish are taken, and scales (which indicate the age of fish) are taken from 100 fish, in order to develop a statistical model of the length-weight relationship. The growth rate of fish, and the natural mortality rate are also estimated. These parameters are then used to statistically fit a gear selectivity curve and a total mortality curve. It is then possible to perform a Virtual Population Analysis, which is used to estimate the total number of fish in the water. By applying the Thompson-Bell model, the DDI scientists then estimate how much fish could be sustainably harvested using different intensities of fishing. In the final step different ways of "optimising fishing" are evaluated by applying the Beverton-Holt yield per recruit model.

According to Jones (1984), in practice it is often quite easy to determine when a species is overexploited but one needs a lot of data to determine the maximum sustainable yield (MSY). Jones (1984) also points out that analytical methods, such as those employed in the Danube Delta, are justifiable only for teleost fisheries (i.e. not a multi-species fishery where species interaction may play an important part in determining recruitment), because for telost stocks recruitment of juveniles appears to be independent of spawning stock size over a wide range of stock sizes.

In practice recruitment levels are difficult to predict because they are very variable and the relationship between stock size and recruitment is not know precisely. Beddington and Rettig (1984) argue that the problems caused by this uncertainty are exacerbated because data accumulate typically very slowly and the techniques for analysing stocks are unable to predict successfully into the future (Gulland, 1977; Pope, 1979; Pope and Sheperd, 1982). Furthermore, data on recruitment and stock size obtained through stock assessment techniques often fail to produce enough evidence to justify reducing the amount allowed to be fished until the process is so far advanced that that strong corrective measures need to be taken (see Saetersdal, 1980, or Gulland, 1983:9-10, for examples).

Since the recovery rate following over-exploitation varies with species, it is hard to predict it accurately. The recovery is also affected by species interaction. Daan (1980) shows that it is hard to predict when and to what extent a species that was reduced through over-fishing will be 'replaced' with other species. Such changes in the community structure may further complicate forecasts if the initial target species was a predator of others and afterwards the prey becomes the object of fishing. Sustainability for the initial target species is then threatened both from potential recruitment collapse and from a reduction in their food supply.

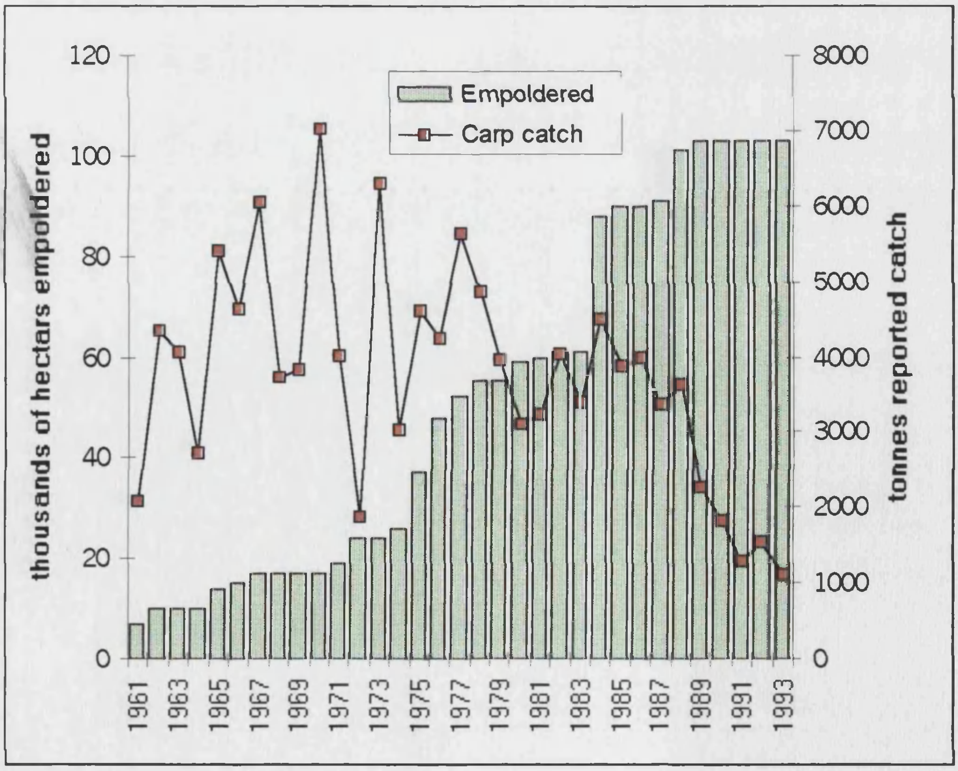
In the Danube Delta fish stock estimation based on the methods outlined above are particularly difficult because there is evidence that in addition to fishing, fish stocks are influenced by a wide variety of environmental factors. The following two examples illustrate this point.

Artificial polders and canals

Physical alterations of the Danube Delta through the construction of polders and canals are believed to have influenced the habitats of several fish species. The following two examples support this hypothesis:

Carp rely on shallow and relatively still waters to spawn. In the past they used the flooded areas east of the Danube Delta and the small ravine-like entries into the branches of the river and the main canals for this purpose. Figure 2-11 shows that there appears to be an inverse relationship between carp catches and empoldered areas, suggesting that empoldering has diminished their numbers.

Figure 2-11: Carp catches and polder construction, 1961-1993



Source: Staras (1994:20a)

Among the most dramatic effects of canal constructions were those brought about by two canals constructed at the turn of this century that directed fresh water from the Danube Sf. Gheorghe branch into the Razim-Sinoie lagoon complex. At the same time the natural opening that linked the lagoon with the Black Sea was closed off by a sluice. The result was that the originally brackish water of the lagoon complex turned into fresh water (see also Antipa, 1914:39-51).

Many other canals have been dug throughout the Delta since then but not all of the effects were so clear as the one mentioned above. Some lead to increased silt deposits and a worsening of the water quality in the lakes because polluted river water is reaching the flood lakes directly through the canals without being filtered by the reed beds it previously swamped. This may have been the main mechanism by which many lakes have become eutrophic (depleting oxygen levels in the water through increased algae growth).

Seasonal variations in fish stocks

Research on fish species diversity in 1993 by the DDI (Navodaru *et al.*, 1993) indicated that there were 57 fish species of which 37 were freshwater species, 18 species living in both salt and freshwater, and two salt water species.[13] Monitoring of the fish stock developments based on catches has been hampered by the fact that the fishing gear used could retain only about 35 species. Statistics, covering the period from 1963 to 1993, have been kept for only 10 or 11 species (Staras, 1994:4). Some of the fish species exhibit large and unpredictable seasonal variations

When there are large spring floods, breeding conditions for those fish species that reproduce in the Danube Delta improve. As a result more fish than normal are born, when there are abnormally large floods. Exactly what the proportions are is not known, but it has been repeatedly observed that some years after a large flood, when the fish born in the year of the flood mature, fish catches rise to surprising levels. One such example, is the nine-fold increase in east-asian species between 1991 and 1992 that led Navodaru *et al.* (1993) to argue that "this strengthens the hypothesis that they reproduce under very specific conditions". Floods were also thought to be responsible for a large part of the 1993 catch of 4,669 tonnes in the Danube Delta which was 1,494 tonnes greater than the Total Allowable Catch determined for that year (Navodaru *et al.*, 1993:21). The fact that flooding has a much smaller influence on the Razim-Sinoie Complex than on the Danube Delta lakes may partially explain why the fish catch in the latter varies much more than in the former.

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[13] Bacalbasa et al. (1984) reported 73 fish species for the year 1983.

2.4.2.2 Predicting the effects of changes in fishing effort

The second step in the production of "biological recommendations" (Pitcher and Hart, 1982:366) for fishery management is a prediction of what happens to a fish stock when it is fished with different intensities. Fishing intensity is a function of the type and amount of gear, number of fishermen, and the time spent fishing. The problems with respect to effort data in the Danube Delta were that the little effort data that was available was both uncertain as well as ineffectively used.

In order to determine the effects of changes in mesh size, DDI scientists employed the widely used methods of Cadima (1978) and Gulland (1961, 1964). In both methods one starts by calculating the immediate effect of, for example, enlarging the mesh size so that less fish are captured.

With the Gulland method one can also calculate the long-term effect of increasing the mesh size: some of the fish not retained in the first period will be caught at an older age and larger weight. The calculation is based on the following idea: only part of the fish not caught initially will survive to the time when they could be caught (depending on the mortality rate and the time required to grow to the new mesh size length). Of those only some will be caught (depending of the fishing effort). The number calculated being caught is then multiplied by the average weight of the individuals that make up the enlarged catch. This calculation can be made more complex if one takes account of the movement of the fish into areas where fishing is not done with the same mesh size.

Data on fishing effort is very important for the fish stock assessment methodology that the DDI uses. They would need to know how many fishermen fish for how long, with what gear. These different data then need to be calibrated so that a relative effort equivalence between the different gears can be established. However, this is particularly complicated in the DDBR due to the slow speed of the current through the Danube Delta (0.3-2 m/second), the great variation in width of the channels (400-1000 m), non-uniform and changing river beds, a great variety of fishing methods and fishing gear have developed (see Table 2-5).

Table 2-5: Fishing methods on the lower Danube and Danube Delta branches

Fishing area	Biotope or behaviour of the fish	Used gears	Species caught	Type of fishermen
Shore line	resting place	rod, castnet, hooks, scoop nets	all species	occasional fisher men
Medium depth shore line	resting place	scoopnets, stiks	welsh	limited use
Shallow shore line	feeding area	fikes, hooks, seines	all species	limited use
At the bottom of the Danube	resting, overwintering and migration	seine, gill nets	welsh, carp, sturgeon	Professional fishermen
In depression area's of the Danube	resting and overwintering	seine, bottom trawl	welsh, carp	Professional fishermen
Sturgeon catch	*feeding and migration*	*gill nets (special)*	*sturgeon*	*recently introduced*
Whole river	feeding, migration	seine nets	all species	limited use
Electric fishing	feeding and migration	electricity	all species	prohibited
Trawling	*migration*	*trawl*	*all species*	*recently introduced*
In the middle and surface area of the river	migration	Gill nets	Danube shad	Industrial fishing

Source: Staras (1994:8-9) based on Bacalbasa (1965)

In the Danube Delta data on effort is, however, extremely poor. In 1992 eleven fishing companies operating in the Biosphere Reserve employed on average 1,186 fishermen and an overall fishing effort of about 138,951 man days, of which about 18,000 man days in the Black Sea. Navodaru *et al.* (1993) noted that this data is supplied by the fishing companies and therefore its "reliability may not be very high", especially regarding fishing with smaller gear.

There is only one set of statistics on effort that summarises the number of employees and the type and number of gears used for the whole DDBR (see Table 2-6). Staras (1994:5) notes, however, that the real numbers are likely to be "much higher".

Table 2-6: Employment and gear used in DDBR, 1993

Fishing Zone	Average nr fishermen	Person days -	Vintire* units	Taliene* units	Navoade * units	Ave 25-40* units	Ave 50-60* units	Ohane* units	Talian* units	Carmace* licenses
Fortuna	21	2,388	105	110	3	204	111			
Gorgova	29	4,256	640	183		203	210			
Uzlina-Isacova	54	13,390	2,360	317	3	147	200			
Somova	47	11,750	2,502	147	9	275	190			
Baclanesti	8	909	60	60		46	40			
Trei lezere	11	1,500	63	89		10	81			
Matita - Merhei	40	8,055	252	101	4	74	210	34 Danube		
Puiu - Rosu	63	9,015	1,700	200	3	315	390			
Razim - Sinoe	372	79,112	800	1,156	74					
Bogdaproste M 23	4	810	28	36		24	35			
Crisan	21	5,080	830	12	4	235	180			
Agro. Nufarul (Razim)	36	4,800			5	144	60	21		
Sulina	156	17,400						80	16	
Isaccea (Danube)	52	6,240	32	32		312	40	80		
Jurilofca (Black Sea)	269	1,614			2				48	
Sf. Gheorghe (Black Sea)	72	11,260			2		200		3	3,000
Pisc.Tulcea (Danube and Canals)	18	4,320	260	90	6	28	54			
TOTAL State Companies	1273	181,899	9,632	2,533	115	2017	2,246	215	70	3,000
TOTAL Private Companies	98	5,790	70	21		204	476			
TOTAL DDBR	1,371	187,689	9,702	2,554	115	2,221	2,722	215	67	3,000

Source: Staras (1994:4f), * denotes Romanian names for different types of fishing gear.

The following tables from Staras (1994:11-12) shows the historical effort data available. It shows that there are many years for which there is no data.

Table 2-7: Fishing effort in Tulcea region, 1929-1924

Year	Licences	Employers/ Selfem-ployed with own gear	Hired labour without gear	Lakes	Danube River	Black Sea	Setci *	Ave *
1920	1,972	1,449	523	1,409	201	362	52,755	71,610
1921	2,177	1,630	547	1,622	190	365	58,407	76, 597
1922	2,321	1,722	594	1,666	198	457	50,885	15,802
1923	2,408	1,796	612	1,768	243	397	80,934	20,9246
1924	3,177	2,199	978	2,425	330	422	88,042	20,2114
* Total number of gear used in lakes, Black Sea, and Danube River.								

Source: Staras (1994:11-12) quoting Daia (1926), * denotes Romanian names for different types of fishing gear.

In spite of the fact that so many of the variables that scientists and policy makers take into consideration in the formation of fishery management policy, and more specifically in the determination of fishing quotas as I have been discussing above, their recommendations do not include ranges, nor statements regarding the accuracy of their figures, nor a discussion of different scenarios.

The following two quotes indicate that this situation is not unique to the DDBR: "rather than dealing with uncertainty explicitly in the management process, managers often resort to producing relatively conservative estimates of MSY" (Rettig, Berkes, and Pinkerton, 1989:284). Gulland (1983:18) argued in a similar vein: "almost inevitably ... the consensus would be reached on the lowest value." He also laments the fact that TAC calculation results or predictions about the effect of a change in mess size rarely acknowledge the possibility of error.

2.4.3 Problems relating to the handling of Conflicting Objectives

The purpose of fishery management is to regulate the extraction of fish and this involves a basic trade-off: prohibiting all fishing maximises the likelihood that the fish stock will be in a good state but at the cost of forgoing all possible income. Once fishery managers decide that there should be some fishing, then they may have to take additional considerations such as equity and efficiency into consideration if they want to maximise welfare.

However, all of the DDBRA's analysis suggests that they were operating as though the mandate given to them through Article 5, Annex 2 of Law 82/1993 meant that they only needed to be concerned with was the specification of a Maximum Sustainable Yield for each fish species. This was wrong on at least two accounts: First, Biosphere Reserves are (see also Section 1.1.2):

> *"multipurpose protected areas established to conserve species ... to find ways to use the environment .... and the societies that depend on [the ecosystems] healthy." (UNESCO,1990)*

In view of this fact, the first problem relating to the handling of conflicting objectives is that the DDBRA and DDI completely left out the social parts of the analysis.

A second reason why the exclusive concern with the Maximum Sustainable Yield was wrong is that the literature on the fishery management approach that the DDBRA and DDI were pursuing, explicitly raises issues relating to trade-offs that are inherent in fishery management policy. The following examples related to the development of Total Allowable Catch (TAC) quotas and the issuing of fishing licences illustrate the complexity of the trade-offs.

2.4.3.1 Trade-offs involved in the development of Total Allowable Catch quotas

Total Allowable Catch limits (TACs) have become the most widely used fishing effort regulatory procedure in the developed world. The principle behind it is quite simple: one decides how much fish one wants to extract and allocates this quantity to the fishermen involved. This limit is then enforced by monitoring how much they catch. In practice, however, the regulation of fishing through TACs faces a number of problems.

Before scientists are able to give advice on TACs they need a management aim such as a specific MSY, a particular fishing mortality rate, or a long-term maximisation of yield per recruit. In the case of the Danube Delta, the DDBRA skirted this issue by simply mandating the DDI to determine a TAC that is within the carrying capacity of the ecosystem. One of the problems with such an approach is that theoretically there is a infinite number of different Total Allowable Catch quotas that would have some chance of maintaining fish activity within the carrying capacity of the ecosystem. The difference between all those TACs is, of course, that they are not equally likely to maintain fishing activity within the carrying capacity of the ecosystem. The choice of a particular TAC entails, therefore, a trade-off between different levels of risk of maintaining a species and different levels income from fishing. A related problem is brought out by Pope (1984), as he highlights the fact that managers seldomly specify the level of accuracy that they seek (in his words "would a systematic bias of 10% either way worry anyone?").

While TACs are intuitively easy to understand, the establishment of wise TACs requires a lot of accurate data on the age or size composition of the catch, the effort and the catch per unit effort of the various components of the fishery (Caddy, 1984). At the same time, however, TAC based management system generate disincentives for fishermen to accurately report both how much fish they have landed as well as with the effort expended. The reason for this that is that accurate reporting of catch by fishermen may turn out to work against them (at least in the short run), since it could show that exploitation is too high (e.g. increasingly young fish are caught, or the total catch is decreasing). This shows that fishery managers must consider many different objectives and they must also examine the many individual decisions that together make up the management system in relation to one-another.

2.4.3.2 Trade-offs involved in the development of Licensing system

After TACs for different species and fishing zones are established, rights to fish the allowed catch must be specified and allocated to fishermen. According to the DDBRA (personal communication), up to the 1994 fishing season fishing rights were allocated in the form of licences by the DDBRA according to extremely simple principle: nine state and two private companies operating in the DDBR reported to the DDBRA how much gear they owned and how many fishermen they employed. The DDBRA then divided the total TAC for the Danube Delta proportionally between the companies.

Nobody knows the extent to which companies over-reported their capital endowment and their employee numbers as an attempt to increase the TAC allocated to them.

The proposed new management system pursued by the DDBRA was for the DDI and the Licensing Department of the DDBRA to determine TACs for different fishing zones (without officially specifying any objectives, other than fishing within the "natural carrying capacity" stated by DDBRA Law) and then to auction the licences with associated TACs in a closed bidding system to the highest bidding registered company for a five year period, and to charge at least 18% tax on the landed catch.

As Rettig, Berkes, and Pinkerton (1989:278,284) note, "allocation is a political rather than a scientific issue" and the reactions of fishermen to different proposals is not certain. A wide variety of issues that need to be considered in allocation are mentioned in the literature (none of which were addressed in the analysis of the DDBRA and DDI). The issues include transfer issues (i.e. are fishermen or companies able to sell their licences to others - this influences their commitment to resource conservation), difficulties of changing TAC for the licences or the number of licences themselves if it is determined that there is either an over- or under-fishing capacity (there are overt and as well hidden costs in changing fishing methods and intensities); and many more (see for example Rettig, Berkes, and Pinkerton (1989), Jones (1984), Pomeroy and Berkes (1997)).

Gulland (1983:18) "most fishery management involves reaching a balance between different economic and social interests..." and "fishery biologists were not equipped to make these choices which should be left to the appropriate political body." The second reason why Gulland (1983:19) found this unsatisfactory is that for the purpose of avoiding any mention of uncertainty scientists used "too often advice .. based on simple yield-per-recruit or similar calculations, and the other, less quantifiable results are ignored. Since these effects are often those that have the greatest long-term impact on fisheries, the scientific advice tends to be rather precise, but wrong, rather than being approximate, but right." He concluded that "it is therefore highly desirable that when advice is being prepared on the basis of stock assessment studies that such advice is not confined to what appear to be reasonably confident statements, but that the uncertainties, especially those that such as the impact on recruitment, that could have a great effect on the fisheries, are fully described" Gulland (1983:19).

Two important observations need to be made at this point. First, even though the fishery management literature raises a wide range of issues that need to be included, and makes numerous reference to trade-offs, it is almost completely silent about the process or the method by which these conflicts are to be resolved (in Chapter 3, when I discuss the existing Decision Analysis approach to these matters, I review the most important contributions within the fishery management literature to these problems). As a result, the DDBRA and DDI are not alone when they deal with the issue of trade-offs either choosing to concentrate on aspects that seem to be easily measurable (such as the quantity of fish fished and in the water). All other issues are then relegated to the "political domain" - outside of the reach of analysis.

The second important point is that the management approach pursued by the DDBRA, which, as mentioned before, is quite common elsewhere, is based on an assumption according to which the underlying fishery management problem is short-term over-exploitation by fishermen that invariably results in the destruction of the resource base. The only way to overcome this tragedy is for the state to assume a role of regulator in the interest of societal welfare. I have shown that for such an approach to work, one needs to handle both uncertainty as well as multiple objectives better. In the following Chapter I will argue that there is evidence that the existing Decision Analysis approaches would be useful for this purpose and that they could be used to assist the DDBRA and DDI in dealing with some of their problems. However, there is also growing evidence (which I discuss in Chapter 4) that the premise on which the management approach itself is based is inaccurate and that there are alternative ways of managing a fishery.

In either case, whether one tries to assist the DDBRA and DDI to better implement the management approach on which they have embarked, or whether on seeks to assist them to develop an alternative management approach, I will argue in the following section that there is evidence of management difficulties that suggests that the institutional context is an important variable in fishery management. In Chapters 4 and 5 I will discuss possible explanations for these observations and the implications for the use of Decision Analysis.

2.4.4 The effects of the Institutional Context on Management

Given the range of uncertainties that were encountered, the multitude of management and research choices that needed to be made, and the number of stakeholders with different objectives and perspectives it was not surprising that there were disagreements. In addition to the technical problems of encoding and handling uncertainty, or incorporating multiple objectives systematically into the analysis, the formal rules and informal constraints of behaviour that structure human interaction (following North's (1995) definition of institutions that I will elaborate in Chapter 4) must also be taken into consideration. Without the institutional context, it is difficult to achieve the objectives of the DDBR as defined by UNESCO (1995:5):

"to preserve and generate natural and cultural values, through management that is scientifically correct, culturally creative and operationally sustainable"

In the informal process of policy discussion a number of different positions could be identified: the Governor of the DDBRA insisted that DDI should be in a position to provide unequivocal prescriptions of an optimal biology. In private conversation other staff within the DDBRA recognized that univocal prescriptions might be difficult to obtain because of various uncertainties but, at least officially, they supported the position of the Governor.

Collaboration within the DDBRA and between the DDI and the DDBRA was difficult. There were many views expressed privately and hinted at the semi-annual presentations of the DDI to the DDBRA on the work completed (see Chapter 7), but constructive discussion very difficult. Many also expressed frustration that the different groups (scientists, managers, different disciplines, different organizational affiliations) did not understand each others' positions and points of view about what should or could be done and what the overall strategies should be.

It was difficult to know what fishing companies and fishermen were thinking because there was little communication between them and the DDBRA or the DDI. Formal interaction between fishermen or fishing companies and authorities was limited to the written reports produced at the fish collection points, the issuing of licences, and the enforcement activities of the wardens. There are a number of factors that made the interaction difficult. Among theses was the long history of command and control management in which a central government authority or company decided without much consultation how much fish was to extracted and by what methods.

The fact that the future management of the DDBR had been discussed since the creation of the DDBR in 1991 but that few systemic changes had been achieved over the course of four years is strong evidence for the difficulty of bringing about change. No matter how ideal and sophisticated the management system proposed, if it cannot be brought about it is of little use!

Commenting on such persistent disagreements, some eminent fishery scientists have argued that: "there are currently many plans for sustainable use or sustainable development that are founded upon scientific information and consensus. Such ideas reflect ignorance of the history of resource exploitation and misunderstanding of the possibility of achieving consensus concerning resources and the environment" (Ludwig, Hilborn, and Walters, 1993:17).

One aspect of this difficulty is simply the fact that in an environment were institutions are understaffed (particularly at the management level), there are so many demands made upon individuals that actual collaborative work between different departments, and even worse, different institutions becomes an elusive ideal. Instead everyone is busy dealing with the next unexpected demand that the system produces. Those who show some ability to deal with it are then swamped with even more demands.

Another aspect concerns the question of how this should be organised. The customary mode is through formal research of work agreements (the DDBRA commissions research from the DDI, who then presents it at an annual seminar where University Professors and members of the Romanian Academy are present to evaluate the methods used and results obtain on scientific criteria). The agreements and work process were formal, but the determination of the aims of the studies must have been much less formal as there were no documented rationales.

2.5 Conclusion

The DDBRA needed to develop an integrated environmental management plan for the DDBR. This management plan was to guide operations of the Biosphere Reserve, whose purpose is to demonstrate how man and nature can co-exist sustainably.

In 1991, the date of it's establishment, the DDBRA commissioned a five year scientific research project from the DDI. The expectation from these studies were high: they were supposed to assess the existing fish stock and "determine the conditions for sustainable use[14] through fishing." (Navodaru *et al.*, 1993)

Three types of problems were observable (all related to the fact that even though the models they used were quite straight forward, in reality the DDBRA and DDI faced tremendous problems):

The DDI did a reasonably sophisticated job on the fish stock estimation but that too fell short because it did not include an analysis of the inter-relationships, or the possible causes for what was happening. I have indicated that many influencing factors identified were identified, but not all were equally likely and that should have been reflected in their conclusions. The analysis therefore fell far short of what needed for the approach to management they had embarked on.

The economics of fishery management were essentially ignored and the effort restriction TAC management considerations much too simplistic The most obvious reason for this might be that there was no economists (but since there seemed to be no demand for one either, the cause for this is deeper: the DDI and the DDBRA

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[14] The Romanian term "valorificare" literally translated means: 'to transform into value.'

shared the belief that it is possible to determine a natural carrying capacity coupled with a command-and-control attitude originating from the state management solution of the Tragedy of the Commons. One could also hypothesise that everyone realised that the available evidence for a carrying capacity did not allow the identification of a unique natural limit and that changing the status quo meant that there would be winners and losers. This in turn would have posed a very difficult problem: how could the DDBRA use uncertain information to impose restrictions on stakeholders in DDBR?

In the next Chapter I will discuss the extent to which existing proposals for the use of Multiple Criteria Decision Analysis, a technology that has been successfully applied in many other fields, are able to overcome the problems of encountered in fishery management that I have discussed in this Chapter.

Chapter 3 Proposals of the existing Multiple Criteria Decision Analysis literature for dealing with DDBRA's problems

3.1 Introduction

A central argument in the Decision Analysis literature that deals with environmental management (see for e.g. von Winterfeldt, 1992:322-324) is that too often experts have been given or taken on the roles of risk estimators, evaluators, as well as decision makers. This, it is argued, is inappropriate, because experts may be knowledgeable about the probabilities of different outcomes from different policy measures, but it is the task of the decision maker to combine that technical information with the wishes of the population.

As a result, much of the existing Decision Analysis literature that deals with environmental management matters, is concerned with the ways in which the Decision Analysis tools can be used for the following three tasks:

1. Assist experts in dealing with increasingly complex technical judgements
2. Inform the decision maker about the objectives of different stakeholders which can be used to evaluate alternatives
3. Help the decision maker to integrate the information, develop further alternatives and to make a choice

This chapter consists of three parts. I first present an outline of the complete Multiple Stakeholder Decision Analysis process and focus on the rationale of the different steps. This is followed by a discussion of the previous applications of MSDA. In the final section I examine the MSDA approach with respect to possible application in the DDBR.

3.2 Rationale of MSDA

Following work on offshore oil pollution von Winterfeldt (1980 and 1987) directed his work to problems in which several groups interacted in a complex way. The resulting approach is now known as Multiple-Stakeholder Decision Analysis (MSDA). According to von Winterfeldt (1992), MSDA is an intermediate approach between game theory and traditional decision analysis (in the latter, decision problems are analysed from the perspective of only a single decision maker). The decision problem is first analysed from the perspective of different stakeholders. The goal here is "not to find the best alternative (as in standard decision analysis), nor to find an equilibrium (as in game theory), but to clarify the values and opinions of the stakeholders, to pinpoint the sources of disagreement, and to develop compromise solutions" (von Winterfeldt, 1992:322).

In his work on prioritisation of research and development activities, air pollution control, offshore drilling and nuclear safety he often encountered conflicts between experts. As a result, the MSDA approach was extended to involve multiple experts "to provide diversity in judgements." Von Winterfeldt (1992:322-324) states the central dilemma which this approach seeks to address thus: "The experts should not control society's technological choices, but [on the other hand] the public and their political representatives are not sufficiently informed to assume complete control themselves." [15]

Von Winterfeldt argues that this dilemma has now become more pressing because the traditional approach to risk management, where the expert was often risk estimator, evaluator, and decision maker, has become increasingly inadequate. There are three reasons why the traditional approach is inadequate: (i) with many of the new technologies (such as nuclear power, bioengineering, or chemicals in food), uncertainties in models and data, disagreements about model assumptions and interpretation of data, have often led to orders of magnitudes of differences among risk estimators. As a result, estimating risks has become much more difficult. (ii) Stakes are often so high that a trial and error approach is not viable because they can lead to disasters and therefore we should never let them happen, and they may also be so uncertain that no data accumulation will ever give final answers. (iii) Debates about "acceptable risk" are essentially controversies about expert versus public values that may be worsened by the danger that experts are not necessarily in tune with the concerns of the public. In these circumstances von Winterfeldt (1992) argues that MSDA is a constructive way forward because it prevents technological questions from becoming so politicised that they have to be resolved by voting or referendums.

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[15] Hamalainen (1991) assessed the preferences of politicians and nuclear power experts and found that for example "average prioritisations of the subcriteria were widely different" (page 469). That study was also the first where politicians were directly involved in decision analytic work on energy policy evaluations. "The main advantages were the building up of a balanced comprehensive picture of the problem and the revealing of questions where the decision makers lacked information" (page 471).

The essential claim is that DA can help overcome the dilemma of how to use both expert judgements and public value judgements in three ways (von Winterfeldt, 1992:324):

1. *"By exploring the value side of the problem and by highlighting multiple conflicting values held by different stakeholder groups;*
2. *By analysing the factual side of the problem through multiple elicitations of experts with differing views of the facts, data, models; and*
3. *By studying the implications of conflicting stakeholder values and differing expert judgements on the evaluation of the available policy alternatives."*

The methodology of MSDA consists of five major steps (see Table 3-1). The methodology for the first two steps, problem formulation and development of objectives and attributes, is best summarised in Keeney (1992), Keeney and Raiffa (1976), and von Winterfeldt and Edwards (1986). Their purpose is to provide stakeholder value inputs into policy decision making. Stakeholders are identified, their values and concerns elicited, and their evaluation strategies are then quantified by a formal evaluation model. Through these models sources of agreement and disagreements in evaluation strategies are identified and it is also possible to develop compromise solutions. The methodology of the third step, in which multiple expert judgements of risks, costs, benefits and other impacts are elicited, builds on the work of Merkhofer (1987), Keeney and von Winterfeldt (1987b, 1991), and Mosleh, Bier, and Apostolakis (1988). The methods for conducting the final two steps, elicitation of a multiattribute utility model from stakeholders and sensitivity analysis and option invention, are best summarised in Keeney (1992), Keeney and Raiffa (1976), and von Winterfeldt and Edwards (1986).

Table 3-1 Steps in a Multiple-Stakeholder Analysis

Problem Formulation	• Translate the risk problem into a decision problem • Identify stakeholders • Obtain broad stakeholder input and objectives
Development of Objectives and Attributes	• Constructing separate value trees with stakeholders • Building a combined value tree • Developing alternatives
Estimation of Risks, Costs, Benefits and Other Impacts	• Identification and selection of experts • Training and assistance in decomposition • Modelling and data collection • Elicitation • Aggregation across experts
Elicitation of multiattribute utility model from stakeholders	• Elicitation of value judgements • Testing and building a multiattribute utility model
Sensitivity analyses and	• Putting the pieces together

option invention	• Sensitivity analyses • Option invention

Source: von Winterfeldt (1992:325)

Other applications of DA to environmental problems use examples that are more readily related to the problems of the Danube Delta. These studies provide a number of additional reasons for why DA could be usefully applied to the problems of environmental management. After presenting them, I argue that the underlying rationale is so similar to that of MSDA, that they can be thought of as variations of the MSDA approach with different emphases. That is why I will use the MSDA approach von Winterfeldt (1992) as representing the current position of decision analysts dealing with environmental management problems. In the description of the approach in the next section I integrate their specific innovations from the other case studies.

A key feature in the MSDA literature is the distinction is made between decision makers (e.g. public officials), technical experts, and the stakeholders or lay people who will be affected by the outcomes. von Winterfeldt (1992:322-324) argues that is that all of these roles have been wrongly collapsed into one, where the expert is risk estimator, evaluator, and decision maker. This is inappropriate, von Winterfeldt argues, because while the expert may know about the probabilities of different outcomes from different policy measures, it is the task of the decision maker to combine that technical information with the wishes of the population. As a result, much of the MSDA literature is concerned with the ways in which an environmental management problem can be analysed as a decision problem and how the tools of Decision Analysis can be used to aid experts, stakeholders and decision makers.

3.2.1 Step 1: Problem Formulation

The task of the first step is to translate a usually ill-defined problem (e.g.. what can one do to ensure the sustainability of the DDBR fishery?) into a decision problem with properly formulated decision frame, that consists of both alternatives and the values considered in that decision. Keeney's work on Value Focused Thinking (Keeney, 1992) provides the most detailed and elaborate structure for this. Here I will use Gregory and Keeney (1994); Keeney (1988); von Winterfeldt (1992) to outline the process:

The initial decision context is set by those facing the decision and those with factual knowledge about the decision. In the case of the DDBR this would be the DDBRA, the DDI, and the consultants assisting them with the management planning exercise. According to Gregory and Keeney (1994:1036) the key role of the decision analysts at this stage is to insure that decision context is set broadly enough so that all stakeholders can agree on the context because disagreements tend to occur when the initial statement of the decision context explicitly of implicitly rules out either objectives or alternatives that certain stakeholder groups consider important.

To achieve the initial consensus on the problem definition, maximise the usefulness of the set of objectives, establish the legitimacy of the decision process, and ensure the willingness of stakeholders to co-operate, Keeney (1988) recommends to:

- involve a broad group of stakeholders or their representatives
- involve stakeholders early in the decision process
- make the first meeting with stakeholders a common meeting so that all receive the same information at the same time
- in the initial meeting, review the problem as it is currently understood, the purpose of involving the stakeholders (obtaining their value judgement to develop alternatives, combine with factual information of experts, evaluate alternatives, and inform decision makers about different view points and concerns), how they were selected (though the MSDA literature is not very clear on this point, because the following quote from Keeney (1988:396) is typical "common sense, reasonable moral principles, and numerous laws and regulations"), issues such as gaming (i.e. intentional biasing of objectives to enhance the eventual selection of a preferred alternative. This, Keeney (1988) argues, won't work because all objectives and alternatives are included and no weighting is usually done at this stage.)
- base the stakeholder consensus on the decision context by agreeing to accept the union of stakeholders' objectives as the set of objectives for the decision context and the union of all alternatives that any stakeholder wants considered as the set of alternatives (Gregory and Keeney, 1994:1036).

Other issues mentioned, but not systematically addressed, are the questions of recognising and involving stakeholder groups that are not represented by an organisation, and dealing with the stakeholders who refuse to co-operate. Von Winterfeldt (1992:326) gives the example of a radical environmental movement which refused to participate in an analysis of energy policies for West Germany because they disagreed with the fundamental formulation of the problem - see also Keeney, von Winterfledt, and Eppel (1990). It can also happen that too many stakeholder groups are found (in the offshore oil case over 100 (von Winterfeldt, 1992:326). In such a case the advice is to "keep in mind that all relevant values should be represented by the participating stakeholders, but not necessarily all groups representing similar values". Usually five to ten groups are thought to suffice, and Gregory and Keeney (1994) also argue that more than one from each group should participate, so that a broad based discussion of each group's perspective is ensured.

3.2.2 Step 2: Development of Objectives and Attributes

Once the problem framework has been set and agreed on, the second step in the MSDA approach consists in the construction of separate value trees (also called objectives hierarchies (Keeney and Raiffa, 1976)) for all stakeholder groups. Table 3-2 presents some techniques that can be used in identifying objectives (for a more detailed discussion see Keeney (1992)).

Table 3-2: Techniques to use in identifying objectives

1. **A Wish list**. What do you want? What do you value? What should you want?
2. **Alternatives**. What is a perfect alternative, a terrible alternative, some reasonable alternatives What is good or bad about each?
3. **Problems and Shortcomings**. What is wrong or right with your organization? What needs fixing?
4. **Consequences**. What has occurred that was good or bad? What might occur that you care about?
5. **Goals, Constraints and Guidelines**. What are your aspirations? What limitations are placed upon you?
6. **Different Perspectives**. What would your competition or your constituency be concerned about? At some time in the future, what would concern you?
7. **Strategic Objectives**. What are your ultimate objectives? Which of your values are absolutely fundamental?
8. **Generic Objectives**. What objectives do you have for your customers, your employees, your shareholders, yourself? What environmental, social, economic, or health and safety objectives are important?
9. **Structuring Objectives**. Follow means-ends relationships: why is that objective important, how can you achieve it? Use specification: what do you mean by this objective?
10. **Quantifying Objectives**. How would you measure achievement of this objective? Why, for example, is objective A three times as important as objective B?

Source: Keeney (1994:798)

In the elicitation process, two concepts are used repeatedly (Keeney, 1988:397). The first relates to the separation, so far as possible, of means and ends (or more recently called "fundamental objectives" (Keeney, 1992)). The difference between the two types of objectives is that one set relates to things that they fundamentally care about, such as environmental quality, and those that matter only through their effect on these fundamental concerns, such as waste disposal (which affects water quality, and in turn the environment) (Gregory and Keeney, 1994:1040).

This does not imply that means objectives are less important than fundamental objectives. Instead, "the distinction between fundamental and means objectives is appropriate to evaluate alternatives. Otherwise, double-counting will distort the evaluation. On the other hand, means objectives are important to articulate and appraise alternatives and to indicate how some stakeholders' concerns that were not stated as means objectives are accounted for in an evaluation" (Gregory and Keeney, 1994:1040).

The process of making the distinction is usually achieved by interviewing stakeholders. After they write down a private list of objectives and concerns, the analyst goes through the list with them and asks "why is this objective important?" When the response is that it contributes to achieving other objectives on the list, it is categorised as a means objective, otherwise as a fundamental objective. The usual process is to work with individuals or small group of stakeholders. Notable exceptions to this general rule are Gregory and Keeney (1994), who also used group discussion, and von Winterfeldt (1992:327), who argues that one should attempt to "enlist the highest-ranking representative of each stakeholder group, since such members are usually willing to participate and interested in exploring value questions". Once these two lists have been developed, the analysts construct the fundamental objectives hierarchy and a means-objectives network (see Figure 3-1).

Figure 3-1 Influence of a means-ends objectives network on fundamental objectives organised as a hierarchy (transportation of nuclear waste example)

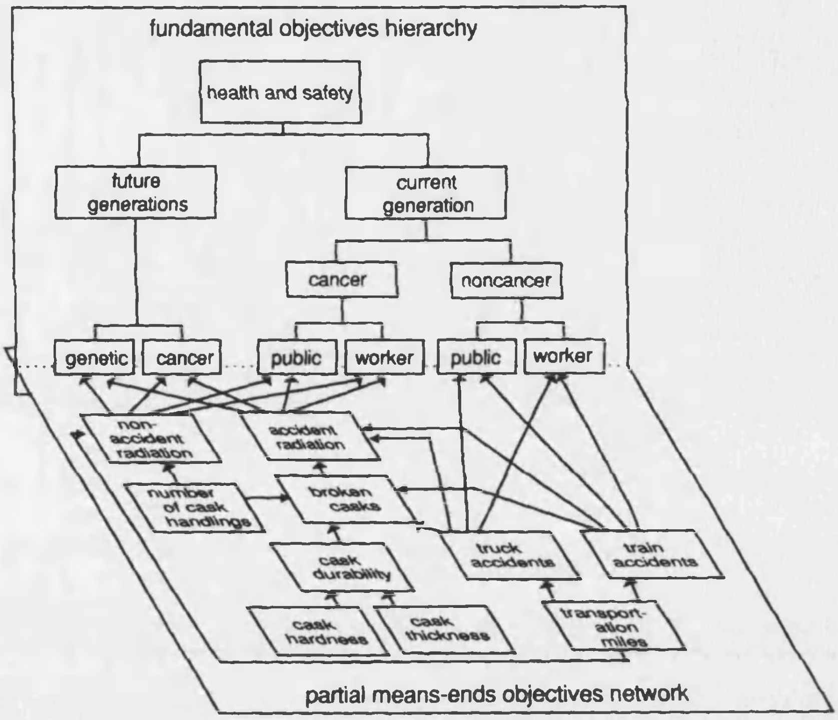


Figure 3.7. Connecting fundamental objectives hierarchies and means-ends objectives networks

Source: Keeney (1992:91)

Keeney (1992:86-87) offers the following reasons for structuring fundamental objectives structured into a hierarchy:

1. *"The higher levels of an objectives hierarchy relate to fairly general concerns, such as the environment, economics, health and safety, and flexibility. Consequently, they can be identified relatively easily.*
2. *Higher-level objectives provide a basis for specification of lower level objectives.*
3. *A hierarchy helps identify missing objectives, since logical concepts of the specification process can fairly easily identify holes in the hierarchy.*
4. *The distinctions between means objectives and fundamental objectives become clearer as the objectives hierarchy is structured.*
5. *Situations where redundancy or double-counting might occur can often be identified with the logic of an objectives hierarchy.*
6. *It is easier to identify attributes to measure the achievement of more specific (lower-level) objectives than of more general (higher-level) objectives.*

7. *The attributes for lower-level objectives collectively indicate the degree to which the associated higher-level objective is achieved.*
8. *The complete set of lowest-level attributes for a fundamental objectives hierarchy provides a basis for describing the consequences in the decision problem and for assessing an objective function appropriate for the problem."*

In the following step, the individual fundamental objectives hierarchies built around a common overall fundamental objective, are combined. This combined hierarchy should include all the objectives in any individual hierarchy, and in a sense is only a logical reorganisation of the individual hierarchies. The main strength of this combined hierarchy is that a "seemingly chaotic diversity of concerns" (Gregory and Keeney, 1994:1041) is presented clearly. All stakeholders should be able to identify all their concerns either in the hierarchy or in the means objectives network. The draft combined fundamental objectives hierarchy should then be tested for nine desirable properties listed in Table 3-3 (Keeney, 1992:82).

Table 3-3: Desired properties of the set of fundamental objectives

1.	**Essential**, to indicate consequences in terms of the fundamental reasons for interest in the decision situation.
2.	**Controllable**, to address consequences that are influenced only by the choice of alternatives in the decision context.
3.	**Complete**, to include all fundamental aspects of the consequences of the decision alternatives.
4.	**Measurable**, to define objectives precisely and to specify the degrees to which objectives may be achieved.
5.	**Operational**, to render the collection of information required for an analysis reasonable considering the time and effort available.
6.	**Decomposable**, to allow the separate treatment of different objectives in the analysis.
7.	**Non-redundant**, to avoid double-counting of possible consequences.
8.	**Concise**, to reduce the number of objectives needed for the analysis of a decision.
9.	**Understandable**, to facilitate generation and communication of insights for guiding the decision making process.

Source: Keeney (1992:82)

The last part in this step of the MSDA approach is to develop attributes that operationalise the meaning of the objectives in the combined fundamental objectives hierarchy. As shown in Figure 3-1, attributes are usually defined at the lowest and most specific part of the hierarchy.

The reason why the attributes are important is they "they provide the linkage between the factual and evaluative part of the analysis. The stakeholder representatives will need the attribute definitions to express their trade-offs in a meaningful way. The experts will need the attributes to understand what is being estimated and to develop models and estimation procedures that allow them to provide estimates on the aspects that are relevant to the stakeholders" (von Winterfeldt, 1992:331).

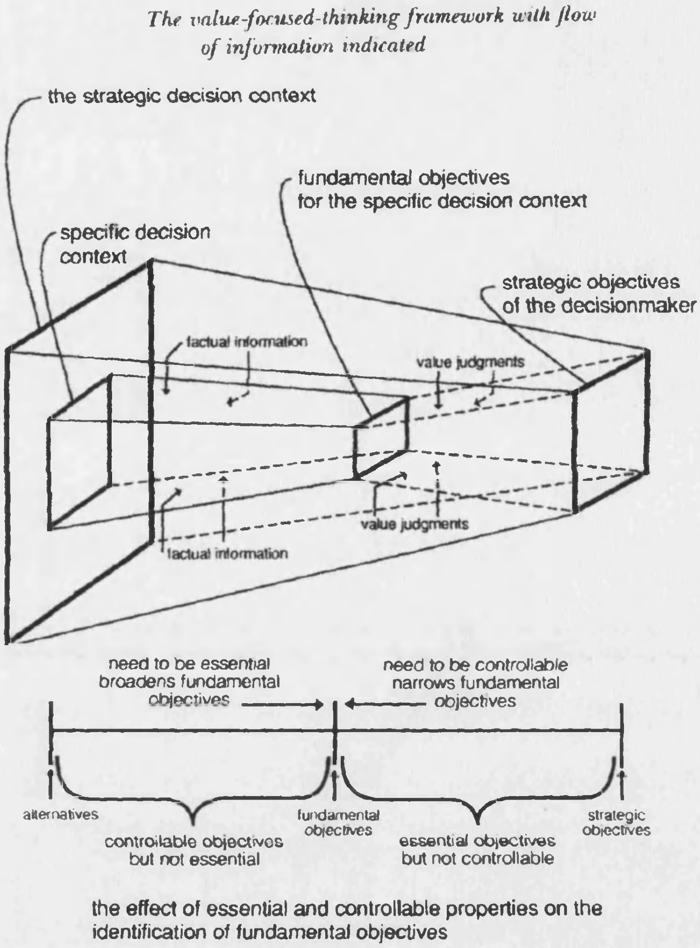
In the terminology of DA, there are two types of attributes: natural and constructed. A natural attribute uses a common quantitative scale, such as "number of local fishermen employed" that could be used to measure the objective "maximise the employment of local fishermen". A constructed scale describes, often in words, several degrees of the level to which an objective may be achieved.[16] Once the attributes for the common fundamental objectives hierarchy has been revised by the analyst, von Winterfeldt (1992:331) recommends that the completed framework is sent to stakeholders and experts for review (stakeholders review it to determine whether the "attributes truly capture their concerns", while the experts review it to determine whether "they can provide estimates of the alternatives' performance on these attributes".)

Figure 3-2 summarises the decision framework used in the MSDA. Noteworthy is the distinction between "strategic objectives" and "fundamental objectives" (Keeney, 1992). Strategic objectives are those "that are intended to guide all decision making" in an organisation (Keeney, 1992:41). All the separate decisions made over time collectively determine how well the organisation performs, and they thereby serve as the mechanism by which management can guide decision making in an organisation. The fact that they are strategic also means that they will not change very frequently. If they are not well specified or not communicated, decisions made over time in the organisation are unlikely fit well together and decision opportunities may be missed.

In contrast to strategic objectives, fundamental objective are defined as objectives that are both essential and controllable, and they need to be specified for each decision problem separately (see Table 3-3). "A set of objectives is essential if each of the alternatives in the decision context can influence the degree to which the objectives are achieved. A set of objectives is controllable if all of the alternatives that can influence the consequences are included in the decision context" (Keeney, 1992:83). This relationship is illustrated in Figure 3-2, which shows that that fundamental objectives must lie somewhere between the decision context and the strategic objectives. The requirement to be essential broadens the fundamental objectives by pushing them toward the strategic objectives, while the fundamental objectives push them back toward the alternatives.

[16] Keeney (1992:Chapter 4) gives detailed guidance on how the attributes are best constructed.

Figure 3-2 *Value Focused Thinking* and the need to balance requirements of fundamental objectives



Source: Figure 2.8 and Figure 3.4 of Keeney (1992:46 and 84)

In the case of the DDBRA, an outline of the strategic objectives was provided at the International Forum, discussed in Chapter 2. The task of the management planning development is to review them and articulate them more precisely if necessary. In the case of fishery management problem, a set of fundamental objectives that fall within the scope of the strategic objectives would need to be developed. The process and methodology that the MSDA approach proposes for that has been described in these first two steps.

The most distinguishing factor of this "value focused" approach is its emphasis on a careful and thorough analysis of values. The reason behind this that in this way decision makers are not only enabled to solve particular decision problem that they may have identified or feel uneasy about, but that they can also identify decision opportunities (Keeney, 1992:47-51, 241-267). The main difference between decision problems and decision opportunities is that decision problems are mostly precipitated by external events, while decision opportunities are identified and defined by the decision maker. A second distinguishing factor of this process is the separation of value judgements (which involves broad stakeholder input, as described above, and are also quantified, as described later), from the factual assessment process that involves work with experts (also indicated in Figure 3-2). The latter is discussed in the next sub-section.

3.2.3 Step 3: Estimation of Risks, Costs, Benefits, and other Impacts

After the values which should guide the decision process have been specified and the attributes by which the impacts of alternatives should be measured have been constructed, the next step in the MSDA approach is to identify and select the experts who will determine the risks, costs, benefits, and other impacts of the alternatives. In other words, the "factual information" part in Figure 3-2 is assessed.

In controversial problem situations von Winterfeldt (1992:331) recommends that a number of different experts are engaged because "experts are likely to take sides." Bonano *et al.* (1990) and von Winterfeldt (1992) recommend that experts be selected on the basis of their professional competence, peer recognition, command of the subject matter, flexibility, their political views, preference among the alternatives. Since these experts usually have little or no background in decision analysis and probability elicitation, they are trained in the task of making probability judgements, and made comfortable in expressing their views and opinions in terms of probabilities. Through this training they will be also made aware of the (cognitive) biases in their judgements and how to avoid such biases. The experts are also assisted by the decision analyst in decomposing their judgmental task into smaller sub-tasks and in the re-aggregation of the sub-tasks.

The purpose of judgement elicitation is to provide a snapshot of the state of knowledge based on their modelling, experimentation, and data analysis in their own domains. Often the work with experts is an iterative process, over longer periods of time (months), where experts are given time to carry out data collection and analysis prior to the actual elicitation of judgements (Keeney and von Winterfeldt, 1991). The decision analyst and the expert usually interact in a one-on-one process, where the analyst first attempts to clarify the elicitation variable or even, to establish boundaries, and to elicit probability distributions over the variable or events. Subsequently, the analyst elicits judgements by asking probability questions and documents both the answer and the reasoning of the expert (Bonano *et al.*, 1990; Keeney and von Winterfeldt, 1991; von Winterfeldt, 1992).

Through this process agreements and disagreements between experts on probabilities of particular events as well conditional probabilities can be brought out. Von Winterfeldt (1992:334) claims that "it is not unusual to find order of magnitudes of disagreements in elicited probability distributions". If disagreements exist, the decision analyst has two basic choices for aggregations of expert judgements: either to employ mechanical aggregation (e.g. averaging) or behavioural resolution (e.g. through the Delphi method or through "group interaction"). No clear rule has been established on how to make the choice between them or to combine them in the analysis. The guidance offered contains three elements:

First, consider the relative importance of highly accurate probability estimates, and if they are indeed central (which they are often not according to von Winterfeldt and Edwards, 1986:132), then use the available debiasing procedures, which according to Fischhoff's (1982) evidence, however, may not be that effective, or try to make the judgement task easier, and give more training to expert.

Second, consider averaging the assessments. Von Winterfeldt and Edwards (1986) argue that while this may not be easy to grasp intuitively, they refer to Seaver (1978:11) who states that: "Since proper scoring rules are convex functions on the probability simplex, the score of the average of individual probabilities will necessarily be better than the average of the individual's scores." The approximate intuitive explanation is that any proper scoring rule (see von Winterfeldt and Edwards, 1986:123-127) has the property that, as the assessment that a particular event will occur gets smaller, the penalty for not assigning that event a probability of 1.0 increases disproportionally. The main problem with the proper scoring rules is that in the case of the logarithmic rule one of its properties suggests that if one happens to assign probability 0 to an event that in fact occurred, than you would lose an infinite amount of money. That is why this rule "is so unattractive that the score is seldom used" (von Winterfeldt and Edwards, 1986:126). An alternative proper scoring rule, the quadratic rule (used primarily in forecasts in meteorology) is more complex but it is difficult to judge the calibration process (von Winterfeldt and Edwards, 1986:125)

Third, consider using a group process for arriving at an estimate, because it could be that the different experts have different kinds or items of knowledge, all which should be considered in the estimate. The main question concerns the process by which the experts' judgements should be brought to bear. Averaging of different estimates is still possible but means also that there is no real purpose of having the experts in a group. One may also insist that the experts come to an agreement. Von Winterfeldt and Edwards (1986:134) cite evidence that the latter is mildly preferable to averaging (especially if consensus itself is an important issue). However, there may be negative effects arising in group situations, such as domination by one group member, power, and conformity (see also the literature on the problem of "Group Think" (Janis, 1972)).

Another approach is through the Delphi procedure (Dalkey, 1975; Dalkey and Helmer, 1963). In its original form, the Delphi procedure was a formal process in which group members never met and remained anonymous. Each expert in the group produced an estimate of whatever was of interest (not necessarily a probability or a distribution) together with written arguments for this judgement. Arguments produced in this way were exchanged anonymously, and a new estimate made in sequential rounds (usually about three). While the Delphi procedure has been applied quite widely (Linstone and Turoff, 1975), it has also been criticised, for example Sackman (1974) concluded that "the evidence did not match the method's popularity". This leads von Winterfeldt and Edwards (1986) to conclude that it is difficult to favour the Delphi method over a "free-form group discussion".

As an alternative to the Delphi technique Delbecq, van de Ven, and Gustafson (1975) proposed the nominal group technique, in which experts are asked to make judgements silently in the presence of the group, present all their judgements, discuss them, reconsider their initial judgements, and then aggregate the judgements mathematically. Von Winterfeldt and Edwards (1986) conclude that the evidence for which method works best is inconclusive, and cite Seaver (1978:52) who argues against group interaction of any kind: "The result of interaction among assessors is quite clear ... it produces more extreme and less well-calibrated assessments. If all of the members of the group agree ..., the individual assessments tend to become more extreme. Apparently, subjects treat the information provided by the group members' assessments as somewhat independent of their own on information, rather than redundant." Von Winterfeldt and Edwards (1986) present their own conclusions very frankly:

> *"To our minds, the implications are clear. By all means use groups if you can; the mathematical advantages are convincing, and you can, by choosing group members carefully, cover the fields of knowledge relevant to your topic. But don't bother to get the members together, unless group pressures or other social factors make it necessary. Instead, simply elicit the desired uncertainty measures from each member individually, using whatever methods of elicitation fit the problem best, transform the results into probabilities, and average them. The odds seem excellent that, if you do anything more complex, you will simply be wasting your effort.*
>
> *The only context in which we have any reservations about this conclusion is that of very low probabilities. Here, interactions*

among kinds of information may be crucial to the formulation of models of the events of interest, and if so, there should be face-to-face discussion of those models. Moreover, for such extreme numbers, we would prefer averaging log odds to averaging probabilities." Von Winterfeldt and Edwards (1986:136)

In the light of the above, it is not quite clear what model or process von Winterfeldt (1992:334) has in mind when he recommends a "behavioural resolution" for cases in which "averaging would hide the true sources of the disagreement" (e.g. when one expert in his case study thought that two events were practically independent, while another thought they were highly dependent.) In situations of wide disagreements among experts, MSDA analysts are most likely to argue that "separate distributions have to be carried throughout the analysis to provide sensitivity results with respect to these differences" (von Winterfeldt, 1992:336).

3.2.4 Step 4: Elicitation of a Multi-attribute Utility Model from Stakeholders

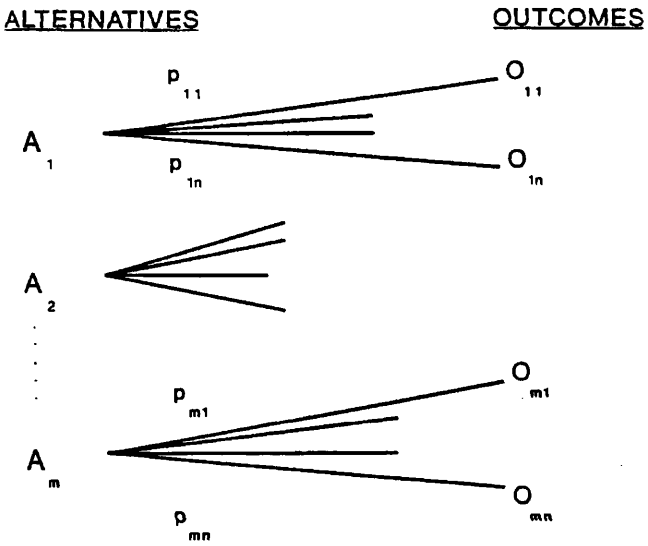
The purpose of this stage is to develop a model of stakeholder values that reflects their relative preference for attainment of different attribute levels, the judgement of the overall importance of different attribute types, and their attitude towards risk. To accomplish this, two type of judgements are elicited from stakeholders: first, judgements about the relative desirability of different levels of an attribute. These are the basis for so-called single-attribute utility functions, and they assess a decision maker's attitude toward risk. The second type of judgement concerns the trade-offs among changes in one attribute versus another.

The methods for developing a multi-attribute utility model were originally developed by Keeney and Raiffa (1976), and are extensively described in Keeney (1992), and von Winterfeldt and Edwards (1986). The following summary, based on Kleindorfer, Kunreuther, and Schoemaker (1993:131-133), presents the assumptions of Expected Utility theory and outlines the process by which multi-attribute utility models are built.

According to Expected Utility theory an individual chooses that alternative A1 from a set of possible alternatives A_i (i = 1 . . .m) with maximum expected value.

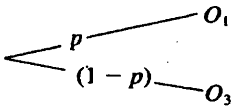
> *Axioms of utility theory.* In utility theory, a person's decision problem is solved through the evaluation of a set of outcomes (Oij) that result jointly from a choice of alternative i and the occurrence of some state of nature j with given probability (p_{ij}). These elements are shown in Figure 3-3 for the case of a single attribute. If the following axioms are satisfied, it is possible to construct a person's utility function. This utility function reflects both the person's attitude toward risk as well as the person's values for the outcomes under certainty.

Figure 3-3 Lottery representation of risky options

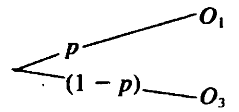


Source: Kleindorfer, Kunreuther, and Schoemaker (1993:132)

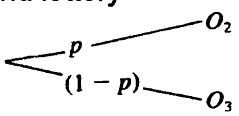
1. *Completeness.* For any choice between outcomes O_1 and O_2, either O_1 is preferred to O_2 (denoted $O_1 > O_2$), or $O_2 > O_1$, or both are equally attractive (denoted $O_1 \sim O_2$).
2. *Transitivity.* If $O_1 > O_2$ and $O_2 > O_3$, then $O_1 > O_3$. (Also if $O_1 \sim O_2$ and $O_2 \sim O_3$, then $O_1 \sim O_3$).
3. *Continuity.* If $O_1 > O_2 > O_3$, then there exists some probability p between zero and one such that such that the lottery



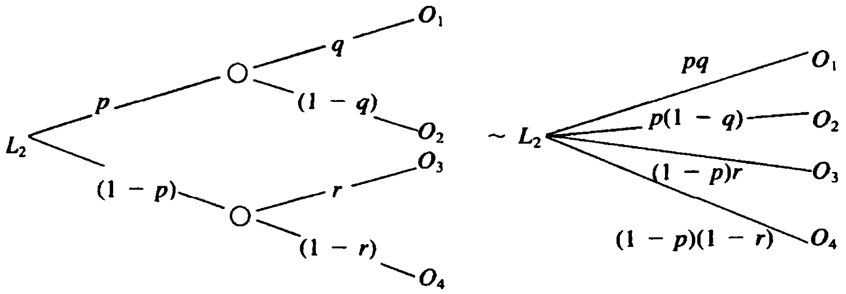
   is as attractive as receiving outcome O_2 for certain.
4. *Independence.* If outcome O_1 is as attractive as outcome O_2 under conditions of certainty then lottery



   and lottery



   will be equally attractive (for any values of O_3 and p). In other words, outcome O_3 and p are irrelevant to the final choice, provided $O_1 \sim O_2$. This is also known as the substitution axiom.
5. *Reduction of Compound Lotteries.* A compound lottery (i.e., one whose initial outcomes are themselves lotteries) is equally attractive as the simple lottery that is obtained when multiplying through probabilities. For example:



These axioms imply the following key Expected Utility (EU) theorem (for proof see Kleindorfer, Kunreuther, and Schoemaker, 1993:402-410)

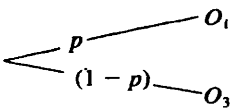
EU Theorem. A utility function U can be defined on the outcomes with the property that an alternative with a higher expected utility is always preferred to one with a lower level of expected utility.

To construct such a utility function, a person must make indifference judgements between a sure option and a two-outcome lottery (usually with the help of a decision analyst). For example, if the analyst wants to derive a utility function for different levels of fish catch, he presents the assessee with the following choice:

A fish catch known for certain to be O_2

versus

A fish catch that is uncertain but will result in O_1 or O_3 from the lottery with probabilities p and (1 - p) respectively



where $O_1 > O_2 > O_3$. The analyst can then elicit preference by specifying three of the four parameter (p, O_1, O_2, O_3) and asking the assessee to indicate the value of the fourth variable such that he is indifferent between the two fish catch levels. Two of the most commonly used methods for eliciting such indifference values are (i) the certainty equivalence method (where an indifference level for O_2 is elicited for given values of p, O_1, and O_3); and (ii) the probability equivalence method (where an indifference level of p is elicited for given values of O_1, O_2, and O_3). The shape of the resulting utility function is determined by both the strength of preference for the outcomes under certainty as well as the person's attitude toward risk.

The utility function elicitation process outlined so far showed how the alternatives are evaluated when there is only one objective. In order to determine the preferred alternative the individual utility functions of a person need to be aggregated. This requires the establishment of a functional relationship between the attributes of the different objectives. The process requires two elements: first, determination of relative importance weights of the different objectives (which reflect the trade-offs that the persons makes between the objectives), and secondly, a way of combining the individually weighted utilities.

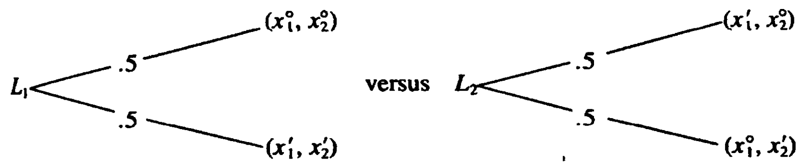
In order to avoid very complex multi-attribute utility functions (see for example multiplicative or multilinear models in Keeney and Raiffa (1976)) decision analysts try to structure multi-attribute decision problems so that the following conditions hold:

Preference Independence: trade-offs between any pair of attributes are independent of a third attribute. This means that x_1 and x_2 are preferentially independent if and only if a persons trade-off between x_1 and x_2 do not depend on the level at which x_3 is fixed. Furthermore, if every pair of attributes in preferentially independent of all other attributes (this condition is called mutual preference independence), then the proper form of aggregating the single attribute utility functions is through addition. Since each attribute x_i has its own utility function $U_i(x_i)$, which can be constructed independently of the others, the overall utility is calculated as follows:

$$U_i = \sum_i w_i U_i(X_i)$$

Utility Independence: a person's preferences for lotteries outcomes on one attribute (e.g. X_2) do not depend on the levels at which other attributes are fixed (x_1, x_3, . . . , x_r). *If this condition holds, then the utility function is either additive or multiplicative.*

Additive Independence: if there exists no interaction between the attributes then the functional form of the multi-attribute utility function is additive. This condition can be tested by the following comparison of lotteries (using here a two-dimensional example):



If L_1 is attractive as L_2 for any given values of x°_1 and x'_1, it means that the assessee is not influenced by how the outcomes from different attributes are combined (assuming also equal probabilities).

If the independence conditions do not hold, then the most common strategy that decision analysts employ is to restructure or redefine the attributes to avoid interaction effects. Once the analyst has ensured that the multi-attribute utility function is additive, he can proceed to determine the relative importance weights which reflect the trade-off which stakeholders make between attributes. The procedure is the same as that for the determination of a single attribute utility function.[17]

The expected utility index U_i that results from the evaluation of an alternative, for example 0.76, implies that the decision maker regards that alternative to being equivalent to a lottery which offers a 0.76 chance with the probability of the best outcome on all the assessed attributes and a complementary probability of 0.24 for the worst outcomes on all assessed attributes (Goodwin and Wright, 1991:93-94).

Keeney (1992:157-198) argues that the usefulness of such a detailed value assessment process, which contains both qualitative (identification and structuring of objectives) and quantitative (identification of attributes and utility functions) aspects, extends beyond the specification of an objective function that can be used to evaluate alternatives. Specifically, it can help identify implicit assumptions and hidden objectives of stakeholders (or decision makers), it can show what data are most relevant for the resolution of a particular problem, and most importantly, it is a thorough and systematic search for creative alternatives and for decision opportunities that may be improvements over those already identified.

Tocher (1977) cited in Goodwin and Wright (1991) argues that the hypothetical questions take the assessee away from the real world and so may not accurately reflect what he would really do.

According to von Winterfeldt and Edwards (1986:213, 215):

> *In our opinion, the distinction between value and utility is spurious, because (1) there are no sure things, and therefore values that are attached to presumably "riskless" outcomes are in fact attached to gambles; (2) risk aversion can frequently be explained by marginally decreasing value functions and/or by regret attributes of a value function; (3) repetitive choices tend to eliminate risk aversion, and an argument can be made that all choices in life are repetitive; (4) error and method variance within value and utility measurement procedures overshadow to a great extent the subtle distinctions that one may extract from the theoretical differences.*
>
> *"The conclusion of our assertion is that for theoretical, psychological, and practical reasons the distinction between utility and value are spurious. This conclusion is at odds with much of the literature on the topic."*

According to Howard Raiffa (1982), who is considered a leading proponent of the utility approach:

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[17] For a simple example with three attributes see Goodwin and Wright (1991:90-92).

"Many analysts assume that a value scoring system-designed for trade-offs under certainty can also be used for probabilistic choice (using expected values). Such an assumption is wrong theoretically, but as I become more experienced I gain more tolerance for these analytical simplifications. This is, I believe, a relatively benign mistake in practice."

The conclusions of Goodwin and Wright (1991:85) is that they would recommend applying utility assessments (as opposed to the simpler value assessments) only when uncertainty is central to the decision maker's or stakeholders' concerns. Due to the problems with such assessments, they recommend that one thinks of the utilities as a useful tool for gaining a greater understanding of the problem.

3.2.5 Step 5: Sensitivity Analysis and Option Invention

The outputs of the MCDA process described so far produced the following elements: a jointly agreed decision problem with an objective hierarchy and attributes, an assessment by experts of the likely outcomes of the alternatives in terms of the attributes, and, a multiattribute utility model for each stakeholder representative that reflects the relative strength of preference for different attribute levels, attitudes towards risk, and trade-offs among the different objectives for that person or group separately.

Next, the judgements of experts (the factual model) and stakeholders (the value model) need to be combined to form an overall evaluation. This is done by integrating the judgements of one expert and one stakeholder. In the case where there are different experts for different attributes, von Winterfeldt (1992:338) recommends that "experts should be selected to represent a common point of view." First, an expected utility is calculated for each alternative and attribute using the expert's probability distribution and the stakeholder's single-attribute utility function. Then a multiattribute utility model is used to calculated the overall utility across attributes.

This analysis is then repeated for all stakeholders and experts, resulting in as many overall utility evaluations of the options as there are combinations of experts and stakeholders. It is unlikely that there will be one alternative that dominates all others, both because of expert disagreements and different stakeholder value models.. In this way One can evaluate by how much one would need to change a judgement (by an expert or stakeholder) before a change in rank order occurs, by sensitivity analyses on expert and stakeholder judgements. This provides information on the importance of different judgements, and systematic differences between experts and stakeholder (groups). These insights can then be used to "facilitate the invention of new compromise solutions" and "the models become a vehicle for dialogue and communication" (von Winterfeldt, 1992:338).

3.3 Previous Applications of MSDA and Variations

I argued in the introduction that the majority of published decision analysis applications to environmental management problems fall within the MSDA approach, even if very few have applied (or proposed to apply) all five steps outlined above other than for nuclear industry related matters.[18] The two main characteristics which differentiate this approach from traditional DA are the attempt to assess the value and factual components of a decision problem with different people and that the analysis is carried out separately with different stakeholder representatives.

An important point that emerges from a detailed analysis of the literature is that the rationale for the different decision analysis approach can also differ substantially. In traditional DA the analyst would seek to work directly with the decision makers to help them clarify a problem and reach a decision on a most preferred alternative. With MSDA, the analysis is often done to inform the policy debate, and the analysis is intended as an input for the decision maker, who is often different from those who provide the value and probability judgements.

In order to substantiate my argument, I now provide an overview of the different types of applications. I am particularly interested in assessing the extent to which the applications differ from the MSDA approach outlined above and in inferring from the conclusions of the authors possible applications (or the relevance of DA for applications) for the fishery management problems of the Danube Delta.

3.3.1 Applications of the whole MSDA process

The following three papers reflect the range of applications of the whole MSDA process:

First, Keeney and von Winterfeldt (1987a) who worked with the U.S. Department of Energy to assist them choose an underground repository for nuclear waste. There are other publications that complement this paper (or similar nuclear energy related questions) such as Bonano *et al.* (1990), Keeney and von Winterfeldt (1987a),

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[18] For example, in Gregory and Keeney (1994) the decision problem was formulated, objectives were developed (with some attributes), objectives were ranked, and alternatives devised. This information provided a basis and guidance for a subsequent Environmental Impact Assessment process that evaluated a proposed mining activity in Sabah, Malaysia.

Keeney and von Winterfeldt (1994), but it appears that full fledged MSDA has been applied very seldom. Von Winterfeldt (1992), which I used as the framework for outlining the MSDA approach, and which uses examples from a number of different applications (which I was not able to access in order to determine if they actually went through the whole MSDA process). Keeney and von Winterfeldt (1987a) also represents one of the most dramatic test for MAU to withstand audits of a decision or recommendation.

Second, the full fledged MSDA approach Gregory, Keeney, and von Winterfeldt (1992) has also been proposed as basis for structuring the existing Environmental Impact Statement process (Council on Environmental Quality, 1987). Among the expected results would be that alternatives are more effectively assessed, the scope of the assessment is widened, uncertainty is treated more effectively, the distinction between facts and values is made more clear, and the public participation is made more effective.

The third type of application is presented in Keeney, von Winterfledt, and Eppel, (1990) who called it a "Public Value Forum". The aim of this process is to inform policy making using MSDA techniques about objectives and attributes that different groups of society consider relevant, the trade-offs that they consider reasonable, and their preferences for alternatives. There are two main differences between the "Public Value Forum" and the MSDA approach outlined earlier.

The first difference is that the participants in the Public Value Forum were "selected from two groups of the general public that were thought to represent somewhat different views", instead of directly affected or involved stakeholders used on the MSDA approach (Keeney, von Winterfledt, and Eppel, 1990:1018).[19].

Secondly, the first three steps of MSDA (problem formulation, development of objectives and attributes, and estimation of risks, costs, benefits and other impacts) were prepared in advance by experts (an "Enquete Commission on Energy Policy" and "leading representatives of 10 major German organisations") and only revised by Forum participants (noteworthy also is the fact that participants representing "the different views" worked separately in two Forum workshops). After revising the

[19] Keeney, von Winterfledt, and Eppel (1990) used a group of apparently self-selected engineers and social science teachers to represent the different views. I will show in the reviews of Adaptive Environmental Management and Assessment (AEMA), and Cultural Theory which I discuss in Chapter 5 and Stratified Systems Theory in Chapter 6, that the neglect of organizational theory within the MSDA approach is a potentially serious shortcoming.

prepared value tree, participants followed the remaining steps of the MSDA approach as described.

Two more features of the Keeney, von Winterfledt, and Eppel (1990) study are noteworthy. The first relates to how the authors view the links of the Public Value Forum to other methods to "illuminate and clarify public values in complex policy problems." (Keeney, von Winterfledt, and Eppel, 1990:1011) The second point relates to the way the authors dealt with the resolution of inconsistencies between the results of the multi-attribute utility analyses and their own intuitive evaluations.

According to Keeney, von Winterfledt, and Eppel (1990), voting for political representatives is, and remains, the main mechanism for incorporating public values in policy making in a democratic society. However, voting at elections does not resolve the problem of how political representatives or policy makers should interpret public values in a specific policy context. Furthermore, the voting and political representation process, does not resolve the question about what roles experts and their values should have, and how expert recommendations and value interpretations should be combined in policy making. In the light of the existing methods for eliciting public values for specific policy questions, Keeney, von Winterfledt, and Eppel (1990) see the Public Value Forum as a combination of focus groups and direct value elicitation techniques (building on Brown (1984), Renn *et al.* (1984), von Winterfeldt, (1987). Keeney, von Winterfledt, and Eppel (1990:1029) come to the following conclusion about the advantages and disadvantages of the Public Value Forum:

- the value forum can provide very specific and useful information, especially about the trade-offs that participants feel appropriate for evaluating alternative policy options
- The acceptance of the expert assessments by the participants and the relative flexibility in their weights and intuitive evaluations indicate that there exists much room for negotiation and adjustment on the value side of the energy problem.
- The process of eliciting and reconciling value-relevant information can lead to changes in the participants' evaluation (specifically "there was a shift toward moderation on both sides of the energy debate as the forum progressed" - which the authors interpret as an "educational effect")
- The greatest disadvantage is the time and cost of the forum (it took two professionals to design the forum and six to conduct it - approximately 60

person days - and 46 person days as an aggregate of participants' time - who were paid for participating).

- Another disadvantage mentioned is the small sample and the lack of representativeness.

The overall conclusion to which Keeney, von Winterfledt, and Eppel (1990:1029) come is that the best use of a value forum "might be for value elicitation and education with small groups of key representatives and leaders of stakeholder groups involved in specific policy debates." My own interpretation of this conclusion is that this shows that the Public Value Forum is, in fact, almost indistinguishable from the MSDA approach presented in the beginning of this chapter.

The second point I want to make relates the way Keeney, von Winterfledt, and Eppel (1990) dealt with the resolution of inconsistencies between the results of the multi-attribute utility analyses and their own intuitive evaluations:

> *Participants were told that the results of their multiattribute utility analysis and their own intuitive evaluations probably showed some inconsistencies. The forum leader pointed out that these inconsistencies were nothing to worry about and they were also told that there were several reasons why these inconsistencies occur, including*
>
> 1. *an incomplete or inappropriate set of objectives and attributes;*
> 2. *an inappropriate aggregation rule for the multiattribute model;*
> 3. *biased intuitive evaluations of the futures or the paths;*
> 4. *biased weights;*
> 5. *biased single-attribute utility functions (ratings);*
> 6. *biased expert assessments of the impacts.*
>
> *Participants were then handed out a form ... [where] the following additional information was provided:*
>
> 1. *the normalised swing weights;*
> 2. *the ratings of the energy futures on the eight component objectives;*
> 3. *the overall ratings of the energy paths;*
> 4. *the calculated multiattribute utilities of the energy futures (combining 1 and 2).*
>
> *Participants were asked to generate a final overall evaluation of the energy paths by referring to the above described reasons for inconsistencies. If they considered the objectives or aggregation rule inappropriate (reasons 1 or 2), they were asked to qualitatively describe the desired changes or additions.*

If, however, they wanted to make adjustments to their numerical evaluations based on reasons 3-5, they should either change their weights, objective ratings, or overall evaluations. If they disagreed with the expert assessments of impacts, they should note desired changes in the appropriate cells ... [on the form] and re-rate the impacts. Staff members assisted them in these tasks. The goal was to achieve at least ordinal consistency between the final overall evaluation of the paths and the multiattribute evaluation model of the [energy] futures (Keeney, von Winterfledt, and Eppel, 1990):1022-1023)

What this passage shows is not, as some critics of DA have argued, that multi-attribute utility analysis is not appropriate because the people's elicited judgements often do not correspond to their intuition. I have already argued earlier (in the outline of the utility elicitation process) that people must only desire to make coherent judgements (as defined by the Axioms underlying the Expected Utility Theorem)[20]. Instead, the point I would make is that this passage shows that the MSDA approach seeks to elicit (and also help develop) a factual and value model that has some validity independently of the people who developed it. The part of the passage that I would highlight most is "that these inconsistencies were nothing to worry about" (because one of the experts, the analysts, or they themselves must have made some mistake which resulted in a less than perfect match). I will show in Chapter 7, when I discuss the Decision Conferencing approach to decision analysis, that this is a very important difference between the two decision analysis approaches. The analogy that Keeney (1992) makes in the following passage also supports my argument[21]:

The data needed for parameterising a value model rest in the minds of decision makers or people knowledgeable about a given problem. The assessor (trained analyst) gathers such data by eliciting judgements from these people. This situation is analogous to many scientific problems where the knowledge necessary for

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[20] There are numerous examples, such as the Allais Paradox, which show that people do not always behave in accordance with the Subjective Expected Utility rule. The position that many decision analysts take (eg Goodwin and Wright (1991) or von Winterfeldt and Edwards (1986)) is that utility theory does not attempt to describe the way in which people make decisions. Instead, it is a normative theory which prescribes what people *should* do *if* they accept the axioms of the theory. If a decision maker wants to ignore the indications then that is his prerogative. For further discussion see for example Kleindorfer, Kunreuther, and Schoemaker (1993:146-153).

[21] This does not mean, however, that the assessee is expected to have the values (or the options) readily formed in his or her mind. Instead, as Keeney, von Winterfledt, and Eppel (1990) argued in their conclusions which I presented earlier, preference can change through the elicitation process itself. However, I would argue, following Phillips (1984) and Phillips (unpublished), that more is involved than just the "educational" effect, and that this can be a very potent source for working on a better understanding of the decision problem.

parameterising a model is "out there", and individuals need to collect it. If the information is about geology, one digs holes in the ground to gather data. If the information is about values, one "digs holes" into someone's mind to collect the data. Keeney (1992:131)

3.3.2 Other Environmental Management related applications

The work of McDaniels (Keeney and McDaniels, 1992; McDaniels, 1994; McDaniels, 1995; McDaniels, 1996a; McDaniels, 1996b; McDaniels, Healey, and Paisley, 1994) shows how the MSDA approach to decision analysis has been applied both through work with multiple-stakeholders and with one stakeholder but from several perspectives (except for McDaniels (1995)). His work is closely related to Keeney, von Winterfeldt, Gregory, and other researchers at Decision Research in Oregon. The reason why I discuss his work, especially McDaniels (1994) and McDaniels (1996a), separately from the MSDA approach above is that in these two papers he uses a very similar rationale to that of the MSDA approach but he does not actually work with different stakeholder groups (while the essence of McDaniels (1996b), and McDaniels, Healey, and Paisley (1994) in which he works with different stakeholder groups, is captured in the MSDA discussion above).

McDaniels (1994:1046-1047) identifies a number of reasons why implementing sustainability concepts (WCED and World Commission on Environment and Development, 1987) by electric utility companies[22] is difficult. Among these he lists the following:

1. "Differences in opinion will always exist between social and economic groups about what ethics and justice mean.
2. Changes to the status quo that are viewed as harmful to established interests are likely to be opposed;
3. Organisations of all sorts are highly resistant to change, and without clearly structured new procedures that are mandated by organisational leaders, they are likely to hold on to old habits;
4. Decisions are often so complex that it is difficult to assess what is ethical and just and what is not."

In the cases where, on the basis of a distinction between natural and man made capital, authors (such as Turner (1993)) recommend the use of decision rules that

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[22] McDaniels and Keeney worked with BC Hydro, Canada

recognise sustainability or the carrying capacity[23] of natural capital as a constraint of economic activity, McDaniels (1994:1046) argues that the following issues need to be confronted:

> *Sustainability in applied utility planning, or any other context, is not only a matter of establishing sustainability constraints and then meeting them. Rather, several important issues must be confronted in implementation. First, there are plausible public objectives that underlie several possible alternative sustainability constraints. Second, there are different levels of costs associated with meeting constraints of different stringency. Third, the acceptability of a given constraint is greatly affected by the characteristics (benefits and costs) of the alternative possible constraints in a given decision context (Derby and Keeney, 1981) Fourth, even when the nature of the appropriate constraint is universally agreed upon, there will often be differences in costs associated with different ways to achieve the constraints, as well as differences in the incidence of costs (and benefits) among groups. These differences will require careful attention to ways to minimise costs in order to achieve the political support needed to turn concepts into action.*

In the context of the DDBR this would mean that the carrying capacity which is supposed to guide the DDBRA does not automatically result in a unique fishery management option.

McDaniels proposes the use of MSDA to deal with these problems. The feature which distinguishes his argument most from the other MSDA authors is that he argues that the approach provides the necessary information about differences in preferences and distributional effects among groups, necessary to overcome "the fundamental obstacle to achieving sustainability: the political economy of change: the inevitability of specific winners and losers when major reallocations of resources occurs and the power of interests favouring the status quo (Samuelson and Zeckhauser, 1988)."

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[23] Since the carrying capacity concept is important in the context of the Danube Delta fishery, McDaniels' elaboration is interesting: "Carrying capacities (sustainability constraints) could be set on the basis of a wide variety of criteria: to protect human health, to protect the health of flora and fauna, to maintain current environmental quality, to enhance current environmental quality, to sustain a population base or economic base, to protect human values associated with the environment, to protect intrinsic (non-human) values associated with the environment, or to protect the complete physical stock of natural capital for future generations. Each constraint would lead to different levels of environmental protection, and different costs. Differences in costs and benefits among several plausible alternatives raises the question of how the 'best' sustainability constraints should be identified and implemented." (McDaniels, 1994:1046)

The most disappointing feature of the McDaniels (1994) paper is that by its own admission, the actual case study was "a relatively simplistic application of multiattribute approaches". I agree with his assessment and would go even further: the main thing his case study showed is that specifying values, thinking about the inter-relationship between different sectors, and considering the effects of alternatives on stakeholder groups helps decision maker to understand the problem better and to develop alternatives. This is, however, a conclusion which much of the earlier decision analysis literature has found repeatedly. McDaniels has fallen far short of showing how institutional inertia is overcome (except for the straight forward point that some leadership is required), or how different stakeholder positions can be rigorously assessed or integrated by a single assessor (or how the approach that he may have implemented would have differed from MSDA). I therefore conclude that the political economy of change and the institutional inertia questions are still unanswered.

In a more recent paper, McDaniels (1996a), also aims to assist electric utilities deal with their environmental impacts. From the perspective of this thesis, the most noteworthy feature of that paper is the fact that McDaniels (page 59) argues that "constructing an environmental impact index requires technical expertise to identify those factors [or "objectives"] that are important in judging impacts, and then requires value judgements by decision-makers or other stakeholders to establish relative priorities among these objectives". The implication of this suggestion is, in a sense, in conflict with the MSDA process, where the importance (and feasibility) of early stakeholder involvement in problem definition is stressed. In some way, this paper also contradicts the rationale of McDaniels (1994), because in the development of the environmental index, the different view points, or information about different winners and losers (i.e. the political economy of change) which is important for the development of "compromise" options is not readily available.

Jones, Hope, and Hughes (1990), like Keeney, von Winterfledt, and Eppel (1990), tried to use decision analysis as a communication tool (facilitate learning within organisations and between organisations). Their approach was different from Keeney *et al.* in the following ways: It did not make a distinction between means and ends objectives. Instead, they developed a list of 41 attributes with 25 individuals from 16 organisations (which they filtered out of a database of stakeholders containing 250 individuals and 100 organisations) on the basis of their belonging to energy industries, political parties, government, pressure groups and trade unions. The options were developed from a number published energy scenarios. However, the two most distinguishing features of the paper are that it seems to have been self-administered using a computer programme (because they speak of "users", "Framework" software, and that model allows users to change scores or ratings and see immediately the effects), and that they used the Simple Multi-Attribute Rating Technique (SMART) (von Winterfeldt and Edwards, 1986) instead of more elaborate probability and utility elicitation techniques that other applications mentioned so far used.[24] They reported some difficulties among users in understanding precisely what the attributes and the options meant and that only in a workshop format were users be able to understand more fully the reasoning of other stakeholders (instead of just inferring the reasoning from the "value sets" of other users).

The only other authors that come close to recommending a decision making process that is very close to a full-fledged MSDA, are Maguire and Boigney (1994). They combine the MSDA approach outlined in Gregory, Keeney, and von Winterfeldt (1992), Keeney (1988), and Keeney, von Winterfledt, and Eppel (1990) with conflict resolution and negotiation analysis (e.g. Sebenius (1992)). Maguire has applied the decision analysis framework to endangered species conservation decisions (several hypothetical cases are explored in Maguire (1986), black-footed ferrets in Maguire *et al.* (1988), captive tigers in Maguire and Lacy (1990), grizzly bears in Maguire and Servheen (1992) and northern white rhino in Maguire and Boigney (1994)). The 1994 study benefited from direct discussion with stakeholders about the issues, but it did not actually elicit the values used directly from them and it appears as though this study is therefore a hypothetical illustration. Three issues are noteworthy about Maguire and Boigney (1994).

First, is their argument that alternative dispute resolution (or conflict resolution) techniques, such as those presented by Fisher, Ury, and Patton (1991), or Lax and Sebenius (1986), promote creative thinking and compromise, but that they lack a formal structure for identifying disagreements in complex disputes. The fact that their proposed process resembles that of MSDA very closely (in essence, it only contains some more explicit feedback loops between the different steps) can be taken as evidence that the MSDA is indeed useful (as MSDA authors argue themselves) for dealing with multiple stakeholder decision problems. Related arguments about the usefulness of decision analysis for negotiations and compromise or consensus

[24] See Section 3.2.4 for a discussion of the difference between MAUT and SMART.

solution development can also be found in Goodwin and Wright (1991), Keeney (1992), and Raiffa (1982).

Secondly, she points out that Adaptive Environmental Management and Assessment (AEMA), (see next Chapter, or Walters (1986)), is an alternative decision aid that has been employed to resolve policy disputes, but argues that it helps only with the modelling of the "factual" side of a decision problem and with the "value side of disputes" (Maguire and Boigney, 1994:33). In essence, the AEMA approach assists experts and decision makers to develop computer simulations which project consequences of different policy options.

Third, Maguire and Boigney (1994:32) summarizes the arguments for why environmental management disputes are difficult to resolve as follows:

1) limited information and uncertainty about natural and social processes affecting policy outcomes;
2) important and potentially irreversible outcomes or effects of alternatives;
3) multiple stakeholders that are affected by, or can themselves influence the outcomes;
4) even though stakeholders may have a common overall objective, they can still have conflicting sub-objectives because of differing financial, political, or technical capabilities;
5) stakeholders (or experts) who value possible outcomes very differently or disagree over the probability of uncertain events may influence disproportionately the outcome of policy actions.

To these they add a sixth one: "the necessity for consensus, since none of the parties is capable of achieving the common goal on its own." I will return the question of the "necessity" of consensus in Chapter 7 and in the Conclusion, because this requirement does not tally with the MSDA approach (as seen for example in my discussion of the sensitivity analysis step of the MSDA approach above, Section 3.2.5)[25]. The discussion in the next two chapters (especially the AEMA and Cultural Theory) will prove useful for the clarification of this point.

3.3.3 Applications to Fishery Management

According to Pearse and Walters (1992), the crucial task of fisheries managers is to determine the most appropriate level of harvest. The problem is that the information they have is never perfect, but instead, to widely varying degree it is incomplete, inconsistent, and contradictory (page 167). Pearse and Walters (1992) argue that

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[25] But I will show what it could mean within the context of the organizational structure of the DDBRA. Before I am able to do that I need to introduce some organizational theory in Chapter 6.

disputes over harvesting regulation are aggravated because of the conflicting interests that are at stake. In their experience, governmental fisheries managers, who seek to specify a harvest that can be sustained tend to be very conservative in the face of uncertainty about stocks and the effects of fishing. Fishermen, on the other hand, who are more sensitive to economic pressures and to the short-term cost of foregone opportunities when harvests are constrained to lower levels, are much more willing to take risks. The essential problem in this conflict is to determine what constitutes 'reasonably' safe limits. The shortcoming in the current fishery management decision making framework is that it does not satisfactorily answer the question of who should decide on the acceptable levels of risk.

To resolve this problem, Pearse and Walters (1992) follow the argument of the MSDA literature very closely (referring also to Keeney (1988), Keeney and Raiffa (1976), and Keeney, von Winterfledt, and Eppel (1990)) distinguishing between assessing risks and making judgements about what risks should be taken. They lament "that too often biologists, trained to deal with the former, are burdened as well with the latter" (page 168). In their view the role of the scientist is clear: risk assessment (assessing the probability of possible outcomes).[26]

Pearse and Walters (1992:170-171) argue that fisheries scientists are "well equipped to make probabilistic statements about the consequences of policy choices", and that probabilities are "a much more helpful way of recognising uncertainty than simply ascribing ranges or confidence limits to expected outcomes. They provide more information from the available data about degrees of risk, and they can be structured in ways that permit ranking and evaluation of policy alternatives." In the light of the MSDA framework discussed earlier in this chapter, I argue that while decision analysts would agree that the fishery scientists have the necessary expertise, but that Pearse and Walters (1992) probably underemphasize the problems that scientists face even for this more clearly defined role.

Pearse and Walters (1992:170) admit that, "there is inevitable debate among scientists [between Bayesians and frequentists] about how historical fisheries data

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[26] They use the following analogy to make the point: "If an aeronautical engineer advises a traveller to fly in a certain aircraft because it has only a 2% probability of crashing, he strays beyond his competence. We should defer to him about the probability of a crash, but not about his conclusion that the risk to the hapless traveller is worth taking. Similarly, biologists, whom we must depend on to predict the effects of harvesting stocks, have no business deciding how much risk we should take, or indeed how we should balance the various benefits and costs of resource management decisions" Pearse and Walters (1992:171).

should be used in probability calculations but these 'esoteric' debates are generally open and constructive. "Experts usually scrutinise them, and the stock assessments resulting from them, objectively and with healthy effects". If there are still problems which cannot be stated in probabilistic terms (something which decision analysts generally deny because most are Bayesians), the problem can be "minimised by independent expert review and open debate". Evidence that this is often not the case can be found in the MSDA applications mentioned earlier, where differences in expert judgement had to be carried throughout the analysis because they could not be resolved (and in the discussion of how to deal with expert disagreements - averaging, Delphi, etc.), (McDaniels, 1995) which I discuss later on, but most clearly in the fisheries literature (see for example Fairlie, Hagler, and O'Riordan (1995), or Smith (1995)).

Pearse and Walters (1992:173-174) also consider the use of decision analysis, and MSDA in particular, for "defining acceptable risks systematically in decision making of fisheries management. They conclude that formal decision analysis based on utility assessment has "much appeal as a way of forcing clarification of attitudes toward risk, but it presents certain practical difficulties":

> *In public decision making as in fisheries management, it is often difficult to identify the decision maker whose attitudes toward risk should be the basis for assessing the utility function. Ministers of fisheries come and go, threatening inconsistency over time; external advisers and bureaucrats raise questions about representativeness and accountability; resource users cannot always be relied upon to represent the broader public interest in long-term conservation. Moreover, these techniques are not so well developed and standardised that they can be routinely applied and readily understood. Nor are the results easily interpreted and evaluated in the usual arenas of political debate.*
>
> *Consequently, responsibility for the decisions, and the choice of decision criteria, should be assigned, as far as practicable, to those who will incur the benefits and costs, thus ensuring that the relevant economic and political implications are brought to bear on these issues. ... This means that decisions about harvest levels must include fishermen, and to a greater or lesser extent it must include representatives of the broader public interest as well. Pearse and Walters (1992:173-174)*

The solution that Pearse and Walters (1992) recommend could be called a "co-management" arrangement (as defined by Jentoft (1989), and Pomeroy and Berkes, (1997)) because both a (governmental) management authority and individual TAC quota holders share authority and responsibility for the fish management decisions. More specifically, a management authority would be responsible for an initial allocating of (transferable) fishing rights and the catch among competing fishermen and fishing groups, but subsequently it would be up to the fishermen to exchange these rights through the market mechanism. The function of the management authority would be to maintain a register of quota holders, keep account of transactions, record catches against quota holdings, and determine the minimum stock size that must be maintained.

By organising the quota holders in an association through which they can take collective action and enforce their decisions (through a system of fines for non-compliance) this system of responsibility sharing would also be the means through which decision regarding risk are shared. The management authority would decide on a suitable minimum stock size required on behalf of wider societal interests, and the fishermen would make the decisions regarding in-season harvest level variations (trading off short terms reduction in catch against longer term security). Note, however, that the required minimum stock size can also be disputed and that Pease and Walters (1992) only uses examples of fisheries in countries where civil society and the free-market system are well developed (much of their discussion refers to New Zealand). The weak market system and the underdeveloped civil society mean that their proposal cannot be readily applied in Romania's case.

Hilden's (1997) paper on the evaluation of fisheries management options using decision analysis is another example of the current difficulty in the Decision Analysis literature when it comes to dealing with different viewpoints. At first, the argument is put forward that fishery management is made more complex when wider environmental objectives than sustainable management of a particular fish stock are included. Hilden (1997:143) argues that the conflict between Shetland's sandeel fishery and the aim of protecting sandeels as a food resources for a declining seabird population is an example of a "new type of conflict". In describing the nature of the conflict he says:

> *Disagreement on resource management issues may arise due to differences in, for example, knowledge, utilities or world views (Amy, 1987; Charles, 1992). Utilities are used here to stress that it is not only a question of strict monetary values. "World view" is used to express a general conception of the world, including values and ethical judgements. Knowledge and utilities will in many cases be influenced by world views and other social factors. Thus a world view can make utilities and even the meaning of knowledge differ between actors to the extent that the same observations lead to diametrically opposite conclusions.*
>
> *The differences in world view between the fisheries sector and bird conservationists have been important in the controversy on sandeel*

fisheries. It would, however, be a mistake to regard the fisheries as homogeneous with respect to world views (Hilden, 1997:144)

Hilden (1997) then goes on to show that different groups (particularly conservationists and fisheries managers) may have different attitudes to risk, have different utility functions, and put different weights on the various objectives. I am not quite sure if that is sufficient to claim the problem he analysed is a "new type of problem". Instead he just showed that you can use techniques from decision analysis, illustrating in particular the use of influence diagrams, to pinpoint sources of disagreements and that, by making utility functions explicit one can assess management alternatives in a more comprehensive manner. However, he did not provide a clear account for how the different worldviews[27] in "these kinds of resource conflicts contain many qualitatively different sources of uncertainty and disagreements", and why they require different solutions. It is also not clear if decision analysis could be categorised as such a "different solution" because he concluded that:

> *disagreements which reflect different world views are the most difficult to deal with. There is no solution in the form of a common world view that could be achieved through new knowledge or bargaining (Hilden, 1997:152)*

McDaniels (1995) is an example of how decision analysis can be used to develop a framework for in-season decisions about allowable catches by fisheries managers. The proposed framework is, in essence, an "expert-aiding system" designed to enable fisheries managers to use their knowledge and judgements more effectively in recurring, similar, circumstances. The proposal is based on an analysis of an in-season salmon management decision that actually arose in 1990 for the Fraser River

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[27] I believe the following is an example for what Hilden (1997:144) calls different worldviews: "The possibility of competition for fish between seabirds and fisheries has changed the focus in the debate on industrial fisheries. The statement "there may be good reason to catch them before they die from other causes" illustrates a common line of thought within the fisheries sector, but it has lost its validity. The failure of fisheries managers to see that for some "the other causes" may represent a valid use of sandeel resources appears to be one of the central causes of disagreement between the bird conservationists and the fisheries managers. This difference will affect for example risk attitudes and the evaluation of consequences of management actions. Conservationists will regard the possibility of any harm to sea birds as a serious loss whereas the fishing industry will be willing to risk some reproduction of seabirds if losses of fish yield can be avoided."

sockeye salmon commercial fishery in British Columbia. McDaniels (1995) used the Keeney and Raiffa's (1976) decision analysis for multiple objective framework which the MSDA approach described earlier is based on, but uses the judgements of only one expert, who is also the decision maker. Having described the MSDA methodology in detail already, the most interesting aspect of the paper is the characterisation of the complex decision problems faced by fishery managers:

- conflicting objectives (e.g. increased catch in the short term against increased catch in the future if more adults are left to spawn now)
- biological uncertainties (ranging from size and timing of runs to stock dynamics)
- structural complexity (intermingled stocks that should be managed separately but must be fished as one pooled stock)
- a compressed time frame (particularly for in-season decisions about daily commercial harvesting openings)
- potentially high stakes

Because of these complexities mathematical or simulation models are developed by fishery scientists. The problem with these models according to McDaniels (1995:415) is that:

- judgements about preferences are expressed as of the single objective: to maximise the present value of fish harvested. The problem with this is that modellers thereby ignore the fact that in practice there are other objectives and as a result their modelling efforts are less informative for real-world decisions. Within this context, he also laments the fact that multiple objective utility functions for salmon fisheries management have been used only to demonstrate how such functions could be constructed (Keeney, 1977) or why they are needed (Healey, 1984), but not actually used for decision making.
- instead of using probability to represent uncertainty, fisheries modelling often postulates "alternative states of the world" and then examines "optimal decisions given that each of these alternative assumptions is true". This is a surprising claim which is refuted in much of the literature because the fisheries modelling literature emphasises Bayesian theory, which shows how subjective probability judgements by experts regarding these alternative hypotheses could be integrated into an overall analysis (e.g. Walters, 1986).

By not representing these judgements as probabilities, the judgements are less explicit and therefore less open to discussion.

In the discussion of the alternative framework that he proposed, McDaniels (1995:424-425) noted that the analysis required several person-weeks to complete and involved several meetings with fisheries managers. In light of the need to make decisions quickly he argued that "huge dividends in insights" could be obtained from spending even a few hours on structuring the decision (especially preparing an "objectives by alternatives" matrix with some preliminary judgmental estimates of impacts). Also, once the framework is established the time required to make decisions in similar situations would be substantially reduced. While the fishery managers McDaniels worked with had no great difficulties establishing probability distributions (i.e. the "technical judgements"), they found the task of making preference judgements "daunting". They would have much preferred to rely on "organisationally approved" utility functions and agreed that, ideally, stakeholders and senior decision makers should be relied upon to provide the preference judgements, while technical specialists should provide the technical judgements.

3.4 Implications for the DDBRA's fishery management problems

The most fundamental issue from the MSDA perspective is that the complex management problem presented in Chapter 2 can be broken down into a factual and a value part, also called the risk assessment, and the risk management parts. The former deals with the likelihood of what might happen, the latter then with the desirability of the outcomes.

On the basis of previous applications of the MSDA approach, and in particular the (suggested) applications of decision analysis to environmental management problems, three main types of applications suggest themselves: (i) the MSDA approach, involving multiple stakeholders and experts, where the aim would be to deal with both risk assessment and risk management; (ii) working only with the DDBRA managers and DDI scientists, again on risk assessment as well as risk management (building on Hilden (1997), Maguire and Boigney (1994), McDaniels, (1994, 1995); and (iii) the approach suggested by Pearse and Walters (1992) where decision analysis is used only to assist DDI staff to deal with risk assessment.

3.4.1 Key assumptions, limitations, and remaining questions regarding the MSDA approach

Jointly agreed-upon problem formulation: For the MSDA approach to work, one must assume the existence of a jointly agreed-upon problem formulation, and at the very minimum stakeholders should be willing to agree on a set of alternatives (von Winterfeldt, 1992:339) In the case of the DDBR, where I have shown in the previous two Chapters that there was no jointly agreed problem, the MSDA approach would seek to establish one through individual interviews about fundamental and means objectives. Von Winterfeldt (1992:339) vaguely indicates possible limitations regarding the extent to which this process can be relied upon to produce a jointly agreed-upon problem formulation when he says: "in cases where the stakeholders have different agendas, choose among different types of alternatives, and have different values, a game-theoretic approach may be more useful." von Winterfeldt also says that other political processes and other methodological approaches are preferable when there is "no agency with ultimate decision-making power, or when the agency is not truly motivated to respect conflicting values and expert opinions, or when stakeholders are essentially non-cooperative." According to these conditions, the feasibility of applying the MSDA approach in the DDBR could be questioned because even though the DDBRA is the agency with ultimate decision-making power, earlier Chapters have shown that the DDBRA's motivation to respect other stakeholders' values or indeed dealing with conflicting expert opinions is limited. Also the stakeholders (the DDBRA, DDI, fishermen, fishing companies, the County Prefecture, communities in the DDBR, in Romania and the international community) have shown widely varying degrees of co-operative behaviour.

Interdisciplinary group work: In Section 3.2.3 (the discussion of Step 3: Estimation of Risks, Costs, Benefits, and other Impacts), and in the discussion of previous decision analysis applications to environmental management, I showed that the MSDA approach (and its variants) is not very clear on the usefulness or the actual process in which parties (experts and/or stakeholders) engaged in the analysis work in joint sessions together. Indeed, von Winterfeldt (1992: 340-341) acknowledges that, at present, process issues, which in many cases "is at least as important as the methodology itself" are inadequately addressed. The MSDA approach only "prescribes a specific series of steps" and provides "some basic guidelines about how to interact with stakeholders and experts".

At the same time, however, it is stressed that the value of the MSDA approach does not lie in any ability to provide an overall best alternative (as I have shown in Section

3.2.5 that is not the intention), but instead is a vehicle for dialogue and communication which facilitates the invention of new compromise solutions. Furthermore, Gregory and Keeney (1994); Hilden (1997); Keeney (1988); Keeney (1992); Maguire and Boigney (1994); McDaniels, Healey, and Paisley (1994) have indicated that interdisciplinary work, usually in reference to scientists or stakeholders coming together, produced important new insights and advanced the work.

Nevertheless, the emphasis in the MSDA literature is on the separation of the facts and value elements (to the extent that that is possible),[28] instead of on a theory which would explain and guide the work of decision analysts so that the positive insight and option development effects that can result from a better understanding and communication of different perspectives are maximised. I would suggest that two important factors contribute to the choice of this emphasis as well as inhibit more generative work with individual participants in the analysis (stakeholders, experts, decision makers, and decision analysts) separately and especially in groups.

The first factor is the use of a positivist framework which assumes that knowledge is not socially constructed, and that a problem can be presented and analysed independently of the organisations, groups, and individuals which grapple with or "own" them. This is why Keeney (1992) can speak of "mining" for value information in peoples heads. He does not mean to say that these preferences are necessarily readily available. In fact, that is why he, like Gregory, Lichtenstein, and Slovic (1993), would argue that they shape during the elicitation process and that by eliciting them in separate parts makes the task easier and avoids biases (i.e. deviations from what the "true" values or models are). The effect of this positivist stance is, however, that it discounts the generative value of working in groups (especially groups where stakeholders and experts interact). This may also be part of the reason why Hilden (1997) found that decision analysis could not effectively deal with different worldviews (the other part relates to a lack of clarity of what he meant by worldviews). In the case of the management planning process of the DDBRA, the position one takes on the epistemology of knowledge is therefore important because it determines the way one approaches and deals with the wide variety of views about the problems of fishery management.

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[28] For example, von Winterfeldt (1992:339-340) acknowledges that this is very difficult since "cleary, values will influence opinions, and opinions will shape values. Moreover, values and opinions can shape the formulation of the problem and the definition of alternatives, and thus precondition the analysis results."

The second factor contributing to the confusion regarding interdisciplinary group work in the MSDA literature is the remarkable minimalism regarding assumptions or theories about the institutional context within which the decision analytic work takes place. The only assumption that MSDA writers (e.g. Lichtenstein *et al.*, 1990) make is that the work takes place within democracies, such as industrialised Western countries, where public policy "is, in fact, shaped by interactions among multiple stakeholders"[29] (von Winterfeldt, 1992:341). Beyond this assumption of a democratic process, the MSDA literature does not mention anything about the effects that different institutional contexts have on all stages of the decision making process, from problem identification to the legitimisation criteria used.

Nevertheless, MSDA authors are aware that there are a number of process issues that have not yet been satisfactorily addressed:

> *"When should the stakeholders meet, and what form should the meetings take? How should the stakeholders interact? Should experts be encouraged to develop consensus opinions and how could this be achieved? How can the role and influence of the analyst be limited? Many of the answers are likely to emerge from trial and error with the application of the approach over time" (von Winterfeldt, 1992:341).*

I would point out three features of these questions: first, they all deal with the "value" part of the decision problem (even the one about the desirability and feasibility of achieving consensus among experts, because underlying the question is a concern that the differences in opinion might provide insights about the problem and that it may be unfeasible to disentangle "facts" from "values"); secondly, that these questions are considered important and have already been recognised to be of relevance in practice because, for example Gregory and Keeney (1994); Keeney (1988) have recognised and stressed the importance of some procedural issues - such as involving stakeholders from early on in the process, see also Section 3.1); and thirdly, that the recommendation (or expectation) that the answers to the questions will emerge from trial and error with application, is both proof of the lack theories about the institutional context as well as an example why this situation is unsatisfactory (because if they had a theory, then they could on answers, or at least

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[29] von Winterfeldt (1992:341) argues that the MSDA approach strengthens the democratic process because (i) it encourages stakeholder interaction, the foundation of democracy; (ii) it "ensures the involvement of groups that should have a stake but are not yet organized"; (iii) it informs decision making and debate but does not force decisions; (iv) it counteracts an increasing reliance on experts who become the decision makers by default. In the MSDA approach, experts are given a very specific role that is appropriate to their knowledge and expertise.

working hypotheses to the important questions they pose more quickly and systematically). Only by understanding the institutional context of decision making can decision analysts find the answer to these questions and thereby also deal with the challenge of overcoming the institutional inertia challenges identified by (McDaniels, 1994).

Another reason why the MSDA assumption that one need not differentiate between stakeholders beyond the question of whether or not they are representatives of stakeholders is that another explanation for the observation made below, which uses the hypotheses of Stratified Systems Theory (SST) (Jaques, 1976; Jaques, 1996) that there are very significant difference in tasks and capacity of individuals at different managerial strata in an organisation, described in Chapter 5, and also used by Phillips (Phillips, 1984 and 1992) in his argument for Decision Conferencing.

> *"It is interesting to note that the process of quantifying values seems much simpler with individuals higher up in an organisation. The "real decision makers" seem to like structuring their values more than do middle-level managers. One explanation is that these executives know very well that they are always making decisions involving such values and feel somewhat relieved that there are some formal techniques that may assist them. A second possibility is that middle-level managers have not thought about the values as much as have executives. Third, managers must try to take the point of view of someone else, namely their superiors, when proceeding with structuring values" (Keeney, 1992:153).*

3.4.2 Decision Analysis for Risk assessment and market process for risk management

According to Pearse and Walters (1992), DA would be suitable only for the risk assessment part of fishery management, because there are so many decision makers that it is not clear whose utility functions should be used. I would argue that they are misinterpreting MSDA, because the aim of MSDA is to present different views, and to provide insight about the implications of combining different stakeholders value judgements (including those of fishermen and the wider public) with factual judgements of experts.

However, their paper also makes the point that it is possible to develop management systems in which fishermen share responsibility and decision making for fishery management with central agencies. Three aspects are noteworthy:

1) The DDBRA does not have to be the only party engaged in risk management because co-management is an option (I will discuss this in greater detail in the next Chapter);

2) Since it is not possible to apply Pearse's and Walters' (1992) proposal directly to the Danube Delta (due to the great difference of the institutional context from that of New Zealand), the underlying principles of co-management need to be investigated further.

3) The Pearse and Walters (1992) proposal ignores the process by which such a co-management regime would be developed. Nor does it deal with question of making trade-offs between the multiple objectives. As I have shown in Chapters 1 and 2, developing a management strategy in the Danube Delta is a multi-objective problem and I would argue that Decision Analysis can be used to assist in the dealing with the problem. Whatever approach one uses - MSDA or Decision Conferencing - it needs to deal with the institutionally specific questions (in the case of Pearse's and Walters' proposal that is particularly obvious because the proposal departs so much from the way a fishery, such as the DDBR, has been traditionally managed).

3.4.3 Variations on traditional decision making with multiple objectives

Hilden (1997) and McDaniels (1994, 1995) are more concerned with aiding the decision making process of the fishery managers themselves. In the DDBR this would mean working with individual DDBRA and DDI staff and providing them with an expert-aiding framework.

While Hilden (1997) brought up the issue of different worldviews, he concluded that Decision Analysis had difficulty with incorporating that information, and in essence he seemed to have taken a position very similar to Lane and McDaniels (1998) in which individuals are simply aided to make decisions about TAC strategies in the light of a multiplicity of objectives and the most effective use of available information.

3.5 Conclusion

The predominant approach to using DA for environmental management problems is through the MSDA or classical decision analysis for multiple-objective problems restricted to work with one stakeholder or scientist at a time. The evidence from the existing publications suggests that the application of Decision Analysis would be of benefit in the case of the Danube Delta.

However, I have shown that the MSDA approach and its variants did not deal satisfactorily with two big problems observed both in the DDBR as well as in the MSDA literature: (i) the institutional context within which they are operating and (ii) the ways in which interdisciplinary group-work (both within and between stakeholder and expert groups) could be harnessed to maximise the insights resulting from the analysis of different perspectives.

The existing MSDA does not deal satisfactorily with the problems presented by strong differences in worldviews that different stakeholders may have. In particular, the processes of collaboration between experts, as well as between stakeholders and experts, have been identified as critical for effective management, but MSDA has not provided a consistent framework for handling such interactions. ; (iii) if there are any differences between different levels of management (Keeney said that higher levels more comfortable; (McDaniels, 1995) talked about the discomfort that managers experienced in specifying value judgements. and (iv) if this would be sufficient to deal with the institutional inertia questions identified by (McDaniels, 1994).

The existing MSDA approach is also unable to provide an explanation for the observation by McDaniels (1995) and Keeney (1994) that higher level managers were more comfortable with making certain value judgements. In cases where managers of different levels would need to collaborate, understanding the reason for these difficulties, would be important.

Even though numerous examples are cited within the MSDA literature that communication among stakeholders or scientists is beneficial, the discussion about the value of group work very ambiguous and the issue of interdisciplinary team work within one organisation is not even considered. Furthermore, even though MSDA decision analysists are aware that process issues relating to the interaction between stakeholders and/or experts affect the success of MSDA interventions (von Winterfeldt, 1992), they can only suggest to proceed through trial and error (instead of a systematic development effort) because the institutional context is not considered as a variable.

The proposal by Pearse and Walters (1992) for dealing with risk management through a particular type of co-management was not directly applicable because institutional conditions in Romania were very different from New Zealand, and to ascertain the feasibility of their proposal one needs to know more about the underlying institutional principles. Pearse and Walters (1992) also fail to discuss the process through which an innovative co-management regime could be brought about. I will argue in the following Chapters that DA could play an instrumental role in helping to bring that about - but it needs to be bound by an institutional context. The only time that "institutional inertia" is mentioned explicitly as a factor hindering transformation (McDaniels, 1994) that hinders the achievement of sustainable development objectives, it is dealt with very unsatisfactorily.

In order to deal with these questions and assess the possible use of DC approach I needed to deal with two sets of institutional questions: the first (dealt with in Chapter 4) relates to renewable resource management systems, and in particular the role of the DDBRA within the DDBR, and the second (dealt with in Chapter 5) relates to the organisational characteristics of the DDBRA and their effect on the management planning process.

Chapter 4 The need for adaptive policies and co-management

In Chapter 2, I presented the models on which fishery management in the DDBR is based and then described how this management was to take place. I showed that many of the techniques, methods and models proposed for management in the Danube Delta were not easily applicable (because data was missing, data was very uncertain, there were numerous factors that could influence the development of fishery, etc.). In Chapter 3, I then showed that those were are all reasons which would suggest that decision analysis might be able to help. However, there were a number of questions left unanswered by the decision analysis literature. One of the most fundamental concerned the way conflicting assessments by experts should be dealt with.

One strand of the literature, cultural theory, has put forward an even more radical or dramatic argument. Cultural theorists (Schwarz and Thompson, 1990; Timmerman, 1986) offer a contentious, but powerful, explanation that ties in with this alternative view of ecosystems but which goes further than AEMA (Adaptive Environmental Management and Assessment) in that it also puts forward an hypothesis for why one can often observe sharply differing explanations and policy by experts on the basis of the same evidence. The most important point of the cultural theorists' hypothesis is that in situations where the data available are highly uncertain the institutional context within which individuals (including "experts") operate exerts a very strong (even inescapable) bias on the interpretation of the data and the policies that are put forward. Within the context of this thesis the cultural theorists' hypothesis is very relevant because it implies that mathematical averaging of different expert opinions, as the MSDA approach suggests, is inappropriate and may even be dangerous. In this Chapter, I argue that part of the answer to the debate about how to handle conflicting viewpoints can be found by examining possible reasons why the evidence of practical fishery management problems, such as that in the DDBR, conflict with the management models employed in the DDBR.

In the light of this literature, I argue that a major task for the DDBRA must be the transformation of their existing management strategy, which was based on a narrowly defined carrying capacity constraint (the Maximum Sustainable Yield) and command and control enforcement interventions, toward a co-management system aimed at maintaining or increasing the resilience of the social, economic, and ecological systems that together constitute the DDBR.

4.1 Ecosystems as complex dynamic systems

The models employed in the DDBR were based on two important assumptions. The first assumption was that a unique long-term natural equilibrium state of fish stocks exists. The second assumption was that the DDBRA can and must determine how much, what kind, and in what way fishermen should fish in order to maximise their own and society's long term welfare.

An implication of the first assumption is that fishery management should try to determine the optimal rate of fish harvesting that maintains the equilibrium. In the first part of this chapter, I show that this assumption is in doubt because of the considerable evidence that there may be several different equilibria and that variability in ecosystems may, in fact, contribute to their resilience. The implication for fishery management is that it is wrong to seek to determine a stable equilibrium rate of harvesting because it both infeasible (there being multiple equilibria) and inappropriate (because variation in fish stocks is natural and desirable).

4.1.1 Ecosystem change in terms of cycles of succession

Since there has been a long interest in what happens when ecosystems are disturbed either naturally or by human intervention, the study of succession - the sequence of events that occur when complexes of plants are disturbed by, for example, fire, storms or pest - has had an important influence on our understanding of ecosystems and through that also on management policy.

Two concepts relating to ecosystem dynamics have dominated for most of this century: (i) that ecosystems develop naturally to a stable climax condition (Clements, 1916); and (ii) that different species dominate the two generic periods in succession: exploitation (R-strategists) and conservation (K-strategists) (MacArthur and Wilson, 1967)

The classical framework developed by Clements (1916) holds that succession leads, through a sequence of highly ordered events, to a stable climax community of self-replicating assemblages of plants. The species of these plant assemblages are determined by precipitation and temperature. After a disturbance, 'pioneer' species (rapid growing and resistant to physical extremes) are the first to colonise the ecosystem. Their presence changes conditions and a succession of decreasingly robust but more competitive species will occur over time. In the course of these events, biomass accumulates, biological, chemical, and physical processes are increasingly regulated, and variability is reduced until the stable climax condition is reached and maintained. "This scheme represents a powerful equilibrium-centred view in which disturbances by fire, storm, or pest are treated as exogenous (and somehow not appropriate) intrusions into a natural order. Clements gave the analogy to an organism and its ability to repair damage" (Holling, 1986:298).

A second influential equilibrium-centred model was developed by MacArthur and Wilson (1967). They proposed a two-fold classification of organisms occurring in the process of succession: the first part is dominated by "opportunist" organisms that are naturally selected as they thrive in unpredictable environments (these are called R-selected) while the second stage is dominated by "equilibrium" organisms that are selected due to their efficiency of food harvests in crowded, predictable environments (called K-selected).[30] Holling (1986:298) characterises R-strategists as having a high reproductive potential, short life, high dispersal properties, small size, and resistance to physical extremes. K-strategists have lower reproductive potential, longer life, lower dispersal rates, larger size, and effective competitive abilities. In Clement's framework, these are the climax species that occupy stable, long-lasting habitats.

Holling (1986:298) argues that while there are communities that have developed a climax maintained through plant-by-plant replacement in the manner proposed by Clements, the view of succession as analogous to the recovery of an organism from injury, with an ordered and obligatory sequence of replacements of one species by another, has been shown to be oversimplified. Referring to evidence from extensive comparative field studies (West, Shugart, and Botkin, 1981), from critical experimental manipulation of watersheds (Bormann and Likens, 1981; Vitousek and Matson, 1984), from paleoecological reconstruction (Davis, 1986; Delcourt, Delcourt, and Webb, 1983), and from studies that link systems models and field research (West, Shugart, and Botkin, 1981), Holling (1995:21) argues that four main points have led to a revision of the useful, but essentially static and incomplete Clementian view of succession that allows for more than one possible 'climax state':

- The species that invade after disturbance and during succession can be highly variable and determined by chance events;
- Both early and late succession species can be present continuously;

[30] The designations derive from the logistic equation and K defines the saturation density (stable equilibrium population) and R the instantaneous rate of increase.

- Large and small disturbances triggered by the events such as fire, wind, and herbivores are an inherent part of the internal dynamics and in many cases set the timing of succession cycles;
- Some disturbances can carry the ecosystem into quite different stability domains, e.g. mixed grass and tree savannahs may be transformed into shrub-dominated semi-deserts;

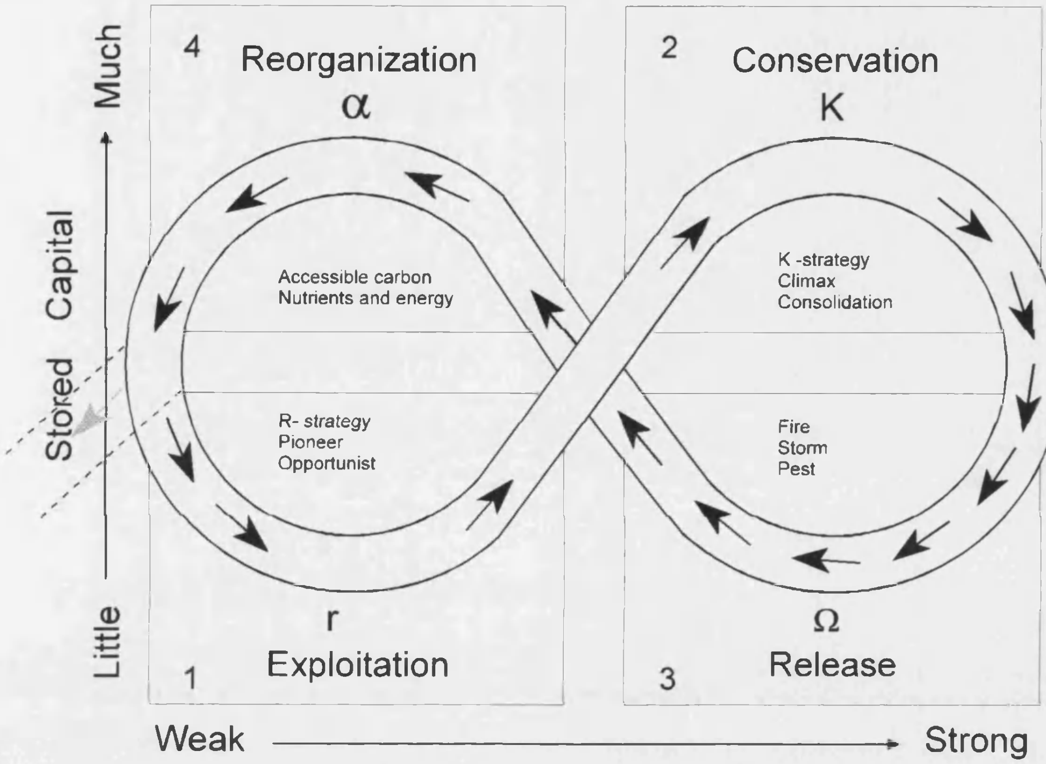
In his 1986 paper, Holling (1986:306-308) combines this view of multiple equilibria with understandings gained from population systems, to propose a synthesis that emphasises four primary stages in an ecosystem cycle (see Figure 4-1). Starting with the two functions that control the ecosystems in the Clementian succession model:

- exploitation, in which rapid colonisation is emphasised; and
- conservation, in which slow accumulation and storage of energy and material are emphasised;

Holling argues that the revised view of succession requires two additional functions:

- release, in which the tightly bound accumulation of biomass and nutrients becomes increasingly fragile and is suddenly released by agents such as forest fire, insects pests, or intense pulses of grazing;
- reorganisation, in which soil processes of mobilisation and immobilisation minimise nutrient loss and reorganise nutrients to become available for the next phase of exploitation.

Figure 4-1: Ecosystem functions and flow of events between them



Source: Holling (1995)

The sequence of events taking place during the stylised ecosystem cycle shown in Figure 4-1 are controlled by the above mentioned four functions and are unevenly spaced through time (Holling calls this biological time flow). The progression from the exploitation phase (box 1) to conservation (box 2) is slow; connectedness and stability among variables increase and a 'capital' of nutrients and biomass slowly accumulates in variables that are the dominant variables at that moment. That capital becomes more and more tightly bound, preventing other competitors from utilising the accumulated capital until the system eventually becomes so over-connected that rapid change is triggered (agents of change might be wind, fire, disease, insect outbreak, or a combination of these). The stored capital is then suddenly released and the tight organisation lost to allow the released capital to be reorganised to initiate the cycle again (box 3 through box 4 into box 1)

> *"This pattern is discontinuous and depends on changing multi-stable states to trigger and organise the release and reorganisation functions. Instabilities and chaotic behaviour trigger the release phase, which then proceeds in the reorganisation phase, where stability begins to be re-established. In short, chaos emerges from order, and order emerges from chaos! Resilience and recovery are determined by fast release (or creative destruction) and reorganisation sequence, whereas stability and productivity are*

determined by slow exploitation and conservation sequence." (Holling, 1995:22-23)

Holling (1995:26-27) argues that evidence from boreal forests, boreal region prairies, pelagic ecosystems, as well as the Everglades of Florida (Gunderson, 1992) is better explained by his hypothesis about succession than by alternative hypotheses about succession. Holling argued already in his 1986 paper (page 305) that there is strong evidence that:

- more than one locally stable equilibrium and stability domain around it can exist;
- jumps between stability domains can be triggered by exogenous events and the size of these stability domains is a measure of the sensitivity to such events;
- stability domains themselves expand, contract, disappear in response to changes in slowly changing variables. These changes are internally determined by the processes that link variables, and quite independent of exogenous events.

Holling (1986:306) concluded that "discontinuous change is an internal property of each system. For long periods change is gradual, and discontinuous behaviour is inhibited. Conditions are eventually reached, however, when a jump becomes increasingly likely and ultimately inevitable."

4.1.2 Carrying Capacity vs. Resilience

In a recent article in Science a group of eminent economists and ecologists (Arrow *et al.*, 1995) attempted to "establish a substantive dialogue ... to gauge whether an interdisciplinary consensus exists ... and to determine what can be said about the joint development of economic and environmental policy." (Arrow *et al.*, 1995:footnote 1).

Arrow *et al.* (1995) argue that the world's resource base is finite, that consequently there are limits to the throughput of energy through the economy, and that imprudent use of environmental resources may irreversibly reduce the capacity for generating a wide variety of services. To "even conceive" of further economic growth and population growth through improved resource management systems and resource-conserving structural changes, "signals that effectively reflect the increasing scarcities of the resource base need to be generated". They go on to argue, however, that indices of the earth's natural carrying capacity are not very useful indicators of sustainability. Carrying capacities[31] are not fixed, static, or based on

[31] For a general review of the concept see Grimble (1995).

simple relations because they are contingent on technology, preferences, and the structure of production and consumption, as well as an the ever-changing state of the interaction between the physical and biotic environment.

Instead, they suggest that a better indicator of sustainability is resilience, which they define in the same way as Holling (1986:296): "the ability of a system to maintain its structure and patterns of behaviour in the face of disturbance." It should be noted that this definition of resilience does not emphasise the speed with which an ecosystem returns to an equilibrium following a disturbance, as, for example Pimm (1984) suggests. Instead, the focus is on the parameter forces of a system that define the existence, shape, and size of stability domains, which may shift if variability patterns in space and time change.

According to Arrow *et al.* (1995:93), the only way one can test the resilience of an ecosystem is by "intelligently perturbing them and observing the response using what has been called 'adaptive management'". Adaptive management views regional development policies and management as 'experiments', where interventions over several scales are made to achieve understanding, produce social and economic products and to identify further management options (Arrow *et al.*, 1995:footnote 12) Similar arguments are put forward in Gunderson, Holling, and Light (1995), Holling, (1978), Lee (1993), and Walters (1986).

4.1.3 Predictive Modelling Workshops

To deal with these concerns Adaptive Environmental Management and Assessment (AEMA) proposes a series of modelling workshops "that depend on a small group of people that interacts with a wider set of experts during a series of short-term, intensive workshops. Most of our workshops have used the construction of a quantitative model as a focus for discussion. The main participants are disciplinary specialists; methodologists who are familiar with techniques of analysis such as modelling; and decision makers who will ultimately use the information that results from the analysis." The main purpose of such workshops is to "provide a brain for the body of the research team - they provide periodic reassessment and redirection" (Holling, 1978:49)

AEMA workshops usually involve three stages:

First-phase workshops: These last between 5 days and two weeks. At first problems are clarified, conceptualised and indicators and state variables are defined. This is followed by a listing of the interactions between variables, and the creation of subgroups that work on different aspects of the problem. Each of the subgroups develops sub-models which are then linked together in the final stages of the workshop. They note that "a special kind of leader is needed for such workshops. He must be someone with broad perspective on the problem, who is willing to make bold assumptions and move onward when proceedings bog down and who can channel trivial arguments into useful directions" (Holling, 1978:55).

Second-phase workshops: The incomplete models resulting from the first workshops are updated with new information and revised as appropriate. This may involve more than one workshop, phased over several months. "The same mix of people, though not necessarily the same individuals, should participate in these later workshops: methodologists, specialists, and decision makers." The main value of these workshops is that they identify the critical issues, data needs, and questions. Evaluation of management policies is carried out by a small study team.

Transfer workshops: "...as the analysis or assessment nears completion, the phase of transfer to the contracting agency or other clients who were not involved during analysis begins." The "client decision makers can ask various questions of the model through interactive simulation. The so-called "implementation phase is quite critical; without a smooth transition, even the best analyses are incomplete" (Holling, 1978:56).

AEMA proponents argue that such a workshop process should be used whenever (1) the system has many variables; (2) there is a wide range of alternative hypothesis for the uncertain variables; and (3) and stakeholders have different sets of objectives (Walters, 1986:333) The main rationale for this workshop process is that

> *"...such technical developments [for dealing with the technical difficulties of modelling and formal optimisation for systems that involve a whole panorama of biophysical and economic variables] will be of little value unless they are accompanied by progress in dealing also with the very human problems of reaching consensus by embracing uncertainty, and of reaching some balance when there is, in fact, no identifiable decision maker and policies proceed from the competitive or co-operative activities of many actors." (Walters, 1986:333)*

Walters (1986) goes on to emphasise four essential steps in the "Adaptive Policy Design for Complex Problems." Even though I will not use this process in this thesis, it is instructive to note the importance that Adaptive Environmental Managers place on working together, facilitation, and the process for generating options. While there are many similarities with Decision Conferencing, it is interesting that the protagonists of AEMA (unjustly, I argue later) criticise Decision Analysis. The steps of the "Adaptive Policy Design" process are as follows:

(A) *Modelling in order to pinpoint uncertainties*: One should build predictive models even though it is known in advance that any predictions derived from them would have little credibility because "other processes for defining uncertainties will lack a necessary focus on and definition of policy options, and so will be used as a forum by various scientists to promote their own research interests." Walters goes on to warn that "serious tactical and political difficulties usually arise at this step, because modelling almost invariably alienates (appearing threatening and superficial to) various members of the scientific community... Thus it is essential to include this community, challenge it to see the problem more broadly, and dispassionately embrace and evaluate various alternative hypotheses that have emerged from within the community" (Walters, 1986).

(B) *Compression for understanding:* This step involves the systematic development of a range of predictions about key policy indicators, using the alternative models and basic policy options identified during the initial modelling work. The key goals are "(1) to gain consensus about how large the range of future outcomes is and how deep the conflicts are about which outcome would be best; and (2) to engender a healthy frustration about the [existing] state of affairs". This "motivates the search for a compressed representation in terms of a few extreme alternative hypotheses, management options, and scenarios of future development." (Walters, 1986:335)

(C) *Seeking the best option:* "moving back and forth between the results based on formal objective functions and the reactions of actors whose objectives these functions are supposed to represent...[leads to] ... clarification of which objectives are really conflicting in terms of policy choice. Often, apparently conflicting objectives in fact imply the same best policy choice and so lead to coalitions of interests that would not be intuitively obvious. But basic conflicts usually still remain, between short-term and long-term values, and between temporal stability and informative variability" (Walters, 1986:336).

Walters (1986) then goes on to comment on Decision Analysis:

> *"Some analysts find it disturbing that modelling exercises intended to bring actors together often result initially in deepening of conflicts, by highlighting conflicts that cannot be avoided. It is somehow expected that co-operation in clarifying what the trade-offs are should be accompanied by a commitment to accept formal calculation of the best compromise policy. There has been much interest in "multiobjective decision analysis" (see (Keeney and Raiffa, 1976)), which emphasises precisely such formal methods. But by seeming to provide a reasonable compromise among options that are all bad in the first place, such formal methods are a lot like*

sensitivity analysis mentioned above[32]*: they may lull the actors into accepting a solution too early. Again, let us recall that there is value in allowing tension and conflict to build, as motivation for seeking innovative policy options" (Walters, 1986:336-337)*

(D) *Imaginative synthesis:* The fourth important step in the "Adaptive Policy Design for Complex Problems" that Walters has identified relates to the necessity "of recognising that emotional involvement is a strong prerequisite for creative thinking, a fact that is obvious to artists, but that many scientists (the bad ones) fear to admit". Relaxed and freewheeling 'brainstorming sessions' where participants are urged to think up wild ideas while agreeing not to be critical of one another, he argues, are unlikely to foster "leaps of imagination" or "intuitive jumps". Only when emotions of frustration and desperation about current static options have been built up among the management actors is it likely that "the magic of imagination is likely to be displayed" (Walters, 1986).

4.2 Cultural Theory

4.2.1 "Managerial heterogeneity" and "Dimensions of sociality"

In AEMA, as in the decision analysis literature reviewed in Chapter 3, as well as in New Institutional Economics which I deal with later, and most other theories of environmental management too, differences in view points of stakeholders or professionals who help stakeholders are seen to be a part of the problem in management and also as a resource to be harnessed in the management of complex resource systems. However, the reasons for differences in perspectives has not been very clearly explained. Some attribute them to different individual experiences with management attempts, others to different sets of knowledge, differences in problem foci, or differences in interests. However, this does not indicate how one should deal with such differences in perspective.

The problem is particularly acute in situations where it is even theoretically impossible to determine one 'correct' solution, such as in the DDBR fishery. Nevertheless, as I have shown, the DDBRA was quite determined to pursue one

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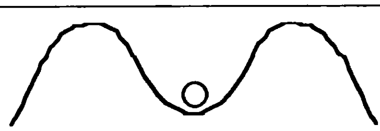
[32] Under (B) Walters argued that sensitivity analysis (where parameters and actions are changed and the effects on model predictions are observed) can be deceptive when applied to complex systems, particularly to those that exhibit multiple equilibria and other sudden qualitative changes in behaviour as parameters are varied. Sensitivity analysis is deceptive in such circumstances because "the possible behaviours have barely been touched". (Walters, 1986:336)

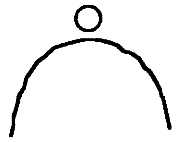
particular management approach based on one particular interpretation of what was happening in the fishery.

Holling (1986) and Timmerman (1986), for example, have found that different managing institutions, facing very similar kinds of conditions, have undertaken remarkably different sets of interventions in those ecosystems. However, these different sets of interventions had some consistency, and as a result, the question that Holling (1986) and Timmerman (1986) posed was something like this: 'What representations of reality would one need to ascribe to each managing institution in order to consider their actions to be rational (coherent)?'

In all, four different interpretations about ecosystem stability needed to be ascribed to the different management institutions, and each of these interpretations could be illustrated by a picture of a ball in a landscape (see Figure 4-2). Holling (1986) and Timmerman (1986) called these minimal representations of ecosystem stability "myths of nature", defining a myth as "a cultural device that captures, in simple and elegant form, some essence of experience and wisdom." Thompson (1991:248) argues, like Holling (1986) and Timmerman (1986), that these myths are not falsehoods, but "partial truths". The essence of Thompson's work lies in the associating of these myths with particular "ways of life: a particular pattern of social relationships and a particular set of moral justifications for the superiority of that pattern to other, rival, patterns."One of the important implications of this plurality of views of nature, and the actions they justify, is that they appear irrational from the perspective of the other views but, nevertheless, each actor is rational (coherent), given his or her convictions as to how the world is in circumstances where science is unable to determine the facts that would decide the matter. These observations of "plural (but far from infinite) rationalities" lead Thompson (1991:249) to ask how the actors obtained those convictions?

Figure 4-2: The myths of nature

 Nature capricious	 Nature Perverse / tolerant
The world is essentially random. Managing institutions merely respond to erratic events but they do not really manage.	World is forgiving of most events but is vulnerable to an occasional strong disturbance, which could knock the ball over the rim. Managing institutions must regulate against unusual occurrences. They need experts to discern the unusual, or strong disturbances. Without these experts "sustainable development" cannot

	be secured.
 Nature benign	 Nature ephermal
The world is forgiving and no matter how strong the disturbances, the ball will always return to the bottom of the basin. Managing institutions can therefore adopt a laissez-faire attitude.	The world is an unforgiving place and the smallest disturbances can lead to catastrophic collapse. Managing institutions (and everyone else) must "tread lightly on earth".

Source: Thompson (1991:248) using Holling (1986) and Timmerman (1986)

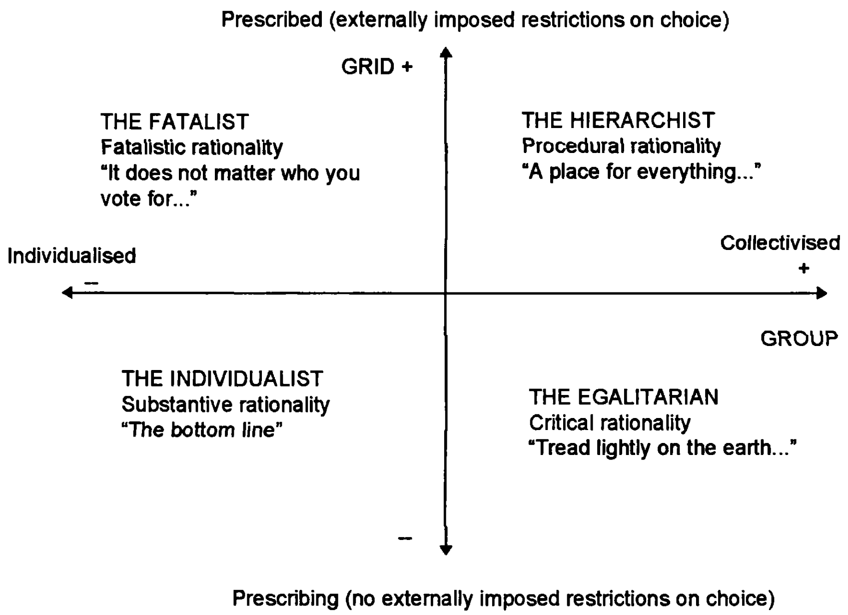
Thompson argues that basic convictions about how the world operates can be linked to the typology of social relationships that has been developed by the anthropologist Mary Douglas and her co-workers (Douglas, 1978 and 1982; Gross and Rayner, 1985; Thompson, 1983; Thompson, Ellis, and Wildavsky, 1990). That typology is based on the answers to two "eternal questions of human existence: 'Who am I?' and 'How should I behave?'"

Douglas argues that personal identity is determined by an individual's relationship to groups. Those who belong to a "strong group", defined as a collective that makes decisions binding on all members, will see themselves "very differently to those who have weak ties with others and therefore make choices that bind only themselves." (Thompson, 1991:249)

Individual behaviour is shaped by the strength of social prescription (the "grid" dimension) that the individual is subjected to. This grid dimension is a spectrum that runs from "the free spirit to the tightly constrained." (Thompson, 1991:249)

In combination, these two "dimensions of sociality" generate four basic forms of social relationships and each of these is "stabilised" by just one of the four rationalities by lending it legitimacy and enabling operation (see Figure 4-3). Thompson, Ellis, and Wildavsky (1990) argue that Lindblom (1977), Weber (1958), or Williamson (1975) are only examples of scholars who have built entire theories on the distinction of two of the four forms of social relationships that result from combining the group and grid dimensions: markets and hierarchies. Market cultures stress the "autonomy of individuals and their resulting freedom to bid and bargain with each other: they have substantive rationality" (Thompson, 1991:250). Hierarchies, on the other hand, "are made up of bounded social groups, each of which is in an orderly and ranked relationship with each other. Their attempts to co-ordinate these components, without violating status differentials, create procedural rationality that is more concerned with the properties of who does what than trying to evaluate the outcome" (Thompson, 1991).

Figure 4-3 The two dimensions of sociality and the four rationalities



Source: Thompson (1991:250)

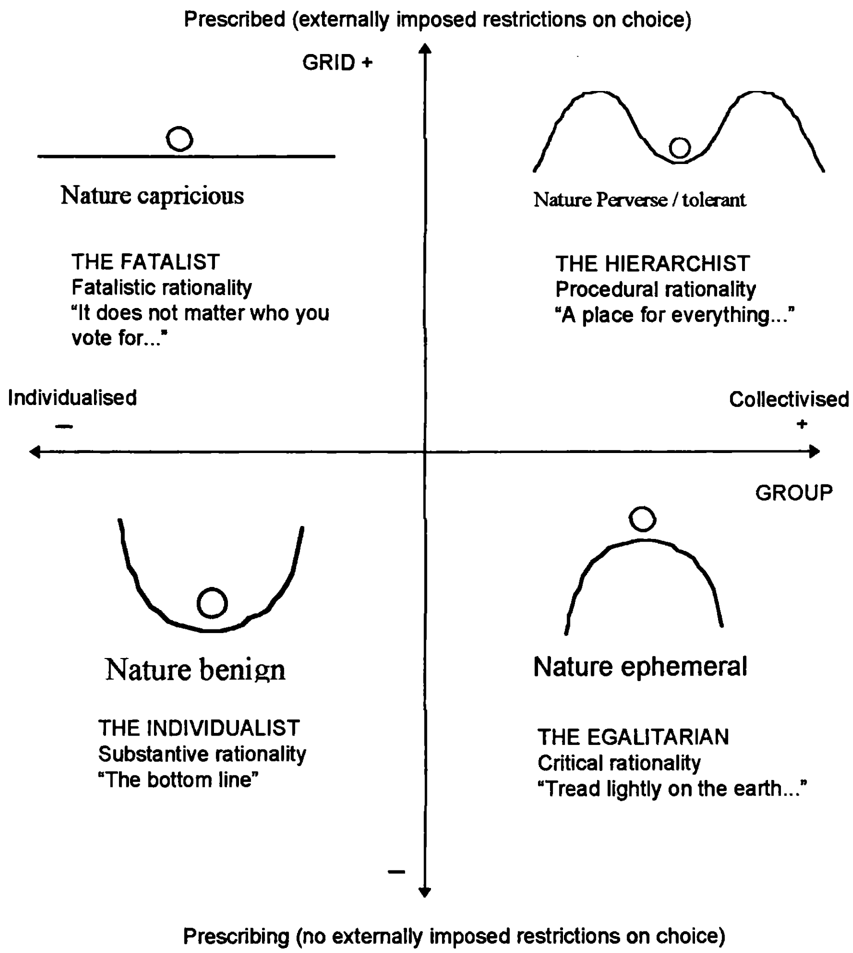
However, the typology of social relationships based on the group/grid dimensions accounts for two further permutations: those who reject both the individualism of the market and the inequalities of the hierarchy prefer the "egalitarian groups ... They have a communal and critical rationality, which stresses the importance of fraternal and sororal co-operation, and therefore strive for social relationships that are voluntaristic and egalitarian. But, since this desired state of affairs is always threatened by the encroachment of hierarchy (which brings status differences) or by the excessive individualism (which all too easily introduces inequalities of wealth, power and knowledge), collective identity has all the time to be sustained by a shared and strident criticism of what goes on outside the group" (Thompson, 1991:250-251). Furthermore, not all those who are individualised are necessarily entrepreneurs. Many of these have numerous prescriptions on their behaviour and as a result minimal freedom or choice. These are the marginal members of society that Thompson calls the "fatalists" since their lack of ability to influence events one way or another has engendered in them a "fatalistic rationality in which outcomes, good or bad, are simply to be enjoyed or endured, but never achieved."

> *"Each one of these rationalities, when acted upon, both sustains and justifies the particular organisational form that goes along with*

it. ... Hierarchists trim and prune social transactions until they fit neatly into their orderly ambit, individualists pull them into the marketplace, egalitarians strive to capture them into a kind of voluntary minimalism (which, to those on the outside, often looks more like "coercive utopianism"), and fatalists endure with more or less dignity whatever comes their way" (Thompson, 1991:251).

By combining the four "myths of nature" identified by the ecologists (Figure 4-2) and the "typology of social relations and rationalities" (Figure 4-3), Thompson (1991:251-254) derives a synthesis (Figure 4-4) which shows "how each of the myths of nature (the ecologist's explanation for "managerial heterogeneity") legitimates and reproduces certain kinds of institutional relationships (the anthropologist's cultural categories)." The importance of this synthesis lies in the fact that it makes it possible to go beyond the question of which viewpoint is right, but instead offers an hypothesis for the emergence and persistence of the viewpoints themselves.

Figure 4-4 The myths of nature mapped onto the rationalities



Source: Thompson (1991:252)

The following are the most relevant implications of this synthesis within the context of this thesis:

4.2.2 Biases and the typology of surprise

The basic argument Cultural Theory argument presented so far is that in situations where scientific data are inconclusive about the workings of ecological or social systems, and in particular the effects of management interventions on the combined systems,[33] individual perception of how the world works and strategies promoted or adopted will be a influenced by the type of social relationships that the individual finds himself or herself in. According to Schwarz and Thompson (1990) such cultural biases can be traced to the following two underlying hypotheses:

1. in addition to self-interest, individuals also need to justify or legitimate their decisions.
2. in addition to cognitive limitations, the rules of closure in individual decision making are also influenced by the type of social relationships that individuals find themselves in.

The implication of this cultural theory is not only that four coherent positions are possible in non-linear complex situations. The extended hypothesis regarding the four positions is summarised in (Schwarz and Thompson, 1990; Thompson, Ellis, and Wildavsky, 1990) but presented here only in the form of Table 4-1. The important point to note within the context of this thesis is the pervasiveness and coherence of the different positions.

[33] Complexity theorists argue that scientific data can never be absolutely conclusive when one is dealing with non-linear complex systems (see Gleick, 1987; Kellert, 1987; Mullin, 1993; or Waldrop, 1992).

Table 4-1 The four Political Cultures

	Hierarchical	Egalitarian	Individualistic	Fatalistic
Preferred way of organising	Nested bounded group	Egalitarian bounded group	Ego-focused network	Margins of organised patterns
Certainty (myth of nature)	Nature perverse/ tolerant	Nature ephemeral	Nature benign	Nature capricious
Rationality	Procedural	Critical	Substantive	Fatalistic
View of resources	Scarce	Depleting	Abundant	Lottery
Scope of knowledge	Almost complete and organised	Imperfect but holistic	Sufficient and timely	Irrelevant
Learning style	Anticipation	Trial without error	Trial and error	Luck
Social context	Positive group/ positive grid	Positive group/ negative grid	Negative group/ negative grid	Negative group/ negative grid
Desired systems properties	Controllability (through inherent orderliness)	Sustainability (through inherent fragility)	Exploitability (through inherent fluidity)	Copability (through inherent chaos)
Ideal scale	Large	Small	Appropriate	-
Engineering aesthetic	High-tech virtuosity	Frugal and environmentally benign	Appropriate (as cheap and cheerful as possible)	-
Ideal of fairness	Equality before the law	Equality of result	Equality of opportunity	Not on this earth
Cultural bias	Ritualism and sacrifice	Fundamentalism/ millenarianism	Pragmatic materialism	Inconsistent eclecticism
Preferred economic theory	Bureaucratisation through increasing transaction costs (O. Williamson)	'Buddhist' and 'thermodynamic' economics (E.F. Schumacher and N. Georgescu-Roegen)	Neo-Austrian: competition without equilibrium (F. Hayek, A. Alchian)	Marginalisation through structural imbalance (neo-Marxist)
Energy future	Middle of the road (technical fix)	Low growth (radical change now)	Business as usual	What you don't know ...
Perception of time	Balanced distinction between short and long term	Long term dominates short term	Short term dominates long term	Involuntary myopia
Preferred form of governance	Leviathan	Jeffersonian	Laissez-faire	It doesn't matter who you vote for ...
Salient risks	Loss of control (i.e. of public trust)	Catastrophic. irreversible and inequitable developments	Threats to the functioning of the market	-
Model of consent	Hypothetical consent	Direct consent	Implicit consent	Non consent
Method of applying model of consent	Natural (or other ideal standards)	Expressed preferences	Revealed preferences	-
Risk-handling style	Rejection and absorption	Rejection and deflection	Acceptance and deflection	Acceptance and absorption
Latent strategy	Secure internal structure of authority	Survival of the collectivity	Preservation of the individual's freedom to contract	Survival of individual
Commitment to institutions	Correct procedures and discriminated statutes are supported for own sake. Loyalty	Collective moral fervour and affirmation of shared opposition to outside world. Voice	Only if profitable to the individual. If not, then exit.	-

Source: Schwarz and Thompson (1990: 66-67)

Since each one is a partial truth and since the world will at times and places be actually best represented by only one of these, three of the positions will be surprised when things do not turn out as they predicted. This is the basis for the "Theory of Surprise" (Clark and Munn, 1986; Holling, 1986; Price and Thompson, 1996; Timmerman, 1986).

According to cultural theorists, there are twelve varieties of surprises possible (see Table 4-2). For example, an individualist, who believes that an ecosystem is robust enough to recover from any perturbation, will be surprised when it collapses (or moves into a very different equilibrium state). Analogously, a hierarchist, who believes that ecosystems can be managed with predictable results, will be surprised when he or she finds out that precise predictions are impossible or that the ecosystems unexpectedly shifts into a new equilibrium (or totally collapses). An egalitarian would be surprised if, contrary to an expectation of a precarious nature, those who disregard the caution he advocated does not result in the predicted disaster.

Table 4-2 Cultural Theory's Typology of Surprise

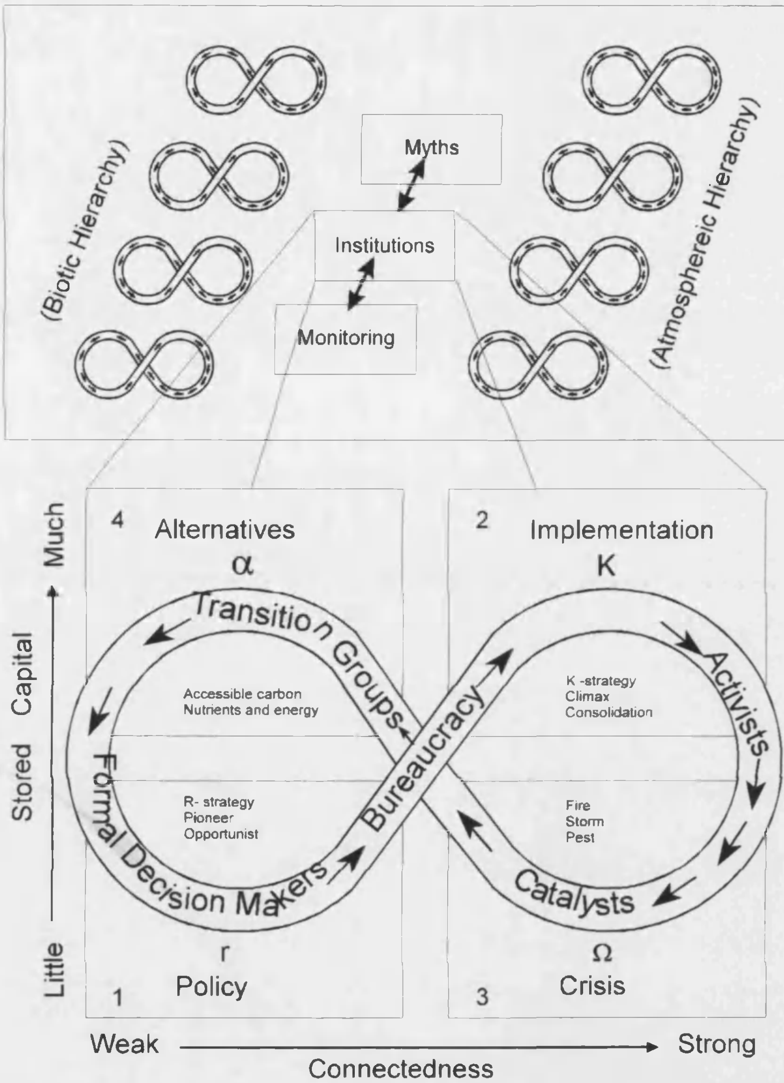
	Actual World			
Stipulated World	**Capricious**	**Ephemeral**	**Benign**	**Perverse/ Tolerant**
Capricious (Fatalist's myth)	--	Expected windfalls do not happen	Unexpected runs of good luck	Unexpected runs of good and bad luck
Ephemeral (Egalitarian's myth)	Caution does not work	--	Others prosper	Others prosper
Benign (Individualist's myth)	Skill is not rewarded	Total collapse	--	Partial Collapse
Perverse/ Tolerant (Hierarchist's myth)	Unpredictability	Total collapse	Competition	--

Source: Price and Thompson (1996)

4.2.3 Surprises and never-ending change

Cultural Theory suggests that movement between these positions is possible through learning (Price and Thompson, 1996:11). In the case of the mentioned fatalist, once he or she can predict and expect the attainment of benefits, he or she will gradually embrace the myth of "Nature Benign". As indicated in Table 4-2, Cultural Theory suggests that twelve types of transitions between myths of nature are possible. That means that cultural theorists do not share the hypothesis put forward by AEMA that there is a socio-cultural analogue to Holling's cycle of ecosystem change (see Figure 4-5). Such an analogue would only be possible if one particular sequence is "privileged" (Price and Thompson, 1996:11), but it is not clear what would be doing that privileging (Thompson, personal communication).[34]

Figure 4-5: Institutional hierarchies and players



Source: Gunderson, Holling, and Light (1995)

The following conclusion from (Price and Thompson, 1996) indicates why cultural theorists argue that it is impossible to develop 'perfect' policies in situations of great uncertainty. The best one can do is develop robust policies which stand up to the critique of different cultural perspectives.

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[34] It is very interesting to note that even though Thompson and the AEMA group have not been collaborating since the mid 1980's (and Thompson was unaware of AEMA major publication (Gunderson, Holling, and Light, 1995) in 1995 when they wrote (Price and Thompson, 1996)) that seemingly independent research has lead to very similar conclusions (albeit with this very important difference about the strength of the sequence between myth which makes the cycle possible).

"Throughout this process, changes in the environment result from the actions of the people or institutions whose strategy happens to be best suited to making the most of the environment in which they find themselves. As more and more of these strategies act, these endogenous changes accumulate, and the environment passes over a threshold into a state better suited to one of the other strategies, ad infinitum. Though this complex model may start at the same place as the simple one and have the same dynamics, its paths are infinitely more surprising and unpredictable. In this inherently complex system, in which ecological and socio-cultural components interact, each myth of nature captures some aspects of the world at some time. No one of them is ever right all the time and everywhere, and this means that each one of them has its vital part to play. If you can never get it right you can at least ensure that you have 'covered all the bases': that is, that your management strategies incorporate the requisite variety" (Price and Thompson, 1996:12).

The resulting recommendation is to define problems not in just one way (based on one, of the four possible myths of nature), and avoid putting all transactions onto the pattern of social relationships that is supported by that myth, but rather that each myth be granted some legitimacy and that transactions be tentatively distributed among the various institutional bases.

4.3 New Institutional Economics and Renewable Resource Management

In addition to assuming that it must be possible to determine a unique long-term natural equilibrium state of fish stocks, the DDBRA also assumed that they (the DDBRA) had to determine how much, what kind, and in what way fishermen should fish in order to maximise their own and society's long term welfare.

In this Section I review the New Institutional Economics (NIE) literature that deals with the principles of natural resource management and show that the DDBRA's second assumption was also wrong. The NIE literature shows that even if there existed unique parameters for fish stocks and for how best to exploit them, management through command and control measures by the DDBRA does not guarantee success; moreover, it is claimed that there are other management systems available which are more likely to work. Those alternatives are various forms of co-management regimes, where the DDBRA would share with the resource users (fishermen, fishing companies) at least part of the authority and responsibility for management of the resource. For the development of successful co-management arrangements a number of design principles have been worked out through case studies.

J.S. Gordon (1954), in one of the most important fishery economics papers written, provides the following analytical explanation and prediction for what happens in an unregulated fishery: initially, as a fishery develops, fishermen experience high returns on their activity as competition is low and the resource abundant. These high profits attract other fishermen into the industry and encourage those already there to increase their investment. As a result, total fishing effort increases, competition between the fishermen rises, and the fish resource decreases. However, even though profits are decreasing, the effort in the fishery will continue to increase to the point where all the economic rent (the difference between the value of the landing and the cost of catching and delivering fish) is dissipated.

Scott (1955) contrasted Gordon's (1954) description of resource system where fishermen were able to enter the fishery and start fishing from a resource base that did not belong to any one in particular, with a fishery is under sole ownership. Under such an alternative arrangement, the profit incentive would automatically lead the sole-owning rational fisherman to conserve the resource so that his income is secured into the future.

4.3.1 Hardin's "Tragedy of the Commons" Model

In a challenging article Garrett Hardin (1968) argued that whenever many individuals are using a scarce resource in common it would be degraded because of a divergence between individual and collective rationality (Feeney *et al.*, 1990:2). To make his point Hardin asked readers to envisage a village pasture that was "open to all" and where each of the herders using this pasture adds a few animals to his herd. Since any pasture can support only a limited number of animals, the outcome will be the overgrazing and therefore the loss of the resource for the entire community. However, from the perspective of the rational herder this is unavoidable because each receives immediate and direct benefits from the additional animal, whereas the costs from overgrazing are delayed and shared by all. Hardin concludes:

> *"Therein lies the tragedy. Each man is locked into a system that compels him to increase his herd without limit. Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons" (Hardin, 1968:1244).*

Although Hardin did not make reference to Gordon (1954), the latter describes the same dynamic as Hardin:

> *"There appears then, to be some truth in the conservative dictum that everybody's property is nobody's property. Wealth that is free for all is valued by no one because he who is foolhardy enough to*

wait for its proper time of use will only find that it has been taken by another ... The fish in the sea are valueless to the fisherman, because there is no assurance that they will be there for him tomorrow if they are left behind today" (Gordon, 1954:124).

Even a decade after his earlier article Hardin argued that the only alternatives to the tragedy of the commons were what he called "a private enterprise system" or "socialism" (Hardin, 1978:314). In other words, there are two options to avoid the tragedy of the commons: either (i) central governments control natural resource systems, and establish a strategy that will specify how the pasture should be used or (ii) the herders would divide the meadow up and assign the different pieces to individual herders. In this way herders would be playing "a game against nature in a smaller terrain, rather than a game against another player in a larger terrain" (Ostrom, 1990:12). Where there is private ownership it is presumed that herders will graze only as many animals as their piece of the meadow can support in the long run.[35] If the value of the meadow differs over time (for example because of uneven rainfall) then some herders will make more profit than others.[36]

While the allocation of private ownership may be relatively straightforward in the case of meadows (involving the division of the land into different parcels), in the case of non-stationary resources, such as fish, it is less clear how private ownership could be established. In fisheries private property usually means that some individuals are given a right to the resource system at a particular time and place or to harvest a particular quantity of fish. In other words, the resource system is still likely to be held in common rather than by individuals (Ostrom, 1990:13). This is also what Clark (1980:117) meant when he argued that "common ownership is the fundamental fact affecting almost every regime of fishery management."

4.3.2 Common Pool Resources and Property Rights

Two major objections have been made to Hardin's Tragedy of the Commons model: first, there is empirical evidence that contradicts Hardin's hypothesis that destruction was the inevitable fate for resources which were held in common (for reviews of the evidence supporting this objection see for example Ostrom (1990) or Feeney *et al.* (1990)). The second objection, which is more important within the context of this

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[35] Ostrom (1990:219) points out that the decision on the rate of use of the resource is dependent on the discount factor used by the herder. If the discount factor is high, for example because of uncertainty, then "mining" the meadow rapidly is the rational action.

[36] For the case of non-homogenous resource development insurance schemes, compensation, or trading schemes may be set up but they may require substantial investment costs.

thesis because it helps to better understand the situation in the Danube Delta, is that Hardin's model rested on a conceptual confusion: he did not distinguish between the intrinsic nature of the resource and the property right regime under which it is held. The rest of this subsection deals with this second objection.

There are, as Ostrom, Gardner, and Walker (1994) put it, different classes of goods that differentiate themselves in terms of excludability and subtractability (see Table 4-3). "Excludability" refers to the ease with which potential users can be excluded from the benefits of the resource. "Subtractability" refers to the extent to which the use of the resource by one agent affects the benefits that others may enjoy.

Table 4-3: A classification of goods

	Low Subtractability	**High Subtractability**
Difficult Exclusion	Public Goods	Common Pool Resources
Easy Exclusion	Toll Goods	Private Goods

Source: Ostrom, Gardner, and Walker (1994:7)

Using these two dimensions, Ostrom, Gardner, and Walker (1994) classify goods into four different types. Two of the four types are frequently referred to: public and private goods. With public goods, such as radio broadcasts, it is virtually impossible to exclude people from benefiting from the service but at the same time the benefits that each individual listener enjoys are not diminished by the number of other listeners. For private goods, such as one's own garden, the opposite is true (i.e. other people exploiting it does subtract from one's own welfare but it is usually relatively easy to keep others out).

There are two further combinations of these dimensions. Goods for which use by an individual does not subtract much of the benefits that others can derive from it, but for which it is easy to exclude others from using it (e.g. a road for which a toll is charged) are called "Toll goods". For this thesis, and the renewable resource field in general, the case of "high subtractability" coupled with "low excludability" is of particular interest. Resources that share those characteristics have been called "Common Pool Resources" (CPRs) (Ostrom, 1986:604). Examples of CPRs are fisheries, wildlife, surface and ground water, range, and forests. It needs to be noted, however, that it is not the type of resource (e.g.. fish, forest, water, etc.) which determines what class of good it is, but the exclusion and subtractability criteria.

In order to understand the resource management systems one also needs to also differentiate between different types of ownership regimes (in addition to the differentiation between different types of goods presented above). In Hardin's "Tragedy of the Commons" model there was a choice between three types of property right regimes: the meadow was either state owned, or privately owned and available only to the owner, or, it was "Common Property" and that he equated to mean "open to all". The most widely accepted criticism of Hardin's model is that he wrongly equated common property (usually presented as "an identifiable community of interdependent users") with an open access situation where "access to the resource is unregulated and is free and open to all" (Feeney *et al.*, 1990:4).

The typology of property right regimes as presented in Table 4-4 makes the distinction between an Open Access regime and a Common Property regime clear: under Common Property there is a clear set of owners who have an enforceable and legally recognised right to exclude others from exploiting the resource. These rights are coupled with a number of duties, namely to contribute towards the maintenance of the resource and to limit the rates at which they use it. Under an Open Access regime there are no owners (it is therefore, in fact, a non-property regime) and as a result there are also no duties imposed on those who use the resource.

Table 4-4: Types of Property Rights Regimes with Owners, Rights, and Duties

Regime Type	**Owner**	**Owner rights**	**Owner Duties**
Private property	individual	socially acceptable uses; control of access	avoidance of socially unacceptable uses
Common property	collective	exclusion of non-owners	maintenance; constrain rates of use
State property	citizens	determine rules	maintain social objectives
Open access (non-property)	none	only capture	none

Source: Hanna, Folke, and Maler (1995:15)

The main conclusion is that Hardin's model has served to indicate the importance of property rights. Secondly, contrary to Hardin's claim, CPR resources that are under a common property regime are not necessarily destined to ruin. There are many examples of CPR resource systems for which it is has been argued that common property offers the best chance for sustainable use (see for example Rettig, Berkes, and Pinkerton, 1989). The key requirement, therefore, of any effective property right regime is that it must provide effective means to limit rights of access to the resource and effectively regulate the rightful users.

4.3.3 The Foundations of the New Institutionalist Approach

Over the past 20 years or so there has been an increasing amount of research into the types of rules and regulations humans have developed to deal with co-operative behaviour in a competitive environment under limited knowledge. This is the field of New Institutional Economics (NIE)[37] (see for example Harriss, Hunter, and Lewis, 1995b). NIE builds on the "fundamental neo-classical assumption of scarcity and hence competition" (North, 1995) but rejects the very restrictive notion of the market "as an abstract realm of impersonal economic exchange of homogeneous goods by means of voluntary transactions on an equal basis between large numbers of autonomous, fully-informed entities with profit-maximising behavioural motivation and able to enter and leave freely" (Harriss-White, 1995).

Instead, New Institutionalists argue that transaction costs exist. These are costs that arise in market transactions because "information is rarely complete, and individuals have different ideas (or mental models) of the way in which the world about them works". Transaction costs arise in finding out the relevant prices, negotiating and concluding contracts, and then enforcing them. In NIE theory, the main function of institutions is to reduce such information and transaction costs (Harriss, Hunter, and Lewis, 1995b:3).[38] This rationale is most succinctly captured by Bates (1995):

> *Rational individuals, confronted with the limitations of individually rational behaviour, create institutions that, by creating new incentives or by imposing new constraints, enable them to transcend these limitations (quoted in Harriss, Hunter, and Lewis 1995b).*

Within this context, institutions are defined as "the rules of the game of a society, or, more formally, are the humanly devised constraints that structure human interaction. They are composed of formal rules (statute law, common law, regulations), informal constraints (conventions, norms of behaviour and self-imposed codes of conduct), and the enforcement characteristics of both" (North, 1995:23).

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[37] It is called 'new' institutional economics because there exists an older school of institutionalism in economics that is associated with Thorstain Veblen, John R. Commons, Clarence Wendell and Allan Grunchy (see Harriss, Hunter, and Lewis, 1995b:4-5). This latter school 'rejects the emphasis on rational-maximising self-seeking behaviour of individuals which is at heart of both neo-classical economics and new institutionalism' (Stein, 1995). Both old and new institutional economics are concerned with the determinants of change. NIE presents change as evolutionary and attaches greater importance to the role of the individual (Harriss, Hunter, and Lewis, 1995a:5).

[38] See also Matthews (1986).

> *"It is adaptive rather than allocative efficiency which should be the guide to policy. Allocative efficiency is a static concept with a given set of institutions; the key to continuing good economic performance is a flexible institutional matrix that will adjust in the context of evolving technological and demographic changes as well as shocks to the system. It is the creation of a stable polity with complementary norms that is the essential characteristic. Successful political/economic systems have evolved such characteristics over long periods of time. The critical issue is how to create such systems in the short run, or indeed, whether it is even possible to create them in short periods of time. However it is doubtful if the policies that will produce allocative efficiency are always the proper medicine for ailing economies. Efficient policies that are perceived to be inequitable will engender political reactions which can stall or reverse effective political reforms" (North, 1995:26).*

North (1995) concludes that "there is no greater challenge facing today's social scientist than the development of a dynamic theory of social change that will fill in many of the gaps in the foregoing analysis and yield an understanding of adaptive efficiency."

4.3.4 NIE and Renewable Resource Management

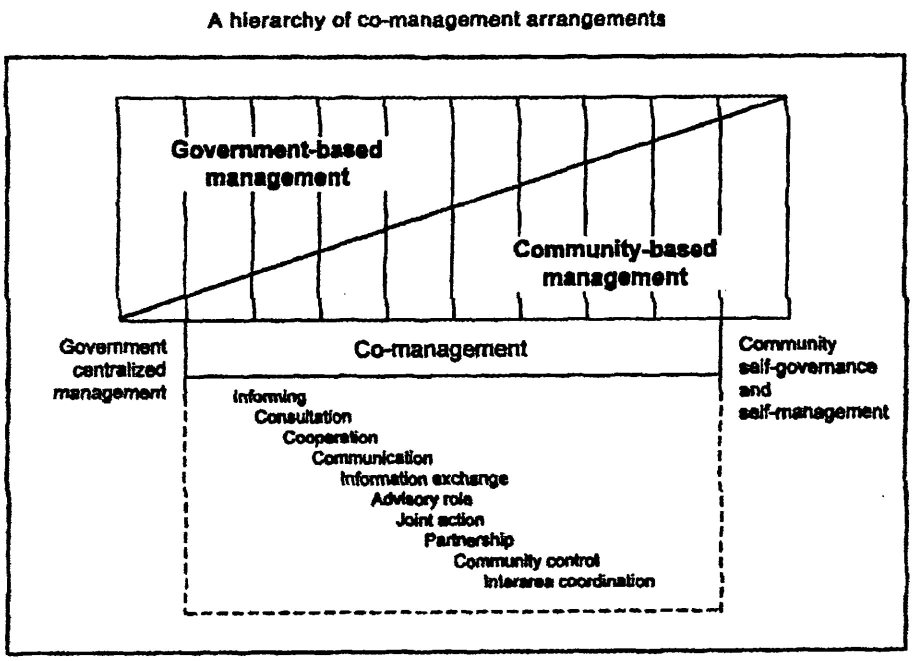
The focus of the New Institutional Economics literature that deals with renewable resource management is on property rights regimes (which contain both property rights, *i.e.* "the bundles of entitlements regarding resource use", and property rules, i.e. "the rules under which the those entitlements are exercised" (Hanna, Folke, and Maler, 1995:15)), and the components that are critical to the structure of the property rights regimes and their ability to limit resource use, co-ordinate users, and respond to changing environmental conditions.

"The performance of property rights can be measured in any one or a combination of three dimensions: economic, social, and ecological. All three of these dimensions are interconnected, interactive, and embedded in a system" (Hanna, Folke, and Maler, 1995:18). It is argued that the economic criterion relates to economic efficiency (least cost combination of inputs necessary to produce the best economic outcome) and may include damage effects of environmental use (Daly and Cobb, 1989). The social criterion focuses on equity considerations which reflect societies definitions of fairness in the distribution of costs and benefits. The ecological criterion is measured by the extent to which natural capital is preserved.

Hanna, Folke, and Maler (1995:18) further note that "unless resources are in surplus relative to demand, trade-offs between these performance measures are inevitable". Furthermore, "uncertainty works at cross purposes in natural and human systems." When there is uncertainty about the effects of management in natural systems, a rational approach dictates a precautionary approach to cover contingencies (Costanza, 1987). In contrast, uncertainty in human systems creates incentives for accelerated rates of use due to the lack of assurance that resources not used in the present will be available in the future (Hanna, Folke, and Maler, 1995:18-19). That is why there is a need for an institutional framework that constrains human actions, and property rights are a necessary, but not sufficient condition for resource sustainability.

In the development of the institutional framework one needs to choose between open-access, state control, communal governance, private property, or a number of mixtures between these different types. Fisheries are increasingly believed to need the sharing of authority among governments, local communities, and the private sector. Each of these actors, it is argued, brings "different interests, abilities, and perspectives to the resource management process" (Townsend and Pooley, 1995:48). The sharing of management responsibility and authority between a Governmental agency and a community of users has been called co-management (see for example Jentoft (1989), or Rettig, Berkes, and Pinkerton (1989)). Figure 4-6 illustrates the fact that co-management refers to a very wide range of the different arrangements. In general, the view is put forward that "just as government managers cannot manage the fishery without fishermen's co-operation, neither can the fishermen manage the fishery themselves in today's complex world" (Rettig, Berkes, and Pinkerton, 1989:285).

Figure 4-6 An illustration of a range of co-management arrangements



Source: Pomeroy and Berkes (1997)

One of the co-management characteristics frequently highlighted is that the budgetary burden of fishery management agencies can be reduced. Using information from fishermen on fish populations and fishing activities reduces the amount of information needed from trained biologists, vessels and equipment. When fishermen or fishing companies are involved in designing a fishery management regime the costs of planning are reduced and local community acceptance is increased (Rettig, Berkes, and Pinkerton, 1989: 278-279).

> *"When incentives are well matched to the situation, individuals make decisions that produce outcomes that are both personally and socially rewarding. In such cases, the advantage that one individual derives also produces benefits for others" (Ostrom, Schroeder, and Wynne, 1993:9).*

One suggested approach to differentiate between them is through a systematic comparison of transaction costs associated with different sets of regimes (Ostrom, Schroeder, and Wynne, 1993). The reasoning behind this suggestion is that the co-ordination of the actions of all actors in terms of gaining agreement, monitoring activities, and evaluating performance requires considerable time and other resources. In a study on a new institutional economics approach to infrastructure project[39] design and management Ostrom, Schroeder, and Wynne (1993) suggest that transaction costs could be evaluated by using a framework that I have summarized Figure 4-7.

In the examples that they work through they do not actually provide cost figures for the different heading items. Instead they perform a relative comparison between different types of institutional arrangements, indicating for each whether or not the respective transaction costs are small, medium, or large.

In fact, Harriss-White (1995) argues that NIE is a relatively blunt instrument for the empirical analysis of 'real institutionalised markets' (as opposed to the theoretical abstraction of neo-classical theory, see also Bates, 1995:41). Harriss, Hunter, and Lewis (1995a:7&12) also note that Bates (1995) and Toye (1995) find that NIE tends to tautological arguments for its justification such as 'existing institutions minimise transaction costs because transaction cost minimisation is their function". Furthermore, 'some of the propositions derived from the NIE approach to the analysis

[39] In Ostrom, Schroeder, and Wynne (1993) infrastructure such irrigation schemes, water supply, and roads are discussed, but I argue that the analysis also applies to fisheries such as the one in the Danube Delta.

of markets, including property rights, are too indeterminate to bear empirical investigation.'

Figure 4-7 Criteria for judging the comparative performance of alternative institutional arrangements

Intermediate performance criteria, provision costs	
Transformation costs	the costs involved in (1) transforming citizen preferences about outcomes and their willingness to pay into articulated demands for packages of publicly provided goods and services; (2) arranging for financing and producing these packages; (3) monitoring the performance of producers; (4) regulating the use patterns of consumers, and (5) enforcing compliance with taxation and other resource mobilization measures (they are a function of the characteristics of the goods and services involved, the scale of the provision unit, the technologies used in aggregating interests, arranging financing and production, monitoring producers, regulating users, and enforcing compliance)
Transaction costs	increases in transformation costs associated with coordination, information, and strategic behaviour. (They are a function of attempts to counteract incentives associated with strategic behaviour.)
Co-ordination costs	costs of time, capital, and personnel invested in negotiating, monitoring, and enforcing agreements about provision among actors
Information costs	costs of searching for and organizing information
Time and place	costs resulting from a lack of or an ineffective blend of knowledge about time and place
Scientific	costs resulting from a lack of knowledge about general scientific principles
Strategic costs	are the increased transformation costs produced when individuals use asymmetric distributions of information, power, or other resources to obtain benefits at the costs of others. The most frequent are: Free riding; Rent seeking; and Corruption
Intermediate performance criteria, production costs	
Transformation costs	costs of transforming inputs (land, labour, and capital) into outputs
Transaction costs	increases in transformation costs associated with coordination, information, and strategic costs
Co-ordination costs	costs of time, capital, and personnel invested in negotiating, monitoring, and enforcing agreements among actors
Information costs	costs of searching for and organizing information and the costs of errors resulting from a lack of or an ineffective blend of: Time and place and Scientific
Strategic costs	are the increased transformation costs produced when individuals use asymmetric distributions of information, power, or other resources to obtain benefits at the costs of others. The most frequent are: Shirking; Corruption; and Adverse selection/moral hazard
Overall performance criteria	Efficiency; Fiscal equivalence; Redistribution; Accountability; Adaptability

Source: Ostrom, Schroeder, and Wynne (1993)

Bates (1995:41-42) argues that NIE shows that people create institutions that allows them to move to the Pareto frontier, but it cannot specify which of the infinite number of non-equivalent points in the Pareto set will be the outcome (hence he calls it a 'blunt theory'). But because people are not indifferent between them and instead possess conflicting preferences over them (since different solutions have different distributional outcomes) Bates (1995) argues that NIE has so far failed to recognise the centrality of politics, since it is the political power of the players and the nature of the political setting that enables one player to gain a preferred institutional solution and thus achieve one outcome as opposed to another within the Pareto set. He contends that for NIE to "fulfil its own agenda, however, it must move into the study of politics. It needs to take into account the allocation of political power in society and the impact of the political system on the structure and performance of economic institutions" (Bates, 1995:44). That is why Bates (1995) concludes that the proper role of "the new institutionalism might be to provide diagnoses rather than to prescribe cure."

4.4 Conclusion

In this chapter I have dealt with the implications of alternative, and more realistic (compared to the simple and more popular fishery management model used in the DDBR) views of the interaction between the social, economic, and ecological systems that together form the DDBR, and of which the DDBRA is a part. One of the important conclusions from this review of the literature is that due to the complex dynamics interaction within and between human and natural systems, the question of a 'perfect' management institution, catch limit, enforcement method, etc. does not arise.

More specifically, I have shown that The MSY concept used in the bio-economic model needs to be replaced with the concept of resilience. In order to deal with the problem of restricting effort, one needs to develop rules and regulations that are appropriate for the specific social, economic, and environmental conditions of the DDBR. To accomplish this, the metaphor of the Tragedy of the Commons and the traditional solution of either state ownership or privatisation were neither feasible nor conceptually helpful or appropriate. Instead, the NIE literature points to design principles that one can extract from the analysis of a wide range of management experiences (both successes and failures). However, little has been said about the type of interventions that would facilitate the development an appropriate set of rules, regulations, and institutions that can adapt to future changes.

All the literature reviewed in this Chapter has also stressed the inherent limitations of knowledge, the effects of different kinds of institutional relationships, and has indicated that decision making is affected by social constraints or influences/biases in addition to the cognitive limitations that the MSDA literature has been mostly concerned with.

The use of different expert and stakeholder views in natural resource management is very important for assessing the resilience of ecosystems (because dynamic variability of ecosystems prevents a univocal and constant determination of the resilience of an ecosystem) as well as for the design of management systems (because of the relevant knowledge that they are able to bring to bear to the problem, which among other things lowers transaction costs).

If maintaining or increasing the resilience of the DDBR (which includes the social, economic, and ecological systems) becomes the strategic objective for the DDBRA, then one of the key features of the fishery management regime that the DDBRA is engaged in planning must be that it is adaptive. This means that all those engaged in the management of the DDBR fishery must be able to recognise changes in the systems that they are operating in and adjust the rules and regulation that govern their interaction. These adjustments can be both reactive to external or internal changes in the system as well as proactive, in the sense that there may be opportunities to improve the social, economic, or ecological systems in a way that is more desirable (increased resilience, or better income opportunities, etc.) There is no agreement over whether these changes are gradual or have a pattern of stability or little change is all of a sudden replaced followed by a period of rapid change and re-configuration. There is agreement, however, that the changes are unpredictable.

Such a revised role for the DDBRA within the DDBR poses challenges for the management planning process (especially allowing and even seeking different viewpoints because there is much evidence (including from the Danube Delta) that those who manage a resource system reduce the variety of institutions engaged in the management process, incorporating a great range of competing objectives instead of a narrow MSY which did not even consider economic criteria) and it also implies that the DDBRA must undergo a transformation process where the old framework (centred around the models first developed by Antipa at the turn of the Century) on which the narrow carrying capacity interpretation as MSY rests, is transformed into a new shared social reality about the aims of the DDBR and the role of the DDBRA.

Chapter 5 The effects of organisational structure on the work of DDBRA managers

This chapter examines the organisation of the DDBRA at its different levels and how it affects the work of the staff. I have organised my analysis as follows: first I consider two theories that deal with differentiation of work according to different hierarchical levels in an organisation: Stratified Systems Theory (Jaques, 1996) and the Competing Values Approach (Rohrbaugh and Eden, 1990). These provide frameworks for analysing decision problems faced by DDBRA managers at different levels. I then use Mintzberg's theory relating to the specific effects of bureaucracies on strategic management (Mintzberg, 1989) in order to examine decision making by managers in the DDBRA.

5.1 Work at the different managerial levels of the DDBRA (Stratified Systems Theory)

According to Jaques (1996), the leading developer of Stratified Systems Theory (SST), the number of managerial layers required in an organisation depends on the complexity of the work performed. For Jaques, complexity is a function of three things: (i) the number of variables that have to be dealt with in a given time, (ii) the clarity and precision with which they can be identified, and (iii) their rate of change. Jaques argues that for an organisation to function efficiently, the complexity of the work that an employee is accountable for must match the mental processing capacity of that individual, and that the individual's role within the organisation must be at the appropriate managerial stratum (managerial hierarchy level). In other words, there must be congruence between the complexity of the work to be done to perform particular tasks, the ability of the individual working on it, and the managerial hierarchical level at which he is working. An organisation where these and some other principles[40] are observed, he calls a "Requisite Organisation".

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[40] Jaques' (1996) work on the "Requisite organisation" also covers "leadership practices" (which refers to the relationship between managers differentiated by one stratum and covers teamworking, context setting, planning, task assignment, personal effectiveness appraisal, merit review, coaching, selection andinduction, deselection and dismissal, and continual improvement), pay scales, functional alignment, human resource management, and many other factors. The focus here, however, is on better understanding task complexity, the work by different managerial levels (in particular as it relates to strategic management), and organisational factors that will help or hinder effectiveness of individuals' work.

In the next three sub-sections I first explain how Jaques proposes to measure the mental processing capacity of individuals, and the complexity of information and roles. That enables me to determine a second set of factors relevant to the different levels of complexity of the problems encountered in the DDBRA and the managerial levels of managers that must be dealing with them.

5.1.1 Work complexity and human capability

The first step in the analysis of work at the different managerial layers in an organisation is a precise distinction between task, role, and work (Jaques 1996:13&18). A task is an assignment to produce specified output within a given completion time and allocated resources. Role refers to the position that an individual occupies in the organisation. Work refers to the exercise of judgement and the making of decisions for the purpose of performing a task.

Jaques argues that the judgement and decision making to which he refers in his definition of work take place at two levels. One is through articulated ideas that constitute knowledge that can be communicated to others. Beneath this level of articulated ideas or knowledge is a second level which Jaques calls "mental processing". Mental processes do not take place in verbal form, but are unconscious or intuitive. Jaques combines these two levels and argues that "all human thinking, and therefore all human work, is a continual interplay between non-verbal mental processes and the knowledge which we use to direct and focus those processes" (Jaques, 1996:20). This leads Jaques to conclude that since human decision making contains both knowledge and non-verbalised ideas, the key difference between decision making and mechanical calculation is that persons cannot, beforehand or afterwards, state all the reasons why they made a particular decision.

Having proposed a definition of work which refers to mental processing of information as a defining characteristic, Jaques goes on to argue that one can analyse the differences in the work done at different levels of an organisation through a combination of three elements: (i) the method of mental processing used at a particular stratum, (ii) the complexity of the information needing to be processed at that stratum, and (iii) the complexity of the particular tasks pursued. Jaques also proposes that the maximum time within which tasks need to be completed can be used as a universal measure for task and role complexity. Analogously, the maximum time span that individuals feel comfortable working with reflects their mental processing capacity. Before using Stratified Systems Theory to analyse the DDBRA, I first outline the three components of complexity proposed by Jaques.

5.1.1.1 Mental Processing Methods

From studying the way people argue about decisions they care about, Jaques and Cason have inferred four distinct methods of mental processing (Jaques, 1996:22):

Declarative Processing: positions are argued by bringing forward a number of separate reasons individually, without making connections between them. This method of processing has a "*disjunctive, declarative quality.*"

Cumulative Processing: positions are argued by bringing together a number of different ideas, which only make the case when combined. This method of processing has a "*pulled-together, conjunctive quality.*"

Serial Processing: positions are argued for by bringing together a number of different ideas and linking them in a logical sequence, so that each reason in the series sets the condition that leads to the next reason.

Parallel Processing: positions are argued for by examining a number of different options, each arrived at by means of serial processing, and useful points from one position are taken from one less favoured to bolster another more favoured position.

5.1.1.2 Information Complexity

Jaques has identified five levels of information complexity. The information at each level may be processed by the four types of mental processing outlined above. The importance of information complexity lies, according to Jaques, in the fact that people vary in their data processing capability. Those in higher managerial roles are able to handle more data and turn them into information more than those in lower positions.

Jaques argues that there are five ways in which people transform data into information. These correspond to the following five levels of information complexity:

Pre-Verbal: concrete information expressed in pre-verbal infancy in the form of gestures and physical contact with objects.

Concrete Verbal: Thoughts and language as observed in children where thoughts and words are connected ostensively to the things thought about or referred to.

Symbolic Verbal: Thoughts and words no longer have to refer to tangible entities, but instead are used as symbols which can be construed and worked with as though they themselves were the things. This is the world of most of the workforce, from shop floor to middle management (Levels I-IV in Table 5-2).

Conceptual Abstract: Thoughts and words are abstract in the sense that they refer to other thoughts and words, rather than to things. According to Jaques, while such conceptual abstract thoughts and words pull ideas together, they do not help in problem solving unless they "reach through their symbol word content to real things". This is the world of Senior Management in large organisations (Levels V-VIII in Table 5-2).

Universals: This level of abstraction is universal in the sense that users reformulate all current thoughts and language (this is the world of genius).

5.1.1.3 Role complexity and the "Time span of a role"

The third element in Jaques' (1996) framework for the analysis of work at different managerial hierarchy levels, after mental processing capacity and information complexity, is the most readily measurable. In essence, he argues that complexity of the managerial roles in an organisation increases in discontinuous steps as one moves up the hierarchy.

According to Jaques, even if the staff of an organisation are pursuing the same objectives (such as the development of a sustainable fishery management system), the role complexity faced by managers pursuing these objectives depends on the number of variables they have to deal with, how clearly these variables can be identified, and the rate at which the variables change (i.e. the complexity of work). As one moves up the managerial hierarchy, managers are concerned with a greater part of the whole system and need to deal with more variables, which are more ambiguous, and which change more quickly. This is why Jaques maintains that "the complexity of a problem does not lie in the complexity of the goal, but in the complexity of the pathway that has to be constructed and then traversed in order to get to the goal"[41] (Jaques, 1996).

One of Jaques' best known achievements relates to his early empirical work in which he analysed the maximum target-completion times of tasks at different managerial levels. Jaques found that there is a strong correlation between the longest time that managers have been allotted to complete various tasks (the "time span of the role"), the hierarchical level that these managers are working in, their mental processing capacity, and the information complexity that they handle (see Phillips, unpublished). This means that the maximum complexity of a task that will be found in a particular role (which is a combination of the mental processing capacity and information complexity) may be determined by the time-span of the role. The reverse is also true.

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[41] Jaques illustrates this point with the analogy between getting the first wagon train to California from St. Luis and flying a plane to California. The first was, he claims, much more complex.

(This relationship is summarised in Table 5-1). This conclusion also means that "*there is one particular category of complexity specific to each organisational stratum.*" (Jaques, 1996:64, emphasis in original).

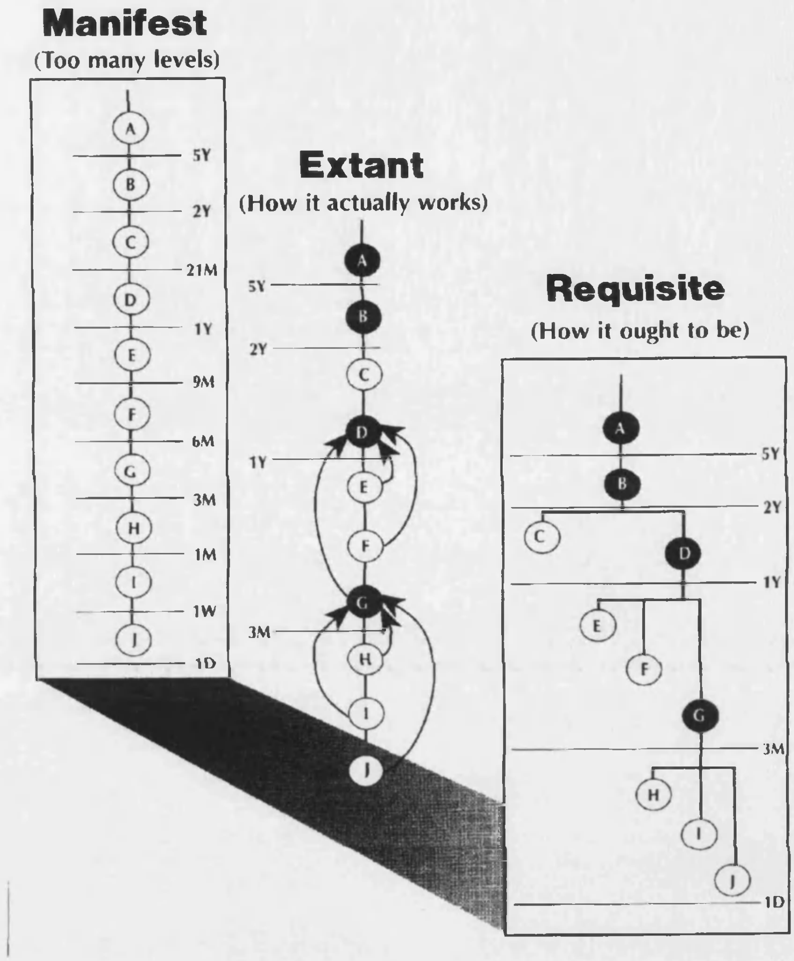
Table 5-1 Time span and maximum complexity of task

Stratum	Role Time-Span	Mental Processing Method	Information Complexity
VII	20+ years	Serial	Conceptual Abstract
VI	10 - 20 years	Cumulative	Conceptual Abstract
V	5 - 10 years	Declarative	Conceptual Abstract
IV	2 - 5 years	Parallel	Symbolic Verbal
III	1 - 2 years	Serial	Symbolic Verbal
II	3 months - 1 year	Cumulative	Symbolic Verbal
I	1 day - 3 months	Declarative	Symbolic Verbal

Source: Jaques (1996)

It should be noted however, that there may be differences between the way that official organisational charts and the way that employees actually assume that the organisation works, the system as it actually functions, and what the organisation structure ought to look like (Jaques, 1996:33-42). Figure 5-1 illustrates an example of an official chart (called the "Manifest Chart") in which there are too many hierarchical levels. Such a situation can occur, for example, when there is no differentiation between the pay grade system (whose purpose is to establish pay and status bands, and which is supposed to allow for merit recognition), and the accountability and reporting system. In the absence of a system of managerial strata the grading system often becomes the managerial system as well. However, people won't really respect such an over-hierarchization, and they will tend to circumvent the imposed reporting system and instead report to the managers one stratum above them (this is the "Extant System" in Figure 5-1). The problem is that the roles are not well specified, communication is discouraged, and as a result, work in the organisation suffers. If the organisation were to be organised in the "Requisite" manner (see Figure 5-1 again), then the working environment would be much improved and made more productive.

Figure 5-1 Time-span and structures of management levels



Source: Jaques (1996:40)

By combining problem complexity, task complexity, information complexity, mental processing capacity, and time span, it is now possible to summarise Jaques' Stratified Systems Theory, which underlies the "Requisite Organisation", and which provides precise hypotheses about the nature of work in different strata of an organisation. I have summarized these relationships and provided examples of the corresponding positions within the DDBRA in Table 5-2.

Table 5-2 Features of Stratified Systems Theory and Requisite Organisation

Stratum	Operational Level - Position Example from the DDBRA	Role Time-Span	Mental Processing Method	Information Complexity	Task Complexity	Time Focus for Planning
VII	Corporation - CEO	20+ years	Serial	Conceptual Abstract	Strategic Options: alternative routs to make or transform operating systems	25 Year Envisionment
VI	Corporate group - Executive vice-president DDBR: Secretary of State, MWFEP	10 - 20 years	Cumulative	Conceptual Abstract	Whole wide world data accumulation & diagnosis	12 Year Concept Programme
V	Subsidiary - Managing Director DDRBA: Mr Tarhon, Governor	5 - 10 years	Declarative	Conceptual Abstract	Practical judgement of immediate & downstream consequences of changes anywhere in the system	7 Year Critical Tasks
IV	Division - General Manager DDBRA: Mr Baboianu, Executive Director	2 - 5 years	Parallel	Symbolic Verbal	Parallel Processing & Trading Off	3 Years Projects
III	Unit - Department manager DDBRA: Mr Constantin, Manager Licensing and Regulation Section	1 - 2 years	Serial	Symbolic Verbal	Construct alternative routes to goals	18 Months Developments
II	Section - First-line supervisor DDBRA: Mr Eduard Ene - Resource Evaluation Section	3 months - 1 year	Cumulative	Symbolic Verbal	Data accumulation & diagnosis	6 Months improvement
I	Shop floor - Clerical worker DDBRA: Laboratory assistants	1 day - 3 months	Declarative	Symbolic Verbal	Direct Judgement	Daily to Weekly Outputs

Source: adapted from Jaques (1996)

5.1.2 Applying Stratified Systems Theory to the DDBRA

There are two ways in which I propose to apply Stratified Systems Theory (SST) in the analysis of the management problems in the DDBR: first, as a theory that provides one possible interpretation of the management planning difficulties observed as a function of the types of work relationships.

The second way in which I apply SST to the DDBRA is to differentiate, in a way that goes beyond the fact that there were multiple objectives and uncertainty, between the different types of judgements that DDBRA managers needed to make. This is useful as it provides a possible explanation for the unexplained differences observed at different levels management that Keeney (1994) reported..

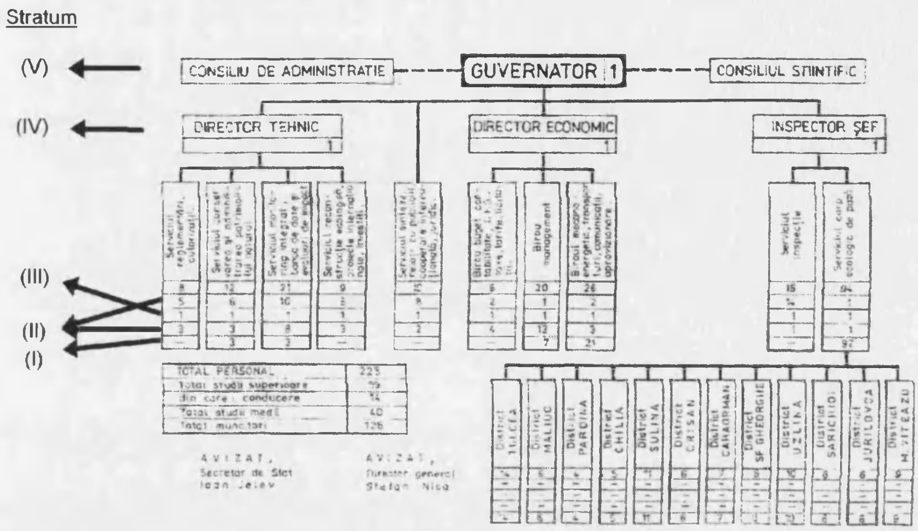
5.1.2.1 Analysis of DDBRA organisational chart

Figure 5-2 shows the organisational chart of the DDBRA before the EBRD Technical Assistance project started. It shows that the DDBRA was supposed to have 225 employees, of which 110 were in the Guards and Inspection Department. In 1993, approximately 100 of these posts were not filled, including 35-40 posts of technically qualified people such as biologists, chemists, foresters, and a lawyer. There were three main reasons for this shortfall. First, the Governor had been unwilling to recruit the whole staff complement because the DDBRA law had not yet been approved. Secondly, there was no office accommodation for them (in fact even the existing head-office staff was distributed across two office buildings in Tulcea). It was difficult to attract senior people to come to live in Tulcea, not least because of the difficulty of finding reasonably priced accommodation (EBRD, Euroconsult, and IUCN, 1993).

In addition to the lack of important personnel and the fact that the existing personnel were not housed together, the main difficulties in the operation of the DDBRA, were associated with a rigid bureaucratic management system in which "decisions were passed on to ever higher levels of management" (EBRD, Euroconsult, and IUCN, 1993:26). To overcome these impediments a re-organisation was proposed by the EBRD project in which additional departments were created with usually fewer staff in each, so as to create "more efficient units that can work as teams" (EBRD, Euroconsult, and IUCN, 1993:26).

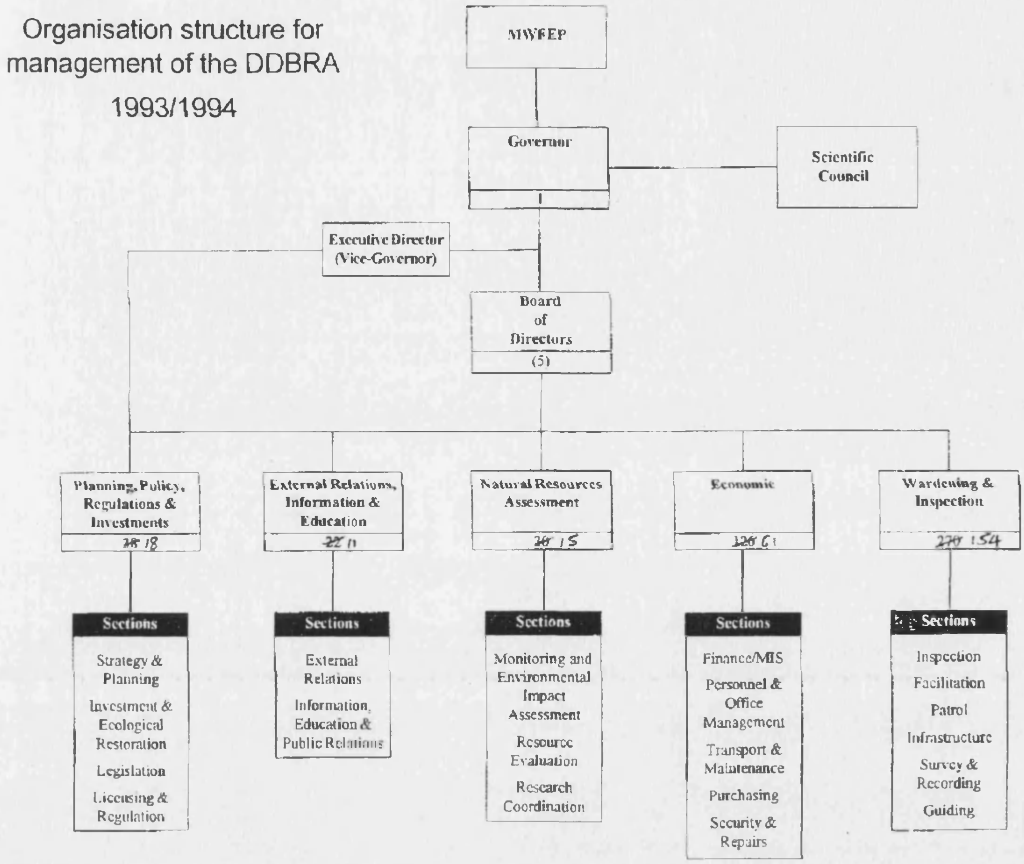
The organisational structure that was eventually adopted is shown in the chart in Figure 5-3. The overall trend was to decrease the number of staff working at the head office and to increase the field presence. The rationale for the latter was to change the operations of the Corps of Guards from primarily policing functions to facilitation, interaction with local communities and visitors, and carrying out of basic survey and data collection.

Figure 5-2 Original organisational structure of the DDBRA, before 1993



EBRD, Euroconsult, and IUCN (1993:27)

Figure 5-3 Organisational structure adopted, end of 1993



Source: Goriup and DDBRA (1994)

By using Stratified Systems Theory, the analysis in EBRD, Euroconsult, and IUCN (1993), and my own observations, we can ascertain the following:

Within the original organisational structure (as it was before 1993), Figure 5-2, the Governor was working with four departments: the "Technical" Department (which was in fact responsible for all aspects of natural resource management, except for enforcement); the External Relations Department (where the absence of a director indicates that it was not considered at the same level as the other departments), the "Economic" department (which was largely concerned with DDBRA administrative matters such as accounting, inventory, etc.), and the Guards and Inspection Department.

The organisational changes first proposed by the EBRD project consultants in the draft report (EBRD, Euroconsult, and IUCN, 1993) were put forward for discussion at the Inception Conference of the project in May of 1993. Nine departments were proposed. Along with smaller, more flexible departments, it was proposed to raise the position of the Director of the Planning, Policy, and Investments Department to that of Deputy Governor (above the positions of the other Departmental Directors). Later in the year, after the DDBRA law was passed, the organisational structure illustrated in Figure 5-3 was eventually agreed to (though the staffing numbers were frequently changing).

Overall there were five managerial strata, as indicated in Figure 5-2 and Table 5-3, and the DDBRA was not requisitely organized because there were significant differences between the official organisational structure (Figure 5-3) and the way the DDBRA actually operated. One piece of evidence is that the actual structure could not really function because there were important departments, such as Planning and Strategy, where all positions (except for the Executive Director who was supposed to head it) were vacant.

5.1.2.2 Role relationships and work complexity at the five strata of the DDBRA

Following Phillips (1992:6) we can expect that managers at the different levels have different ideas about what constitutes strategy because they have different time horizons. According to Jaques (1996), the perception of a manager about what he or she considers the relevant time frame for planning can be used as an indication about the manager's mental processing capacity and whether or not he is employed at the appropriate stratum. Without the concepts of time-span and individual capacity, it would be difficult to explain why commonly observed disagreements about plans and strategies arise. Phillips (unpublished:7) argues that the various strata of managers emphasize either the use of data or judgement in decision making more. I will now summarize the relationship between role relationships and task complexity at each of the seven strata that SST claims exist. Stratum III, IV, and V are of particular relevance in DDBRA because as I report in Chapter 8, the Decision Conference that I organized and the workshops that led up to it involved these levels (Table 5-3 below relates staff of the DDBRA to the different managerial strata).

Stratum I (Direct Action Tasks): This refers to first-line manual or clerical work. The time-span of these roles is between 1 day and 3 months. "At Stratum I an individual proceeds along a prescribed linear pathway to a goal, getting continual feedback in order to proceed, and using previously learned methods for overcoming immediate obstacles as they are encountered, or else reporting back" (Jaques, 1996).

Tasks of this kind can be accomplished with the symbolic verbal order of information complexity and using declarative mental processing. Uncertainty is reduced by trying out different ways of accomplishing the task, a 'touch-and-feel' approach that relies heavily on judgement (Phillips, unpublished:4).

Stratum II (Diagnostic Accumulative Tasks): Refers to first-line managerial work, and what is usually described as specialist work done by graduates (engineers, scientists, therapists, etc.). The time-span of these roles is between 3 months and 1 year. "At Stratum II an individual not only overcomes immediate obstacles by direct action as they are encountered but must also be able to reflect on what is occurring so as to note things that might indicate potential problems and obstacles; and they must accumulate, (verbalise) and consciously sort such data to diagnose emerging problems, and initiate actions to prevent or overcome the problems identified." Phillips (1992) argues that this means that at Stratum I, uncertainty is dealt with through predictions. Tasks of this kind can be accomplished with the symbolic verbal order of information complexity and cumulative mental processing.

Stratum III (Alternative Serial Paths): This refers to managers of units small enough for all of its members to be able to recognise one another; "senior" or "chief" engineers, scientists, etc., or many lawyers and doctors. The time-span of these roles is 1 year to 2 years. Since this stratum is of particular significance in my work in the DDBRA, I quote at length two descriptions of what work at this stratum means:

> *"In order to get on with work, including both overcoming obstacles and diagnostic accumulation, the person must first consider the situation and work out alternative pathways or routes by which the problem might be resolved. In particular, he/she must find a path that stands a chance of coping with short-run requirements (say a week or a few months), while at the same time providing the initial stages of a realistic path towards longer-term goals that could be a year or more ahead. The person must be able to change to alternative paths if the initial choice of paths turns out unsatisfactory."*
>
> In short, *"at Stratum III, you must not only use direct judgement plus diagnostic accumulation, but must also be able to encompass the whole process within a plan that has a pathway to goal completion that you have worked out in the first place - and have pre-planned alternative paths to change to if need be" (Jaques, 1996)*

Phillips (1992) argues that this means that Stratum III managers need to employ forecasting systems that are either based on experience and judgement of trends, or on statistical forecasting systems. Since the time-span is no longer than two years, the forecasting would work quite well if the environment in which they operate was not very complex. However, in the case of DDBRA, which operates in an unusual context of rapid social, organizational, economic, and natural change, the reliability of such a forecasting system would not be very high.

Table 5-3 Selected Staff Profile

DDBRA Department	Job Title	Stratum
Planning, Policy & Investment	Director / Deputy Governor (1) Personal Assistant (1) Administration Liaison Officer (1) Financial Analyst (1) Business Liaison Officer (1) Communications/Audit Officer (1) Clerical Support Staff (4)	III / IV II II II II II I
Natural Resource Assessment and Monitoring	Director (1) Personal Assistant (1) Clerical Support Staff (3)	III I / II I
Monitoring Section	Section Head (1) Scientific Staff (5) Technical Support Staff (5)	II / III II I
Research Co-ordination Section	Section Head (= Director) Contract Manager (1) Environmental Manager (1)	III II II
Legal and Regulatory	Director (1) Legal Secretary (1)	III I / II
Licensing	Director (1) Technical Assistant (1) Licensing Clerks (6)	III II I

Source: building on EBRD, Euroconsult, and IUCN (1993:30-31)

Stratum IV (Parallel Processing Tasks): This refers to Product Development/Sales/Production General Managers or to project managers, researchers, analysts. At this Stratum one moves from direct management to general management. The time-span of this role is 2 to 5 years. Such managers construct a number of serial pathways (and alternatives) that all run at the same time and are interconnected in some way. Stratum IV managers can either pursue a number of sub-projects simultaneously and connect them themselves, or manage a number of subordinates, and work at keeping them synchronised, resourced, on schedule, as well as guiding any or all of them into alternative paths when necessary. In short, "at Stratum IV you have to parallel process several interacting projects, pacing them in relation to one another in resourcing and in time. You must make trade-offs between tasks in order to maintain progress along the composite route to the goal."

According to Phillips (unpublished:4), the 2 - 5 year time-span is too long for forecasts to be relied upon, even if the operating environment is quite stable. That is why uncertainty is dealt with through the construction of portfolios of departments and systems that balance out unexpected failures or delays. Models might be constructed in order to predict where the organization might go in the near future, but overall decision making at this stratum relies more on judgement than on data (Phillips, unpublished:5).

Stratum V (Unified Direct Action): This refers to the management level where "human beings construct unified whole systems" and the time span of this role is between 5 and 10 years. By "unified" and "whole" system, Jaques refers to the Systems Theory definition of "intact and complete in itself and operating in an unbound environment". Full-scale business units are located at this level. It is similar to Stratum I in the sense that one needs to take direct action to problems as one encounters them, and it involves declarative mental processing. However, the big difference compared to Stratum I is that information of conceptually abstract complexity needs to be processed. Stratum V managers must be able to:

- "judge the likely impact of changes or events (from both inside and outside the business unit system), on any and all parts of the system;
- pick out those parts where the impact is likely to be important;
- trace the likely 2nd and 3rd order consequences of these impacts;
- and sustain an active anticipation of what changes are likely to unfold."

Phillips (unpublished) argues that managers at this level use scenarios and exercise their own judgement in creating those scenarios in order to develop strategies that are robust enough for unanticipated events.

Stratum VI (Cumulative Processing/Conceptual Abstract): This refers to managers who manage at one level higher than the single unified system. Complexity thereby increases to another level and the time span of this role is between 10 and 20 years. Like Stratum II, accumulation and screening the relevance of data is important, but here the data are conceptual abstract in complexity (e.g. political, economic, social, technological, intellectual) and needs to provide insight about the workings of the wider environment in which the business units operate so as to be able to feed it back to the corporation and business units.

Stratum VII (Serial Strategic Options): This refers to the executive leadership of large corporations. Their work relates to judging the needs of society, nationally and internationally. The time-span of this role is more than 20 years. Like Stratum III paths and alternatives must be constructed (serial mental processing), but here they are conceptually abstract, and are at the scale of whole business units (develop new ones, develop some, divest in others, joint ventures, mergers). "Strategic option pathways must be constructed as a series of conceptual abstract intangible sets, since even the near-term choice points have to be construed in terms of their long-term intangible context, and all of the sets making up the pathway have to be analysed in relation to one another."

5.1.3 Stratified Systems Theory applied to Team Work and Planning

According to Stratified Systems Theory, one of the key conditions for effective managerial work is the existence of a requisite structuring of organisational layering into strata. Furthermore, the level of individual capability in a stratum must match the corresponding role complexity. Thus, the mental processing method of the manager must be one category above that of the immediate subordinates, all of whom are in roles at the next lower stratum. Jaques defines a manager within an organisation that employs people as a person who "is held accountable for the outputs of others, for sustaining a team capable of producing those outputs, and for giving effective leadership to that team" (Jaques, 1996:35).

Two (of ten) leadership practices that Jaques describes for effective leader- follower relationships between managers and subordinates are particularly relevant in the context of this thesis: managerial team working and planning.

Jaques (1996:100) submits that there are three types of content for a meeting between managers and subordinates: current information exchange, discussion out of which the manager will take a decision; and exploration of a difficult problem, without a decision being made. Jaques also argues that although the manager and the subordinates may be working as a team, this does not imply that the group makes decisions. The making of decisions (as well as context provision, direction setting, priority indications) is the clear accountability of the manager. Therefore, informed decisions are taken by managers in the light of the knowledge, expertise and perspectives of the subordinates.

With regard to planning, (which he defines as "a judgement about the best way to go about achieving an intended goal" (Jaques, 1996:102)), Jaques extends his analysis of work at the different organisational strata (1996:102-104). Iterative discussion between different management strata in the planning process is essential because in that way plans are integrated at different levels, and it provides managers with the information necessary to develop plans. However, while subordinates (and other support services with in the organisation) assist managers, they do not decide the plans ("not even to decide the options for the managers to choose from"). The reason is that "no subordinate can have the necessary capability and time-horizon to think out plans at the manager's level of complexity" (Jaques, 1996:103). If subordinates did decide on the plans, it would result in truncated planning proposals and because subordinates use shorter time horizon than their managers, opportunities which exist in the longer term would not be considered.

5.2 Competing Values Approach and Stratified Systems Theory

In a paper which focuses on an analysis of the match between a decision-support consultants choice of method (or mix of methods), consulting style, and the organisational setting of the client, Rohrbaugh and Eden, (1990) argue that "the dominant values that receive expression in each stratum (of Stratified Systems Theory) can be linked directly to alternative models of organisational analysis described by Quinn and Rohrbaugh (1983)." (see Figure 5-5). They also argue that the appropriateness of the consultant's method(s) and style, "must be consistent with the predominant concerns of the organisational stratum involved" (Rohrbaugh and Eden, 1990:45).

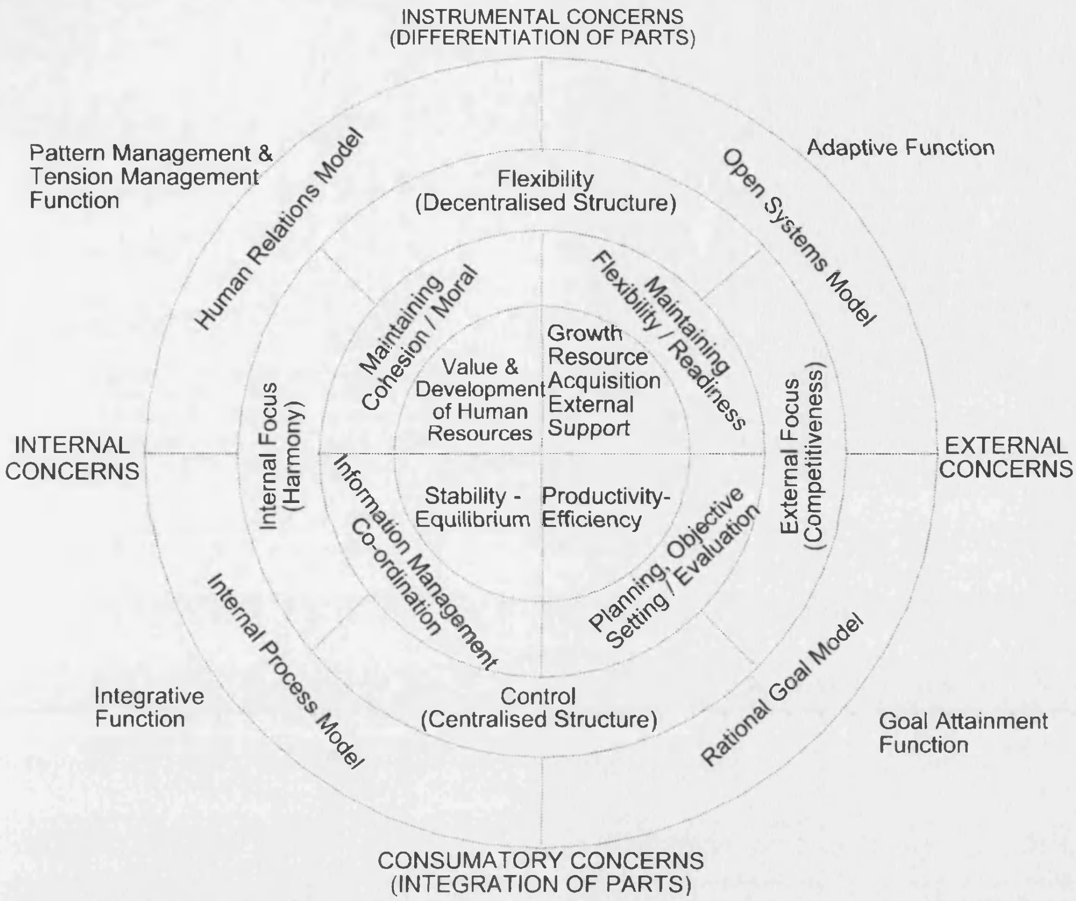
The Competing Values Approach (CVA) framework (see Figure 5-4) proposes four "middle range models of organisational analysis" (Rohrbaugh and Eden, 1990:40): (a) a model of internal processes that focuses on "*information management and co-ordination* as the means by which stability and equilibrium can be developed as organisational outcomes of primary interest"; (b) a model of rational goals that focuses on "*planning and objective setting* as a means by which productivity and efficiency can be improved as models of primary interest"; (c) a model of open systems that focuses on "*flexibility and readiness* as the means by which source acquisition and growth can be increased as organisational outcomes of primary interest"; and (d) a model of human relations that focuses on "*cohesion and morale* as the means by which the value of human resources can be made greater as an organisational outcome of primary interest."

In the CVA framework the above mentioned models of organisational analysis are related to:

"the four functional prerequisites of any system of action" as identified by Parsons, (1959): (a) the integrative function; (b) the goal attainment function; (c) the adaptive function; and (d) the pattern maintenance and tension management function.

The two general models of organisational analysis identified by Gouldner (1959) are: (a) the "rational model" with an emphasis on formal, planned behaviour, and (b) the "natural system model" with an emphasis on flexible, spontaneous behaviour. In the CVA framework these two models are combinations of the open systems and human relations models which reflect "instrumental concerns" (i.e., differentiation of organisational parts), while the combination of the internal process model and the rational goal model reflect "consummatory concerns" (i.e., integration of parts).

Figure 5-4: The Competing Values Approach (CVA) framework



Source: Rohrbaugh and Eden (1990)

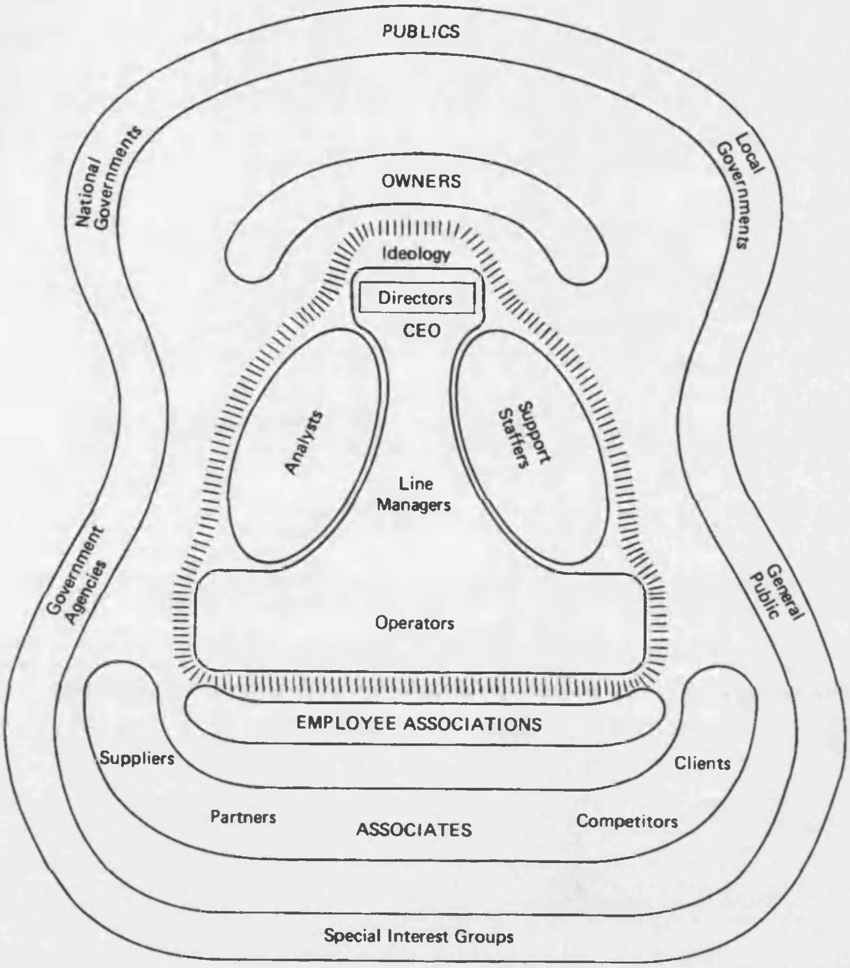
The conclusion that Rohrbaugh and Eden (1990:45) propose as a result of the juxtaposition of SST and CVA (see Figure 5-5), is relevant in this review of organisational theory, planning, and work of this chapter: "Stratum V and VI clients will not be well served by consultancy practice that views better co-ordination and information management as a primary solution principle. Similarly, stratum II and III clients would be expected to reject consultancy practice that emphasises maintaining flexibility and continuing adaptations."

bureaucratic model fits the DDBRA best, and I conclude with a summary of Mintzberg's hypotheses of the strategy development and adaptation process in bureaucracies.

5.3.1 Organisational configurations

In Mintzberg's model (1989) (illustrated in Figure 5-6), any large organisation is made up of six parts: the operating core (generating products and services), a strategic apex (at least one manager who oversees the whole system), a middle line (which is the hierarchy of authority between the operating core and the strategic apex), technostructure (analysts, external to the hierarchy of line authority), support staff (providers of internal services), and ideology (or culture, which encompasses traditions and beliefs that distinguish it from other organisations). An organisation thereby has a number of employees who form an "internal coalition" (which determines the distribution of power), but there is also an "external coalition" that exerts influence on decisions and actions of the organisation from outside. This external coalition is made up of groups such as owners, unions, suppliers, clients, partners, competitors, and "all kind of publics, in the form of governments, social interest groups, and so forth." The external coalition can be passive, dominated by one active influencer, or divided.

Figure 5-6 Internal and External Influencers of an Organisation



Source: Mintzberg (1989:100)

Mintzberg (1989:110-115) argues that the many attributes of an organisation in practice combine to form only seven basic types of organisations depending on which one of the six basic parts of the organizations exerts the dominant influence (Mintzberg (1989) also argues that in reality organisations may also be combinations of these types, or be in transition from one configuration to another - see Figure 5-7):

1. If the strategic apex exerts the dominant pull to lead, retain control over decision making, and co-ordination is achieved through direct supervision, then the configuration is called the *entrepreneurial* organisation.
2. If the technostructure exerts the dominant pull towards rationalisation, standardisation of work processes, and there is limited horizontal

decentralisation,[42] then the configuration is called the *machine* organisation. This the configuration that best describes the DDBRA.

3. If middle managers exert the dominant pull towards balkanisation of the structure in search for autonomy, then the configuration is called the *diversified* organisation.
4. If members of the operating core exert the dominant pull towards professionalism in order to minimise the influence that others (colleagues and administrators) can have on their work, then the *professional* configuration is created.
5. If support staff exert the dominant pull towards collaboration order to involve themselves in the central activity of the organisation, or when the distinction between line managers, analysts, support staff, or operators becomes blurred, then the *innovative* configuration is created.
6. Once ideology goes beyond "pulling the members of an organisation together" and dominates other considerations, and the standardisation of norms becomes the primary co-ordinating mechanism, then the *missionary* configuration is said to emerge.
7. When no one part of the organisation, or no one mechanism of co-ordination dominates, then the forces of conflict are always in danger of pulling members apart. Mintzberg calls this the *political* configuration.

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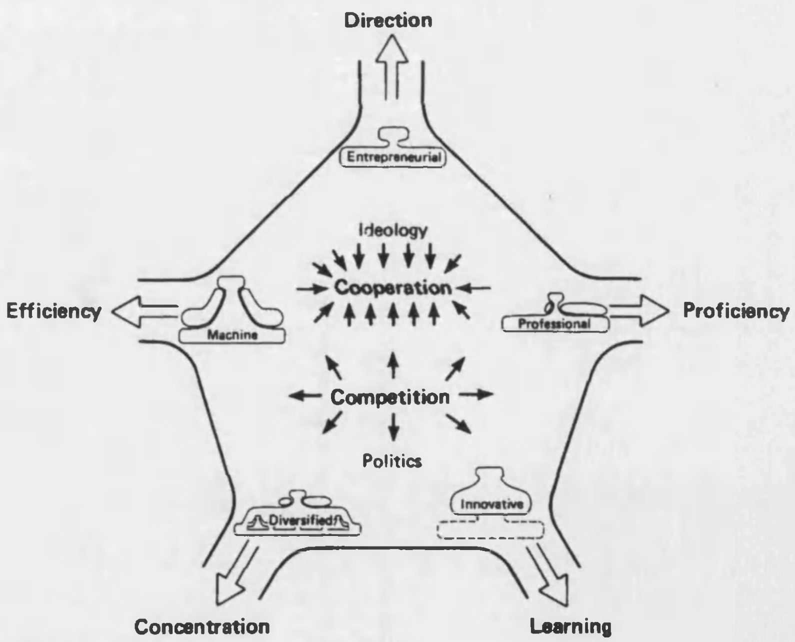
[42] Horizontal decentralization is the "extent to which formal or informal power is dispersed out of the line hierarchy to non-managers (operators, analysts, and support staffers)" (Mintzberg, 1989:105.

Table 5-4 Mintzberg's Typology of Organizations

Configuration	Prime Co-ordinating Mechanism	Key Part of Organisation	Type of Decentralizations
Entrepreneurial organisation	Direct supervision	Strategic apex	Vertical and horizontal centralisation
Machine organisation	Standardisation of work processes	Technostructure	Limited horizontal decentralisation
Professional organisation	Standardisation of skills	Operating core	Horizontal decentralisation
Diversified organisation	Standardisation of outputs	Middle line	Limited vertical decentralisation
Innovative organisation	Mutual adjustment	Support staff	Selected decentralisation
Missionary organisation	Standardisation of norms	Ideology	Decentralisation
Political organisation	None	None	Varies

Source: Mintzberg (1989:110)

Figure 5-7 An Integrating Pentagon of Forces and Forms



Source: Mintzberg (1989:256)

5.3.2 Conditions of the bureaucratic or machine organisation

The essential attributes of the "machine" organisation, according to Mintzberg (1989:133), are highly specialised and routine operating tasks, very formalised communication throughout the organisation; large-size operating units; reliance on the functional basis for grouping tasks; relatively centralised power for decision making; and an elaborate administrative structure with a sharp distinction between line and staff. A number of reasons for the emergence of bureaucratic organisations have been mentioned above, but an additional factor, particularly important in the Danube Delta, is the presence of strong external control. Even if the environment is not stable, or does not favour standardisation of work, a bureaucratic or machine organisation may emerge because "they must be accountable to the public for their actions. Everything they do ... must be seen as fair, and so they proliferate regulations" (Mintzberg, 1989:138).

Middle managers in the "machine" organization have three functions according to Mintzberg (19:

(i) to resolve problems and conflicts that arise due to lack of informal communication in operations (or transfer them further up the hierarchy to a level where common supervision is able to deal with them by authority);

(ii) to work with staff analysts (the technostructure) to incorporate set standards into the operating units;

(iii) to support vertical information and feedback flow in the organisation. Even though staff of the technostructure do not have formal authority, their power to influence the work of operators emanates from the setting of standards (i.e. the rules and regulations which make the high degree of specialisation possible).

The principle of division of labour, and with it specialisation and formal role differentiations that inhibit collaboration require very strong control and co-ordination capabilities throughout the organisation.

> *"All this suggests that the machine organisation is a structure with an obsession - namely control .... The obsession with control reflects two central facts about these organisations. First, attempts are made to eliminate all possible uncertainty, so that the bureaucratic machine can run smoothly, without interruption, the operating core perfectly sealed off from external influence. Secondly, these structures are ridden with conflict; the control systems are required to contain it" (Mintzberg, 1989:135-136).*

The necessity to contain conflicts and to deal with disturbances within an organisation where even mid-line managers are specialists means that the top managers are usually the only generalists in the organisations. Furthermore, the "the strategic apex of these organisations are concerned in large part with the fine-tuning of their bureaucratic machine ..... and considerable power in the machine organisation rests with the managers of the strategic apex." (Mintzberg, 1989:136).

The power of top management derives both formally from the chain of authority (which is strongly developed) but also informally, because it is only at the top that formally segmented knowledge of the organisation comes together.

The desire to work in simple environments, which are amenable to specialisation and repetition, means that bureaucratic organisations may act "aggressively to stabilise it." (Mintzberg, 1989:138) The effect of this, in combination with the indispensable requirement of survival and the necessary efficiency, is that growth (instead of other primary tasks such as profit, or in the case of the DDBRA conservation and human welfare) of the organisation (i.e. the closed system that it represents) becomes the primary objective which makes power sharing (as in natural resource co-management) very unattractive. If there a very strong outside influence (such as the Ministry of Forests, Water, and Environmental Protection in Bucharest, of which the DDBRA is a part) exists, then the whole organisation may become a 'control instrument' "...by appointing the chief executive, charging that person with the pursuit of clear goals (ideally quantifiable ...), and then holding the chief responsible for performance. That way outsiders can control an organisation without actually having to manage it" (Mintzberg, 1989:139).

5.3.3 Strategy and adaptation in the bureaucratic organisation

Understanding the dynamics that prevent adaptation by bureaucratic organisations is important in the context of this thesis because it may suggest leverage points as well as possible inherent limitations in the usefulness of Decision Analysis support. Mintzberg (1989:144-152) presents the following argument:

In theory, strategy in the bureaucratic organisation is supposed to be developed at the level of the organisation where the perspective is broadest, all information is integrated, and power most focused, namely the hierarchical top. Once developed, the strategies are then supposed to be refined by lower levels of the organisation and finally implemented. However, Mintzberg argues that strategies (as opposed to action plans) are best developed in a much less formal manner, and because strategy development relies on synthesis, while planning relies on analysis and decomposition, planning may actually impede strategic thinking.

There are at least four reasons why changes in strategy are very difficult in the bureaucratic organisation:

1) When the emphasis is placed on separate analyses by various function units who work on the principles of increased efficiency and perfection of narrowly defined

tasks, questioning of operating assumptions, innovation, transformation, and synthesis are not promoted or encouraged (they may even be penalised).

2) Great efforts are required to produce a functioning bureaucracy where role, task, and control systems are put into place to produce specific outcomes. Continued refinement of the system over time results in uniqueness and integration that is so tight that when avoided changes eventually become inevitable the system disintegrates. "Thus does success eventually breed failure" (Mintzberg, 1989:147).

3) Changes in the operating environment call for changes in strategy. However, as the different specialised operating sections are not able to solve their problems, these get "bumped up" the hierarchy, leading to overload at the top managerial level. To integrate, reconcile, and develop solutions, strategies, managers need appropriate information and intimate knowledge of the areas of business. However, the different functional groups "package and filter" information differently, stripping it in particular of qualitative aspects, and pass it up the hierarchy with delays. The managers therefore seek to develop alternative information channels but this raises the transaction costs still further.

4) As a result, those who are supposed to formulate strategy do not have full and sufficient information, while those who are supposed to implement, face an environment that is different from that predicted by those who formulated the strategy (either because strategy was ill-informed, or because the environment is changing).

To break out of this mould, the bureaucratic organisation must change its configuration during the time of fundamental strategy reformulation. Mintzberg (1989) suggests that short of demise, there are two possible temporary re-configurations: (i) entrepreneurial, when a single leader develops a vision and strategy, which he/she guides closely in implementation (this configuration favours quick turnaround changes); (ii) innovative configuration, where the lower levels of the organisation develop strategies which are integrated and championed by middle management (this configuration favours slower revitalisation of organisations).

Mintzberg (1989) concludes: "overall, the machine organisations seem to follow what Miller and Friesen (1984) call a "quantum theory" of organisation change. They pursue their set strategies through long periods of stability (naturally occurring or created by themselves as closed systems), using planning and other procedures to do so efficiently. Periodically these are interrupted by short bursts of change, which Miller and Friesen (1984) call "strategic revolutions".

5.4 Conclusions

According to Stratified Systems Theory one needs to differentiate between the complexity of the strategic objective pursued by the DDBRA with respect to fishery management (development of a management system that increases or maintains the resilience of the DDBR) and the role complexity of different managerial levels within the DDBRA. In other words, while the DDBRA is pursuing a joint strategic objective, the complexity of the tasks that the managers of the DDBRA need to deal with differs in accordance with the managerial stratum that they are working in. This is important because it enabled me to differentiate between the different types of judgments made by the different levels of managers. I could therefore determine what type of decision support was most appropriate for them.

The need to match the choice of decision support to the organizational setting of the client has been identified before. The work of Rohrbaugh and Eden (1990) is particularly relevant because they show that the Competing Value Approach (CVA) to organizational analysis matches (or can be combined with) SST. It showed that the main concern of the Executive Director (Stratum IV) is with planning, objective setting and the evaluation of alternatives which enhance the productivity and efficiency of the DDBRA so that it will attain its goals (strategic objectives). This is why Stratum IV will not be well served by consultancy practice that sees information management and co-ordination, or the maintenance of flexibility or organizational growth as the primary solution principles.

While my work with the DDBRA largely supports this hypothesis about different managerial needs and their acceptance only of a narrow range of management approaches that are consistent with the pulls dominant in their organisational configuration, it also poses a serious challenge. If fishery management planning work for the DDBR is focused on setting objectives and evaluating alternatives for the achievement of these objectives, is it possible to increase the DDBRA's capacity to manage for increased resilience? Adaptive Evironmental Management and Assessment (AEMA), New Institutional Economics (NIE), and Cultural theory (CT) all argued that resilience requires flexibility and adaptation. I dealt with this in the DDBR by: (i) focusing on development of an institutional framework that contains the requisite variety of institutions (using New Institutional Economics and Cultural Theory for very specific proposal for what requisite means and by specifying relevant objectives and using adaptation as an objective - see Figure 7-7); (ii) ensuring that the assessment contained a variety of viewpoints in order to guard against too narrow a focus and institutional bias. For this part, AEMA, CT, and SST can be employed as a framework for guiding the selection of different viewpoints in an effort to ensure that views are not excluded. The most novel thing about this suggestion is that it includes both variety from within as well as from outside the DDBRA.

While SST provided insights into differences in judgement and decision making tasks at the different levels of an organization, and outlined the effects of managerial role relationships that are not requisitely structured, Mintzberg's framework is useful for analysing the effects on strategy making, planning, and management of different types of organizations. I have argued that within that framework, the DDBRA best fits the description of a "bureaucracy". In order to control and co-ordinate the narrow specializations of the operating core, the administrative functions mirror the specializations.

The existence of a bureaucracy for the management of the Danube Delta, which I have shown to be a dynamic environment seems not to make sense at first because the latter does not favour standardization of work. However, there are two explanations for this: first, the DDBRA is part of the Ministry for Water, Forests, and Environmental Protection which is itself a bureaucracy. Secondly, since the DDBRA is an organization which has been imposed from the outside (as it has not developed out of an agreement between stakeholders to coordinate and inform their activities) its legitimacy rests primarily on the argument that it is in the interest of the local and international community. However, since there was no direct accountability mechanism between the DDBRA and the people it was supposed to serve, guidelines, standards, and regulations (such as carrying capacity, MSY, etc.) proliferated.

Two conditions of the bureaucracy are especially relevant within the context of this thesis. First, due to extensive specialization and formal role, collaboration between departments within the DDBRA and as well as between the DDBRA and other organizations on fishery management is very difficult. Secondly, the primary way of enabling specialized work to go on is by seeking to eliminate uncertainty (because otherwise the policies would need to be more contingent and flexible). The easiest way to prevent uncertainty from affecting the work of the technical staff of the DDBRA is to seal it off from external influences. That also means that only the top managers in the DDBRA (specifically, the Executive Director and the Governor) are generalists, and also that the one preoccupation that came to dominate the DDBRA was to increase its operating efficiency.

As a result:

1) it is very difficult for the DDBRA to manage adaptively (because that would require it to be sensitive to emergent changes and patterns of development within the social, economic, and natural systems of the DDBR);

2) the DDBRA's preoccupation with efficiency also means that it does not favour power-sharing in some co-management arrangements, as suggested in Chapter 4;

3) the development of management strategies that are sensitive or appropriate to the social, economic, and ecosystem conditions is very difficult because the top managers, through whom all the information in the bureaucracy is supposed to be synthesized, receive information that is filtered, packaged in different ways by the different functional groups, and delayed.

To break out of this vicious circle, Mintzberg suggested that the DDBRA would need to (temporarily) change its configuration during the time of fundamental strategy reformulation, such as the development of a fishery management strategy appropriate for the Biosphere Reserve. The two possible re-configurations are the entrepreneurial configuration, when a single leader develops a vision and strategy, which he or she guides closely in implementation, or the innovative configuration, where the lower levels of the organization develop strategies which are integrated and championed by the middle management.

Chapter 6 The Use of Decision Conferencing for Strategic Management Support

6.1 *Introduction*

The purpose of this chapter is to analyse the use of Decision Conferencing in support of strategic management. Since Decision Conferencing is a Multiple Criteria Decision Analysis approach, and therefore shares many methodological similarities with the Multiple Stakeholder Approach that I have discussed in Chapter 3, I concentrate on the one aspect that I argue is most important within the context of this thesis: the rationale for and method of incorporating or addressing the institutional setting within which problem solving takes place.

Like other decision analysis approaches, Decision Conferencing uses coherence of preferences as the definition of rationality and more specifically, the Expected Utility Theorem as the prescriptive method for integrating value and probability judgements. The use of decision theory and the prescriptive use of Expected Utility Theorem are conditional in the sense that the decision maker desires his preferences to conform to the five axioms specified in Chapter 3. Like the other decision analysis approaches DC also assumes that breaking a decision problem down into a value and probability part aids decision makers to gain insights into the problem and facilitates a systematic manipulation of decision problem components.

6.2 *Overview of Decision Conferencing*

Decision Conferencing (DC) is a Group Decision Support System (GDSS) invented in the late 1970s by Cameron Peterson at Decisions and Designs Inc., USA, which in its current form draws on experience and research from information technology, decision analysis, group processes and behavioural studies of actual decision making (Phillips, 1988:213). "The goals of decision conferencing are to develop among the participants a shared understanding of the issues, to create a sense of common purpose, and to gain commitment to action" (Phillips, 1988).

Decision Conferences are intensive two or three day sessions in which a group of people work, with the assistance of at least one facilitator and a decision analyst, in a structured way at modelling participants' judgements by talking to each other and by using a computer to analyse the implications of their modelled judgements so as to gain insight into the problem faced and be able to decide on how to proceed. The work takes place in a carefully selected location away from the clients' organisational environment.

Phillips (1988:214) describes the stages of a typical Decision Conference thus:

Stage 1: before the Decision Conference begins, the facilitator meets with the client to establish the nature of the problem and to determine whether a Decision Conference is appropriate. If it appears that a Decision Conference is suitable for the problem, then the facilitator assists the client to set objectives for the decision conference, identify "key players", determine what preparation is required of the participants, and agree on the main points that should be included in the invitation letter to the participations.

Stage 2: The Decision Conference is started with a brief introduction of the purpose and the desired outputs by the manager to whom the facilitator reports, and this is followed by a brief presentation by facilitator in which he sets out the process and the methods that will be employed in the Decision Conference. The participants are then asked to discuss the issues and concerns that are the subject of the Conference. While the participants attempt to formulate the nature of the issues, for example development of a strategy, evaluation of a few alternatives against many objectives, project or budget prioritisation where there are usually few major objectives but many alternatives, etc), the facilitator needs to decide whether exploration in depth of a few issues or a less thorough discussion of a wide range of issues will best help the work of the group.

Stage 3: The facilitator chooses a generic structural form to represent the issues, and the group members begin to provide the content that is used in constructing the model. As the model develops, the facilitator draws it out on a whiteboard or on a flip chart in the room, while the analyst inputs the model to the computer. Both data and subjective judgements are added to the model and the computer output is projected onto a screen so that all participants can see the results.

Stage 4: "These initial results are rarely accepted by the group. Modifications are suggested by participants, and different judgements are tested. Many sensitivity analyses are carried out; gradually, intuitions change and sharpen as the model goes through successive stages" (Phillips, 1988).

Stage 5: Once the this process of revision and elaboration stabilises, the model has served its purpose, and the group concentrates on summarising the key issues and conclusions. The Decision Conference ends with the development of an action plan so that when participants return to work, they can begin to implement the solutions.

According to Phillips (1986:193-194) there are four "basic rules" for Decision Conferences:

First, in order to ensure that the groups solves the right problem and does not leave out important objectives, the decision maker (i.e. the person who is accountable for the decision must be present. Secondly, all the major problem owners must be present in order to ensure that all legitimate viewpoints on the problem are represented, as well as to moderate the influence of dominant people. A third rule in Decision Conferences is that no papers or printed materials are used on the first day, because Phillips argues that prepared materials often hide the real problem. The fourth, and final basic rule, is that the problem addressed must be a live one because hindsight biases are so sever that it is not possible to do a retrospective analysis as if it were current, and judgement about hypothetical problems will be ill-informed.

6.2.1 Relevance of Decision Conferencing to DDBR

Since the late 1970s Decision Conferencing has been applied to a wide variety of problems, ranging from strategy development to option evaluation, investment portfolio prioritisation, and impact estimation of highly uncertain events. These applications occurred in many different areas of business, as well as military, medical, and charity fields and some public policy problems. Environment management applications have been quite rare - the only three I have been able to discover use versions of Decision Conferencing that are so different from the more standard Decision Conferences described by Phillips which use the Expected Utility model as their modelling basis (for example in Phillips (1984b), Phillips and Phillips (1993), and Phillips (unpublished-a)) that I will not discuss them here in depth. Hamalainen and Leikola (1995, and forthcoming) report on work they have done with Finnish parliamentarians on energy policy in sessions that lasted only a few hours (as opposed to the usual duration of days) while Vari and Rohrbaugh (1996) report on work in Hungary on the development of a long-term national environmental agenda.

The main features of the Decision Conferencing that suggest that the approach is of great relevance in the case of the DDBRA's management planning are the following:

1. While decision analytic work with individuals is not excluded, a central aspect of Decision Conferencing is that analysis is done in a workshop format where group interaction is promoted and facilitated using well-developed theories of group processes. (Phillips and Phillips, 1993) The techniques and procedures that the facilitator uses a number of techniques and procedures drawn from social

analysis (Rowbottom and Billis, 1978), group feedback analysis (Heller, 1969), group process work (Gustafson *et al.*, 1973; Rice, 1965, 1969), and soft systems analysis (Checkland, 1981), as well as the Strategic Choice Approach (Friend and Hickling, 1987).

2. Analysis work usually consists of two or three intense days using on-the-spot modelling assisted by information technology (usually at least a computer) directly with the decision makers or problem owners rather than much longer periods ranging from weeks to months of analysis by the decision analyst for decision maker as usual in the MSDA approach. This does not preclude preparatory or follow-up work with individual decision makers, experts, or stakeholders, nor the use of a series of decision conference workshops.

3. The expected results of the DC include coherent preference judgements, individual insights to decision problem, improved alternatives, an increased commitment for action and enhanced communication between those who participate, like the MSDA approach, but the creation of "shared social reality" (Phillips, 1984) as a pivotal outcome is unique to DC.

4. It may be possible to consider a cross-functional, inter-departmental, and inter-organisational decision conference workshop to be a temporary reconfiguration of the DDBRA bureaucracy into an "innovative configuration" as suggested by Mintzberg (1989) and argued in Chapter 5, because lower level managers of the DDBRA would be encouraged to assist in the development of strategies which are then integrated and championed by the middle or higher management.

5. Decision analysts in decision conferences work in teams of two or three where at least one of the analysts takes a clearly defined role of facilitator. Furthermore, the facilitator usually has some training in group processes.

The central argument of the MSDA approach is that environmental problems, including the kind encountered in the DDBR fishery, include a mixture of value and uncertainty dimensions that are so complex that decision analyst should work with experts, stakeholders, and decision makers separately. A colliery of this argument is that they do not expect advantages from working in groups.

I argued in Chapter 4 that MSDA decision analysts could reach their conclusion on the basis of the following assumptions:

- The experts role should be limited to factual judgements that can be used to predicts the effects of alternatives on the value dimensions which are specified by stakeholders or decision makers.

- Work with stakeholders separately to elicit their values for the purpose of informing decision makers.

Given that the DC approach is so different, the following questions arise: why should (and under what circumstances could) decision makers, stakeholders, and the experts meet and work together in relatively short time (days) compared to the MSDA process (which can take weeks or months)?

In the remainder of this Chapter I will answer each of these questions in turn on the basis of the literature available, and in the conclusions (Chapter 9) I will re-evaluate them using the insights resulting from my application of DC in the DDBRA. For the first question I need to be more precise about the assumptions and methods used by Decision Conferencing.

6.3 *Rationale of Decision Conferencing*

In the literature three related components can be distinguished in the rationale for Decision Conferencing. The first, most succinctly presented in Phillips (1988), relates to the requirements of good communication and a sense of common purpose if management through responsibility delegation is to work. This is, as I have shown in Chapters 2, 4 and 5 very relevant in the case of the DDBRA. The second component, originally presented in Phillips (1984b) and extended in Phillips (1992; unpublished-b), relates to his assertion that all decision problems are social problems where there exist multiple perspectives onto a problem and where the resolution and/or joint action requires the creation of a new shared social reality. This component is most relevant in the case of the DDBRA, because it addresses specifically the question of what is being modelled, namely the problem owners' subjective understanding of the problem instead of physical reality. The third component of the rationale for Decision Conferencing is derived from experimental evidence.

The first set of experimental evidence that I will be referring to is the work at the Decision Techtronics Group (DTG) at the Rockefeller Institute of Government, State University of New York (Mumpower and Stewart, 1996; Reagan-Cirincione, 1992; Reagan-Cirincione, 1994; Reagan-Cirincione and Rohrbaugh, 1992a; Reagan-Cirincione and Rohrbaugh, 1992b; Vari and Rohrbaugh, 1996). This group is particularly interested in the conditions under which a group of experts are able to outperform the best individual members of a group. They describe decision conferencing as a facilitated group work structured into an "estimate-feedback-talk" process. They report that groups can outperform individuals as long as the interaction process is carefully managed and group members are aided in making judgement with appropriate problem structuring models.

The second set of experimental evidence that I will be referring to is Phillips (1998), who showed that behavioural aggregation of expert judgements about uncertain variables produces consensus probability distributions that are different from statistical aggregation and are to be preferred, particularly when the uncertain quantities which need to be estimated evoke bias. A third set of experimental evidence for the suitability of Decision Conferencing for assisting managers at different organizational strata can be found in Chun (1992). In that PhD thesis Chun shows, on the basis of an evaluation of a survey of past participants in Decision Conferences, that Decision Conferences are particularly effective for managers in Stratum IV and higher (using the Stratified Systems Theory terminology).

6.3.1 Delegation of responsibility and the requirements of effective group work

A manager is accountable for his own work as well as that of his subordinates. There are two types of managerial style: either delegation of specific tasks to subordinates or delegation of responsibilities to subordinates where the manager specifies only what needs to be done, in what time, and to what standard but not also how to do the task. The first, and older, style is more centralised, and is characterised by top-down communication, whereas the alternative, and newer, style is more collegial, involves more dialogue, and relies on periodic performance reviews (as opposed to continuous review in the centralised management style).

Delegating responsibility has the advantage that the motivation of subordinates is increased by the greater sense of ownership, responsibility, and accomplishment. A disadvantage, however, is that the sense of ownership can be become so strong that "fiefdoms" are built up, which inhibit lateral communication and prevent good team functioning. Without good communication and team working towards a common goal there is the danger that although each subordinate may be optimising his or her resources, this may not be optimal overall. Phillips (1988; 1995) likens this to the Tragedy of the Commons (Hardin, 1968) taking place in organisations.

A great problem in managerial work is therefore the conflict between the efficient use of limited resources in the pursuit of a common goal, which is done easier with task delegation (i.e. centralised management), and real ownership of the work, which is achieved through responsibility delegation (i.e. decentralised management). Phillips (1988:209) argues that improved communication and a sense of common purpose among the management team are required to secure the advantages of responsibility delegation and at the same time ensure that resources are used as effectively as possible.

6.3.1.1 Work in Group Decision Support Systems

One way of achieving this improved communication and sense of common purpose is through Group Decision Support Systems (GDSS), in which information technology is employed to support the work of groups. According to Phillips (1986), two styles of GDSS have emerged. First, those that provide a network of computers and where a central screen displays individual computer screens or aggregate information in order to facilitate group communication. DeSanctis and Dickson (1987) is an example of this style. The second style, Decision Conferencing, provides a problem-solving environment that is group-centred, is primarily intended to help managers consider uncertainty, form preferences, make judgements, and take decisions.

Phillips (1988) argues that DeSanctis and Dickson's (1987) view of group work is too narrow; as they consider that "the most fundamental activity of group decision making is interpersonal communication" and that "the primary purpose of a DGSS to be to improve group communication activities." Phillips argues that this is wrong, and that more is required than simple communication. Decision theory tells us that if we want to make coherent decisions, then we must take into account two features that characterise all choice situations: uncertainty and preferences. That means that the work of individuals in groups should involve more than communication, they are engaged in problem solving where they need to consider uncertainty, form preferences, make judgements and take decisions.

This decision theoretic approach complements that of Jaques very well, because Jaques (1976) defined work as "exercising discretion within prescribed limits." The first component of this definition relates to the psychological component of work (the "exercise of discretion") and decision theory provides a more specific view of what this exercise of discretion entails, while the second part of Jaques' definition relates to the organisational context which imposes limits on the scope of that discretion. According to Stratified Systems Theory (SST), the organisational limits on discretion open out as one progresses up an organisational hierarchy (see discussion in Chapter 5). In other words, the scope of the manager's work is greater than that of his subordinates, and so he is in a position to ascertain if the work of his subordinates is in line with the overall organisational objectives.

Meetings between a manager and his direct subordinates are quite frequent and are important because the meetings serve to set the context of work, contribute to mutual understanding, sharing of values, and generate "maximum commitment by all to the achievement of commonly valued goals" (Jaques, 1996:100). In Chapter 5 I discussed the conditions specified in SST for effective team work and planning. I pointed out that there are three types of content for a team meeting: "first, everyone is providing current information; second, discussions out which the manager will take a decision; third, brainstorming discussions for exploration of difficult problem, without a decision made."[43] (Jaques, 1996:100) Phillips' (1988) concept of work in groups applies to all three types of meetings. Decision Conferencing, however, is probably particularly well suited for the second and third type of meeting because it extends beyond information sharing (for which other support systems, including Management Information Systems for example, could also be applied equally well). In the following discussion I will use the second type of meetings, those result in a decision by the manager.

6.3.1.2 Uses of decision analytic models

Having specified how he understands the work in groups and why the sense of common purpose that may be achieved through group work is important, Phillips (1988) goes on to argue that (i) decision analysis is suitable for modelling the issues that concern a group and (ii) that during the work of the group one needs to manage the process of work in addition to content and structure.

Phillips (1988:211-212) identifies three main reasons why decision analysis is useful for modelling issues in work groups:

1. Wooler (1987) has shown that senior executives lack a common language for discussion of strategic issues. Frequently there is no shared understanding of terms such as mission, vision, goal, objective, strategy, option, scenario, or risk. Decision theory can be used to fix the meaning of these terms in a way that contributes to communication and subsequent model development. In Phillips' (1988) words, "decision analysis provides a language that participants can share."
2. Since most problems, in both private and public sectors, involve multiple objectives one needs to consider trade-offs between objectives in order to find a solution. Considering such trade-offs, and establishing priorities is difficult with

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[43] This classification applies to managerial accountability hierarchies (such as the DDBRA), but that in the case of other types of organisations, such as clubs, partnerships, community groups, collegial groups, groups may also take decisions. See also Phillips and Phillips (1993:535).

words alone because that requires comparison of objectives that have very different attributes. These obstacles can be overcome through the use of multi-attribute models. In a sense, the decision theoretic model can be used as "a grammar for manipulating meaning" (Phillips, 1988).

3. The effect of using a model for problem solving is that it "provides structure to thinking" because it shows how the issues interrelate. In the words of Phillips (1988), "the model is the expression of the language, and it shows how the grammar should be used." There are many different models that can be used. They range from decision trees (which is model form traditionally associated with decision analysis), to multi-attribute value or utility models, event trees, fault trees, influence diagrams, Bayesian models, and credence decomposition models (see Phillips (1989) for a more extended review). Models based on theories other than decision analysis have also been used in decision conferences, for example social judgement theory (Hammond *et al.*, 1986), or systems dynamics modelling (Richmond, 1987).

Phillips (1988) argues that two multi-attribute value model forms seem to accommodate most of the concerns expressed by senior managers: evaluation problems (which are characterised by a few options such as strategies, projects, choices, systems, etc, and many objectives) and resource allocation problems (where there are only few objectives but many options, or ways of allocating resources).

The goal in evaluation problems is to find an overall ordering of the options. This can be achieved by scaling the options on all the objectives separately, assigning relative importance weights to the objectives, and then taking a weighted average of the individual scales. In resource allocation problems, the goal is to find the best way of allocating a fixed resource, such as people, material, or money. This can be achieved by creating a small multi-attribute model for each budget category in which different resource levels are evaluated against the objectives, then assessing relative importance weights across the budget categories and the objectives, and combining all models into one efficiency curve that shows the overall best allocation for any given level of resource.

In the course of this modelling work managers and sub-ordinates discuss and agree trade-offs in light of identified strengths and weaknesses, opportunities, and threats in the areas over which they have responsibility. The work in the group thereby serves to create an understanding of the problem that incorporates the viewpoints of all those present, and therefore provides the sense of common purpose requirement for management through responsibility delegation discussed earlier. If the group work results in a decision, such as to adopt a particular strategy, the manager, and not the sub-ordinates, or the group as a whole, needs to take it as only he can be held accountable for it.

6.3.1.3 Facilitators manage structure and process but not content

While decision analysis models may be useful for structuring thinking and managing content, the process by which the group works is also important because the process by which a group works should change as content develops, but process also effects content. This observation leads Eden (1990) to argue that group decision support in which organisational or group processes are dealt with separately (e.g. sequentially) from group model building exercises is different from decision support in which both aspects are dealt with in tandem. In Eden's view, the outcome of an intervention in group decision making is not the addition of process and modelling outcomes, but instead it may be represented by a multiplicative relationship between process and modelling. "The multiplier is the imposition of designed intervention that explicitly accounts for process and content issues together. Process management is informed by the analysis of content, and the analysis of content is informed by the analysis of process issues" (Eden, 1990:49).

As an illustration of the differentiation between content and process intervention consider Table 6-1and Figure 6-1. Other good reviews can be found in Chun (1992) and Phillips and Phillips (1993).

Table 6-1: The foci of observation and intervention

	Task	Interpersonal
Content	Formal agenda, goals	Who is doing what to whom
Process	How the task is done	How members relate to each other, communicate, etc.

Source: Schein (1987:40)

Figure 6-1 Different roles in intervention

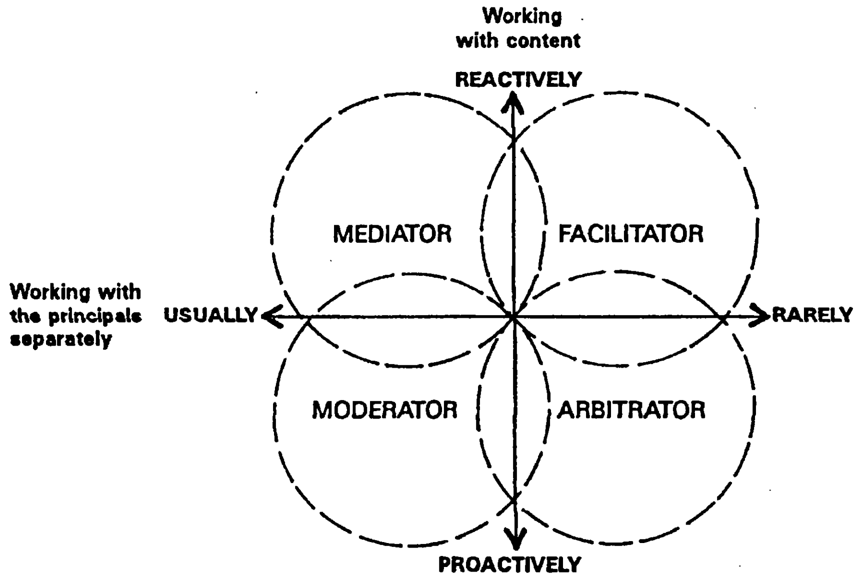

Table 1: The different roles in 3rd-party intervention

Source: Hickling (1995:1)

Phillips' (1988) conclusion about need to manage both process and content leads him to argue that to do this effectively one needs knowledge of behaviour in groups:

> *"It is helpful to know how the inevitable anxieties that arise when individuals work in groups can affect the group, how groups impose roles on individuals who may find themselves acting on behalf of the group, how different assumptions may operate covertly to influence the group's behaviour, how deflections from the task at hand can be managed with effective facilitation. Research on group processes has identified conditions and situations that increase the ability of groups to solve problems effectively (Bion, 1961; Higgins and Bridger; Low and Bridger, 1979; Menzies, 1970), and it is knowledge of small group functioning that is used by a facilitator to help a group achieve its goals."*

6.3.2 Requisite Models as representations of a shared social reality

A second explanation for Phillips' view of the goals of Decision Conferencing can be found in his assertion that there can be no 'objective' problem external to the observers. Instead, "each person in a group creates an internal representation of the problem (Cliff and Young, 1968; Phillips, 1982; Phillips, 1984a), bringing to bear on the initial problem statement any experience and knowledge that seems relevant, and it is in a group setting like a decision conference that the different perspectives become apparent" (Phillips, 1984b:33). The purpose of modelling in a group setting in Phillips' view is to capture the value judgements of the group in relation to the advantages and disadvantages of different alternatives. Even though no person in a group would necessarily agree with all the judgements, "the model is expressing a social reality that is evolving as the group works" (Phillips, 1984b:32).

In other words, the models used for problem solving in decision conferences are not representations of ideals or standards, because the models are usually very incomplete, but they are sufficient to produce insights and problem resolutions, nor are they representations (or descriptions) of objects external to the participants. Instead, they are "models 'about' the judgements of the group". They "express a shared social reality" and are "merely the working agreement among members, some of whom may temporarily be suspending their disagreements with parts of the model, to see whether their differing positions will affect the overall evaluation in subsequent sensitivity analyses. If these differences are acknowledged by the group and are held as alternative representations, then there may be several social realities in existence at any one time" (Phillips, 1984b:32-33).

In order to attain this generative function (facilitating the subsequent construction and management of a new reality) not all aspects of the problem need to be captured by the model. Instead, Phillips (1984b) argues that the model of the social reality needs to be developed in form and content only to the point at which participants can solve the problem.

A key feature of the requisite model development process is that it uses the sense of unease among problem owners about the results of the current model as a signal that further modelling may be needed. Work progresses by examining discrepancies between holistic judgement and model results through, for example, sensitivity analyses; model content or form are modified until no new intuitions about the problem emerge. In this process flexible computer programmes are useful because participants are able to examine, for example, if disagreement between individual assessments make a difference in the final result.

Phillips (1984b) calls models that represent, or can simulate, everything that is required to solve a particular problem "requisite". Such requisite models are representations of a shared social reality that are simpler than reality in three respects (Phillips, 1984b:35):

1. elements of the social reality that are not expected to contribute significantly to solving the problem are omitted from the model;
2. complex relationships among elements of the social reality approximated in the model (for example through additive value structures); and

3. distinctions in either form or content at the level of social reality may be blurred in the model (because as Savage (1954) has argued, even though models are small-world representations of a grand-world, they are also idealisations resulting from a necessary blurring of grand-world distinctions).

Table 6-2 Features of requisite decision models and the process of generating them

Definition	A model is requisite when its form and content are sufficient to solve the problem
Representation	Requisite models represent a shared social reality
Generation	Is achieved through iterative interaction among specialists and problem owners
Process	Uses sense of unease arising from discrepancy between holistic judgements and model results in sensitivity analyses
Criterion	Model is requisite when no new intuition arise
Model status	Requisite model is at best conditionally prescriptive
Goal	To serve as a guide to action, to help problem owners construct new reality

Source: Phillips (1984b:40)

6.3.2.1 Validation of requisite models

Even though the models developed in Decision Conferences do not even conditionally prescribe action, as they are only meant to assist analysis and be a guide to action (in the sense of enabling individuals and groups to find solutions to problems and decide what to do next - even if that means getting more information), there is still the question as to how to judge their validity. The overriding criterion in Decision Analysis is the coherence of the process by which a decision is taken, and not whether the hoped for consequences materialise. Phillips (1984) argues that any validation process must itself be a "more or less complete" multi-attribute utility model that uses both experimental and control groups to provide data for comparing performance on certain criteria, but they would also use human judgement to assess performance on other criteria (in other words it is a requisite validation model)[44]. The reason why this is does not lead to a circular argument is that the structure and the content of the two multi-attribute models is different (even though their form is the same).

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[44] According to Phillips (1984:43) "one could also argue that for science the to-and-fro of confrontation is seminars, conferences and scientific journals, attest to adversarial processes operating like sensitivity analyses on validation models".

Humphreys and McFadden (1980) found that a MAU-based decision aid is judged to be most useful in cases where the correlation between initial model and holistic judgement is low. Within in the context of Decision Conferences this makes sense because low correlation is expected at the start of the modelling process, with high correlation necessarily emerging at the end when the model is requisite. Since the discrepancy between holistic judgement and model result is used to refine the model, validity cannot be judged by reference to correlation between these variables. "When the correlation is high, the resulting MAU model provides a good description of judgements that is already so well-understood by the people making them that the model is of little use in helping them construct a new reality" (Phillips, 1984b:41). This shows quite a significant difference between the Decision Conference and the MSDA approach; in the latter realistic description seems to be of more concern. Even though the use of Decision Analysis for creating innovative solutions (in Phillips' terms this could be a "a new reality") is considered to be one of the most valuable uses of Decision Analysis in the MSDA literature, there is insufficient concentration on this aspect in MSDA.

Phillips (1984:43-45) offers the following four guidelines for the development of the requisite model in order to ensure its subsequent adequacy in validation:

First, one must ensure that a variety of views are represented in the Decision Conference: "The main safeguard against the creation of idiosyncratic, even eccentric, models is the same as for science: reliance on adversarial processes. A key requirement of decision conferences is that the problem owners must represent a variety of viewpoints. ... Experience with decision conferences suggests that the adversarial process helps participants to broaden their individual perspectives on the problem, to change their views, to invent new options acceptable to everyone, in short, to create a model that fairly represents all perspectives."

Secondly, one must be aware of the influence that norms, values, expectations, assumptions about what is acceptable and unacceptable, that pervade all organisations (see Peters and Waterman (1982) or Schein (1992)) exert in positive but also negative ways on the analysis process. Phillips stresses that the decision analyst who is minimally invested in the outcome of the decision conference and who has the benefit of the experience of working in other organisations, is in a better position than the group members to recognise these effects and counteract the negative influences (for example by enabling less vocal members to bring their views to bear). Holding the decision conference away from the organisation also assists in minimising the effects of the company's climate.

Thirdly, one must ensure that the models constructed are requisite for the organisational stratum that is being assisted by the decision conference (Chun, 1992; Jaques, 1976, 1996; Rowbottom and Billis, 1978; Humphreys and Berkeley, 1983). Requisite models for different managerial strata differ in both form and content because the nature of work changes as one moves from one level to the next higher one in an organisation. The decision analyst therefore also needs to shift to the appropriate level in facilitating the work of the different strata.

Phillips (1984:45) points out that his choice of decision analysis as the source for requisite decision models is a value judgement that is predicated on the assumption that model coherence is a major attribute of important in construction as well as validation of the model. Table 6-2 shows that Phillips' theory of requisite decision models does not require agreement with his judgement. In the next sub-section I shall indicate that other model sources, such as social judgement analysis or simulation modelling have also been used.

Since this thesis is about the uses of decision analysis for the development of management strategies for the DDBR fishery I will not attempt to compare decision analysis with other decision aids, but instead conclude the presentation of Phillips' rationale for decision conferencing with his observation that decision analysis can provide both guidance for the assessment of input parameters that is based on much experimental work of behavioural decision processes (see for example the work of von Winterfeldt and Edwards (1986) presented in Chapter 3). Furthermore, the use of decision theory enables work group members, facilitators, and decision analysts to easily change the structural form of the model because all decision analytic model structures (from decision trees, to influence diagrams, multi-attribute models, etc) are consistent with decision theory.

6.3.3 Experimental evidence for benefits of Decision Conferencing

The third component of the rationale for decision conferences is built around an argument that attempts to show that facilitated work groups, which are structured into an "estimate-feedback-talk" process, produce better judgements than initial "pre-meeting" work with one or two group members. Like Phillips, the Decision Techtronics Group (DTG) at the Rockefeller Institute of Government at the State University of New York, acknowledges the shortcomings and biases to which individuals are prone when working alone or in groups, but their aim is to identify the conditions under which individuals working in groups can excel.

6.3.3.1 Groups can outperform individuals

Reagan-Cirincione (1994) argues that there are two main issues that need to be addressed in order to avoid the findings of Forsyth (1990) and McGrath (1984) about the superior accuracy of individual work. The first concerns productivity losses due to faulty interaction processes (see Steiner 1972; Janis 1972; Janis and Mann, 1977). The second concerns productivity losses due to inappropriate responses to the cognitive complexity of the judgement task by the group (see for example discussion of von Winterfeldt and Edwards (1986) against group work in Chapter 4).

In order to improve group performance and in Reagan-Cirincione's (1994) words, raise "accuracy in group judgement" (note that this may be different from Phillips' emphasis on the creation of "shared social reality" which enables a group to build a "future reality") both interaction process and problems with cognitive processing need to be dealt at the same time.[45]

Reagan-Cirincione's (1994) study aimed to investigate the value of an iterative "estimate-feedback-talk" procedure (Reagan-Cirincione, 1992) which is very similar to Decision Conferences as it provides both process and cognitive process support through the use of group facilitation, decision modelling, and information technology. Her claims concerning the role and effects of these three elements is similar to that of Phillips (1984b; 1988) and Phillips and Phillips (1993). The main difference between Reagan-Cirincione's and Phillips' approach is that the former does not mention the effects of and ways for dealing with covert group life dynamics, nor the generative aspects of requisite modelling as Phillips (1984b; 1992) do.

Table 6-3 outlines the steps in Reagan-Cirincione (1992) study. The task involved the development of a judgement policy[46] to predict the average salaries of teachers in

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[45] Hackman and Morris (1975:93) asserted that "interpersonal interventions are powerful in changing patterns of behaviour in the group - but that task effectiveness is rarely enhanced (and often suffers) as a consequence", whereas procedure-oriented intervention directed at improving cognitive processing "often may be helpful in improving effectiveness on the task immediately at hand, bur rarely can they be incorporated readily into the ongoing process of the group." In response, Eils and John (1980:269) concluded: "if Hackman and Morris are correct, the obvious next step is to develop and test interpersonal and procedural techniques in concert with one another" (quoted in Reagan-Cirincione, 1994:248-249).

[46] A "judgement policy" refers to the method by which multiple pieces of information (predictors or "cues") are integrated by an individual or group to form one or more judgement (Hammond *et al.*, 1986). The development of a judgement policy requires the specification of the relative importance of each cue in predicting the criterion, as well as the functional relation between each of the cues and the criterion. If

different states of the USA (using demographic and economic data), and to predict the number of games that baseball teams won during a season (using selected team statistics). Participants worked both individually as well as in groups. This study demonstrated that small, interacting groups were able to perform significantly better than their most proficient members on decomposed judgement tasks when aided by an enhanced, iterative, "estimate-feedback-talk" process (80% of the experimental groups outperformed their most proficient members) (Reagan-Cirincione, 1994:265). By comparing the judgement accuracy at different stages of the process and with control groups, the study showed also that this improved group performance was achieved only when both the process of group interaction and cognitive processing were supported in tandem.

Table 6-3: Overview of "estimate-feedback-talk" intervention process

	Individual
Estimate	Specification of weights and functional relations of predictors Holistic judgments on 25 cases
Feedback	Display of statistically estimated weights and functional relations
Estimate	Reconciliation of statistically estimated and intuitively specified weights and functional relations
	Group
Feedback	Display of reconciled weights and functional relations
Talk	Facilitated group discussion
Estimate	Facilitated specification of weights and functional relations Facilitated holistic judgments on 25 cases (each judgment followed by predicted judgment)
Feedback	Display of statistically estimated and intuitively specified weights and functional relations
Talk	Facilitated group discussion
Estimate	Facilitated respecification of weights and functional relations Facilitated holistic judgments on 25 cases (each judgment preceded by predicted judgment)
Feedback	Display of statistically estimated and intuitively specified weights and functional relations
Talk	Facilitated group discussion to final consensus judgment policy

Source: Reagan-Cirincione (1994:252)

The main difference between the experimental groups using the "estimate-feedback-talk" procedure and Decision Conferences is that the latter, by definition, involves groups of people who with a stake in a pressing organisational problem. Reagan-Cirincione (1994:267) is therefore cautious in drawing conclusions regarding the

correct weights and functional relations are specified for every cue, the judgements predicted by the policy will be as accurate as possible, given the proportion of explainable variance in the criterion (i.e. the multiple R^2). (Reagan-Cirincione, 1994:251) efficacy of Decision Conferencing based upon the results of ad hoc groups in her study. However, Reagan-Cirincione argues that management groups and executive teams must also be concerned with the accuracy of their assessments and evaluations. Her findings suggest that a simple averaging technique for aggregating individual judgements can only be justified when errors are randomly distributed, but that "mathematical aggregation schemes starkly fail when prospective group members share some systematic bias. Since it is impossible to know how much bias is evoked by actual judgement tasks, particularly forecasting tasks that require the assessment and weighting of a number of variables, it is prudent to assume that any important judgement task for an organisation may evoke a great deal of bias" (Reagan-Cirincione, 1994:267).

6.3.3.2 Behavioural aggregation produces results different from any statistical aggregation

Phillips' (1998) study also investigated the effects of group versus individual elicitations of probability distributions. I indicated in the discussion of the assessment of probability distributions from experts in Chapter 3 that in the MSDA approach statistical aggregation of different expert judgements is favoured because there seemed to be no satisfactory behavioural aggregation method, a fact that led von Winterfeldt and Edwards (1986:136) to argue that one should "not bother to get the members together unless group pressures or other social factors make it necessary".

The importance of Phillips' (1998) study, I believe, lies in the fact that he presents evidence that "a statistical average of individual judgements does not represent the shared, constructed social reality of a consensus distribution." A key assumption underlying this assertion is that participants in work groups come with labile values about the issues in question (Fischhoff, Slovic, and Lichtenstein, 1988; Fischoff, Slovic, and Lichtenstein, 1980) and that "in the process of exchanging knowledge and expertise participants' uncertainties are shaped and generated, allowing them to construct a group consensus distribution which represents the social reality of their collective expertise" (Phillips, 1998). That is why a consensus distribution is "a group product, not an amalgamation of individual distributions. If individual views really are labile, then even the group process of constructing the consensus distribution could affect the individual's views, with the result that individual distributions assessed after the consensus distribution might show further convergence." (Phillips, 1998:2-3)

Phillips worked with two groups of experts to assess the rate at which carbon steel corrodes as an input into a risk analysis conducted by Nirex (a private company whose shareholders are the producers of radioactive waste in the UK), in order to ascertain whether a proposed repository (Sellafield) was complying with the Government regulation that the chance of the most exposed person suffering serious radiation-induced health effects should not be larger than one in a million (Department of the Environment *et al.*, 1984). He took each of the groups of experts in one-day facilitated work group session (similar to that of a Decision Conference in that it used a facilitator, information technology, and decision analytic models) through a 31-step process based on Stael von Holstein and Matheson (1979) revised for use in groups.

Phillips (1998:14) argues that the results of his work support the following five hypotheses:

> 1. *Group discussion leads to convergence of individual probability distributions whose variances increase as information is exchanged and assumptions are surfaced.*
> 2. *The assessment process is itself generative, i.e., insights, new ideas, shifts in problem framing, new concepts, etc., can all occur during the process. In other words, the process is not simply one of measuring or quantifying existing beliefs, it helps to form those beliefs.*
> 3. *Consensus distributions exhibit important properties that are different from statistical averages.*
> 4. *Differences between groups are mainly due to different conditioning assumptions.*
> 5. *Behavioural aggregation is preferable to statistical aggregation. A consensus distribution represents the shared understanding of a collection of experts, and, as shown in this experiment, it can be different from any statistical average of individual views. This difference could matter in a probabilistic risk analysis, particularly for an uncertain quantity that evokes considerable bias. As Reagan-Cirincione (1994) has shown, the group can provide a corrective for the bias, with the result that the consensus distribution would be located at a more extreme position than any individual distribution or average. This experiment showed that a new factor was introduced and accepted by the group during the elicitation of the consensus distribution. Thus, a full behavioural approach may be needed to allow the group to arrive at a better result than either their best member or any average (Phillips, 1998:14-15)*

The implications that Phillips (1998:15) draws for practice are as follows:

1. Behavioural aggregation can reduce overconfidence in assessed probability distributions.
2. A structured, facilitated process is required to obtain good probability judgements.
3. "Averaging individual probability distributions is less defensible than modelling uncertainty about the uncertain quantity.

4. The choice between statistical or behavioural aggregation must take account of the use to which the resulting distribution is put, and this requires appreciation of what the distribution represents. An uncertain-quantity-average represents the central tendency of the experts; a probability-average represents the spread of opinion of the experts; a consensus distribution represents the collective and shared understanding of the experts. ... Although each participant said they could support the consensus distribution, most gave individual distributions that were somewhat different. Thus, the individual can sign on to the collective while still maintaining a different personal view. The difference is attributable to the conditioning events, not the probability assessment itself"

Chapter 7 Managing the DDBR fishery management strategy development intervention

7.1 Introduction

In the previous Chapters I discussed the problems that the DDBRA faced in the fishery sector and showed that there were several different opportunities for the application of decision analysis in support of their task of developing an improved management strategy for the fishery sector.

One of the problems with the predominant, MSDA, approach to environmental management planning that I identified was its lack of attention to the institutional setting within which the analysis was to take place. In the case of the DDBRA, I argued that the problems of multiple objectives, uncertainty, and many stakeholders, were compounded by (i) the specific historical development of fishery management (from Antipa, through collectivisation, to central planning, and then rapid changes which in 1993 led to the beginnings of a management regime that was based on the auctioning of scientifically determined fishing quotas for different zones), and (ii) the specific organizational characteristics of the DDBRA.

This Chapter starts out with an examination of the two DDBR fishery sector studies (Staras, 1994; and de Graaf and Staras, 1994). These two studies were prepared by the Scientific Director of the DDI (Staras) and the foreign fishery management consultant (de Graaf) in order to form the basis of the four sectoral management planning workshops organized by the EBRD technical assistance project in August and September of 1994. I argue that the conclusions of these studies had the effect of shifting the discussion in the DDBR management planning process from one that was dominated by technical concerns about how to integrate many complicated and uncertain variables and objectives that I presented in Chapter 2, toward a higher-level systemic debate about the appropriateness of different fishery management strategies. I also present evidence from the management planning workshops in which these studies were discussed that indicates that the rift between the fishery scientists' understanding of management and that of the DDBRA was very deep. The second section then deals with my preparation of the Decision Conference.

7.2 The work on the fishery sector during the EBRD project

7.2.1 The EBRD projects' management planning workplan

The workplan for 1994 revolved around two main activities. The first, was to complete the outstanding projects initiated in 1993 to assist the development of the management capacity of the DDBRA. These included (Goriup and DDBRA, 1993:11):

1. Conversion to computerised accounts/MIS system;
2. Recruitment for important vacancies in the DDBRA using secondments/trainees;
3. Provision of local training in management skills and languages;
4. Overseas study tours;
5. Assistance to the Project Implementation Unit for the EBRD Investment Portfolio;
6. Enhancement of DDBR legislation.

The second set of activities, which are more relevant for this thesis, were focused on the development of management policies and projects for the DDBRA which together would form the "DDBR Integrated Management Plan" (Goriup and DDBRA, 1993:2).

Through discussion between the Resident Advisor and the Executive Director, the original method of work, which would have relied largely on "prescriptive management documents" (Goriup and DDBRA, 1994:1) by international sectoral experts, was changed because it was found to be inappropriate. The rationale behind the change was the realisation that the problems were "too complex and the site simply too large to cover in the few weeks available for each expert." The revised approach was "to instigate and institutionalise long-term consultation and planning processes rather than produce detailed prescriptive management documents" (Goriup and DDBRA, 1994:1; see also Goriup and DDBRA, 1993).

The specific "products" sought through the alternative strategy were as follows:

i. "a consultation document proposing management policies and projects for the DDBRA;

ii. an organisation, namely the DDBRA itself, which having co-ordinated the formulation of the management policies and projects, understood their opportunities and limitations, and had sufficient confidence to change them in the light of new information and circumstances;

iii. an example of how to develop capacity for, and community participation in, protected area management that could serve as a model for other areas in

Romania, as well as elsewhere in Europe, and which enhances Romania's credibility and reputation for upholding its international commitments" (Goriup and DDBRA, 1994:1).

The process through which this was to be achieved is outlined schematically in Figure 7-1 and the schedule is presented in Table 7-1. The main elements of the planning process were sectoral studies undertaken first by Romanian experts, joint work between foreign sectoral experts and Romanian counterparts, and a series of five workshops organized by the DDBRA with the help of the EBRD team. The sectoral studies commissioned from Romanian experts were to summarise existing knowledge about the field and also provide an initial set of policy and project proposals (for the fishery this was Staras (1994)). These sectoral studies and their recommendations were then refined or elaborated with the assistance of a foreign expert into "zonal policy briefs" (for the fishery these were (de Graaf and Staras, 1994a; and 1994b)). The five sectoral studies undertaken were: (i) hydrology (8 weeks) to support workshops 1, 2, and 3; (ii) fisheries (6 weeks) to support workshops 1, 3, and 4; (iii) tourism (5 weeks) to support workshop 3; (iv) reedbed management (3 weeks) to support workshop 3; and (v) low-input agriculture (3 weeks) to support workshop 4. Ecological input into each of the studies and overall co-ordination was provided by the Resident Adviser. The zonal workshops were as follows:

1. Coastal and Marine Buffer Zone (22-24 August 1994)
2. Strictly Protected Areas (29-31 August 1994)
3. Freshwater and Terrestrial Buffer Zones (6-8 September 1994)
4. Sustainable Economic Development Zones (12-14 September 1994)

To my knowledge the policy briefs were not, as Figure 7-1 suggests, disclosed to the public by the Information Section of DDBRA. Instead, public participation only came in the form of field trips (which all sector experts undertook), invitation of stakeholders to the workshops, and the attendance of the media at press conferences held at all workshops. The selection of workshop participants (around 30 at each workshop) was made at the discretion of the workshop convenors and they included researchers active in the area from a variety of research institutes and universities, state agency representatives, local political bodies such as a Prefecture and commercial company directors. However, not all accepted the invitations and actual attendance was lower. In the case of the Coastal and Marine Buffer Zone Workshop only about 20 persons participated.

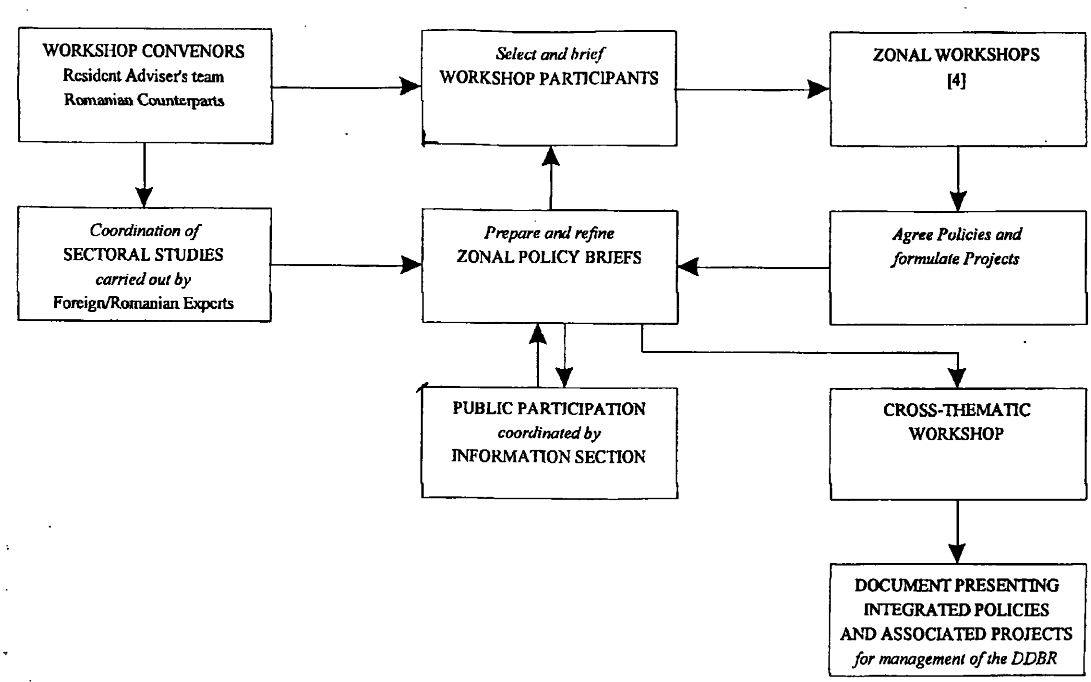
At each of the zonal workshops, the "zonal policy briefs" were presented by the Romanian experts, and then the policy and project recommendations that they put forward were discussed in question and answer sessions that were moderated by the convenors. Discussions continued to the point where the original policy and project proposals were modified or amended and some consensus about the wording emerged. The policies and projects that were elaborated at each of the four zonal workshops were then collated by the Resident Advisor and the Executive Director.

The final cross-thematic workshop took place about one month after the zonal workshops (18-20 October, 1994). It was attended by members of the project steering group (see Appendix, Section 10.3) and was originally intended to be up to five days long (see Goriup and DDBRA, 1994). However, in the event, this workshop was just as long as all the other ones: two full work days and half a day for arrival/registration/departure. Close to fifty persons were invited to this workshop, and attendance was higher than in the zonal workshops. Most of the participants had already attended one of the zonal workshops, but in addition, the IUCN, EBRD, and Members of the International Steering Group were also present, as were the members of the Scientific Council (see organizational chart of DDBRA in Chapter 5). Even though local political bodies and commercial company directors were invited, their attendance was very poor.

After this workshop, the Resident Advisor continued to work with the Executive Director of the DDBRA to synthesise the sectoral studies, the zonal policy briefs, and the policies and project chosen and amended at the final workshop. That work resulted in the publication of the "Draft Management Objectives for Biodiversity Conservation and Sustainable Development in the Danube Delta Biosphere Reserve, Romania" (Baboianu and Goriup, 1995). This document was intended to serve three purposes: first, it specified the policies and projects that the DDBRA was going to pursue between 1995 and 1999 (with a review in 1997). Secondly, it was to serve as a public consultation document that would focus discussion and provide an outline of the work that led to the adoption of the policies and projects. Thirdly, it was supposed to provide a way of co-ordinating the many research activities that were under way in the DDBR at the time, and which could be initiated in the future as international awareness about the DDBR increased.

I will describe the organisation and rationale of the fishery management workshops that I organised in greater detail in Section 7.3. Here it is useful to note, however, that my fishery management workshops were not formally part of the management planning process though they were fully endorsed by the EBRD project managers and the DDBRA. I scheduled them such that they gained from the momentum of the other planning work, and this made it possible for the foreign fishery expert to participate. That meant, however, that they took place during a period when everybody was very busy (Table 7-1 shows the number of activities taking place during that period).

Figure 7-1 Flow Chart of steps for preparing DDBR Management Policies and Projects



Source: Goriup and DDBRA (1994:3)

Table 7-1 Schedule of Management Planning work in DDBR

	JUN	JUL	AUG	SEP	OCT	NOV
Management Planning Workshops						
[1] Coastal/Marine Buffer Zone			23-25			
[2] Strictly Protected Areas			29-31			
[3] Freshwater/Terrestrial Buffer Zones				6-8		
[4] Sustainable Economic Development Zones				13 ,15		
[5] Integration, Law and Implementation					18-20	
Project Personnel						
Project Co-ordinator			22 -	- 16		
Resident Adviser		18-29	8-12; 22-	- 16	3 -	- 4
Economics Researcher ("LSE student")			15 -		- 29	
Romanian Sectoral Experts						
Foreign Sectoral Experts [Workshop involvement]						
(a) Hydrologist [1,2,3]		18 -		- 9		
(b) Fishery Management [1,3,4]			8 -	- 16		
(c) Tourism [3, 4]			15 -	- 16		
(d) Reedbed Management [3]			22 -	- 9		
(e) Low-input Agriculture [4]			29 -	- 16		
Fishery Management Workshops (organised by Axel Kravatzky)						
Preparatory Session I				5		
Preparatory Session II				12		
Preparatory Session III				16		
Decision Conference					12-13	

Source: based on Goriup and DDBRA (1994:4)

Five major workshops were organised, which dealt with the Marine Area, the Sustainable Economic Development Zones, the Buffer Zones, and the Strictly Protected Areas individually. At these workshops the current status of knowledge was summarised, specific objectives developed, and individual projects specified through which the development objectives for the areas could be achieved.

In the final workshop, to which members of the International Steering Committee were invited, the outputs of the individual workshops were reviewed and the first integrated Management Plan put together. All of the objectives and associated projects were reviewed and collated, priorities were set by consensus, and an action plan for the DDBRA agreed for the next five years (with a major review due after two years).

The explicit intention of the EBRD project team was to conduct this management planning process in an open and participatory manner, and to "provide a valuable model to many other Romanian developments in these times of transition and challenge". In the development of the Inception Report, seminars were held for particular interest groups (fishing, reed harvesting, agriculture, forestry, shipping, water sanitation, tourism, education, as well as NGOs, Voluntary Nature Conservation bodies, the Tulcea Chamber of Commerce and Industry). The Tulcea

District Council members, the Prefect, and parliamentarians took part in the discussions leading up to the establishment of the DDBRA and its operation.

7.2.2 Fishery Sector Studies and Proposals

Many of the themes of the Fishery Sector Study (Staras, 1994) have already been presented in Chapters 1 and 2 of this thesis and they are essentially summaries of the work done by the DDI for the DDBRA (e.g. Navodaru, 1992; Navodaru *et al.*, 1993). The sectoral study did, however, include three sections which contained some new material which was very important for this thesis. Two of those three sections with new material dealt with specific management activities of the DDBRA, and in the third conclusions about management objectives and projects were put forward.

In the following sections I show that Staras (1994) and de Graaf and Staras (1994a; 1994b) presented two very powerful arguments:

First, Staras (1994) argued that the fisheries management strategy the DDI and DDBRA had been working on was, in effect, unfeasible and incoherent. I will also argue that the fact that none of the proposals regarding fisheries management put forward by Staras (1994) were accepted in the workshops, is evidence for my hypothesis that there was quite a deep rift between the fishery scientists' understanding of management and that of the DDBRA.

Secondly, de Graaf and Staras (1994b) presented evidence that the restoration efforts under way and proposed for the DDBR were, in fact, not necessarily in accord with the objectives of the Biosphere Reserve. This was a very stark and powerful hypothesis because the evidence was persuasive and completely undermined the prevailing belief in a self-evidently good and desirable natural balance. However, this belief was so fundamental to the DDBRA's management approach that further research into the matter, as proposed by Staras (1994) and de Graaf and Staras (1994a), could be accepted in the workshops without much discussion.

For me, these developments meant that the problem of developing a management strategy for the fishery had shifted from initially focusing on ways of integrating many complicated and uncertain variables and objectives (as presented in Chapter 2) towards enabling the DDBRA to constructively work with DDI and other stakeholders to transform their existing management strategy into one that was coherent and feasible.

7.2.2.1 Analysis of the DDBRA's fishery management approach

The fishery sector study by Staras (1994) is a 36 page document, of which fewer than three pages make specific reference to management policy issues facing the DDBRA.[47] The arguments that Staras (1994:29-31)he did make are as follows (translated by this author):

Law NR 82/1993 (the Law for the DDBRA) specified that the DDBRA was given the authority to manage the fishery through concessions to authorised economic agents and had to give the local population priority. In 1994 the DDI developed the documentation necessary for the 25 fishing zones in lakes, 20 on the Danube river, and 4 on the coast of the Black Sea. The documentation they prepared consisted of the delimitation of the fishing zones, establishment of maximum fishing limits for different species, the formulation of rules governing the method of fishing, and the duties of both parties. The rationale underlying that work was presented as follows by Staras (1994):

- By issuing concessions, the DDBRA will be able to obtain data on fishing effort, landed catch, fishing gear used, and catch per unit of effort. These are needed to devise models of sustainable production that can be applied more easily, and with greater accuracy, in the diverse conditions of the DDBR. Applying some models for the Danube and the Black Sea seem to be one of the problems that are harder to resolve.
- Economic agents will be interested in the stability and optimal exploitation of the fish resource, and thereby participate in the attainment of the objectives of the Biosphere Reserve.
- Through the leasing system the state will be able to get a revenue of about US$580,000 per year, and that will enable the DDBRA to sustain a research and investment programme for the improvement of the DDBR fishery.
- While the priority given in law to the local population in leasing will encourage the privatisation of fishermen as family associations, the current system of leasing does not encourage individual privatisation of fishermen.
- The appearance of private companies has resulted in an increase of the number of fishermen fishing with the authorisation of the DDBRA on the Danube river has also led to an increase in fishing by these on other fishing grounds that were not

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[47] In light of my analysis in Chapter 2 of the way fishery biologists see their role (providing scientific inputs but not policy judgements) this was not very surprising.

used by the state companies until 1990. These private companies fish the whole year round [presumably violating the prohibition period]. This will lead to an over-exploitation of the fish resources since fish conglomerate during certain development stages (reproduction, over-wintering, or feeding), but also because the ecological conditions in lakes worsen at certain times (low water levels, higher water temperatures, etc.)

- It seems necessary that the DDBRA should organise (for itself) an efficient system of data collection and control at the landing of fish by fishermen and the wholesale of fish to the market.

"In the opinion of the author of this study, the current concession system needs to be seen only as a first step towards moving to the system of selling fish licences. This will only be possible after the accumulation of some data regarding fishing effort and catch per unit effort in each of the fishing zones" (Staras, 1994:30).

Staras' (1994:30-31) analysis of the trends and shortcomings of management of the DDBR fishery comes to the following conclusions/observations:

- The DDBRA does not have a department specialised in the monitoring of the way in which the main resource that it is administering is used. There is no database regarding the quantities of fish caught in the different fishing areas, the evolution of species, the number and types of gear used, or the effort used. The database of the DDI is not complete enough for the purposes of management.

- The DDBRA is issuing licences to fishing companies that include specific restrictions. However, these restrictions are not communicated to the actual fishermen employed by the companies. Fishing companies seem not to be interested in the protection of the fish resource, relying solely on the enforcement of the restrictions by the DDBRA ecological guards (wardens). Fishing companies own the fishing gear and issue licences to their fishermen as though it were their God-given right or only a matter of formality. This system needs to be re-assessed.

- Illegal trade and poaching are common because the market price of fish is 5-6 times greater than the value that fishermen receive from the companies for the fish they land at the collection points. This situation will not change until the fishermen become the owners of fishing gear and title-holders of the fishing rights.

- The DDBRA's wardens deal mostly with poaching, less with the enforcement of fishing regulations (mesh size, minimum length of fish caught, fishing of species other than those specified, etc). The wardens have a lot of presence in the DDBR and they should also be employed in the monitoring, including sampling work for fish stock assessment.

- There does not exist an up-to-date fishing law in Romania. It is necessary to work with fishery managers from outside the DDBR to advocate a fishing law that promotes the interests of the DDBR. There are endangered fish species that are uselessly protected on the DDBR territory, because they are intensely fished outside that territory.
- The fish stock assessment methodology needs to be improved by applying the most appropriate methods to the specific conditions present. In order to ascertain the state and trends in fish populations, fish stock assessment studies are needed.

In the conclusion of his fishery sector study, Staras (1994:32-33) put forward a number of management objectives and projects (see Figure 7-2).

Figure 7-2: Proposed Management Objectives and Projects

1) **Restoration and conservation of habitats:**
   a) *Reduction of nutrient pollution of Danube rive water.* Integration of DDBR interests with the national and international organisations with respect to the Danube and the Black Sea.
   b) Restoration of flood areas in the lower Danube and the Danube Delta.
      - Project: Study on the current use of endyked areas in the DDBR and the lower Danube floodplains in order to determine management alternatives.
   c) Improvement of the water circulation system in the canals and lakes
      - Project: continue with project of the same name
2) **Conservation of some species**
   a) Prohibiting of fishing of endangered species in buffer zones of DDBR and the development of some international conventions for the protection of some species that migrate in the Danube.
   b) Feasibility study for the construction of a Sturgeon hatchery in the DDBR.
      - Project: continue with project of the same name.
   c) Identification and conservation of some pristine habitats in the buffer zone and in some of the fish polders in which there still there still are some fish populations of endangered species.
      - Project of the same name.
3) **Legislation and regulations**
   a) Collaboration with fishery managers from outside the DDBR to put forward a Draft Fishery Law which should take into account the fishery management interests of the DDBR.
   b) Improvement of the system by which fishing rights are allocated.
      - Project: Study regarding the possibilities and avenues for the privatisation of the fishing in the DDBR (with foreign assistance).
4) **Monitoring, Administration, and Research**
   a) Improvement of the DDBR fishery monitoring system
      - Project: Training of DDBRA and wardening staff regarding the requirements of DDBR fishery management;
   b) Implementation of specific fishery management objectives in the DDBR
      - Project: Case study regarding the management of the fishery in two representative zones of the DDBR (with foreign assistance).
   c) Improvement of fish stock assessment
      - Project: Adoption of appropriate methods for the evaluation of stocks in the Danube and the Delta lakes (with foreign assistance)
   d) Identification and monitoring of the factors which control the state of the fish resource
      - Project: Improvement of hydrological factors in the main waterbodies of the DDBR
      - Project: Research on the factors that influence stock recruitment
   e) Evaluation of the state of other aquatic animal populations of economic interest (cray fish, frogs, mussels) and the possibility of their exploitation
      - Project of the same name.

Source: Staras (1994:32-33)

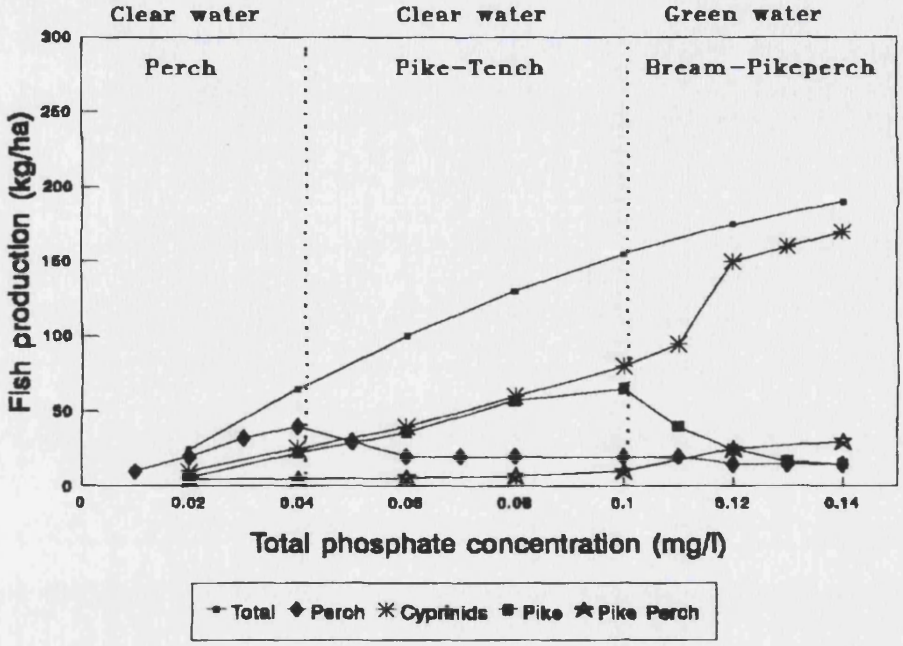
7.2.2.2 The effects of eutrophication on fish communities

The foreign fishery consultant (Mr de Graaf) arrived in Romania at the time when the local fishery experts were finishing their report (Staras, 1994). Their joint work on the "policy briefs" for the management planning workshops resulted in two papers (de Graaf and Staras, 1994a; 1994b) and field visit notes (as well as a brief analysis of fish farming which showed that most fish farming is unprofitable due to poor soil conditions and the large size of the fish farms that makes them very difficult to manage effectively).

I deal first with de Graaf and Staras (1994b) in which the two experts argue that there is a correlation between the changes in species and the nutrient content of water (especially phosphate and nitrogen). Figure 7-3 summarises the relationship that has been reported elsewhere (Grimm and Backx, 1992), and that seemed to be present in the DDBR fishery as well (de Graaf, 1994:8) (the process is explained below and illustrated in Figure 7-4 and Figure 7-5):

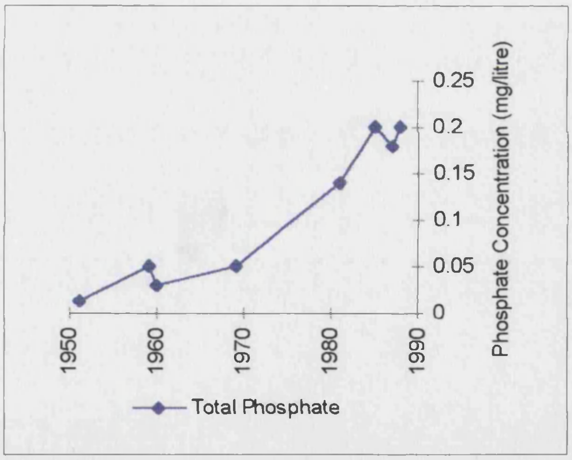
- When the concentration of phosphate is below 0.04 mg/litre, the water is clear, there are few macrophytes (submerged plants), perch is the dominant predatory fish species.
- When phosphate concentration varies between 0.04 and 0.1 mg/litre the availability of nutrients increases and with it the number of macrophytes. At this phosphate level the water is still clear and the major fish communities are pike, tench, and white fish. This best describes the situation in the Danube Delta until the mid 1970s. Macrophytes were present and were providing shelter for predatory species such as pike, while the extended vegetation near the embankment provided breeding and nursing places for tench and pike.
- At phosphate concentrations above 0.1 mg/litre macrophytes disappear and the water becomes green because of the increased presence of blue-green algae. In eutrophic waters (i.e. waters too rich in nutrients) the major fish communities are bream, roach, and pike-perch. As Figure 7-4 shows, around 1976 the phosphate load for the Danube Delta surpassed 0.1 mg/litre and eventually reached 0.2 mg/litre in 1985. At such high phosphate loads algae grow so quickly that oxygen shortages develop in the water, which kills off fish, and the sunlight penetration is reduced to such an extent that the macrophytes disappear. As a result, pike and tench are replaced by bream, roach, and pike-perch. The mechanism behind this change was understood only relatively recently (Lammens *et al.*, 1985). Under eutrophic conditions bream, which normally feeds on chironomids that live in the bottom layer of water bodies, switch to filtering zooplankton out of the water. As a result the zooplankton population is kept relatively low, which in turn leads to more rapid growth of algae (as less zooplankton are feeding on algae). The waters therefore become increasingly green and turbid. "The ultimate effect of eutrophication is that the ecosystem changes completely; the water becomes turbid, macrophytes are disappearing, the wildlife and bird communities are changing and this is exactly what happened in the Danube Delta" (deGraaf, 1994:10).

Figure 7-3: Fish communities and their relation with phosphate load



Source: de Graaf and Staras (1994b) and Grimm and Backx (1992:8).

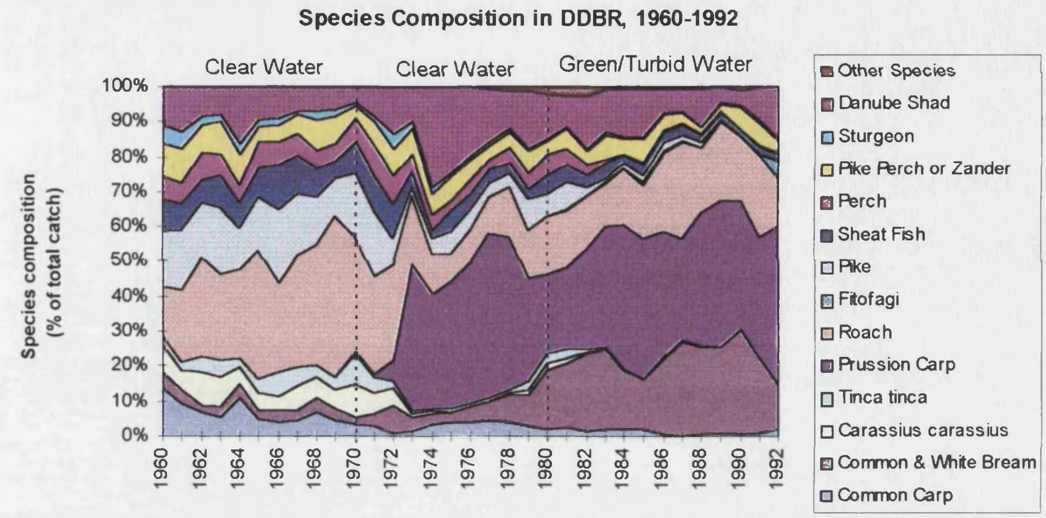
Figure 7-4: Total phosphate concentration Danube Delta Water, 1960-1990



Source: de Graaf and Staras (1994b:9)

Figure 7-5: Changes in Species Composition & Water Quality in Danube Delta Fishery, 1960-1992

Source: Fischer (1993:14) & de Graaf (1993a:6)



Two implications of this hypothesis are of significance within the context of this thesis. First, in the work of the DDI up to that point a wide variety reasons for the observed changes in fish communities were put forward without any indication of which were more likely (see Chapter 2). With this analysis about the effects of eutrophication on fish communities, the environmental factors seemed to gain some dominance over the others. This conclusion undermined the predominant view that fishing activity was the main factor influencing fish stocks and that without fishing, there would be a natural balance that would keep fish stocks constant over time.

The second important implication of this hypothesis dealt with the proposed restoration programmes in the DDBR. The construction (over the past few decades) of dykes for fish and agricultural polders has resulted in the landscape of the Danube Delta not looking very "natural". Furthermore, many of the canals dredged for the collection of reed, and for various water circulation improvement programmes were considered to be against the prescriptions of Antipa, who argued that the general flow of water in the Danube Delta should be from west towards the Black Sea. These two factors, together with fact that a sizeable canal dredging and earth moving industry had built up over time in the Delta, led to most staff for the DDBRA and the DDI vigorously supporting the attempts to "restore" the Delta to some undefined more "natural" state by closing canals which were deemed to harm the right type of water flow and to break down dykes so as that polders were flooded again.

While the details of the canal building and closing activities were never fully disclosed or discussed with the EBRD consultants, the DDI had established a polder restoration programme that was endorsed by the consultants who prepared the GEF Biodiversity Programme (Huntington Technical Services Ltd and Partners, 1993) and this programme was going to receive substantial financial support under that programme.

The questions that de Graaf and Staras (1994b:10-11) raised about the restoration programme is that most of the "clear water systems" which provide habitats for perch-type fish communities (see Figure 7-5 and Figure 7-3) are located in 'un-natural' looking polders where the entry of polluted Danube water is limited or completely blocked off. If the dykes are broken down nutrient rich water would enter these systems and the effects of eutrophication described above would destroy the last habitats of pike and pike-perch fish communities. This led de Graaf and Staras to conclude that "from an ecological point of view it is maybe better to replace the term 'restoration of fish polders' with the term 'protection of original ecosystem by bio-manipulation'. Bio-manipulation is added because several actions have to be undertaken in order to keep the original system if the hydrological regime in the polders is changed. The major actions are: (i) keep the nutrient load of the in-flowing water low; (ii) avoid that the bream population becomes dominant; (iii) maintain the macrophyte association" (de Graaf and Staras, 1994b:10-11).

The most significant implication of this analysis, I believe was that it provided a tangible[48] and scientifically sound example of the arguments in Chapter 4 about the necessity to make value judgements in environmental management and about ecological equilibrium shifts. But besides illustrating the inherent limitations of the ability to use science for prescriptive purposes (because it does not say which system is better overall, and instead only what the likely effects are of different systems), it also indicates the need for value judgements about trade-offs. The effect was quite fundamental: it challenged the dominant assumption that the DDBRA's cability to control the development of ecosystems, the paradigm about what can be considered 'natural' and 'good', and the method by which the DDBRA made decisions.

This hypothesis about the effects of eutrophication on fish communities was the only piece of sectoral analysis that was discussed in any detail in the *Draft Management Objectives for Biodiversity Conservation and Sustainable Development* in the DDBR publication that resulted from the management planning process (Baboianu and

[48] "Tangible" because the pictures taken during an aerial survey of the DDBR clearly showed how the waters in polders was dark and clear, while that of the canals was light green, indicating the presence of algae, which thrive in nutrient rich water.

Goriup, 1995). However, my analysis of the management objectives that were actually put forward in the Management Planning Workshops (next sub-section) indicates that this input alone fell short of changing the thinking of the DDBRA.

7.2.2.3 Proposals put forward at the Management Planning Workshops

The second policy brief (de Graaf and Staras, 1994a) was a summary of (Staras, 1994) with some additional notes by de Graaf. First, the main additions to the proposal:

- The total market value of the fish caught in the Delta is probably around US$6.2 million (if the total real catch is 8,000 tonnes per year). The DDI staff of 3 fishery biologists and 2 field workers is not sufficient if the aim is to establish or manage a fishery that is sustainable in the long term (the number may be sufficient if the aim is only biological research).
- It may be advisable that the DDI should also use a holistic (Schaefer, 1954 and 1957) method for stock assessment (monitoring total catch in different areas, and the effort used) so as to establish Catch per Unit Effort indices which indicate how the fish catch effort developed over time.
- It is important that different persons/institutions be responsible for data collection and regulation enforcement because accurate and direct monitoring of the fishery can be done only if those studying the fish catch are neutral and enjoy the trust of the fishermen.
- The fisheries management regime in effect at the time suited fishing companies because the DDBRA did not actually charge them for the licences and with the low operating costs, they were still profitable. Fishermen are also satisfied because they do not have to buy their own gear and "they make their living by selling a part of the probably high valued species directly to the market." However, "the DDBRA should not be happy, as this system provokes a complete mess in monitoring of fisheries and in sustainable harvesting of the fish stocks" (de Graaf and Staras, 1994a:9). That is why they are not sure to what extent the decline in fisheries output over the previous three years is a real decline or a decline in registered catch. However, de Graaf and Staras (1994a) did not go on to suggest how one should deal with this problem beyond the problem statements contained in Figure 7-2 and the recommendation to separate monitoring and enforcement activities.

While de Graaf and Staras attended all the management planning workshops, the discussion of the proposed fishery management objectives occurred in the fourth Management Planning Workshop ("Sustainable Economic Development Zones"). This was the only workshop where they presented their work in a formal way (rather than informally during the discussion part of the workshops). There are a number of points to be made about the workshop:

Attendance was poor: even though a total of 30 persons from seven institutions were invited (3 from MWFEP, 8 DDBRA, 4 Euroconsult, 6 DDI, 5 Company Directors, 2 Chamber of Commerce, 1 County Counsel, 1 RomSilva), attendance over the two days was limited to DDBRA, DDI, and EUROCONSULT staff. It was noted that the company directors did not come as this was a problem throughout the management planning work. The DDBRA Executive Director and the EUROCONSULT project co-ordinator were the convenors.

1. The one-hour presentation of the fishery sector study by Dr Staras was followed by a two-hour unstructured discussion in which the DDBRA was essentially stunned because the fishery managers said that they cannot give them the prescriptions that they want and that they do not see their role to make the decisions that the managers are supposed to make.
2. No formal or explicit methodology for the selection of management policies or management projects was used. In fact, much of the potential conflict about priorities had been avoided by drawing up a very long list of management policies and projects.
3. Most of the proposals were adopted with few modifications which resulted from discussions and which the workshop convenor (Mr Fischer) summed up.
4. It was interesting to analyse which ones could not be agreed to: legislation and regulation, and the first three points of Monitoring, Administration and Research (i.e. points 3a, b, and 4a, b, c). Instead, the following management policy and associated projects was agreed to (DDBRA, 1994): "Institute a system of management for the sustainable utilisation of fish resources. (Management Policy 18)
    - Analyse the existing management of fisheries and develop options for improvement (Project Reference 18.1).
    - Select and apply a system of licensing fishing based on: catch limit, fishing effort, permitted species and selective methods; and the obligation of economic agents to forward data on catch per species, number of nets, etc., and fishing effort to the DDBRA (Project Reference 18.1)".

5. Mr de Graaf's humorous note (shown in Figure 7-6) indicates what he perceived the main dilemma was: suggestions for an elaborate command and control management system that, in the view of the fishery scientists, did not take account of the limitations imposed by the nature of the fishery and the management requirements.

Figure 7-6 Impromptu humour on DDBR fishery management

SEMINARIILE DE PLANIFICARE A MANAGEMENTLULUI

Management objective: Improvement of fisheries resources

Problem: It has been observed that high valued and protected fish species do not follow the rules as has been set by the ARBDD during the last years conference.

Management solution: Scientific research executed in Pikeland (Stiuca et al, 1993) proofed that a highly hierarchic community awareness can be created within the fish population by making use of the so called "police fish" and under water traffic lights. Essential for such an awareness creation is a good training of "police fish" and a good connection system for the traffic lights. For the latter it has been proofed optic fibres covered with ecological grown reed functions the best (Tulcea et al., 1988).

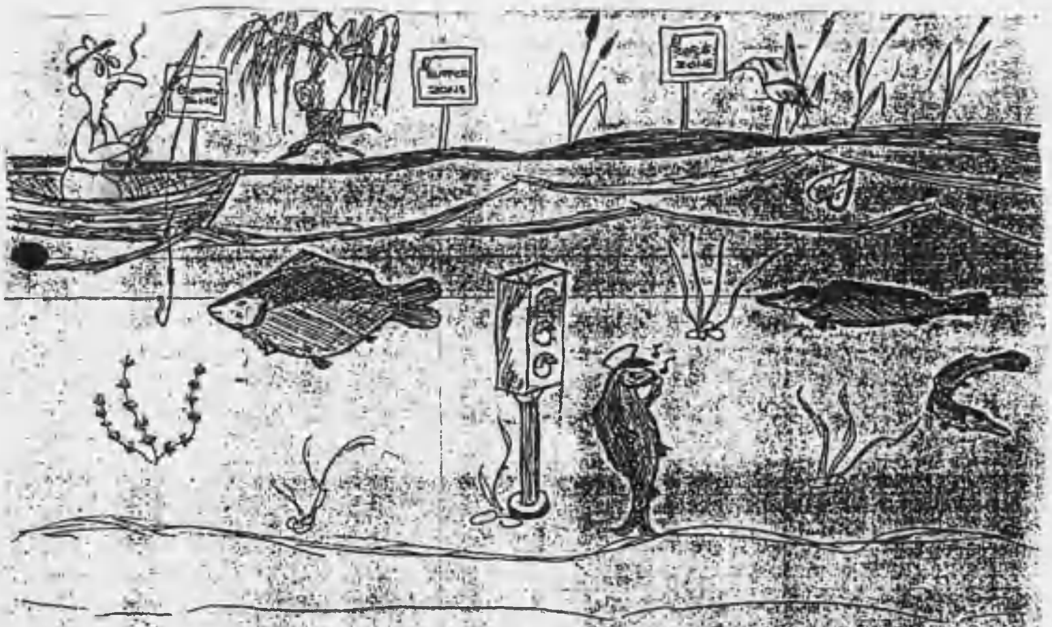
Project Name: Training of Pike as a "police fish"

Proposed activities: Pike will be train in police activities at the police fish training centre in Babusca (Pikeland).

Project duration: 3 years

Implementing agencies: ARBDD, DDI with technical assistance of CARPACONSULT.

Necessary support: Interpreters with a sound knowledge of international fish languages and under water microphones.



Source: de Graaf (15 Sept. 1994).

Notes: "ARBDD" is the Romanian acronym of DDBRA; "Stiuca" means pike in Romanian, and this is also the name of the Director of the DDI.

Other observations:

1. Uncertainty and difficulties of judgement in fish stock assessment were not prominent. This is further evidence that transformation in the problem understanding had taken place - it had moved from questions of technical scientific assessments to management policy.
2. There was a big difference in the understanding between the fishery scientists and the managers. Both sides seemed to be trying to do their best as perceived from their own institutional and departamental perspectives, but for the overall fishery, it was leading to failure. The certainty about their positions that had set in over the previous 2-3 years was beginning to shake a little bit because of their continued failures to develop a management system that lived up to their expectations. While this seminar managed to bring up some issues and direct the discussion in a new direction, it did not manage to provide a new consensus.
3. No clear and coherent fishery strategies were discussed, but instead it was recognised that there were many inter-dependent decisions (in the sense that a decision in one area affected decisions in another one).
4. There was no agreement about what the goals or strategic objectives of the DDBRA were. A good example of this was the fact that the Governor did not agree with many of the proposal put forward in the other areas discussed at the seminar, such as tourism or agriculture. He saw the DDBRA as having primarily a role of conservation based on scientific prescriptions, but what was put forward were measures, such as helping in marketing (e.g. labelling), which put the DDBRA in the role of facilitators of sustainable economic development. In his view, the DDBRA was a conservation agency and not economic development agency, and if people did not make as much money as they could within the scientifically determined limits for conservation, then that was their problem.

My only comment during that workshop was to publicly announce that in that very week we had started a process (see Table 7-1 on page 211 for the timing; I describe this process in the first part of Chapter 8) in which we had begun to evaluate different fishery management options. The Governor said that he was open to all suggestions and particularly keen to resolve the fishery problems, but although he endorsed the workshops we were undertaking I felt that he remained sceptical.

7.3 Preparing the Decision Conference intervention

7.3.1 Choosing the Decision Analysis Approach

Up to the point when de Graaf, the foreign fishery expert, arrived in August of 1994 before the Management Planning Workshops, I was considering two types of interventions. The first option was an MSDA intervention through I would have developed a decision analytic model with the input of experts and stakeholders. In particular, I would have tried to incorporate the NIE design principles and transaction cost criteria into the model and then interview fishermen, DDBRA, DDI, local government, and other stakeholders to get the probability data (and make sure that all the value dimensions were captured). If things worked out well, I planned to also include a decision conference for behavioural aggregation of disagreements in the assessment.

The second option was a Decision Conference, for the reasons that I have discussed earlier in this Chapter. Even though I was not yet sure on which aspect of the fishery would be addressed at the Decision Conference, the following factors persuaded me gradually to choose this option.

The Director of Licensing at the DDBRA (Mr Constantin) worked on regulations for fishery and other sectors, but repeated attempts to find out what was really going on failed. Maybe because they had not actually summarised it. The essence of what I got was that it was a cumbersome process that involved the DDI doing the technical studies etc. (as described in Chapter 1). Not even de Graaf was able to get more precise information on the fishery management regime than that included in Staras' report.

The fact that the DDI and especially the DDBRA went on with their normal work and ideas (canal dredging, auction preparation, etc) suggested that another piece of analytic work was unlikely to affect the DDBRA's management approach very much. Nevertheless, it would have been interesting to find out if the fact that the MSDA model would have been based on issues that they themselves had raised and evaluated, would have altered the DDBRA's staff usual position in which they ignore the work of consultants on the basis of claims that their conclusions do not apply in the Danube Delta as they does not understand the realities of the DDBR.

The fact that objectives and policies were used interchangeably in the management planning workshops as well as in Baboianu and Goriup (1995), could be seen as an inconsequential error or imprecision. However, I believed that the fact this mistake fited so well with the condition of bureaucracies as described by Mintzberg, (1989) and Gunderson, Holling, and Light (1995), it was probably more than coincidence (see Chapters 4 and 5). It stood for the tendency of organisations such as the DDBRA, to pursue policies for their own sake rather than for the goals or objectives that they were originally meant to achieve.

Mr Goriup, the resident advisor of the EBRD technical assistance programme argued (personal communication) that time and resource constraints can partially explain why the management planning workshops did not work out that well. A US$4.5 million Global Environmental Facility (GEF) project was becoming operational and the DDBRA and DDI had to manage it. This proved to be quite a distraction from long term planning, as it took up much of the time of an already short-staffed organisation, and it reduced the attractiveness of the proposed loan by the EBRD (rather than the grant from the GEF through the World Bank). This situation made also Decision Conferencing more attractive, because it involved much less time than a MSDA process.

The emphasis in Mr de Graaf's work in the DDBR had been to point to the inter-relatedness of the factors that make up a management regime, with emphasis on the fact that a top-down system is unlikely to work because of the great costs involved and the many possibilities of circumvention, and that it was better to try and design a system in which the interests of the fishermen were taken into account.

This is relatively easy to state in theoretical terms, but the situation in practice was one of one dominated by confusion, secrecy, and mistrust.

7.3.2 Experimenting and building support through the Sinoie Lagoon decision analysis

I organised and facilitated on the evenings of August 23rd and 24th, at the occasion of the "Coastal and Marine Buffer Zone Management Planning Seminar", some decision analysis work on management options for Sinoie Lagoon. The problem there was rapid coastal erosion and the threat to an important fish species through potentially rapid increases of water salinity.

The purpose of this work was to (i) provide a multidisciplinary evaluation of an important management concern; (ii) provide me with an experience of my first decision conference; and (iii) build support for the Decision Conference planned for later in the year.

Among the recommendations put forward from that workshop were (DDBRA, 1994):

- Improve the ecological status of Lake Sinoie (Management Policy 28).

- Undertake a study on the evolution and current situation of Lake Sinoie to establish the optimum conditions for the management of biodiversity (Project Reference 28.1).
- Design and construct hydrotechnical works to allow the discharge of fresh water directly from Lake Razim (Project Reference 28.2).

I discussed the outcomes of the Sinoie workshop with the Resident Advisor, with the Executive Director, and with L.D. Phillips. Through those discussion I learned that important elements had been left out of the analysis. I also realized that I did not have a good handle on managing the process (including the fact that I had mixed content and process consultation). As a result, L.D. Phillips directed me to the work of Schein (1987) on Process Consultation, and Friend and Hickling (1987). This:

a) confirmed my conviction that it was important to adhere strictly to a process intervention,

b) expanded my understanding of the puzzling observation that even though there was disconfirming information that the current approach and the one they were working did not work, they still went ahead or could not stop the process,

c) enriched the range of techniques from which I would be able to choose and in particular enhanced my techniques for handling process issues when the problem solving process is drawn out over a longer period of time,

7.3.3 Process Consultation

The basic premise of Schein in Process Consultation (Schein, 1987) is that consultants (as well as managers) can take on different roles in their relation with clients (or subordinates) as they attempt to influence situations toward desired goals in the human system in which they intervene.

"In a technologically complex society neither managers nor consultants can really give commands or tell others what to do. Even in medicine, specialists and surgeons are finding themselves in complex relationships with their patients where they are helping those patients to make a beneficial decision rather than just 'ordering' a given procedure. This point appears paradoxical, because, one might reason, the more complex the world, the more dependent we become upon experts to tell us what to do since we do not understand ourselves how things work. The problem is that, because we do not understand, when the expert tells us what to do, we often misunderstand or mistrust what we are told, and then either do it wrong or are afraid to do it at all. So the expert learns the hard way that just having expertise does not guarantee that one can influence others. A more realistic model of management as well as consulting is to see the process as one of intervening facilitatively to accomplish agreed upon goals" (Schein, 1987:9).

The central premise of Schein's (1987) process consultation model is that the client needs to retain control (and therefore "ownership") of content in the problem solving process and that the consultant only intervenes on issues relating to the process of problem solving or structuring of the problem (see also Table 6-1).

"Even if the consultant feels he or she knows exactly what is wrong and what to do about it, such diagnosis and prescriptive ideas should probably be withheld early in the process for three basic reasons: 1) the consultant is most probably wrong to some unknown degree because of the likelihood that there are hidden cultural, political, and personal factors operating; 2) even if the consultant is right, the client is likely to be defensive, to not listen or deny what is being said, or to argue, or to misunderstand and thereby undermine the possibilities of solving the problem; and 3) even if the client accepts the consultant's diagnosis he probably fails to learn how to do such a diagnosis in the future himself" (Schein, 1987:30).

By involving the client in the process of diagnosing what may be wrong, and in the process of generating a solution, Schein (1987) claims that the chances of finding an appropriate solution that will be implemented, and that the client learns the skills of problem solving are maximised. Furthermore, since diagnosis and intervention cannot be separated in practice, process consultation needs to be guided by intervention theory and not diagnostic theory. Since, according to intervention theory, any interaction between client and consultant constitutes an intervention (even if the purpose is thought to be only diagnosis), there are often limitations on what questions can be asked by consultants, of whom they can be asked, what terminology is used in asking them.

Schein (1987:20) argues that what process consultation best fits those situations where people are troubled but neither know what the problem is or what kind of help they should be seeking. The most important pre-requisite for the process to begin constructively is some intent on the part of someone in the organisation to improve the way things are going.

7.3.3.1 Initiating and managing change

The situation in the DDBR fishery required change. However, I was rather concerned about the readiness of the DDBRA to actually undertake real transformation with regard to the fishery because staff just seemed to go on with their usual work. This is why I needed to better understand what a process of change entailed. I have already discussed some of the issues in Chapter 5, relating them in particular to strategy formulation, and in Chapter 6 when I discussed Decision Conferencing.

According to Schein (1987) the process of change consists of three stages (see Table 7-2): (i) unfreezing, where the motivation and readiness is to change is created, (ii) changing, and (iii) refreezing.

Table 7-2 A three-stage model of the change process

Stage 1.	*Unfreezing:* Creating motivation and readiness to change through a. Disconfirmation or lack of confirmation b. Creation of guilt or anxiety c. Provision of psychological safety
Stage 2.	*Changing through cognitive restructuring:* helping the client to see things, judge things, feel things, and react to things differently based on a new point of view obtained through a. Identification with a new role model, mentor, etc. b. Scanning the environment for relevant information
Stage 3.	*Refreezing:* helping the client to integrate the new point of view into a. The total personality and self-concept b. Significant relationships

Source: Schein (1987:93)

Three elements are necessary for the *unfreezing* stage to be successful:

a) The client needs to recognise that results have fallen short of expectations. The problem is that this information usually comes from outside the organisation or from information that higher level managers provide to subordinates, peers, or superiors. Communicating disappointment is difficult because it is threatening to face and if either the communicator or the recipient faces this threat, he or she will distort the information so that face can be saved (and thereby self-esteem preserved). Mintzberg's work suggests that this is a particular problem in the bureaucracy because of the poor communication within the organisation. The work of Gunderson, Holling, and Light (1995) also supports this view because they found that bureaucracies are quite intent on implementing and refining (or concentrating on efficiency gains rather than evaluating the strategy, in Mintzberg's (1989) terminology).

b) Data that disconfirms expectation needs to become significant. That occurs only when some important goal or objective is not being met (this induces anxiety), or when some important ideal is being violated (this induces guilt). In the case of the DDBRA, the DDI, and the consultants what seemed to happen was that the different actors had different objectives or goals, and this meant that different sets of information were seen as significant and anxiety or guilt were raised in response to different things. That was another reason (besides the ones mentioned in Chapters 6 and 7) why it I saw it as important to work in a group setting.

c) Disconfirming information that has been deemed significant will only be accepted if it does not involve personal humiliation and loss of face or self-esteem. In other words, a condition must be created in which it is possible for a person to feel specific guilt or anxiety without feeling worthless as a whole person, because otherwise he will find a defence mechanism that distorts or in some other way counteracts the disconfirming information. There is no standard formula for creating psychological safety, and Schein (1987) recommends that the consultant worry about "face" and be very careful not to exacerbate the feeling of being at a disadvantage that the client already may have by virtue of admitting a problem. My approach to creating this psychological safety was to offer assurance about the effectiveness of the workshop format, that we were going to deal with the issues that concern them, that we would have a small core group of people working over time together (see Section 7.3.4), and that the fact that de Graaf assured them that the difficulties they were facing were "normal" by international standards. This strategy of having Mr de Graaf take the role of content expert and myself as process consultant also created sufficient neutrality to be able to facilitate the Decision Conference.

> *"The three consultant roles - expert, doctor, and process consultant - each have a key contribution to make. The expert and the doctor are most likely to be useful sources of disconfirmation and to be able to induce guilt or anxiety, to see how a given client situation if failing to meet important targets and how this should cause the client to want to do things differently. The reason these two models are not more successful in causing change, however, is that they often do not create enough psychological safety to permit the client to accept the information. Hence no real unfreezing occurs until the more process oriented process consultant creates enough psychological safety" (Schein, 1987:105).*

I would argue that the second stage (cognitive restructuring) is quite well covered in the Decision Analysis (particularly in the literature that I reviewed for the Decision Conferencing approach).

Refreezing refers to that portion of the change process where, according to Schein, (1987), a new point of view is embedded both in the person's own psychic life space and in the organisational relationships. By ensuring that the client remains the problem owner through the change process, it is more likely that the client will choose accept those parts that fit into his personality. Schein argues that this is important because otherwise the client will, at best, attempt to implement the recommendations in a stilted way which makes them seem incongruent and leading to disconfirmation and the erroneous conclusion that the suggestions were wrong. However, a compatibility/fit with the client's own personality are not sufficient for successful implementation because the new view or the recommendations may violate the expectations of other around the client (his boss, peers, sub-ordinates, etc) to such an extent that they either not reinforce them or actually disconfirm them. In other words, the process of change and implementation must be managed carefully if the client's new perceptions, attitudes, and behaviours are to survive.

7.3.4 The Strategic Choice Approach

The Strategic Choice Approach (SCA) is a planning and decision making approach developed by Friend and Hickling (1987) to enable groups of individuals representing different organisational departments, expertise, institutions to work together in a transparent, cyclical, and task oriented way on decision or planning problems that facilitates the incremental development of plans and the management of uncertainty (both visible, such as reports, and invisible, such as increased understanding and commitment). SCA belongs to a set of Soft Operations Research Approaches (for an overview see Rosenhead, 1989).

My primary interest in this approach derived from Friend and Hickling's (1987) detailed discussion of the practicalities of managing the SCA approach as it contained a lot of very pertinent advice on issues such as choosing and organising a work room, managing the flip charts in a way which allows members of a work group to participate actively in analysis, to producing records of the meetings. This was important because of my lack of experience in facilitating workshop processes.

As I studied Friend and Hickling (1987), I decided that one more aspect of SCA could be employed in my work, without straying too far from my primary task which was to evaluate the use of decision analysis. This was related to my earlier argument about the fact that one of the issues that had struck me as my analysis of the DDBRA's management problem progressed was that the planning process that they were engaged in did not take the inter-relatedness of the elements of the fishery management strategy sufficiently into account. For example, the DDBRA's decision on what to base the licensing fee on determines the incentives faced by fishermen about what proportion of their catch they would report. At the same time, the DDI decided to adopt the VPA method for determining fish stocks, and reliability of that method is a function of the fish catch reported.

In SCA, option schemes (alternatives) are developed by starting with an analysis of a range of Decision Areas ("opportunities for choice in which two or more different courses of action can be considered"). The next step is to establish working assumptions about the usefulness of consider the choice of alternative within each Decision Area in relation to choices made in other Decision Areas. By systematically determining the compatibility (or incompatibility) of different options within interconnected Decision Areas, it is then possible to develop a set of Decision Schemes (i.e. alternatives that are composed of different combinations of options within Decision Areas). Within the context of this thesis it is not necessary to go into further details about how these Decision Schemes are evaluated or refined, nor into the approach of SCA of managing uncertainty, because we did not use those elements of the approach in the workshops and due to task and space limitations of this thesis.

I will report in the next Chapter that we did use the concept of Decision Areas and that it was a useful mechanism for eliciting the elements of the licensing scheme that was in operation at the time as well as the one which the DDI and DDBRA were working on. Most importantly, this elicitation led to the production of much disconfirming data, which created enough guilt and anxiety so as to lead to the withdrawal of the licensing scheme that the DDBRA was about to submit to the Ministry of Privatisation for approval (myself and Mr de Graaf learned about that only in the course of the workshops that I organized), and thereby create the necessary conditions for the Decision Conference work to take place.

7.3.5 The formal agreement to hold the Decision Conference on Fishery Management

As indicated throughout the thesis so far, the fishery management problem was very peculiar. Even though there was a general dissatisfaction with the existing situation, it was not clear what the problem really was. Fishery management seemed on one hand to be stuck in very detailed analyses of particular issues (and this inhibited effective action from taking place), while at the same time the regulation department of the DDBRA simply pressed ahead with the design of regulations, practically ignoring the fact that the whole point of the two-year EBRD technical assistance project was to assist them in with development the most appropriate form of management for the fishery of this Biosphere Reserve.

Since DeGraaf had come for the first time, and the seminar process for the Management Planning Sessions was prepared, it became increasingly clear to me that there was the opportunity to engage the consultant and the others through the means of a Decision Conference.

I got the agreement of the Governor, the Executive Director, the EBRD project team, and the fishery consultant to hold a Decision Conference with the following three objectives (elaborated in in Figure 7-7):

1. Enable the DDBRA to make a coherent policy choice.
2. Enable the DDBRA to transform their existing fishery management strategy.
3. Facilitate collaborative work between different departments within the DDBRA and between the DDBRA and other organisations.

In order to overcome the problem with my lack of experience in organizing and facilitating Decision Conferences (I had facilitated one – Sinoie, and observed one conducted by L.D. Phillips in London), I obtained the agreement of the London School of Economics to pay for Mr Peter Hall, an experienced Decision Conference facilitator associated with the LSE, to facilitate the conference in the DDBR together with me.

In the next chapter I will report on a three-day workshop series that I organized in preparation of the Decision Conference and on the two-day Decision Conference itself.

Figure 7-7: Objectives of my intervention

1. **Enable the DDBRA to make a coherent policy choice, in which they:**
   - 1.a assess all value dimensions that they consider relevant and their relative priorities (this means that they are able to also consider aspects that they have so far not incorporated into previous analyses such as economic considerations, Biosphere Reserve objectives, value judgements of other stakeholders, and common-pool resource management design principles)
   - 1.b consider the likelihood of events, their causes, effects, and relationships
   - 1.c integrate and manipulate data efficiently and effectively
   - 1.d assess different alternatives and if possible develop new innovative alternatives that are more preferred than the ones already identified
   - 1.e deal with disagreements about value, likelihood, or preferred alternative judgements in a generative way
   - 1.f avoid biases resulting from heuristisc employed in judgement
   - 1.g generate commitment to action (in the sense of knowing what to do next)
   - 1.h generate a type of understanding of the problems and preferred alternatives that enables them to legitimate their choice of action

2. **Enable the DDBRA to transform their existing fishery management strategy in which the DDBRA's role was to determine a narrowly defined carrying capacity constraint (Maximum Sustainable Yield) and to command and enforce management activities, toward a co-management role aimed at maintaining or increasing the resilience of the social, economic, and ecological systems that constitute the DDBR.** This meant that the strategy development process needed to:
   - 2.a Create the motivation and readiness to change through
     - 2.a.i identifying data that disconfirm the viability of the existing strategy,
     - 2.a.ii making this data significant by contrasting it important objectives or ideals of management
     - 2.a.iii providing psychological safety
   - 2.b Facilitate cognitive restructuring that includes:
     - 2.b.i the development of a new shared social reality (needs to be social because it is strategy for co-management role which implies delegation of responsibility)
     - 2.b.ii analysis of appropriate common-pool resource management regime features/elements
     - 2.b.iii different view points so as to ensure robustness of the management strategy
   - 2.c Facilitate the embedding of the new point of view into the psychic life space of employees of (at least) the DDBRA and in organisational relationships by ensuring that they remain owners of problem throughout the process.

3. **Facilitate collaborative work between different departments within the DDBRA and between the DDBRA and other organisations so as to ensure that:**
   - 3.a the process of work is sufficiently flexible to respect time constraints
   - 3.b social tragedies are avoided by working towards:
     - 3.b.i serving the needs and capacities of different stratum managers
     - 3.b.ii making responsibility delegation possible

Chapter 8 The DDBR fishery management Decision Conference

8.1 Introduction

In the preceding Chapters I have discussed the situation in the DDBR, the objectives of EBRD technical assistance project, the specific problems that the DDBRA had to deal with in designing and implementing a fishery management regime for the DDBR, alternative decision analysis approaches, the reasons why I chose to apply the Decision Conferencing approach, and the preparation of my intervention.

In this Chapter I discuss the work in the fishery management Workshops leading up to the Decision Conference, the Decision Conference itself, and the presentation of the results at the final integrative management planning Workshop of the EBRD project. The main question that I seek to address in this Chapter concerns the extent to which the process and the techniques that I employed enabled the DDBRA Executive Director and the persons whom he chose to help him develop, decide on, and promote a preferred fishery management strategy for the DDBR.

8.2 Preparatory Workshops

The main task of the preparatory fishery management Workshops that I organised was to create the motivation and momentum for the Decision Conference. These day-long Workshops took place on September 5th, 12th, and 16th 1994.[49] Their main purpose was to prepare the Decision Analysis Conference that I report on in Section 8.3.

As already discussed in Chapter 7, I had obtained agreement from the Governor and the Executive Director of the DDBRA as well as the Resident Advisor of the EBRD project to hold a Decision Conference to develop and assess different management strategy options for the DDBR fishery but there were two major problems. First, the DDBRA was pressing ahead with working out the details of a concessioning system whose elements were not made public, and of which the consultants, who were supposed to help, knew little more than that it contained controversial elements and that the DDI scientists had reservation about it. Secondly, it was not clear to the Executive Director what exactly we would be dealing with in the Decision Conference

[49]I would like to thank Ms Gabriela Ioan, Ms Diana Bota, and Mr Eduard Ene for their help in translating the posters of the workshops.

and at the same time I did not have training in facilitation; also LSE resources were limited to providing a Facilitator for only one Decision Conference.

I therefore suggested to the Executive Director that we start the process with one or more exploratory Workshops in which we analyse the individual decisions that constitute the DDBRA's fishery management strategy. Together with the Foreign Fishery Consultant of the EBRD team, I argued that such an analysis would enable us to determine which decisions would most usefully be analysed through the Decision Conference.

Concerning the participants in the Workshop, I suggested to the Executive Director that it would be best if he formed a Core Group that would meet throughout the process and that further participants be asked to attend or consulted as the work progressed. I also suggested to the Executive Director that, since it was he who was ultimately accountable for the strategy that would be recommended on the basis of the analysis, it was most important that all those persons whose view he would like to take into consideration be present at the Workshops, but that he should also ensure that view points from outside of DDBRA and DDI should also be represented. In the event, ignoring my advice, he decided to invite only participants from the DDBRA, the DDI, and the EBRD project.

Since this was only a preparatory Workshop, and I felt that the main task was to create the motivation and readiness to change, I did not regard it as a serious drawback. With the exception of the Mr de Graaf – the Dutch fishery consultant - only a variety viewpoints from within the DDBRA and DDI were represented (see Table 8-1).

Table 8-1 Participants at Preparatory Workshops

Dr Grigore Baboianu	Executive Director, DDBRA
Dr Mircea Staras	Scientific Director & Fish Biologist, DDI
Mr Nicolae Constantin	Licences Department Director, DDBRA
Dr Ion Munteanu	Natural Resources Department Director, DDBRA
Mr Ene Eduard	Scientific Officer, Natural Resource Department, DDBRA
Mr Gertjan de Graaf	Fishery Expert, EUROCONSULT
Mr Axel Kravatzky	Facilitator, EUROCONSULT & London School of Economics

For the location of the Workshop I had suggested that we leave the DDBRA headquarters in order to create some distance from the DDBRA environment and to ensure that we were not disturbed. This proved not to be possible, because the nearest suitable venue would have required a boat ride and so involved more time. I obtained the assurance of the Executive Director that we would ask the participants not to be interrupted during the Workshop, and eventually we decided to hold it in the conference room of the DDBRA in Tulcea. We moved out all unneeded chairs and tables, so that there was sufficient room to move about. Refreshments were provided in the room. We also removed pictures from the walls and left only a map of the DDBR so that there was ample room on the walls to display flipchart sheets. During the Workshop we worked mostly on the flipcharts on an aisle, but all participants were encouraged to make use of coloured markers to correct or make additions to the posters sheets already created on the walls.

Both Romanian and English were used in the Workshop, but in keeping with the objective of ensuring that the Romanian participants remained the problem owners, all posters were written in Romanian (either by myself or by participants). The majority of the discussion was in Romanian, and Dr Baboianu and Dr Staras usually translated for Mr de Graaf. I used both Romanian and English in facilitating the Workshop.

We also agreed that the discussions in the Workshops would remain confidential until we agreed otherwise.

8.2.1 Session 1: Agreeing on whether or not there is a problem

The session started with the Executive Director welcoming the participants[50], outlining the purpose of the Workshop, and introducing me as the Facilitator. I then outlined the process which I proposed for the Workshop. I pointed out that throughout this process those present would form a core group that worked together closely, but which could invite others to participate in the Workshop or consult others in between Workshops. I also emphasized that I was only in the role of Facilitator (and not as 'economics researcher' as they had previously thought of me), concerned only with process issues.

To start the analysis process, I first proposed that participants think of all the major Decision Areas, which I defined (following Friend and Hickling (1987)) as: "opportunity for choice in which two or more different courses of action can be considered". The response I got to this suggestion was not very encouraging as most hesitated in responding or thinking about the fishery management strategy/planning in that way. I explained more about the Decision Areas concept, and where the analysis would lead to, but then decided to work towards the Decision Areas, using a 'bottom-up' approach. (i.e. building an objective hierarchy by starting with the lower

[50] Dr Munteanu was unable to attend the first session.

level objectives and then grouping them into increasingly higher levels (Watson and Buede, 1987).

I therefore used the following question: "What do we need to know in order to develop a sustainable fisheries management plan for the DDBR?" Participants were responsive to this question and discussion became lively.

At first Mr de Graaf outlined the general method for fishery management from a fishery science point of view: "one follows the stocks, observerves what with stocks over time, and on the basis of this makes decisions and develops a management plan. This overall plan is translated in into regulations and then the regulation is implemented". Dr Baboianu picked up on this introduction and said: "let us make a management plan for sustainable fishery on the data that exists". However, Dr Staras surprisingly announced categorically: "we can't do that because we do not have the data! We can rely on the data we do have only 30-60%, we need effort data, we don't have the data on catches in different areas – at present we only have some idea on larger areas, such as Razelm."

Mr de Graaf continued by drawing attention to the problem of economic prices: "What about economic prices? I also bring in the point of view of the fisherman, because that's what the fisherman uses to make his decisions." The difficulty that participants had with this line of enquiry was well captured by Dr Staras' concentration on the relatively minor point of what the price of transport of fish from the cherhana to the market was – as they had not incorporated economic considerations into their analysis they were repeatedly tempted to make lists of shortcomings without following through with the implications of these points.

A similar pattern emerged with regard to Mr de Graafs first point ("first follow your stocks"): if information on stocks for different zones was needed, then how do we define zones, Dr Staras and Baboianu asked? "Lakes, hydrological units?" Following this question de Graaf explained that it depends on what monitoring system is eimployed (the analytic, stock based approach of the VPA, or the more hollistic Schaeffer method which focused on catch). "But fish migrate between lakes" Dr Staras continued. "What about the natural mortality of fish? This also needs to be taken into account" Mr Constantin interjected. Dr Baboianu repeatedly came back to Dr Staras' first point – the problem is that available data "does not reflect reality" – "what is the minimum level of monitoring needed? Maybe we try to be very exact and detailed using a system that is very expensive?" Mr de Graaf emphasised that it was most important to know what the total catch was. Dr Baboianu concluded that it will be very important to find out what percentage of fish was not reported.

Dr Staras and Dr Baboianu's comments and conclusions suggest they had already started to acknowledge to themselves that their fishery management approach was severely flawed because on all of the points that were raised and discussed with respect to the information necessary for management (see Figure 8-1) there were major question marks and problems. Mr Constantin was still exploring different ways in which existing data could be used to shed some light on the information needed for management. For example, he was wondering if one could not use some indicator species to judge the overall state of the fish stock (something which both Dr Staras and Mr de Graaf said was not possible – either because there were too many different options and no scientific agreement or because it could not yield the information necessary for harvesting decisions as opposed to ecological health of a system).

Among the other fishery management aspects discussed were institutional requirements (the need to separate monitoring (data gathering) and enforcement activities because fishermen would be less inclined to accurately report information about their catch if they knew they might be penalised), as well as trade-offs that need to be made when choosing between different monitoring methods (e.g. between accuracy, intended users, and costs).

Figure 8-1: Information needed for Management

Session 1, 5 September, 1994
Poster 2

Information needed for Management

Elements	**Explanation**	**Problems / Questions**
* Monitoring of zones	* catch * effort (nr of fishermen & gear) * species	* For what size areas? * Which are representative zones? * Need to standardise effort measurement * Do we need to take special account of economically valuable species? * Which are the areas for reproduction?
* Monitoring of complexes		
* Monitoring Method	* through stock (VPA) * through catch (Schaefer) * VPA + Schaefer	* What accuracy is required? * What are the differences in data requirement?
* Who does the monitoring?	* How is it organized?	* What kind of monitoring? * How is the monitoring done?
* Different interpretations of monitoring!		
* How are the data used?	* Can other institutions or the public use it?	
* What are the financial restrictions?		
* What influences the accuracy of data reporting?	* Catch * Effort	

Note: this, and the following figures are literal translations and representations of the posters developed in the course of the workshops.

I then asked them what factors they thought were responsible for this lack of information for management? Initially Mr Constantin and Dr Baboianu argued, with the support of all other local participants that there is a "psychological tendendency" to refuse to say the truth. This, they thought was related primarily to the the history of living under the Ceausescu regime. I continued to repeatedly probe what the effects of telling the truth would be at present, and it was Dr Baboinau who first said that "it has to do with the payment of taxes." In the subsquent discussion and elaboration, two main reasons were identified why catch and effort data were so unreliable.

The first reason for unreliable data, they argued while summarizing their points as on the flipchart as shown in Figure 8-2, relates to the economic incentives facing the fishermen, fishing companies, and wholesalers. On average, there is a 500% difference between what fishermen get from the companies that employ them and the retail price of the fish. Furthermore, Dr Staras argued that in practice rights to fishing areas are not clearly delineated nor are the rights and duties of fishing strictly enforced. As a result, fishermen illegally sell a substantial proportion of their fish directly to wholesalers. Mr Constantin elaborated by adding that "fishermen use primarily the gear from companies but do not deliver all their catch at the cherhana". Mr de Graaf concluded that "this system suits all three groups involved". The fishermen face few risks and are able to make a living (the risk of being caught is low because the DDBRA has limited resources to enforce the regulations, and the risk of over-investment in gear is also minimized because they get their gear from their employers, the fishing companies). The fishing companies know that the fishermen sell part of their catch illegally but tolerate the situation because they are able set monopoly prices and in that way can even cover their losses from fish farming, and wholesalers, who do not have to invest much in their operations are able to live comfortably on the difference between what they pay the fishermen and their sales on the wholesale or retail market.

Figure 8-2: Economic incentives

Fishery workshop, September 5, Poster 3

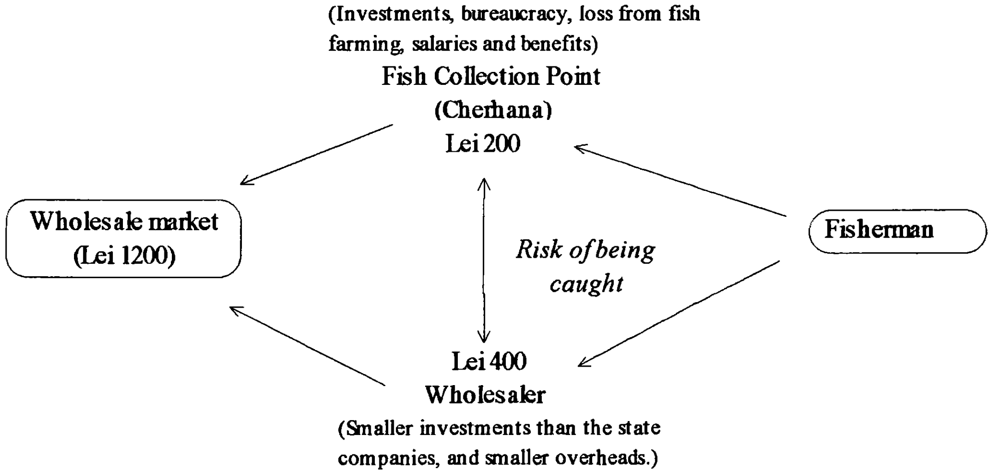
Economic Incentives

* 500% difference (average) between what the fishermen gets per kg and retail price
* vagueness in the delimitation of fishing areas (both in terms of fishing right and in the protection of that right)
* current system suits the following groups:

Fishermen: are employees of companies and get gear from the companies (no expenditures, little risk) and sell on black market (against which there is hardly any enforcement).

Companies: know that fishermen sell on the side, but they can survive, even though they are inefficient and top-heavy because they can set monopoly prices.

Wholesalers: buy from companies as well as from fishermen and are able to live well on the mark up.

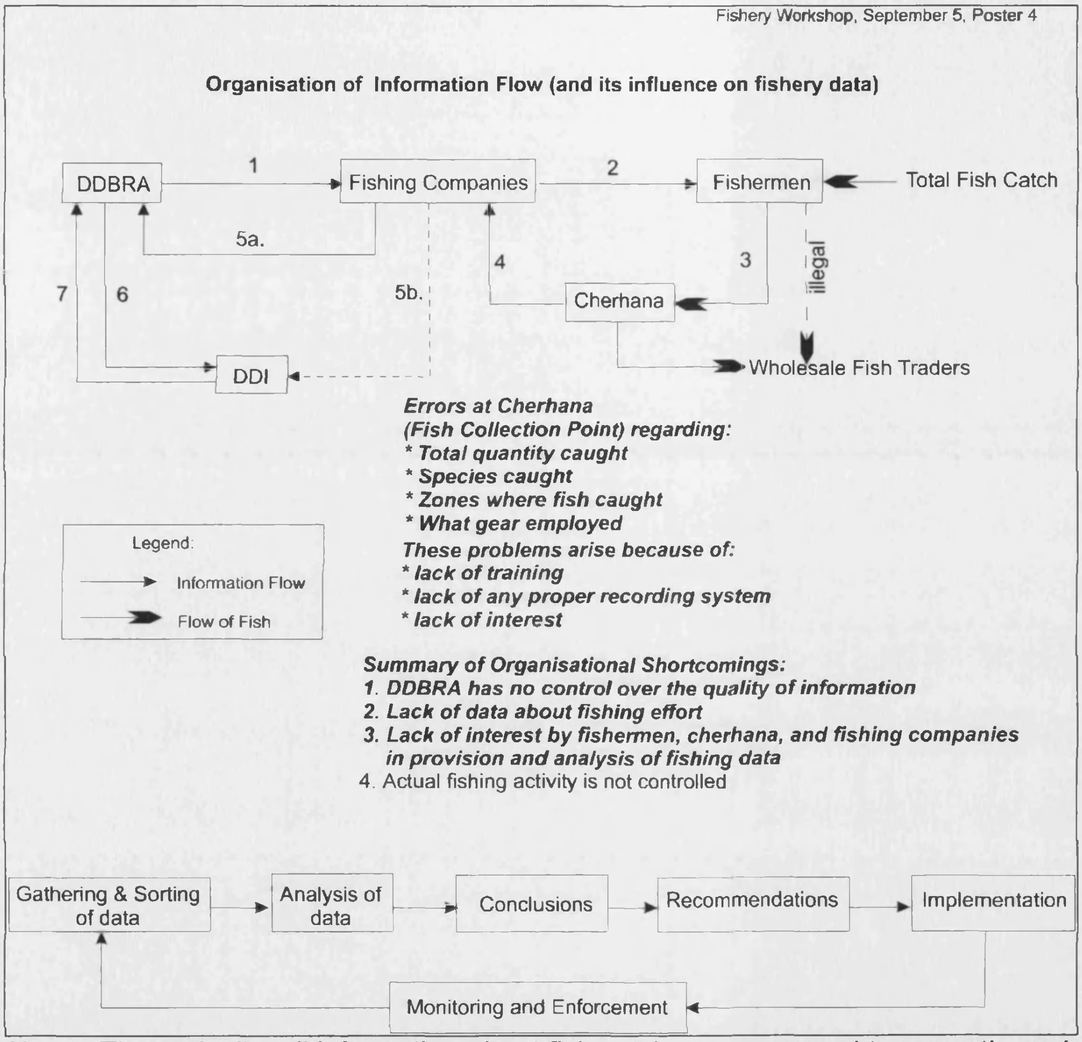


The second reason for unreliable data on fishing that participants identified related to the organisational system, and in particular to the way in which recommendation were implemented and data about the effects of regulations were distorted along the chain of information flow. Figure 8-3, which illustrates the information flow system and its shortcomings, was drawn up mainly by Mr. Constantin, the Director of the Licensing Department, the person in charge of developing the licensing system.

In theory, the management system was supposed to operate like the closed linear system shown at the bottom of Figure 8-3. In practice, Mr Constantin explained, even the data about those fish that were actually delivered to the fish collection point ("Cherhana", which are owned and operated by fishing companies) were distorted – Dr Baboianu used the estimate of 20% being reported. Mr Constantin emphasized that due to lack of training, the lack of any proper recording system, and a general lack of interest, the fishing companies (and in particular their personnel at the fish collection points) introduced mistakes regarding the total quantity of fish delivered to them, the composition of the catch in terms of species and length of individual fish, in what zones of the DDBR the fish were caught, with what gear and in how much time.

The result was that the DDBRA had, in effect, no real information or control over the actual fishing activity. This was quite a devastating conclusion, and even though it was not surprising to anyone, I sensed an uncomfortable feeling among most participants because it was stated so clearly that the data they were using was inadequate for the management system they wanted to implement.

Figure 8-3: Organisation of Information Flow



Notes: Theoretically, all information about fish catch was supposed to come through the DDBRA to the DDI. In practice, the DDI collected most information themselves from the companies (hence the broken line 5b) as well as through some experimental fishing.

Having established what information fishery management ought to be based on I led participants to continue with a more detailed analysis of exactly how the present and proposed management systems were falling short of providing what was needed. The next phase was important for two reasons: first, neither the existing management system nor the proposed one were ever cleary captured on paper, there were no summaries of them, and no one person seemed to be in a positition to explain them fully. In order to improve and innovate, it was important to be clear on what existed.

The second reason for the importance of the next phase was that we were still in the first, or what Schein (1987) calls the "Unfreezing" stage of the change process (see Table 7-2, page 229). In the first step of the day we established what information management ought be based on we established a clear goal that because it was not being met started arouse anxiety among participants. By taking the process further and continuously comparing and contrasting the existing and porposed management system to the the management principles they had elaborated, I was also seeking to establish an important ideal that was capable of bringing up feeling of guilt among participants when violated. By end of this process consistent evidence was being to emerge that all participants had started to "unfreeze".

Before assessing the regulation framework that the DDBRA and DDI had been working on for the whole year, we turned to the regulation system in effect at the time. Participants started to analyse the existing regulation system in relation to the five main components drawn out by Mr Constantin and shown in Figure 8-4. Dr Staras, who was in charge of the fish stock assessment at the DDI, explained that there were two possible ways to determine a Total Allowable Catch (TAC): through Virtual Population Analysis (VPA), which uses experimental sampling in different fishing zones to obtain data about fish stocks, and the Schaefer method (Schaefer, 1954; 1957) which uses landed catch statistics. He argued that three factors prevented the DDI from establishing meaningful TACs: (i) there are many environmental factors that could affect fish mortality which so far have not been integrated into the analysis; (ii) catch statistics were unreliable; (iii) in both methods one needed to relate catch statistics to effort data in order to establish TACs, but that the information that they had was very inadequate.

Discussion then turned to the concessioning system through which individual fishing companies obtained exclusive use of fishing zones. For the most part the fishing zones consisted of whole lake complexes (systems), but for larger lakes or the Danube river, this meant that a continuous water body was divided up into different areas. The problem with this arrangement, Dr Staras argued, was that it was not consistent with the behaviour of either fish or fishermen. Fishing in open waters is a hunting activity and fishermen follow the fish which migrate between different areas (either within the same lake or between water bodies). Fishermen also used to fish in different areas depending on the season (for example, fishermen from the Black Sea used to join the Danube river fishery in the winter). Romanian participants also explained to Mr de Graaf that individual fishermen had traditional areas for passive gear that only they fished, while with active gear there were no traditional zones and fishermen moved around. The effect of this regulation element was twofold.

First, fishermen and fishing companies did not respect the regulation (and this was another factor why they did not accurately report what fish they caught where). Second, since it was obvious to all involved in the fishery that dividing up a lake into different areas is not practical, they tried to give concessions for whole lakes. This meant that only larger and established companies with sufficient gear, manpower, and capital had a real chance of obtaining the concessions (in Figure 8-4 auctions are mentioned, but in reality no real auction had taken place yet; instead fishing companies were allocated concessions on the basis of tradition and the number of gear and persons they employed).

The remaining three regulation elements referred to specific gear and fishing restrictions. The notes in Figure 8-4 explain what they consisted of and what the identified problems were.

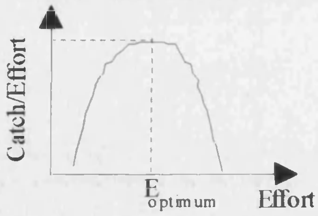
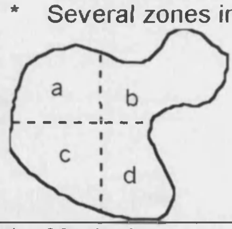
Figure 8-4: The Existing Regulation System

Fishery Workshop, September 5, Poster 5

Existing Regulation

Legal basis: Law 12 / 1974, Law 82 / 1993, Government Decision 248 / 1994

Since 1993 the following management system is in effect (up to 1990 a "state plan" was used):

	Regulation Elements	**Explanation**	**Problems / Implications**
1	Total Allowable Catch (TAC)	Procedure with VPA: * experimental sampling by zones * analysis Calculated Effort + reported catch => TAC Procedure for Schaefer method: * Minimum 10 year data on catch and effort * Calculate catch/effort ratio  	* Environmental influences need to be taken into account * Calculated effort & reported catch are sources of error. => Can't be used (information lack) * Environmental influences need to taken into account * Effort data inadequate * Catch statistics inaccurate => Can't be used (information lack)
2	Establish Fishing Zones	* As far as possible lake complexes * Several zones in same lake  	* Fish migrate * Goes against principles of fishing (where seasonal migration important) * Because of the large size of the zones only large companies will have real access at the auction.
3	Gear restrictions	* Mesh size * Gear type * Areas of fishing	* Many fishermen have their own gear but because they are not allowed to own any, they must use it clandestinely.
4	Regulation for individual species protection	* Minimum fish size * Prohibited species * Closed season * Fishing method	* Applicable only in DDBR (but for e.g. migrating sturgeon intensely fished outside DDBR, and trawlers used in other parts of Black Sea)
5	Reporting on intensity of resource use (effort)	* Report on: - time period fished - quantity caught by species - areas fished - number of boats used - number of gear used - number of man-days fished	* inconsistency in record keeping * mixing of species * false quantities * inaccurate record keeping * total nr. owned by company & not those actually used * total no. in company & by zones * inaccurate (overestimation)

After having established what the regulation system in effect at the time consisted of and having realized and written down that every single component of the system had severe problems, we turned to the proposed regulation system.

The Director of the Licensing Department (Mr Constantin) took us through the different elements of the regulation system as shown in Figure 8-5. The first element discussed was the proposed concessioning of contracts for fishing in zones. At this point a lengthy discussion took place because there were different understandings of what the law required or allowed. Eventually the following transpired: according to Romanian law the DDBRA can only auction concession contracts for certain areas and the resources they contain. In the case of the DDBR this meant that DDBRA would auction fishing rights for areas for which the DDI established a Total Allowable Catch. Since an area might have multiple uses (eg. tourism and reed harvesting) the exclusivity of the concessionaire's rights would be limited to the Total Allowable Fish Catch. In order to give smaller fishing companies or incorporated individual fishermen the possibility of obtaining a fishing area, the DDBRA had earlier in the year (March) proposed to establish 51 fishing areas, ranging from large to very small lakes. In response to this proposal fishermen and fishing companies came to protest at the DDBRA.

One of the problems aired was the fact that small fishing areas would yield too few fish to support a fishermen for the whole year. The other problem was that the proposed concessioning of zones would prevent fishermen from moving between different fishing areas with the seasons, as they have done in the past. In response, the DDBRA tried to estimate the annual fish yield which would enable the average fisherman to live per year. They arrived at the figure of between 5 and 10 tonnes of fish. They then thought of establishing a large number of small fishing areas, and auctioning off packages of fishing areas so that fishermen would be able to catch sufficient fish and fish in different areas. For example fishermen from the Black Sea able to fish on the Danube in the winter months.

This did not work out either, apparently because this would have required a tremendous organizational and administrative effort from the DDBRA, they were not really convinced that it would work, and there was also the risk that if the actual fish catch in a fishing zone turned out to be lower than the TAC calculation assumed, there was the danger that fishermen would be almost forced to overexploit it. Furthermore, Dr Baboianu was adament that the DDBRA did not have the responsibility to provide fulltime employment in the fishery for all who considered themselves fishermen. Instead, the DDBRA should establish how much fish a particular area can yield and develop a mechanism through which the right to fish that area can be attributed in a fair way. Mr Constantin, on the other hand, explained that he was mostly concerned with possible objections by fishermen who could argue that their area does not contain enough fish for all to make a living.

At the time of this first Workshop, a total of 49 fishing zones had been established (25 in lakes of the DDBR, 20 on the Danube river, and 4 on the Black Sea part of the DDBR). As Figure 8-5 indicates, participants perceived the main problem with this proposal to be that it favoured larger companies rather than traditional family-based fishing. The other problem that Dr Staras mentioned and to which the other participants agreed to was the way the fishing zones were established – "the use of the ruler is the biggest problem – but if this is what the Governor wanted, what can we do?" (see Figure 8-4 for illustration).

Most of the remaining time of this first Session was then spent discussing the proposed concession fee (element 4 in Figure 8-5). Two aspects of the concession fee were noted: first, companies who wanted to bid for the rights to fish in an area had to make a sealed offer to the DDBRA about how much more than a minimum of 18% of the value of the estimated TAC, calculated at the current unprocessed average fish price level, they were willing to offer as a fee for the concession. The bidder who offered the highest percentage would win. The second element, however, is that the company that obtained the contract would be required to pay only 10% of the promised concession fee in advance. The remaining 90% of the fee would be paid during the fishing season and would be a function of how much fish the company actually caught. Enforcement of this arrangement was to occur through self-reporting by the companies and one specialised inspector for the whole DDBR!

Theoretically, private companies should be favoured by this arrangement because having lower overhead costs they should be able make higher bids than state companies. Participants noted, however, that this was unlikely to happen in practice. In fact, Dr Baboianu was worried that there would be no private sector participants at all in the auctions, mainly because the fishing areas were too large for them. The other major observation, first put forward by de Graaf, was that the proposed concession fee would act as a disincentive for accurate reporting of fish catch. "Surely", de Graaf argued, "a profit maximising fisherman or fishing company would seek to declare as little catch as possible so as to avoid paying taxes - just like anywhere else in the world". The other participants could see his point but were unsure what realistic alternatives there could be.

The implication for the proposed regulation system as whole was, however, that there was no reason to believe that this system would yield the information they thought was necessary to manage the fishery in a sustainable way.

Figure 8-5: The Proposed Regulation System

Fishery Workshop, September 5, Poster 6

Proposed Regulation System

(Concessioning of zones with resource)

	Elements	**Explanation**	**Problems / Implications**
1	**Concession contracts for zones (limiting rights only to fish resources)**		* It possible that only larger companies (state) can participate at auction because zones quite large. Many, smaller, zones are difficult to administer. This contravenes the traditional family nature of fishing in DDBR.
2	**Concessioning through auction**		
3	**Contract length 5 years**	* 3 years is too little for duties given (which include restocking waters with fingerlings) * 10 years may be too inflexible for the DDBRA	
4	**Concession fee**		
	* minimum 18% of TAC for auctioned zone	* calculated at current unprocessed fish price level.	* state companies have large overheads -> private companies may be favoured
	* in function of landed catch (max. TAC, min 18%)	* 10% in advance	* Fee with minimum leads to false (profit maximising) declarations => Management impossible
5	**Total Allowable Catch (TAC)**	* Established through VPA method	* accurate data essential!
6	**Duties**		
	* fishing method	* For active, passive, seasonal fishing. Only through traditional methods (DDI establishes these)	
	* maintenance of zone	* Access ways * Protection of reproduction areas * Selective Repopulation	
	* placing, marking of gear	* Visibility & ownership	* Often invisible now
	* access ways	* Traditional canals & existing fish collection points	* Prevent re-entry into area after landing catch
	* max. fishing effort (nr. gear, boats & usage)	* Based on last years declarations	* Private gear was not declared => underestimation
	* rules for access to zone	* Taking account of other activities in zone. * Can be changed at any time.	
7	**Rules for enforcement** * who * where * how * what	* DDBRA wardens * According to law	* Poaching occurs at night

At the end of the Session we agreed to meet again the following week to identify decision areas more systematically, to specify options for each decision area, and to determine a decision focus. We did not plan to evaluate the possible alternatives, leaving that instead to the Decision Conference in the following month.

From the perspective of the objectives of my intervention (see Figure 7-7 page 235), this first Workshop Session had established two important points:

First, the motivation for change had been initiated. By outlining and explaining the problems of the current and the expected regulation system for the first time in a systematic form on paper, and openly coming to the conclusion that the proposed regulation system were not going to enable the DDBRA to manage the fishery in a sustainable way, all the essential conditions for creating a motivation and readiness to change had been established.

The second important point of the Session was that effective collaboration between different departments of the DDBRA and between the DDBRA and DDI had been initiated. Participants felt satisfied that some progress had been made because a lot of ground had been covered, and they very much enjoyed the facilitated way of working as it allowed them to concentrate on content and discussion, while I ensured that group maintained its focus on the primary task. Evidence for this constitutes the fact that they explicitly supported me when I interrupted discussions that had started to get stuck and urged them to make a note of it move on.

8.2.1 Session 2: Decision Areas and Options

Between the two Workshop Sessions I met with de Graaf. We tried to include some more technical issues that de Graaf was concerned about, but also to experiment with the Strategic Choice techniques and to reflect, analyse, and anticipate the direction that we were going to take in the next Workshop session. I took one of the products of that experimentation, the poster with the Decision Areas and their options, into the next Workshop but very soon found out that participants did not really like working with them, and instead preferred to continue from where they left off.

The session started with a review of the work we had done the last time we had met. Dr Munteanu, the Director of the Natural Resource Department, who was unable to attend the previous session was briefed by Dr Baboianu and myself on what we had discussed the last time. One of the reasons why this could be done reasonable quickly was that we had displayed the posters along the wall, and could refer to them and pick out the most important points. Nevertheless, it took almost an hour of explanation and discussion between Dr Munteanu and the other participants before they all felt comfortable of each other's understanding as to where they had reached so far.

The main task of this session was to identify all the opportunities for choice between two or more different courses of action (Decision Areas) and to develop a full, but still realistic, list of options open to the DDBRA. One could have then evaluated the compatibility of the different options with each other and in that way generated a wide variety of different regulation packages for further evaluation. My idea behind this approach was to show that the proposed regulation scheme was only one of many more schemes open to the DDBRA. More specifically, my expectation was that this process would have further emphasised the point that there were very important inconsistencies in the proposed regulation scheme and that there are, in fact, alternative schemes that avoid them. If time had allowed, I planned to return to consider the aims of the regulation scheme, which we briefly discussed at the beginning of the first session, in order to elicit some more specific objectives of fishery regulation.[51]

The first Decision Area we discussed was labelled "Auction Type?" (see Figure 8-6). The form of notation was adopted from Friend and Hickling (1987). We noted that it was possible in principle to auction concessions for zones for the exclusive use of one company (as in the proposed regulation) or to auction concessions for a certain amount fish to several different companies within the same zone. The discussion of this point was rather long, but informative, as participants explained to each other their different understandings of how fishing operated in practice.

My main mode of intervention was to repeatedly ask what other decisions needed to be taken into account if they had to decide between the options they identified within each Decision Area. In this way we identified fourteen Decision Areas. As this analysis progressed, I realised that some of the options specified for the Decision Areas were not properly defined (for example, the options listed under "How do we protect the recruits?" were not strictly alternatives because they would always be employed in some combination), while some Decision Areas could be better specified (example "What gear ownership do we promote?" was probably better thought of as a Comparison Area (in the language of Strategic Choice) or an objective (in decision analytic terms)). There were also some Decision Areas, such as "what auction zone?" and "what type of monitoring?" which were probably too specific compared to the other issues that we were dealing with.

The main reason why I did not insist on specifying the Decision Areas more consistently is that an important transformation in the understanding and thinking of participants took place through this analysis and they were able to interpret the notes on the flip chart sufficiently well. The transformation that I am referring to relates to

[51] However, in the event there was not enough time for that, but we dealt with that in the Decision Conference.

the fact that participants were able to see that there were two generic roles open to the DDBRA: in addition to a command-and-control role which the DDBRA had been assuming until then as the only possibility, it was also possible that the DDBRA would adopt a more facilitative role, in which its 'policing' role was reduced and co-operation with fishing companies and fishermen increased. There are several underlined notes in Figure 8-6 that indicate this second role.

We ended this session by agreeing that we would briefly meet one more time to decide on the specific objectives and dates for a Decision Conference in which we would develop alternative regulation options which we would evaluate against common objectives and which we would present for further discussion or adoption at the Final Interdisciplinary Management Planning Workshop in the middle of October.

Figure 8-6: Decision Areas

Fishery Workshop, 12 September, poster I a,b

Decision Areas

Opportunity for choice in which two or more different courses of action can be considered

	Label	Decision Area	Options
1	Auction Type?	What auction type?	* One zone for each agent * Multiple agents within one larger zone -> better for enforcement.
2	Zone?	What auction zone?	* Lakes & Danube in Delta (Econ & Buffer Zone) * Razim & Sinoie Complex (Econ Zone) * Danube Arms (Econ Zone) * Black Sea (Econ Zone)
3	Tax?	What concession Tax?	* None * In fish * Lump Sum Fee on TAC * As a calculated equivalent * As a proportion of caught fish
4	Contract?	What Terms of Contract?	* Length: * 3 years (short) * 5 years (medium) * 10 years (long) * tradeable / non-tradeable * Facilities offered by DDBRA * restocking fingerlings * environmental investment facilities * tax exemptions
5	Duties?	What type of Duties?	* Only duties * Duties linked with benefits (incentives)
6	Gear?	What type of gear ownership do we promote?	* Economic agent ownership? * State companies * Family associations
7	Recruit?	How do we protect the recruit?	* Restricted areas * Closed seasons * Prohibited species * net eye-size * Min. Catch size
8	Stock?	How do we protect the stock?	* Regulation of effort (gear) or/and Total Allowable Catch
9	Enf. Type?	What type of enforcement?	* Only control * Only incentives * 70% control & 30% incentives * 30% control & 70% incentives
10	Enf. Who?	Who will do the enforcement?	* DDBRA * Other enforcement bodies (police, financial police)
11	Mon. Type?	What type of monitoring?	* Razim / Sinoie * North Danube Delta * South Danube Delta * Danube River * Black Sea
12	Mon. Method?	What Monitoring Method?	* Virtual Population Analysis (VPA) * Schaefer Method * VPA & Schaefer
13	Mon. Who?	Who does the monitoring?	* DDBRA effort & DDI stock
14	Performance?	How do we monitor the performance of the concessioning system?	* Through researchers * From the DDBRA * Through the fishermen

8.2.2 Session 3: Agreeing on the details of the Decision Conference

Looking back at the schedule of events summarized in Table 7-1 of Chapter 7, one can see that the Sustainable Economic Development Zones Workshop was held the day after the second session of the Workshops I organized on the fishery. I had already indicated in Chapter 7 that all the proposals made by the fishery experts, as presented in (Staras, 1994) and (de Graaf and Staras, 1994) were adopted, with the exception of those relating to licensing.

Though I expected that, it was still a good confirmation of the fact that we were working on a very important point. I was also very pleased that the Governor, Mr. Tarhon, had publicly given us the authority to work on the development of a fishery regulation scheme. However, I was not expecting the following:

We met, as agreed in Session 2, at Dr Staras' office to establish the dates for the Decision Conference and to agree on its objectives. Dr Staras, Mr de Graaf, Dr Baboianu, and Mr Constantin were present. Once we started to talk about participants, and timing, Mr Constantin announced that he would not be able to attend because that was exactly the time that he had to be in Bucharest at the Ministry of Finance and the Ministry of Privatization to present the concessioning system for approval. We were all quite surprised, most of all Mr de Graaf and myself, because it so clearly went against what we had established in Session 2.

We enquired about how this was possible and Mr Constantin's view (maybe supported by the others) was that our work on the fishery management issues was important, interesting, and worthwhile, but the DDBRA had submitted the request to meet with those Ministries a long time ago, and it takes many months before meetings are granted. Furthermore, postponing this meeting would mean that it would be impossible to organise a concession auction for the next season (in spring) because even arranging for a new meeting with the ministries would probably not take place till the new year. Mr de Graaf and myself argued that it was their, and in particular the Executive Directors' choice. If they went ahead and submitted the proposal we would see no point in continuing with this process, and Mr de Graaf would not return to Romania as agreed. After a short but intense moment, Dr Baboianu and Mr Constantin decided to withdraw the proposal and Mr Constantin announced that he would not go to Bucharest after all. I believe that this was the moment when the readiness to change had really been established.

After this session I met with the Executive Director of the DDBRA and we discussed the details of the upcoming Decision Conference. There were two main issues that needed to be dealt with: first, what the intended goal of the Decision Conference would be, and secondly, who would participate.

The Executive Director of the DDBRA decided that he wanted to focus on the licensing aspects because he thought that this was the most contentious and difficult aspect of the fishery management strategy. The specific objectives that we agreed on for the Decision Conference were as follows:

1. To review the progress made in the three preceding Workshop Sessions.
2. To establish long term fundamental objectives for inland and marine fishery management.
3. To agree on a set of preferred strategies for achieving the objectives.
4. To agree on a set of proposals for licensing inland fishing which will be presented for consultation at the Interdisciplinary Management Seminar on October 19 and to agree also on how these will be presented. If time allows, to consider wider strategies for fishery management.
5. To agree on the actions necessary to implement objectives 3 and 4.

We discussed participation at the Decision Conference and I earnestly pressed Dr Baboianu to consider inviting at least two higher level managers of private fishing companies, higher level managers from state fishing companies, NGOs, and other persons from the DDBRA, DDI, and others from Ministries who would be in position to criticise decisions or whose assistance he would like to have in deciding on the new licensing strategy. The persons Dr Baboianu invited are shown in Table 8-2.

Table 8-2: Participants at the Decision Conference

Dr Grigore Baboianu	Executive Director, DDBRA
Dr Mircea Staras	Scientific Director & Fish Biologist, DDI
Mr Nicolae Constantin	Licences Department Director, DDBRA
Dr Ion Munteanu	Natural Resources Department Director, DDBRA
Mr Eduard Ene	Scientific Officer, Natural Resource Department, DDBRA
Mr Ernst Sîrbu	Lawyer, DDBRA
Mr Cristocea	Director, Tulcea Fishing Company & Vice President of Romania's Fishing Company Association
Mr Gertjan de Graaf	Fishery Expert, Euroconsult
Mr Peter Hall	Decision Conference Facilitator, Enterprise LSE
Mr Axel Kravatzky	Facilitator, Euroconsult & London School of Economics

Following the choice of objectives and participants for the Conference I briefed Mr Peter Hall, the facilitator from the London School of Economics, and we agreed on the wording of a calling notice for participants (see Appendix, Section 10.1). In that invitation we outlined the objectives for the Conference and emphasized that the role of the facilitators is to assist with the process of analysis and decision making. We suggested that participants prepare a key-word outline of different options together with their advantages and disadvantages.

Mr Hall arrived two days before the Decision Conference so as to have time to meet with Dr Baboianu as well as members of the EBRD project team and left the day following the Conference.

8.3 *The Decision Conference Workshops*

The Decision Conference took place on the 12th and 13th of October 1994 in the conference room of the DDBRA. Mr Hall took the lead in facilitating and my role was that of co-facilitator and decision analyst. In the following description of the Decision Conference whenever I speak of "we", I refer to Mr Hall and myself. Both Romanian and English were used during the conference and I was also the main translator (since not all participants spoke English).

Dr Baboianu welcomed the participants, explained the objectives of the Decision Conference as I have shown them on page 256. Subsequently Mr Hall outlined the process that we were going to use over the next two days. Rather than continuing straight from where we had reached at the end of the preparatory Workshop Sessions, we asked participants to briefly describe some of the main concerns that they wanted addressed in this Decision Conference. We summarized the discussion, in keywords on a flip chart (see Figure 8-7). This made it easier for the 3 participants who did not take part in the previous sessions to link into the process and the group, allowed all to start contributing (for example Mr Cristocea added his concern that "that there was already legislation and regulation for fishery management, but that this needed to be applied in practice") and helped everyone to start thinking about objectives (I have discussed the reasons why this is important at length in Chapter 3 and 6).

Figure 8-7: Initial Key Issues and Working Agreements

Initial Key Issues	Working Agreements
True estimates of fish stock. System of licensing.	Focus on licensing Context of likely overall DDBRA strategy
Fit resource law to requirement in fisheries management Solution for 3 aspects: a) protecting resources b) economic use of resource c) legislation	Currently 40-50% of the high value fish are sold unreported on the black market Time scale of strategy at least 5 years
How to protect fish species of high economic value.	First consider from fisheries management point of view then consider legal aspects and political acceptability
How to apply current regulation in full.	Current legal position: 1. Only companies may be licensed 2. Only one licence per zone (area)
To establish maximum sustainable yield levels. Data reported by fishermen poor. To find the best way and time through regulation to achieve sustainable fish resource. Sustainable harvesting of fish resources. Unreliable fishing data (unknown volume of fish going direct)	

In order to assist the group to stay focused we asked them to establish some assumptions that they all agreed to for this Decision Conference (these are indicated in Figure 8-7 under the heading "working agreements").

The "focus on licensing" agreement was put forward by Dr Baboianu, as he wanted to ensure that the workshop did tackle the most thorny issue, while also acknowledging that there were other important issues to consider at another occasion. Mr Constanting added that he wanted the group to agree to focus on what would be likely developments in the overall DDBRA strategy, as opposed to proposals that look good but which are not implementable. In order to avoid renewed lenthy discussions about fish catch numbers, Dr Staras and Mr de Graaf proposed to start with the shared agreement that 40-50% of the fish catch is not reported.

It was significant that there was a consensus among the participants who were part of the preparatory workshops on wanting to evaluate the management options first from a fisheries management point of view and only afterwards introduce the existing legal and political constraints. It indicated that they were willing to go beyond their previous preoccupation with prevailing constraints. When we asked the group what time scale they wanted to consider, Dr Baboianu said without much hesitation "5 years". There was some laughter because the communist regime had frequently referred to 5year development plans, but even on reflection this was time frame that

Dr Baboianu was most comfortable with. His choice of the five year planning horizon also confirmed the hypothesis that he was a Stratum IV manager (see Chapter 5).

The group then went on to discuss the relationship between the objectives of the fishery and those of the DDBR. Participants defined the strategic objective of the DDBR to be: "Nature conservation and the restoration of fisheries resources." In terms of the fishery, participants identified three subsidiary objectives through which the main objective of the DDBR would be achieved:

- *Biodiversity Protection:* To protect existing fish populations with a high ecological value and restore the previous natural balance.
- *Fishing Regulation:* To achieve a licensing system which maximises the conservation value[52] of the fish biodiversity.
- *Sustainable Use:* To maximise economic potential and to achieve sustainable use of the fishery resources for local fishermen.

8.3.1 The First Model

Having established these three subsidiary objectives for fishery management in the DDBR, we then turned to develop licensing options and to evaluate them. This process started with resumé given by myself of the preceding fishery sector Workshops (referring to the posters from those Workshops were displayed on the walls of the conference room), highlighting their different stages and the main conclusions.

8.3.1.1 Developing the first set of alternatives

The following phase of the workshop dealt with the development of a first set of regulation alternatives. As indicated in the invitation to the decision conference (see Appendix 10.1 on page 316) all participants were asked to think of realistic alternatives. Their proposals show what aspects of fishery management they found important, it gives an indication of their values, and the perspectives with which they entered this process.

We started by asking participants to summarise the licensing scheme in operation at the time (which we called the **Current** system) and the one that the DDBRA and DDI

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[52] The term "conservation value" was introduced by Mr de Graaf as he explained that conservation meant "wise use", and that the fishing regulation should aim to maximise the value of both the caught fish and that left in the water.

had been formulating for the past year (which we called the **Proposed** system). By noting the features that participants used to describe and discuss these two schemes, we drew up a list of key differences. There were three main categories of features: the type of licence (for an area with a certain catch limit, for a certain time period, what fees were charged, etc); who was conducting the actual fishing activity (state companies with fishermen as employees or associations, small companies, or individual fishermen who owned their own gear); and how the fish was distributed and marketed (through companies at fixed prices, or auctions).

Participants identified many problems (already indicated in Figure 8-7) with these two proposals. We then asked participants to suggest other options that would address their concerns and have a better chance of achieving the fishery management objectives. As participants described and explained their preferred options we summarized them in two ways. First, we summarised them through an Option Name and a brief narrative, as shown in Table 8-3. Secondly, we noted the components that they mentioned, and set them down as "Key Differences" on four adjacent flip chart sheets, so that all the options and their differences were summarised in a table like format (see Table 8-4 page 273).

Table 8-3: The first set of fishery licensing options

Option 1 **Current** System	Twenty one licences are issued by the DDBRA free of charge. Those who obtained licences often pass them on to others and as result probably about 130 ´companies´ are operating in the DDBR. Enforcement of quotas is difficult, and management is impossible because companies provided either not information or false information.
Option 2 **Proposed** System (DDBRA & DDI)	DDBRA staff had worked together with the DDI on this for the past year and they had withdrawn it from the approval process, pending the result of this Decision Conference. In total 50 concession contracts (licences) were prepared, giving exclusive fishing rights for certain areas, and only companies are allowed to participate in the auction. The highest bidder agrees to pay a percentage of the value of the fish he declares (or a previously agreed minimum).
Option 3 **Direct** (Dr Staras)	Licences, for fishing quotas, are auctioned directly to fishermen who pay a fee on the quota they obtained. Fishermen auction their fish at the ´cherhanas´ to achieve the best price. The state fishing companies become service companies taking only a small percentage of the sale price.
Option 4 **Distribution** (Mr Cristocea)	Licences, for quotas and areas, are auctioned only to companies. The companies' distribution/marketing system is improved by opening more retail outlets, thereby increasing their income, and fishermen are paid more. Otherwise it is like Option 2.
Option 5 **Associations** (Mr Constantin)	Licences, for areas, are auctioned to companies and fishermen associations. Fishermen own their gear or lease it from the companies, who would also auction the fish for the fishermen. The companies therefore serve as distributors and service companies to the fishermen.
Option 6 **Margin** (Mr de Graaf)	Licences have a contract length of 20 years and are made transferable and inheritable. The idea is to introduce more competition as well as provide incentives and security for investments.
Option 7 **2 Improved** ("Governor")	During the groups discussion with the Governor the importance of rapid implementation was re-emphasised. Therefore, only the most important change was made to option 2: the licence fee is a fixed lump sum on the quota and not on the eventual fish caught.

Initially, four main alternative options emerged: Dr Staras and his colleague from the DDI (Mr Navodaru) proposed a licensing system in which quotas (instead of fishing areas) were auctioned **Directly** to the fishermen, and the licence fees being based on the total quota obtained (i.e., the Total Allowable Catch) instead of on the fish landed. They argued that this would ensure that the data reported was more accurate because fishermen had nothing to lose from declaring their real catch. Furthermore, they proposed that fishermen should be allowed to own their own gear and choose the Cherhana to which they delivered the fish. This licensing system would thereby combine modern fish stock assessment with the traditional Cherhana system that was in effect before the Communist period (specifically the Cherhana system in operation at the time of Antipa, 1890s to 1940s).

The Director of the Tulcea Fishing Company (Mr Cristocea) suggested auctioning licences for either areas or fishing quotas, depending on the size of the fishing areas in question. He also argued that as the fishing companies were presently undergoing a transition and that as competition between companies increased and their loss-making fish farming operations were taken out of operation, they would be able to improve their **Distribution** and retail operations, thereby increasing their own revenues also enabling them to pay fishermen more for their catch. While he did not express a clear preference for either licences for areas or quotas, the perspective which made this possible was most clearly expressed in his estimation how many licences would need to be issued under the prosposed system: between 1-30. In other words, there would be a consoldidation of the current fishing companies – even up to point of re-creating something like the former "Centrala Delta Dunarii"[53]

The Director of Licensing at the DDBRA (Mr Constantin) proposed to improve the Current system by allowing fishermen to own their own gear and to form **Associations** which could compete with the fishing companies in the auction. In order to reduce the price differential between the retail price of fish and what they receive from the Cherhanas of the fishing companies, the latter should be assisted in developing a wholesale auction system of the fish that fishermen delivered to them. This was therefore only a slight modificaction from the **Proposed** system – the most significant point being that associations would be included in the auction.

The fishery consultant (Mr de Graaf) argued that neither the **Current** nor the **Proposed** licensing system gave enough incentives for profit competition at the **Margin** because the contract length of licences was too short for individual fishermen or companies to feel secure about any possible investments (either in gear or in resource husbandry). He, like the participants before him, built on the proposals made by others and suggested that the contract length should be extended to around 20 years and be transferable or inheritable. This would mean that if the DDBRA decided that it was necessary to reduce effort, they would need to buy back licences rather than simply withdrawing them or lowering the TAC below what they really thought was appropriate. After hearing the explanation for the making licences transfereable and inheritable, Dr Staras and Mr Navodaru ammended their proposed

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[53] This is the name of the monopoly company that conducted all economic affairs in the Danube Delta during the Ceauseco regime – see Chapter 2.

alternative to include this feature as well. Mr de Graaf also explained that he put forward this particular alternative so as to represent the point of view of the eventual resource user. More specifically, he said that only if contract lengths were sufficiently long and tradeable, could the more productive fishing companies prove themselves afford to buy up licences of those who were less competitive.

In the early afternoon of the first day, the Governor joined the Decision Conference participants for about one hour. Dr Baboianu explained the process we were engaged in and asked him to give us a brief overview of his main concerns. The Governor explained that he was very glad that we analysed the problem in such a systematic and rigorous way because he felt that fishery was one of the most important and difficult problems that the DDBRA was dealing with. He emphasized that he wanted to "bring order" into the fishery, that management needed to be based on scientifically established facts, and most importantly, that action was urgently needed. Following this intervention by the Governor, participants developed an **Improved** version of the **Proposed** licensing system. The main idea was to replace single most damaging feature of the **Proposed** system – namely making the license fee a function of the declared catch – with a fixed lump sum fee on the TAC of the auctioned zone..

8.3.1.2 Developing an Objectives Hierarchy

In order to elicit the set of objectives against which to evaluate the licensing alternatives, we asked participants to discuss the trade-offs that a choice between the alternatives implied, why they preferred one over another, and other similar questions. Note that this process is not like the one recommended in the MSDA approach (see Chapter 3), where all participants list their different concerns. The emphasis here was on creating a shared understanding out of a reflective discussion on the key trade-offs.

In the course of that discussion, we, the Facilitators, noted (through keywords on flip chart) a series of different value dimensions that emerged. We then asked participants to reflect on these, add to them or change, and then to formulate these as objectives with a direction of preference and attributes through which they could be measured. Participants specified the following six objectives:

- "LEGAL DIFFICULTY: Minimize the extent to which current laws need to be changed or amended". Initially it seemed as though alternatives would either fall within the law or not, but Mr Sirbu pointed out for some alternatives, such as **Association**, the Government would only need to make an amendment by issuing a Government Decision.

- "ILLEGAL TRADE: Minimize the black market fish trade, measured through the expected price differential between wholesale market price and what fishermen receive when delivering fish at the fish collection points".
- "TIME: Minimize the time required for implementation of the first auction of licences, measured by the amount of preparation needed by the DDBRA, DDI, fishing companies or associations".
- "BIODIVERSITY: Maintain or increase the diversity of the fish stock in the ecosystem, measured by the extent to which the licensing system encourages selective fishing" (i.e. what species are caught, what size/age, and respect for prohibition periods).
- "SUSTAINABLE INCOME: Maximise the degree to which the licensing scheme promotes the sustainability of income for the local population through the maintenance of the fish stock (ie, protect the overall fish stock, as opposed to diversity of the fish stock, from overexploitation) and the access of local fishermen to it."
- "DATA COLLECTION: Maximise the degree to which the licensing scheme promotes access to data on total effort and total catch, as measured by the price and organizational incentives faced by fishermen and fishing organisations."

Before ranking these objectives in order of importance, we sought to ensure that the objectives satisfied the mutual preference independence condition that is necessary in a simple additive Multi-Attribute Utility Model. For this we asked several questions about participants' preferences between two attribute levels on one objective while holding a third attribute scores on an different objective constant (see Chapter 3 for more details about the technique). For most objectives this condition was satisfied without any major difficulty, but for two it required some careful thinking and precise definitions.

In the case of the BLACK MARKET and DATA COLLECTION objectives, participants (especially Mr Constantin and Dr Staras) insisted that these were two different dimensions (eg. illegal trade can be low but data availability still poor due to organisational problems), and that the definitions they eventually agreed on, enabled them to make preference statements such as 'we prefer to reduce black market trade even if this diminishes data on total effort and catch are available.' In the case of the

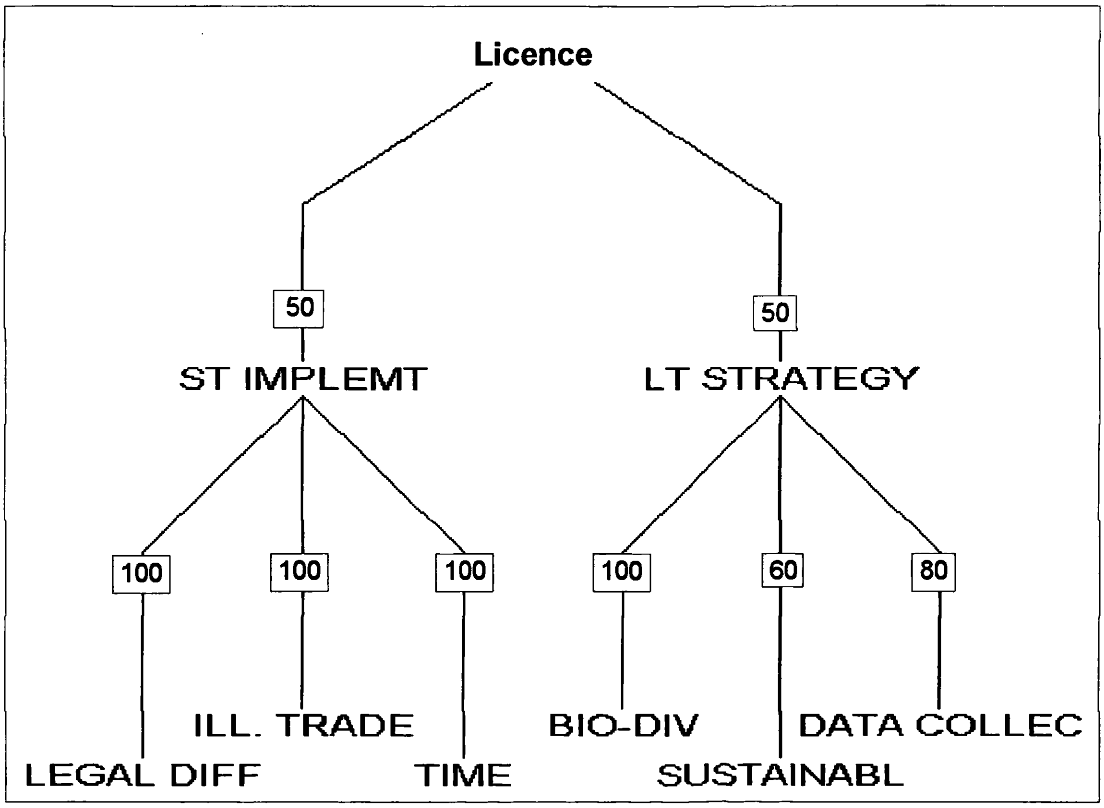
BIODIVERSITY and SUSTAINABILITY objectives, a re-definition was necessary because initially both objectives included the attribute measure of staying within the TAC, but it was not easy to distinguish between the effects on biodiversity and total fish stock (the latter primarily thought of in terms of as the basis of incomes).

Having alerted participants to the dangers of double counting or the incoherence which could be brought about through preference aggregation through addition in cases where preference independence did not exist, and the care that was needed to take when evaluating alternatives (see Chapter 3 for more details), we proceeded to suggest to the participants that it seemed to us, the Facilitators, that participants also talked of one further trade-off: the need or the difficulties of short term implementation of a licensing strategy, and the features of the licensing schemes in terms of a longer term considerations. We pointed this out to the participants and they found it a helpful intervention. As a result, they then proceeded to group the six objectives into Short Term (ST) and Long Term (LT) Strategy objectives. The result was that participants had developed the first objectives hierarchy (shown in Figure 8-8).

One of the most interesting aspects about this hierarchy of multiple objectives was that it reflected a change in perception, or a transformation in their view of the fishery management problem, because from this point on all participants felt much more comfortable in talking about future management strategies even in the light of current restrictions and limitations. It transformed in particular the difficulty of the legal constraints, which led some to argue earlier that it was futile to discuss licencing aspects which did not strictly fall within the current law. The effect was greatest with Mr Constantin because once his initial key concerns about the whole process – namely legal considerations and the time frame for implementation were noted, he did not mind exploring other avenues.[54] The grouping also enabled Mr Cristocea, the company director, to go along with the evaluation as he argued that "we will see what happens when we give these objectives weight and when we compare the alternatives."

[54] Evidence that those were his main concerns can be found in the details of his proposed alternative, **Association**, as detailed in Table 8-. The main difference to the **Proposed** and **Current** alternatives was that the number of licences increased from 50 to 60 (in other words about 10 associations would also be allowed to participate). Keeping the other features as in the **Proposed** and **Current** alternative meant that they would score highest on LEGAL and TIME objectives.

Figure 8-8: First Objectives Hierarchy and Weights



Note: This is a screenshot of the computer generated diagramme that we displayed in the Decision Conference (HIVIEW for Windows). The boxes with numbers refer to importance weights (see Section 8.3.1.3)

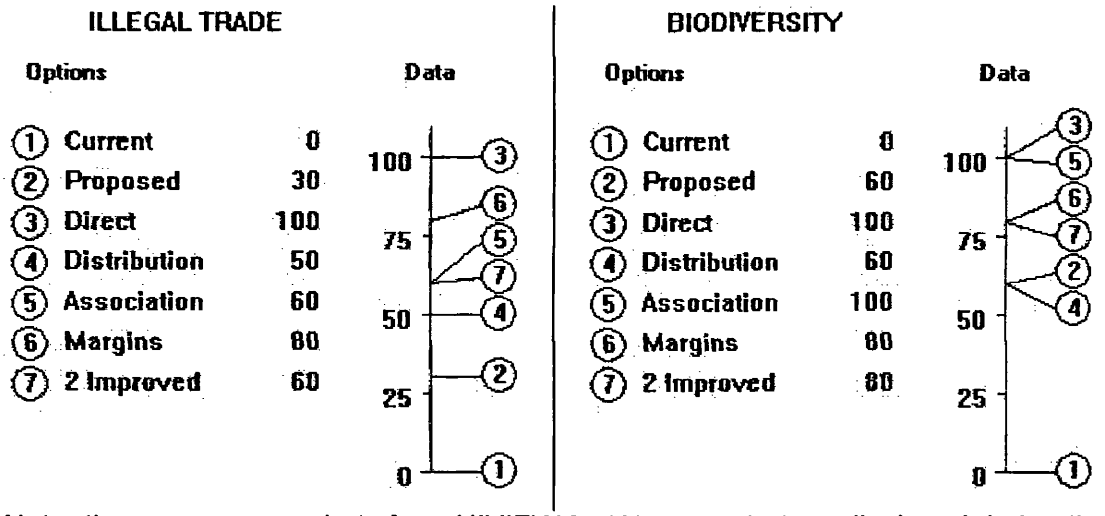
8.3.1.3 Evaluating the Alternatives

The evaluation of alternatives consisted of three stages: first, they compared the alternatives on each of the objectives separately, then they assigned importance weights to the objectives, and in the third stage, participants explored the inconsistencies between the model results and their intuition about which options were most preferred. For the third stage we used three main techniques: maps of various parts of the model, sensitivity analysis and direct comparisons of option pairs.

Our explicit intention in employing this process was to explore any differences in opinion in a constructive, or generative, way. We emphasised that participants were not asked to reach compromise positions with regard to any particular score, but that the aim was to develop a consensus licensing strategy for the DDBRA which took into account their concerns and differing views on what was desirable and likely to happen.

To illustrate the process by which participants assessed the relative preference between licence scheme options on each of the objectives, I will use the example of the ILLEGAL TRADE and BIODIVERSITY objectives (see also Figure 8-9). In the preference scales used, 100 represented the most preferred option, and 0 the least preferred. For example, on the ILLEGAL TRADE objective, **Association** was scaled at 60 because participants judged the difference in illegal trade reduction compared to that of **Current** (0) to be one and a half times as important as its difference from **Direct** (100). Similarly the importance of the difference in illegal trade reduction between **Association** (60) and **Proposed** and between **Proposed** and **Current** (0) was judged to be equal. As a result, **Proposed** was scaled at 30. To ensure consistency and an equal-interval scale, other differences between intuitively estimated illegal trade reductions were compared and revisions were made so that the scales reflected the group's views accurately. In the case of **Distribution**, only the Director of the Tulcea Fishing Company argued that there would be significant reduction in illegal trade reduction (giving it therefore a score of 50 - others argued that illegal trade under **Distribution** would be closer to **Current**) and so we noted that for further exploration through sensitivity analysis.

Figure 8-9 Illegal Trade and Biodiversity Scores, 1st Model



Note: these are screenshots from HIVIEW for Windows that we displayed during the Decision Conference.

In the case of the BIODIVERSITY objective, participants judged the options **Direct** and **Associations** which relied largely on licences for quotas were most preferred because they allowed fishermen to move between lakes and therefore were most encouraging of selective fishing. The **Current** system was judged to be worst in this respect (as on all other objectives). The effects on selective fishing brought about by options **Proposed** and **Distribution**, which introduced some degree of control to the fishery, were judged to be more than half as important as the effects on selective fishing brought about by the most preferred option (**Direct** and **Association**). Using similar reasoning, participants thought that the effects of **Margins** and **2 Improved** should be rated at 80 (half way between the effects of the most preferred options and

Proposed and **Distribution** because even though they were using area licences, the licence fees were based, like the most preferred options, on the TAC of the area and not on the declared fish catch - the latter, they thought, would encourage black market activity in which prohibited fish sizes or species were more easily traded).

While participants rated their relative preference between options separately on all objectives, we asked them to ignore the relative differences in importance of the objectives themselves. In other words, all preference scales were of equal size - from 0 to 100.

The complete model and the notes made during the Decision Conference of the rationales for the different scores are presented in Appendix 10.4 (starting on page 321). Among the most noteworthy dynamics were the following: on the TIME objective **Distribution** received a very high score of 90% at the urging of the Company Director because he insisted that it would take very little time for the companies to improve their retail networks. Others, particularly Mr de Graaf, were more skeptical that the conditions could be brought about so quickly. The score was highlighlighted for subsequent sensitivity analysis.

The discussion on the BIODIVERSITY turned out to be significant in two respects. First, the need to be exact about what is meant by Biodiversity, and which parts are valued enabled participants to explain to each other what they had in mind when they used that term. For Dr Baboianu biodiversity referred to the Danube Delta ecosystem before the intervention of man. For Dr Staras it had more to do with the total number of fish species and especially the number economically valuable species. For Mr de Graaf it was the clear water species whose habitats were endangered by eutrophic Danube water. For Mr Munteanu it was the total number of species. For Mr Cristocea it was the maintenance or re-establishment of the traditional mix of species that used to caught in the Danube Delta.

The second reason why the discussion was important is by giving **Direct** and **Association** 100% DDBRA and DDI participants realized that one of their most important objective could be realized even when they were not fully in control of the whole process/information (for example, with **Association** it was quite likely that illegal trade would still prevail (that is why **Association** scored only 50% on that objective)) – here Biodiversity was more a function of the interest of the individuals rather than the rigour of the DDBRA enforcement. This realization made the idea of co-management which Mr de Graaf had been speaking about much more palatable or imaginable. This was re-enforced by Mr Constantin's explanation that one of the reasons why the **Current** system was bad for BIODIVERSITY was that through the prevailing subleasing practice individual fishermen and companies did not know who was allowed to fish were and so "peer enforcement" became impractical.[55]

In the next step, we asked them to assign relative importance weights to the objectives (i.e. rescale the preference scales themselves). For this task they needed to consider two aspects at once: first, how large the difference between the most and least preferred option on a particular objective was, and secondly, how much they cared about the objectives themselves. To facilitate this judgement, we employed the "swing weight method" (see for example von Winterfeldt and Edwards, 1986). The initial question we put to them was as follows: "Imagine that all objectives were at their worst possible level - according to the judgements you made so far, in the DDBR this happens to be the level of the **Current** scheme. If you were able to change only one to its best level, and all others remained at their worst, which one would it be?"

Figure 8-8 shows that participants judged all three of the Short Term Implementation objectives to be of the same, highest (100), importance, while among the Long Term Strategy objectives only the difference in swing from its worst to the best level on the BIODIVERSITY objective was considered to be equally important (i.e. 100). Participants rated DATA COLLECTION at 80 and SUSTAINABLE INCOME at 60.

Sensitivity analysis showed that in all cases **Margins** came out as the apparently preferred choice and that the proportion of overall weights (out of 100) that needed to be placed on any one of the objectives to had be increased by more than three orders of magnitude in order to get the preferred choice to switch (mostly to **Direct** – only for LEGAL objective **Margin** dominated throughout, and for the TIME objective the switch was to **2 Improved**).

Participants were surprised to see how robust the outcomes were. Another aspect which Mr de Graaf drew to the attention of his colleagues in the workshop was that the weights they had allocated thus far represented a rather "technocratic" or "conservative" set of priorities. As evidence he used the fact that the one criterion which dealt with the direct interests of stakeholders, namely SUSTAINABILITY of income, received the lowest weight. The others took this comment seriously and eventually Dr Baboianu responded by saying that the lower weight they did not mean to say that it was not important, but that they merely followed the instructions given

[55] Mr Cristocea used that same explanation to argue that with the **Distribution** alternative where there would be fewer companies in operation, the confusion would be cleared up and enforcement made more easy and consequently BIODIVERSITY conservation significantly aided.

by the facilitators, namely to indicate the extent to which they wanted to the objective to influence their decision in view of the difference of the impact their final choice.

Since there was only one hierarchical level in this model which could be more easily evaluated using a visual representation of the judgements already made (shown in Figure 8-11), we assigned equal weight to the ST and LT objectives level, and proceeded to the next phase of the evaluation process.

Up to this point Mr Hall and I facilitated the groups' work by working mostly with flip charts which we continued to post on the walls of the conference room for easy reference and amendment. As we were building the model on paper, Mr Ene assisted us by entering the same information on a laptop computer into HIVIEW, a Multi-Attribute Utility Theory decision analysis programme developed at the LSE specifically for use in Decision Conferences.

Figure 8-10: LT Strategy Scores and Weights - model 1

LT STRATEGY Node

Add

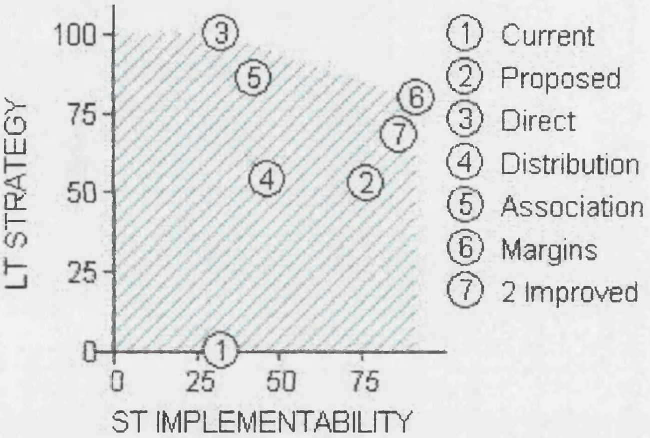
BRANCH	WGHT	Current	Proposed	Direct	Distribution	Association	Margins	2 Improve	CUM
* BIO-DIV	100	0	60	100	60	100	80	80	20.8
* SUSTAINABL	60	0	60	100	50	70	80	60	12.5
* DATA COLLEC	80	0	40	100	50	80	80	60	16.7
TOTAL		0	53	100	54	86	80	68	50.0

Figure 8-10, is a screenshot of that programme, and it shows the window in which importance weights are entered (in the WGHT column). The programme also normalizes the weights, by dividing each by their sum so that the numbers add up to 1.0, and then displays a weighted average of the scales, using these normalised weights, in the TOTAL row of the figure. The last column, CUM (standing for 'cumulative weight'), showed the calculated overall weight that each criterion had in the complete model. This screenshot also showed the preference scores assigned to the alternatives on each objective, and could be used in this way for consistency checks.

In this way, the weighted averages of all Long Term Strategy (LT) objectives provided a single LT scale, and similarly a single Short Term Implementation (ST) scale was constructed. Using these index figures, we then displayed a scatter plot of

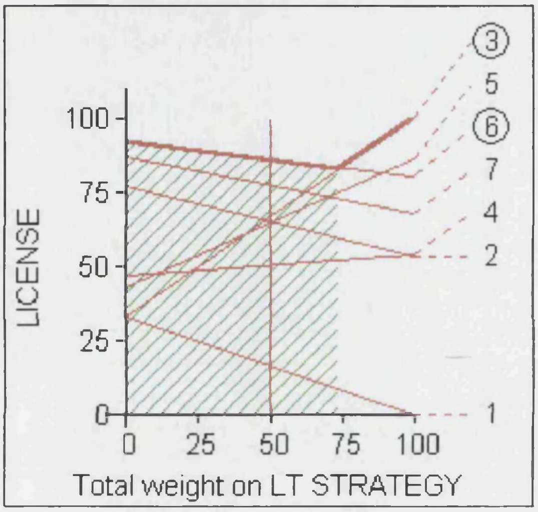
ST Implementation versus LT Strategy, see Figure 8-11, which showed all licensing schemes in terms of different abilities to satisfy the ST and LT objectives.

Figure 8-11: Comparing the options of the first model in Short Term versus Long Term space



Direct was the most attractive in terms of LT Strategy objectives, while **Margin** was most preferred in terms of the ST Implementation objectives. If the decision analytic model developed up to that point would have been requisite (see Chapter 6), then the prescription of the model would have been that one of these two licensing schemes should be chosen. As the sensitivity analysis shown in Figure 8-12 indicates, when equal weight is given to ST and LT objectives, then option 6 (**Margins**) is preferred. In fact, **Margins** would have been the preferred option as long as LT objectives were considered as up to three times more important than ST objectives. Figure 8-12 also shows that licensing scheme 7, **2 Improved,** dominated licensing schemes 1, 4, and 2, on both LT and ST objectives. These implications were somewhat surprising to participants and this indicated that the model was not yet requisite (either some objectives were missing or an objective could be somewhat re-defined).

Figure 8-12 Sensitivity Analysis on LT Weights, 1st Model



After examining the sensitivity of this outcome to differences in views noted earlier, we proceeded to examine the relative strength of options through pair-wise comparison of different licensing scheme options. Figure 8-13 illustrates one such comparison.

Figure 8-13 Comparing the weighted preference differences of the Direct and Margins licensing scheme options

Direct vs Margins

	MDL ORDER	CUMWT	DIFF	WTD	SUM
LT STRATEGY	BIO-DIV	20.8	20	4.17	4.17
ST IMPLEMT	ILL. TRADE	16.7	20	3.33	7.50
LT STRATEGY	DATA COLLEC	16.7	20	3.33	10.83
LT STRATEGY	SUSTAINABL	12.5	20	2.50	13.33
ST IMPLEMT	TIME	16.7	- 95	- 15.83	- 2.50
ST IMPLEMT	LEGAL DIFF	16.7	- 100	- 16.67	- 19.17
		100.0		- 19.17	

On aggregate, **Margins** was preferred to **Direct** because it scored much better on two of the six objectives (TIME and LEGAL DIFFICULTY). As a result of the discussion centred around those objectives, participants started to wonder if it was not possible to create some other licensing scheme which combined the relative strengths of both options. Furthermore, it seemed that the existing objectives omitted some important considerations: under the **Margins** option licences were issued for a much longer time (20 years instead of 5 years in **Direct**) and this meant that there was much greater security of investment for fishermen or companies who considered participating in auctions, while from the DDBRA's point of view, this difference also meant that the technical and administrative difficulties increased (since long term licences meant that any effort reduction needed to be executed through buying back licenses).

At the close of the first day we briefly reviewed the steps we had gone through in developing the model, gave participants printouts of the HIVIEW model (preference scores, objectives, weights, sensitivity analyses, and pair-wise option comparisons), and agreed to meet the next morning. The task for the next day was to build on the progress made thus far, to develop better licencing strategies, and to agree on a option that the Executive Director could put forward at the Final Management Planning Workshop the following week.

In terms of the overall transformation process and the coherence of the decision making process the first decision conference day had achieved significant results. One of the most tangible outcomes had been a clarification and beginning of development of shared understanding of what biodivirsity conservation meant in the DDBR. It was also surprising that only two options (**Direct** and **Margins**) dominated the others and that by choosing one over the other one had to give significantly greater weight to either ST or LT. The discussion about what alternatives assisted with the conservation of biodiversity and the fact that the results as presented above were derived from a model in which they had placed such great weight on the more conservative dimensions, were probably encouraged participants to try to make the model more complete so that it reflected their intuition better, to make some more differentiated judgements with respect to scores as well as weights, and to experiment with some more innovative alternatives.

Figure 8-14: Score summary of model 1

Add

BRANCH	Wt	Current	Proposed	Direct	Imp. Distrib	Association 2	P. Margin	Improved	CumWt
ST Implement	50	29	75	36	44	45	91	82	50.0
LT Strategy	50	0	58	100	56	88	80	71	50.0
TOTAL		14	66	68	50	66	86	77	100.0

Table 8-4: Fish Licensing Options

Nr	Option Name	Auction Type	Fee on What	Fee Type	Contract Length	Nr of Licences	Distribution Channels	Market	Gear/Boat Ownership	Price Determination
1	Present Situation	One per zone with sublease	No fee	n.a.	1 year	21 licences but 130 'companies'	Officially: only through companies fixed price to fishermen	Companies are price takers	Companies own gear and boats. Fishermen may own or rent gear only if in private companies.	Average / kg: Fishermen 200; Interest 200; Investments 200; O&M 150; Salaries & Social 150; Profit 150; Wholesale price 1050; Consumer price 2000
2	Current Proposal: Area licensing to fishing Companies	as 1 without sublease	18% of catch or fixed minimum	Monthly (varying with catch or 10% of annual minimum in advance)	5 years Not transferable Not inheritable	50	as 1 & tighter enforcement	as 1	as 1	as 1
3	Quota licensing direct to fishermen	Quotas in Complexes	Fee on quota	Monthly fixed instalment (indexed)	5 years Transferable Inheritable	600	Auction at 'Cherhana'	Free market	Fishermen own or rent	Cherhana' takes 10% for distribution and service
4	Area/Quota licensing for companies with improvement of fish distribution through retail trade	Area and Quotas depending on lake size	as 2	as 2	as 2	1 to 30	as 1	as 2 with more shops for companies	as 1	as 1 only that fishermen receive more since company sells for more
5	Area licensing to fishermen associations	as 2	as 2	as 2	as 2	60	as 3	as3	as 3	as 3
6	Area licensing with profit competition & invest. security	as 2	as 3	as 3 but yearly	as 3 but 20 years	as 2	as 3	as 3	Smaller companies and fishermen own gear and boats	as 3
7	Area licensing with quota fee	as 2	as 3	as 3	as 2	as 2	as 2	as 2	as 2	as 2
8	Best Strategic: advantages of 1-7	Area and/or quota. Co-management of stock.	as 3	as 3	as 3 but 10 years	400	as 3	as 4	as 3	as 3
9	Phased strategic: best within law + 8 as pilot	as 2 + trying to include smaller complexes + pilot 8	as 8	as 8	as 2 but 1 year	50-100	as 2 + Pilot 8	as 4 + competition by pilot	as 8	as 2 except for those owning gear or in pilot

Note: Options number 8 and 9 in this table refer to the options developed on the second day (described in Section 8.3.2)

8.3.2 The Second Model

8.3.2.1 Developing new options and identifying additional objectives

At the start of the second Decision Conference day, participants began to develop an 8^{th} option by trying to combine all the best features of the previous seven. The process of identifying these "best" features involved both systematic comparison of option pairs (as illustrated in Figure 8-10,Figure 8-11, Figure 8-13, and Table 8-4), as well as more intuitive and holistic judgements about desirable features. This option was supposed to represent the management option that participants considered most appropriate for the DDBR in the longer run, and towards which the DDBRA should work. The key difference to previous occasions where they talked about how the fishery should be managed (perparatory workshops and first decision conference day) was that now they were attempting to derive from their previous analysis a description of how they would thought the fishery could and should be managed in about 5 years time. A 9^{th} Option, which was modification of the 8^{th} was also developed, and it had the advantage of allowing the DDBRA to implement it immediately (see also Table 8-5).

Strategically the **Best** option would be one in which both zones and quotas were auctioned. For larger lakes or lake complexes, licences should be based on quotas and several fishing companies or associations would be given access within it. For these resource systems the DDBRA together with the DDI determined the annual TAC. For smaller lakes or lake complexes, licenses should be for the area. The rationale behind this is that individual fishermen or their families would form an association (so that they can participate in the auction) and they would be given the responsibility for 10 year periods to look after the fish stock (building on options **Direct**, **Association**, and **Margins**).

This particular combination was first put forward by Dr Baboianu. Mr Constantin and Dr Staras then supported his proposal explaining that for the purpose of ensuring that the fish stock is maintained it was sufficient if they received accurate information on the landed catch and the effort with which that was obtained. Mr de Graaf went to on to comment that this was precisely what he had in mind when he referred to co-management, and that his experience in Bangladesh, Vietnam, and Africa suggests that the proposal was feasable. Mr Constantin, with support from Mr Munteanu, also explained that fishermen's associations were in a better position than individual fishermen employed by larger fishing companies to take on the responsibility of enforcing their own fishing rules because they would be in more frequent and regular contact with each other, most likely be from the same village. Furthermore, given the 10 year contract then their interest is to enforce and monitor the activities of their fellow fishermen so as to ensure that the yields of the areas their association had access to would be maximized. The main role of the DDBRA in such a co-management arrangement would be to provide some monitoring and enforcement support, and to give scientific advice when necessary. The fee for both quota and area licences in this scheme would be based on the TAC and not on the catch declared (as in options **Direct**, **Association**, and **2 Improved**). The DDBRA would encourage fishing companies to allow the fishermen they employ to own their own gear and to improve their marketing and distribution network (as in options **Direct**, **Distribution**, **Association**, **Margins**). Both of these measures were designed to improve the efficiency of the fishery economy in the sense that it would encourage greater competition, reward quality in product and service, and reduce the price differential between what the fishermen gets and the wholesale price.

One of the problems was that participants realized that there were not many ways in which the DDBRA could actually 'encourage' fishing companies to initiate or follow through with such a change by using the command-and-control measures relied on so far. Instead, Dr Baboianu and Dr Staras thought that once fishermen and companies would experience the benefits a new regulation would bring, then they would be more inclinded to go ahead with it and transform their own role. The problem, however, was how to minimize the resistance to any change? On the basis of this discussion we suggested that they were probably talking about another criterion that should be added to the objective hierarchy: "political acceptability".

A further criterion that had also emerged from the earlier discussion had to do with the different levels of "bureaucracy" in the administration of the licensing scheme as Mr Constantin was discussing the procedures and difficulties associated with the different alternatives. Mr Cristocea was mostly observing and reflecting while the **Best Strategic** alternative was being developed. However, once the question of the 10 year time frame for the license came up, he became more involved and made reference to the comparison between **Direct** and **Margins** on the previous day where it was noticed that the longer the time frame, the greater the security of the

[56] Participants did not actually use the terms "transaction costs", but they did refer to this idea as they described many of the features that I discussed in the NIE Section in Chapter 4.

investment. This is why he favoured the inclusion of this aspect as an additional criterion in the objective hierarchy. The three additional objectives were defined thus:

- "POLITICAL ACCEPTABILITY: Maximise the political and social acceptability of the licensing scheme." This objective would be measured through the extent to which it eliminates conflicts of interest in short term or provides means to deal with them (i.e. the latter is one part of transaction costs or NIE principles: conflict resolution mechanisms).[57]
- "BUREAUCRACY: Minimise the administrative complexity of the licensing scheme, as measured by the complexity of the designing, implementing, enforcing, monitoring, and updating licensing system" (i.e. transaction costs).
- "SECURITY FOR INVESTMENT: Maximise the extent to which the licensing scheme secures the investments made by auctioneers, as measured through the length of the contract and the transferability and inheritability of the license."

Before turning to the evaluation of this licensing scheme against all nine objectives, participants created a 9th option, which they wanted to be better on at least three of the five ST objectives: it needed to fall within the current law, be politically more readily acceptable, and take less time to implement. The option they created was as follows:

Initially the DDBRA re-designates the 50 fishing areas that it has already identified so as to include a series of smaller lake complexes which a single fishermen association could bid for. In order to gain momentum for transformation, as well as gain some concrete experience and evidence for the feasability of **Best Strategic**, the DDBRA and DDI initiate at the same time a *pilot programme* for a limited area in which they auction quotas directly to individual fishermen or associations. The second part of the pilot programme is to experiment with different ways of organizing the auctioning of fish at a fish collection point (cherhana). In both cases, the fees for the license are based on the TAC and paid in monthly instalments that are indexed to avoid depreciation through inflation. The contract length of the license is limited to one year in order to set a clear signal that this is a **Phased** introduction of the **Best Strategic** licensing scheme.

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[57] As Appendix 10.5 shows, participants used mainly first part of attribute in sense of minimizing resistance to implementation of scheme, but second part can also be seen in option 9.

Table 8-5 The second set of licensing schemes

Option 8 **Best Strategic**	Auction by zone and/or quota. For smaller lakes that contain several allocated quotas seek and promote active collaboration in management with the fishermen (co-management). The licence fee is fixed and based on the quota auctioned (paid in instalments which are indexed). The licence is for a longer term (10 years), as well as transferable and inheritable. The character of the state companies shifts to distribution and service (due to market conditions and economies of scale). They allow fishermen to own and rent boats and gear. Only local active fishermen may be employed.
Option 9 **Phased Strategic**	One licence per zone is auctioned. There are small zones, suitable for fishermen associations (which form themselves into companies in order to be able to participate in the auctions). The licence fee is based on the quota the auctioned zone contains (the fee is payable in advance in indexed instalments). The contract length is short (1 to 3 years) in order to allow for possible adaptations in the law and prevent system rigidities taking root. Start Option 8 as pilot scheme by changing one cherhana to an auction house (ensuring it is large enough to be economically feasible). Do everything necessary to move as quickly as possible towards Option 8.

8.3.2.2 Re-evaluating the licensing strategies

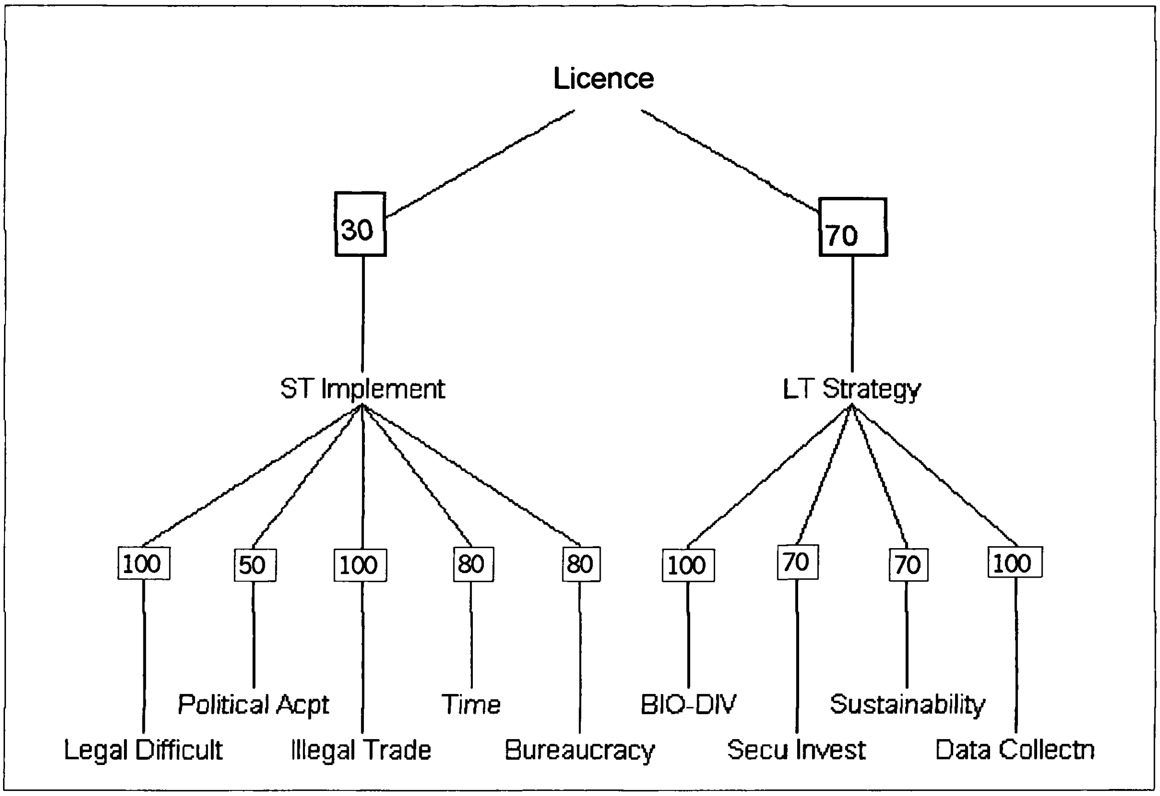
Having two further licensing strategies and additional objectives in the model meant that all options had to be re-evaluated on all the objectives and new importance weights had to be assigned. The final objectives hierarchy is shown in Figure 8-15 and an example of the evaluation of options against individual objectives is illustrated in Figure 8-16. These figures illustrate three important aspects of the Decision Conference process.

First, it was very easy and quick to make the changes to the objectives hierarchy, the preference ratings and the weights, and then to work with model results (discussed below). One of the positive effects this flexibility was that the momentum of the group's work could be maintained.

Secondly, importance weights were more varied than in the first model of the first Decision Conference day, and this reflected greater ability of participants to differentiate between objectives, more familiarity with the method and the techniques, but also a real transformation of their understanding. Most significant was the discussion surrounding the allocation of a weight of 50 to POLITICAL ACPT. Dr Baboianu argued that he had come to realize that the fishermen, the companies, etc were basically resistant to *any* change – it did not seem to matter too much what the content of the proposed change was. Furthermore, he emphasized that for him the "management point of view" which had started to figure highly in the discussion since the preparatory workshops was very important because he thought the DDBRA has a wider responsibility to society than simply catering to individual interests in the short term. The other participants agreed, referring specifically to the disillusionment that they had all developed the over the past few years.[58]

Thirdly, we took special care to capture the participant's rationale for their preferences and weightings. These notes were used when participants re-examined the ratings for consistency and were then available when the model was printed as an aid memoire for the rationale used.

Figure 8-15: Final Objectives Hierarchy and Weights



[58] Because much was promised since the revolution of 1989, but little had actually been accomplished

Figure 8-16: Illegal Trade Criterion

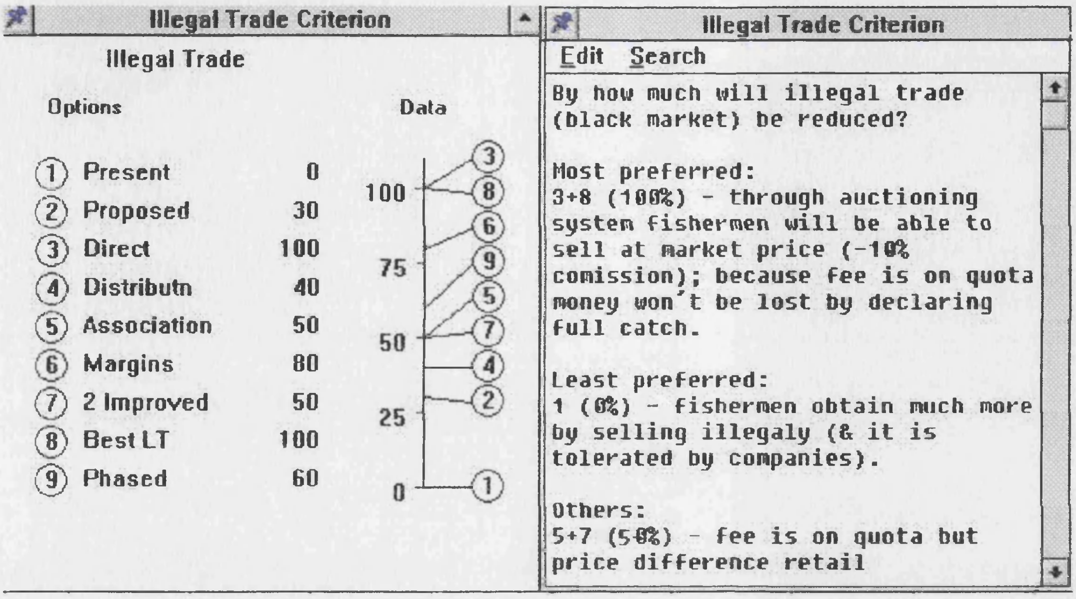


Figure 8-17: Short Term Implementation Scores

ShortTerm Implementation Node

Reset Add

BRANCH	WGHT	Present	Proposed	Direct	Distributn	Association	Margins	2 Improved	Best LT	Phased	CUM
* Legal Difficult	100	0	100	0	0	50	100	100	0	88	7.3
* Political Acpt	50	1	50	40	40	40	90	70	90	100	3.7
* Illegal Trade	100	0	30	100	40	50	80	50	100	60	7.3
* Time	80	100	100	0	90	20	75	100	0	85	5.9
* Bureaucracy	80	90	0	100	20	40	60	40	100	50	5.9
TOTAL		37	57	49	36	41	81	72	55	75	30.0

In the column furthest to the right (CUM) the cumulative weights of the four ST Implementation attributes are listed. They indicate the proportion of weight the attributes have in the overall model. Some of the notes taken during the scoring process, indicating why the various scores where given, are listed below:[59]

"Political Acceptability: To what extent is the licencing scheme politically and socially acceptable? To what extent does it eliminate conflicts of interest?

[59] A complete report of the entire second model and the online summary made for all the alternative rating is presented in Appendix 10.5.

Most preferred: 9 because it is introduced gradually. The pilot experiment will most probably demonstrate that with this licensing scheme there will be a net gain for everyone: professional fishermen will earn just as much or more than they currently do; fishing companies, who will need to be restructured anyway, have a viable future as distributors (auctioning & retail if they want to) and servicing companies. A good case can be made for its appropriateness from a fisheries management point of view.

Least preferred: 1 (1%)[60]- while many gain from the current confusion, everybody can gain from a clarification of the status quo (either consolidating current position or more substantial changes)

Others: 2 (50%) - intermediate between 9 & 1. Companies would consolidate position, fishermen could continue with current practices (employment + benefits + money from selling on black market). Not very dramatic changes from current situation. 3+4+5 (40%) - a little bit worse than 2 because: under 3 radical change for companies and likely conflict between companies and fishermen; under 4 fishermen will not gain very much more; under 5 associations would have to compete with companies who have monopolistic position. 7 (70%) - like 2 but more justifiable from management point of view. 6+8 (90%) - just as good as 9 but it is not gradual, and legally not possible.

Figure 8-18: Long Term Strategy Scores

Long Term Strategy Node

Reset | Add

BRANCH	WGHT	Present	Proposed	Direct	Distributn	Association	Margins	2 Improved	Best LT	Phased	CUM
* BIO-DIV	100	0	50	80	50	80	60	60	100	100	20.6
* Secu Invest	70	0	20	80	60	60	100	20	90	90	14.4
* Sustainability	70	0	50	83	42	58	67	50	100	100	14.4
* Data Collectn	100	0	40	100	50	80	80	60	100	100	20.6
TOTAL		0	41	87	50	71	75	50	98	98	70.0

Figure 8-19 shows the strategy options plotted in terms of their ST Implementation LT Strategy objectives. As expected, strategy 9 was in the top right hand corner, meaning that it was most preferred on both ST and LT objectives. It was just as good as 8 on LT, and while a little bit worse than 6 on ST Implementation, but much better

[60] The score of "1%" is the result of entering the score for the alternative using the graphical input device on the 'thermometer" scale.

on the LT Strategy than the latter. Depending how much weight one placed on ST and LT, one would adopt either **Margins** or **Phased**. **Best** is not possible due to the current legal position.

Sensitivity analysis, such as that illustrated in Figure 8-20, showed that Phased (option 9) was preferred with a relative importance weight of 50% of the model on ST Implementation, and that option 6 would become most attractive if this weight were increased to over 75% of the total importance in the model. While there was some discussion over what the appropriate ratio should be, none of the participants thought that more than three quarters of the model weight should be placed on ST Implementation (and only 25% to LT Strategy). In fact, participants were convinced that more weight should be given to LT objectives.

Figure 8-19: ST Implementation versus LT Strategy space, Final Model

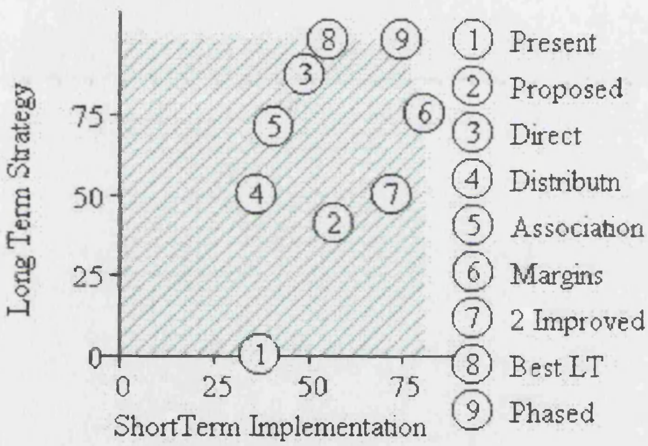
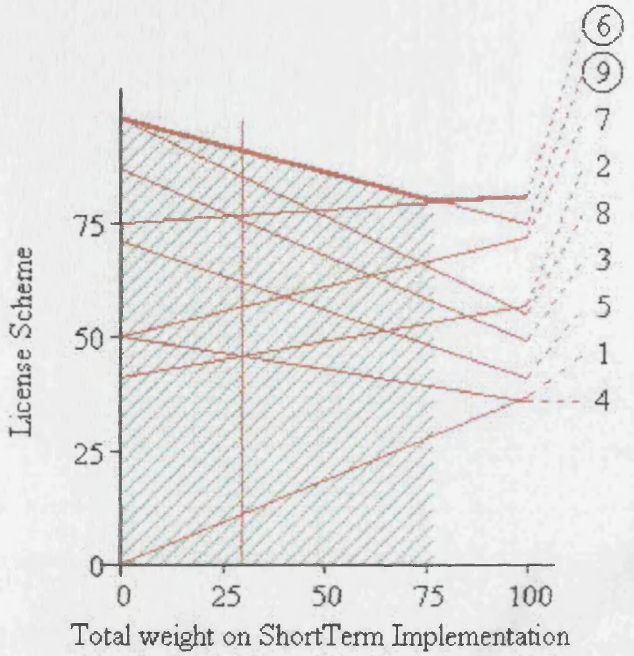


Figure 8-20: Sensitivity Analysis on Weight given to ST Implementation



With respect to the positions of the key stakeholders in this Decision Conference the following observations can be made:

For Mr Cristocea, the Director of the Tulcea Fishing Company and Vice President of the Association of Romania's Fishing Companies, the phased introduction and the prospect of a longer term license were key factors that made it possible for him to support **Phased Strategic**. Another important aspect that enabled him to move from the rather conservative alternative **Distribution** from which he started in this process, was the fact that **Phased Strategic** was so robust to rather extreme changes in ratings and weights. For Mr Cristocea the worst case scenario of the **Phased Strategic** would have been that over the coming year new companies would form and the competition intensified.

For Dr Baboianu, the Executive Director of the DDBRA, the key was that he had a feasable licensing scheme for the medium term that has been examined rigorously from all key perspectives: fishery science, administration, commercial interest, and international experience. Equally important was that he had a concrete way in which that could be achieved. The pilot project was particularly important because it presented the possibility for gaining experience with a different type of organisation and if successful, it might provide the necessary reference point that could be used to indicate that the DDBRA was serious and change could be positive.

For Dr Staras, the most positive aspect of the Decision Conference process must have been that he had been engaged in very productive work with both the administration and private industry. Judging by the information that he had been contributing in the preparatory workshops and the Decision Conference, and the fact that in none of the reports he wrote on the fishery and "the conditions for sustainable exploitation through fishing" (Navodaru et al. 1993) did he ever discuss or follow through on the implications of missing data and the other inconsistencies in the approach and recommendations, we can safely assume that he must have been harbouring serious frustrations. Being able to develop a feasible approach together with the colleagues with whom he would have to follow on in future and having developed a shared understanding of each others positions, constraints, and expectations must have enough to raise expectations for future development as well as relieving.

For Mr Constantin, the person who displayed the greatest resistance to the process in the third preparatory workshop, and who was very anxious about the mechanic/process details of actually submitting a new licensing scheme soon to authorities was fully supportive of the **Phased Strategic** because it provided a clear goal that built on his **Association** alternative and it was immediately implementable. He had also been able to explain to the other colleagues some of the challenges with which he worked with daily.

For Mr de Graaf, the foreign fishery consultant, had two main concerns from a content point of view: first to widen the working definition of what constituted biodiversity and how to protect it (not by building further canals). Secondly, that the management approach should take into consideration the perspective of the fishermen – working with, rather than trying to find effective ways of coerceing fishermen. **Phased Strategic** fully addressed both of those concerns. Although this was the first time that he conducted his intervention in such a participatory way, the fact that his entire report (de Graaf, 1994) was centered around the Decision Conference, the objectives developed, alternatives that were worked out, the assessments, and the conclusions that one could draw from it.

As a result of the analysis participants came to the following conclusions:

1) **Phased** Strategic was the preferred licensing strategy.
2) This strategy was not sensitive to the proportion of weight given to Short Term or Long Term objectives.
3) The strategy was not sensitive to the weight accorded to legal, time, or data collection.
4) **Margins** and **Best** Strategic were the next preferred licensing options.
5) The characteristics of strategies 9, 6, and 8 were:
   a) taxing the quota licensed and not the catch obtained.
   b) improved distribution through
      i) auctioning the caught fish
      ii) state fishing companies become distribution and service companies
   c) reduction of the price differential between the retail price and that obtained by the fishermen
   d) ensure that the fisherman have the possibility of owning their gear and boats
   e) ensure that licences are tradable and inheritable.
6) Recommend that licences be given to active local fisherman only.

In order to help participants to keep the momentum gained through the conference, and to ensure that the necessary follow-up steps were taken in a coordinated way, we helped participants to draw up the following "commitment package" (Table 8-6):

Table 8-6: Commitment package agreed to at end of the Decision Conference

Nr	Action	By Whom	By When
1	Write the report	de Graaf	Saturday, 15.10.94
2	Legal Contribution	· Sirbu	Friday, 14.10.94, P.M.
3	Test the solution with Staras and Constantin	· Baboianu	Friday, 14.10.94, AM
4	Presentation to Governor	· Baboianu · Kravatzky	Sat, 14.10.94, Evening
5	Consultation at the Management Seminar	· Baboianu · Kravatzky	Wednesday, 19.10.94
6	Modify the current proposal	· Constantin	2 Weeks
7	Begin the negotiations for the pilot project	· Baboianu · Staras	2-4 Months
8	Formulation of the pilot project (including finance)	· de Graaf · Fischer · DDI	

Figure 8-21: Description of the preferred option (Phased)

The concept is to use a practical phased introduction of the new licensing scheme.

Initially we will use the existing proposal so that there is no delay in its introduction.

The only modification is that the tax will be raised on the quota given in the license given for each zone, not the fish caught.

The licence for each zone will be sold in an auction to existing companies and new companies, if local active fishermen wish to form a company.

It is our firm recommendation that licenses are only given to active local fishermen.

Initially the licenses will be for one year only so that the scheme can be developed once the necessary legislation has been made to allow for individual fishermen (or groups of fishermen) to obtain licenses for quotas.

Within each zone multiple quotas will then be possible if the area of the zone is too large for one quota. In such cases the DDBRA will encourage the co-management of the fish resources.

After gaining government approval, a pilot scheme will be established based on a cherhana, with an economical feasible fishing area.

The purpose of this scheme will be to establish the practical rules for an auction house by selling the fish caught by individual fishermen direct to the retail trade. The auction house will charge only a small handling charge so that the fisherman gets the highest possible price for his catch.

In parallel both state and private companies which get the first licenses will be asked to improve their efficiency, and to offer fishermen the option of owning or renting their gear and boats if they want to, so that the fishermen get 50% of the selling price instead of 10% as at present.

Also, the companies will be helped by improving the retail trade with local shops to sell the fish direct to lessen the margin between what the consumer pays and what the fisherman gets.

After one or two years, with the experience of the pilot scheme, the existing proposal will be changed and the licenses made for a ten year period, transferable and inheritable, so that investment will be attracted and the investor will have security.

Ultimately the aim is to move to a free market with true competition to ensure economic efficiency and fair distribution of profit, through a licensing scheme that builts on the rich traditions of the Danube Delta.

I will evaluate the Decision Conference in detail on all the objectives set out for it (see Figure 7-7, page 235) in the Conclusions Chapter. In the next two sections I report on the events and the developments that took place after the Decision Conference.

Unlike the MSDA approach, and even most reported Decision Conferences, the effectiveness of my intervention should not only be judged by the coherence of the decisions made (this is the core and standard criterion of all decision analysis work and it does constitute my first major objective). Instead, I also sought to:

Objective 2: "Enable the DDBRA to transform their existing fishery management strategy... toward a co-management role aimed at maintaining or increasing the resilience of the social, economic, and ecological systems that constitute the DDBR." One would therefore expect that if a transformation did take place then, at a minimum, one should be able to observe that all of the following elements which were all addressed in the Decision Conference were followed-up on and continued:

- Institutional effects (eg. incentive structures) should continued to be taken into account;
- There should be significant changes in the way the fishery is organized (ie. it should not only be a 'transformation on paper')
- Analysis of fishery data should remain more coherent – now that they have brought in the effects of the black market this needs to be sustained.

Together with the experience at the International Management Seminar (see next section), one of important functions of the second half of the second decision conference day was, from a transformation point of view, one of "refreezing" – that is incorporating a new point of view into their personal worldview, and into the significant relationships with other.

8.3.3 Presentation at the "Integration, Law, and Implementation" Workshop

A week after the Decision Conference, I was asked by Dr Baboianu (who was co-chairing the workshop) to present the results of this Decision Conference at the "Integration, Law, and Implementation" Workshop which was also the end of the Management Planning process of the EBRD technical assistance project. Since the Governor of the DDBRA had often emphasized that he wanted to hear about solutions and not problems, I decided to start my presentation with an outline of the **Phased** Best licensing scheme. Only afterwards did I present the process by which we had reached that conclusion. This was a mistake, because he and others who were not present at the Decision Conference did not seem to be able to follow my reasoning on this contentious issue. Phillips (personal communication) later told me that such a negative reaction is common if one does not take great care in explaining process, though not necessarily all the details, by which the group arrived at their conclusions.

However, in the event Mr Constantin, the Director of Licensing at the DDBRA, got up in the middle of my presentation and asked if he could take over and explain. Without making reference to the overhead presentation which I had been using, he explained all the reasons why the DDBRA needed to change their strategy, and that it was possible to move forward with the Pilot project, that it was better to charge the tax on the TAC rather than on the catch landed. There were only a few questions of clarification before discussion moved on to the proposals from the other Sectoral Studies (agriculture, reed harvesting, tourism, etc). The following were the management objectives that the Seminar agreed to for the DDBRA:

Figure 8-22: Fisheries Management Objectives adopted for DDBR

Economic Objective #24:
Institute a system of management for the sustainable utilisation of natural resources.
#24.1 1 Analyse the existing management of fisheries
and develop options for improvement between 1995 and 1996
#24.2 1 Select and apply a system of fishery licensing between 1995 and 1997
#24.3 1 Implement a licensing system and set bag limits for hunting game species between 1995 and 1997

Economic Objective #25
Develop and improve fish farming on the basis of economic efficiency.
#25.1 2 Evaluate the existing situation of fish farming and make recommendations about alternative methods of management between 1996 and 1997
#25.2 2 Encourage investment in deterrent techniques for protecting fish farms from piscivorous birds between 1996 and 1997

Source: Baboianu and Goriup, 1995

8.4 The effects of the Decision Conference

The first question that can be asked with regard to the effects of the Decision Conference is whether the actions agreed to in the "commitment package" were carried out:

1. Mr de Graaf to "write the report" – this was completed in the week following the conference and I have referred to his report as de Graaf (1994). This report constituted the formal submission of the foreign fishery consultant. The rationale of the objectives, the alternatives, a summary of the discussions and a description of the recommended **Phased** Strategic alternative constituted the essence of it. It was supplemented by some additional comments that drew on the consultants work in de Graaf and Staras (1994, 1994a) which I have referred to in Chapter 7.

2. Mr Sirbu to develop the "legal contribution" – this was completed before the "Integration, Law, and Implementation" Workshop. It constituted just a note that addressed the laws which governed fishery management at the time, and some additional comments clarifying the differences in the process by which Government Decisions and ammendments to the law would be obtained.

3. Dr Baboianu to "test the solution with Dr Staras and Mr Constantin" – both of these participants had to be absent for some time during the afternoon of the second Decision Conference day and the other participants wanted to be sure that these two crucial participants were fully in agreement with the recommended alternative. Dr Baboianu reported that he had spoken to them before the "Integration, Law, and Implementation" Workshop and that they agreed.

4. Dr Baboianu and Mr Kravatzky to make "presentation to the Governor" on the recommended **Phased** Strategic alternative – only Dr Baboianu met with the Governor in the following days. According to Dr Baboianu the recommended alternative constituted one of the points that they discussed in preparation of the "Integration, Law, and Implementation" Workshop. No particular decision was taken as a result of those discussions.

5. Dr Baboianu and Mr Kravatzky to "consult at the Management Seminar" – as mentioned in the previous section, Dr Baboianu was one of the chairpersons at the "Integration, Law, and Implementation" Workshop and I was given the responsibility to present the outcomes.

6. Mr Constantin to "modify the **Current** proposed" alternative – Mr Constantin reported (personal communication) that he had made modifications but that it was redundant because the **Current** system was not replaced until 1997 – that was an scheme that was consistent with the **Phased** Strategic alternative but strictly speaking not the same (see further details below).

7. Dr Baboianu and Dr Staras to "begin negotiations for the pilot project" – under the existing law the DDBRA was not allowed to give associations a license for fishing. The pilot project of the **Phased** Strategic alternative proposed such an arrangement and thus it was necessary for the DDBRA and the DDI to consult with the MoE on the specific modalities of how that could be done. In the course of the preparation of the Pilot project (see next point) this was done during December 1994.

8. Mr de Graaf, Mr Fischer, and the DDI to "formulate the pilot project" – by January 1995 a four year joint project proposal by Euroconsult, Nefisco, DDBRA, DDI,

Agriculture University of Wagenigen, and the State Fisheries Institute IJmuiden (Netherlands) was submitted to potential funding agencies (EC, World Bank, EBRD, among others) (Euroconsult et al, 1995). The project sought to improve the overall fisheries monitoring system and to use the pilot project cherhana to experiment with the licensing system so that it can be introduced for the whole DDBR in three years time. Funding for this particular project was not obtained. Instead Euroconsult became engaged again in the DDBR through the GEF Biodiversity project (providing training in procurement and other project related training activies).

On the basis of this evidence one can conclude that there was almost a complete follow-through on the actions agreed to in the "commitment package". The most significant shortcomming was that the auction of fish licences for a one year period where the fee would be charged on the estimated yield of the area (rather than on then on the landed catch – i.e. the first part of the **Phased** Strategic scheme) was not implemented.

Mr Munteanu, the Director of the Natural Resources Department of the DDBRA, reports[61] that the Government approved only in 1996 a Government Decision with respect to the concessioning system for the fishery and other natural resources. However, in the fall of 1996 national elections were held in Romania and the Government changed. As a result of that change a new Governor for the DDBRA was installed and in 1997 the earlier Government Decision withdrawn.

Within these circumstances the **Current** licensing system continued to operate between 1995-1997. Thus individual fishing companies were issued licenses for specific zones and quantities of fish by species in accordance with the calculations of the DDI and with the approval of the Tulcea Judet Council. They were required to pay between 5-10% tax on the catch of the previous month and the collected money went to the state budget. State companies were usually not able to pay their dues though private companies paid immediately.

In the second half of 1997 the DDBRA changed the licensing scheme: rather than issueing general licenses to companies who then handed licenses down to their fishermen, the DDBRA issued separate licenses to individual full-time professional fishermen. In a first round 800 licenses were issued. The choice of 800 was in

[61] E-mail to author dated March 20 & 28, 2000

keeping with the **Phased** Strategic alternative were it was decided that only "active local fishermen" should be issued licences.

Companies were not happy with this move as they were also using seasonal fishermen (about 400-500). However, the DDBRA drafted a Government Decision which was approved in September 1997 (HG516/1997) according to which licenses could be issued to fishermen employed by companies, indpendent fishermen, and seasonal fishermen.

According to Mr Munteanu, "the DDBRA tried to be an opener of avenues in this direction [co-management], at present the only place in Romania where licences are issued [directly to fishermen] by an adminstration. ... The guidance for this decision was derived to about 70-75% from the management studies of the DDI, and it received both the acceptance of specialists as well as political support. The strongest arguments for taking this decision were:

- The very low price given to fishermen by the state companies for fish, ca. 10-15% of the market price;
- Breaking of the state company monopoly which ruled the fishery both in terms of price as well as fishing effort (as they were using a very large number of seasonal fishermen who were in reality fulltime fishermen but to whom the company had no obligations);
- Protection of the fishermen and obliging companies to employ and fulfill their [social security] obligations vis-à-vis the fishermen." (Munteanu, 28 March 2000)

By 1998 a total of 1,686 permits had been issued. "The effect of this action has been that fishermen migrated from the large state companies to the existing private companies or to others that entered this activity. In this way, while the number of state companies remained the same, the number of private companies that offered better prices to fishermen grew very much (about 50 companies in 1999). Independent fishermen and family associations of fishermen have also appeared (about 50) who are delivering their fish at private fish collection points." (Munteanu, 20 March 2000) Dr Baboianu also reports (personal communication) that only one state fishing company, Jurlivoca SA, had made significant advances before 1997 in transforming its own role in the sense of allowing fishermen to buy/own gear and in return receive higher prices for the fish they deliver. Table 8-7 presents a summary of the developments.

Table 8-7: Reported Catch, State Company, Private Company, and Associations statistics 1994-1999

	1994	1995	1996	1997	1998	1999
Fish catch State (tonnes)	6,285	4,996	3,573	3,329	3,300	2,341
Fish catch Private (tonnes)	266	78	97	177	376	890
State co's	13	14	13	13	14	14
Private co's	8	8	10	11	20	48
Private fishermen Associations					15	57

Source: Ion Munteanu (Director of Natural Resources Department, DDBRA)

Officially reported fish catch continues to decrease, and in 1999 it reached a record low of 2,341 tonnes.[62] Mr Munteanu attributes this to the difficult economic situation through which Romania is passing at the moment, the fact that there are only 6 DDBRA inspectors for the whole Delta, and that only 26 tonnes of Danube Shad instead of the usual 500-600 tonnes were caught. The solution to the problem would be an updated fisheries law, a coherent national fisheries policy and realistic prices paid to fishermen. (Munteanu 20 & 28 March 2000)

However, the fisheries research conducted at the DDI has also transformed in a very significant way and now researchers are no longer working with the officially declared figures alone. Figure 8-23 illustrates that although the official numbers are going

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[62] A recently published article in The Guardian Newspaper (Thorpe, 2000), describes a much bleaker picture, claiming that "the delta is fished out". The article suggests a terminal decline in fish yield. Thorpe does not give any indications as to why that might be the case. However, the reader could infer two reasons: (i) there are no more fish; or (ii) means to catch them are failing (ie licensing problems). Both of these inferences are wrong. Figure 8-23 and Table 8-7 present the opposing claims made by the DDBRA and the DDI: only the proportion of reported fish catch has decreased. The fact that the number of fishing companies and associations is increasing is also not supportive of Mr Thorpe's claims. Furthermore, there are other claims in Mr Thorpe's article that can be easily cross checked, and which further damage his credibility. Thorpe (2000) also claims, for example, that the pelican's food supply was ruined by drainage schemes through which fishing polders were created. This is wrong, the fact is that under Ceaucescu fishermen were issued with bullets to shoot pelicans and cormorans because pelicans and cormorans were feasting in the fish in the fishing polders (fish polders are heavily stocked shallow water bodies). The DDBRA has stopped this practice and fishermen are now complaining about the protection of these birds. An example of other wrong and misleading claims by Mr Thorpe are that "the biosphere began breaking holes in the dykes three years ago" (i.e. according to him 1997) thereby "giving back 5,000ha to the water". In fact, the DDI and DDBRA started this process in 1993 with Babina polder (2,400ha) and then in 1996 the second polder, Cernovca (1,580ha), see Tudor (1997) or Kravatzky et al (2000) for details.

down, once the black market is taken into account (the black part of the stack-bars) then the total catch is in the region of 8,400 tonnes.

Figure 8-23: Official catch statistics over the previous 12 years with black market corrections for previous 4 years

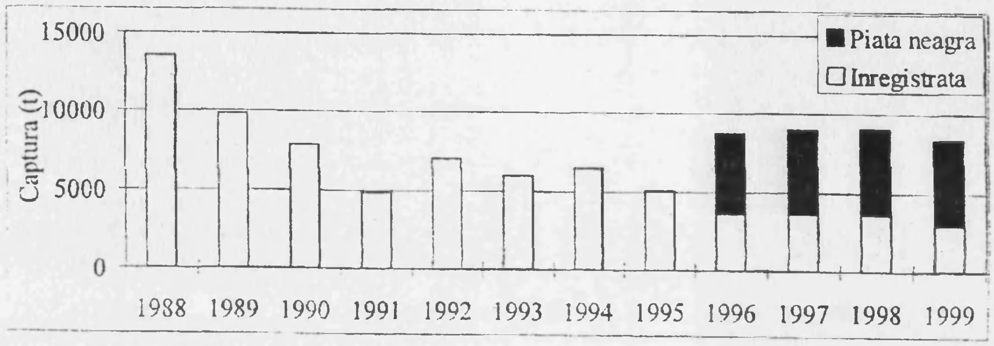


Figura 5 Statistica oficială a capturilor pe ultimii 12 ani (1988-1999) cu includerea pieței negre pe ultimii ani.

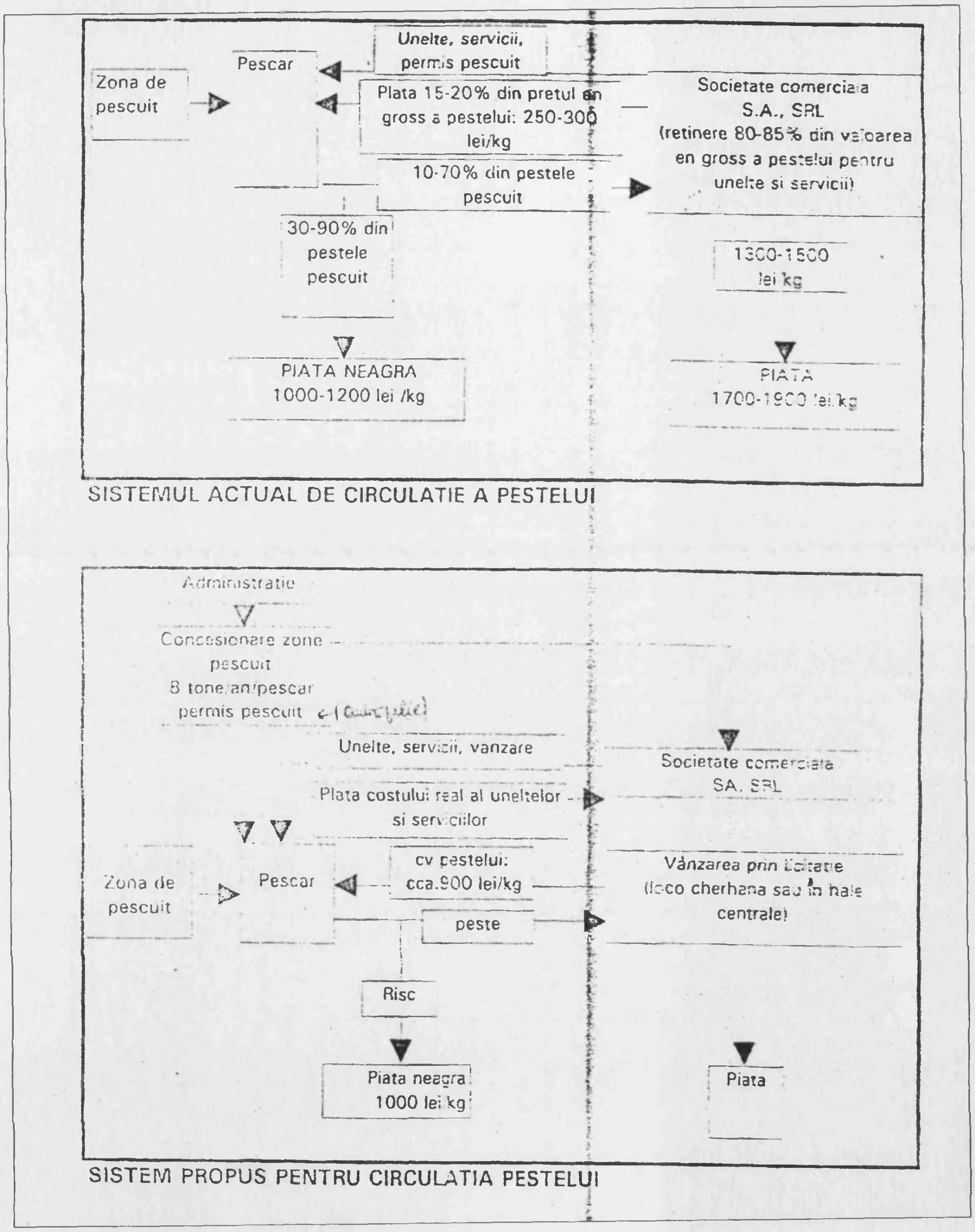
Source: Navodaru and Staras (2000:72)

I have argued repeatedly in earlier chapters that the methodology and approach that the DDI were using was not up to the task of dealing with a situation like that encountered in the Danube Delta. I had reached that conclusion after careful examination of the reports they had produced over 4 years and the methodology they had relied upon.

The fact that for the first 4 years of the DDBRA's and DDI's existence no economic or institutional aspects were incorporated in their (or anyone else's) analysis of the Danube Delta fishery, that there were no other interventions that dealt with fishery management between 1994 and 1995 besides the workshops that I report on in this chapter, and the fact that in the second quarter report of the DDI fishery scientists Navodaru and Staras (1995) extensively report on and analyse the institutional setting and the economic forces that drive the fishery, lead me to conclude that the Decision Conference process had significant impact.

For example, Figure 8-24 shows how Navodaru and Staras (1995) describe the existing and proposed system for fish circulation. The structure and way of illustration is remarkably similar to Figure 8-2 and Figure 8-3. I interpret the fact that there are some difference in content and illustration as evidence that the workshop participants remained owners of the problems and solutions and that were willing and able to develop the analysis further.

Figure 8-24: Current and proposed system of fish circulation mechanism

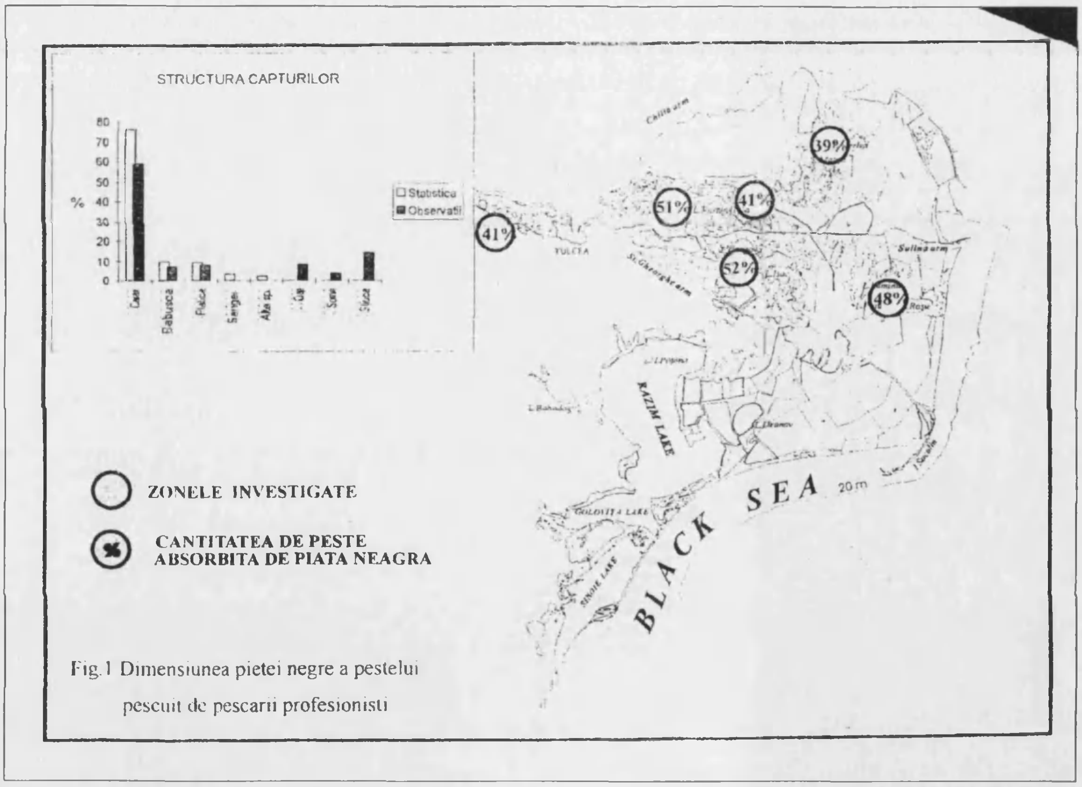


Source: Navodaru and Staras (1995: 41)

In the subsequent years the DDI scientists went further and in 1997 they produced concrete estimates of black market figures (see Figure 8-25) estimates of how much gear is really used in the DDBR (see Figure 8-26). This was the first time that uncertain information was taken into account in the analysis of the DDI and DDBRA. This is important because for a number of reasons:

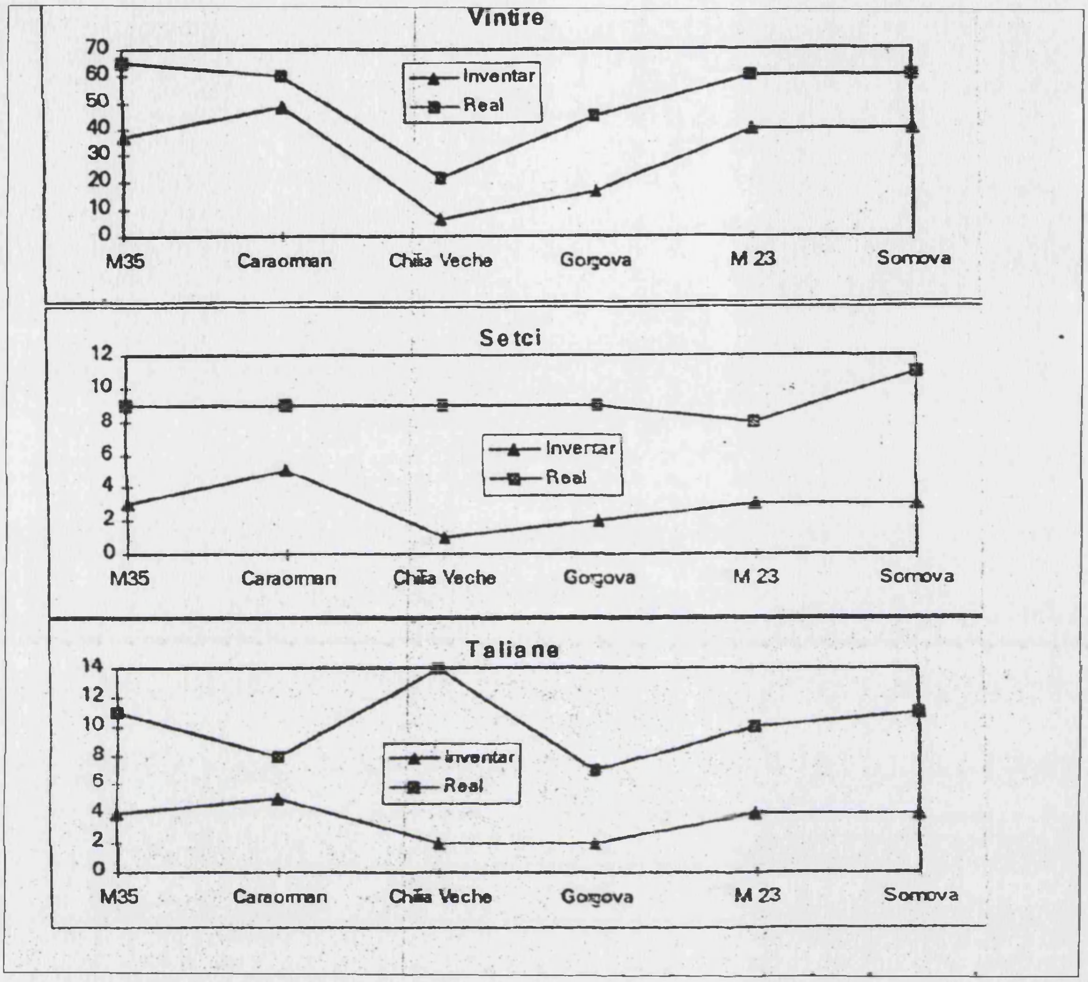
- the coherence of the their decision making process dramatically improved;
- it shows that something that had been ignored for the past 5 years which something like an "unspeakable" aspect could now be openly and officially be addressed;
- the way the information was collected suggests that some change in attitute and approach had taken place: in addition to routine data collection from the official fish collection points and fishing companies, the DDI scientists systematically observed and interviewd fishermen, traders, etc, went out and counted nets, etc.

Figure 8-25: Estimates of black market percentages in the DDBR



Source: Navodaru and Staras (1997:76)

Figure 8-26: Results of survey comparing "official" and real quantity of gear used.



Source: Navodaru and Staras (1997a:79)

The information they gained in this process allowed them to get a much more realistic and believable understanding of what was happening with the fish stock (see for example Figure 8-27 which illustrates that in reality the diversity of species is much greater – especially economically valuable species such as pike perch (*stiuca)* appear again in significant proportions).

Figure 8-27: Structure of fish catch by species according to official statistics (left) compared to observation and interview data (right) in 1996

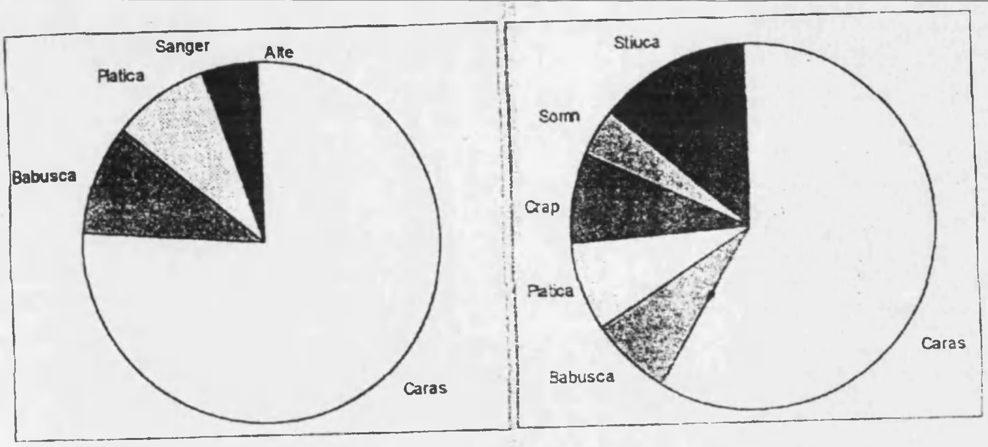


Figura 3 Structura capturilor conform datelor statistice (stânga) şi cea rezultata din interviuri şi observaţii (dreapta),în 6 zone reprezentative din Deltei Dunării în anul 1996

Source: Navodaru and Staras (1997a:79)

This evidence shows, therefore, that after the decision conference workshops the DDI and DDBRA were willing to give up, to a large degree, their previous insistence on a command-and-control type of management approach. Even though it still remains unsatisfactory that so much of the catch goes unreported, by starting to implements significant elements of the **Phased** Strategic alternative and by changing their research method to suit[63] significant progress has been made.

In 1997 the DDBRA and DDI also started to implement the pilot fishing association of the **Phased** Strategic alternative which operates its own fish collection point (cherhana) and recently its financial feasibility has been analysed (de Graaf and Rowney, 2000).

> *The programme originated from the study on "sustainable fisheries management and options of fish licensing in the Danube Delta" carried out in 1994[64]. The basic conclusion was that sustainable management of fisheries resources in the Danube Delta can only be*

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[63] Institutional, economic, uncertainty issues have found their way into the heart of their management research, and this has, of course, also enabled them to expand their stock assessment methods. Since 1997 the DDI has started to use Schaefer method in addition to the VPA/Berverton-Holt method.

[64] De Graaf (1994)

> *achieved through co-management of this resource by its major stakeholders.*
>
> *...*
>
> *The first steps have therefore been made in the direction of sustainable management of fish resources. This remains a long term goal and its achievement will require a change in attitude towards management of natural resources both from the DDBRA and the fishermen." (de Graaf and Rowney, 2000:1-2)*

The main conclusion of the study is that at least 30 fulltime fishermen need to be part of an association for it to be financially feasable. The analysis was also helpful in providing a model through which one can perform basic business planning calculations. The DDBRA and DDI have found that over the past two years they have been approached with increasing frequency by fishermen who are interested in forming their own associations and companies but who need assistance or guidance with the basic mechanics of forming and operating such organizations. There is therefore still much room for improvement in the service that the DDI and DDBRA play but the overall development of fishery management is in a promising direction.

Chapter 9 Conclusions about the use of MCDA for the development of adaptive fishery management strategies

9.1 *Introduction*

In this Chapter I present my conclusions about the three study questions that I posed in the Introduction of the thesis in relation to my experience the DDBR. In Section 9.4 I evaluate the extent to which the Decision Conference described in the previous Chapter was able to achieve the objectives that I set out in Figure 7-7 of Chapter 7.

9.2 *Adequacy of previous MCDA applications*

The essence of the criticism of Multiple Criteria Decision Analysis in the fishery management literature is captured by Pearse and Walters (1992). They claim that the fatal problem with the application of Decision Analysis to fishery management (and by implication most of environmental management) is that one cannot make a defensible choice about whose utility function ought to be encoded since due to the public nature of fishery resources, there are many decision makers. My work responds to this criticism at two levels. At one level, I have argued that the criticism is wrong. I have shown in the review of the Decision Analysis literature in Chapters 3 and 6 that decision analysts do not seek to determine utility functions for society, nor do they claim to be establishing prescriptive recommendations. Instead, DA seeks to assist decision makers in structuring problems and problem solving process in a way that helps them to consider uncertainty, multiple objectives, form preferences, and develop options, and make decisions. My analysis of the proposals in the DA literature for dealing with the problems of fishery management suggests that many of them would be useful in practice and they have helped to better understand the problems.

At a deeper level, however, the underlying problem that Pearse and Walters' (1992) point to is that those who decide or are being asked to decide about risk, are not the same as those who bear the risks. Even though this is the same problem that the MSDA literature is using to justify their own approach (see Chapter 3), I do not believe that it has been adequately dealt with so far.

Using MSDA in a case such as the DDBR, would have meant that one would have developed a very sophisticated model in an attempt to determine a Maximum Sustainable Yield estimate on which to base the management system (following either an approach similar to that of McDaniels (1995), or one would have followed the outline of the full MSDA as presented in Chapter 3). However, the result would still have been very divergent views, that would have been dealt either by presenting different options and sensitivity analyses to the DDBRA which show by how much estimations, weights, or preferences had to change in order to produce a change in the order of preference for different options by different stakeholder groups, or through some form of statistical aggregation.

However, neither of the outcomes would have satisfied the DDBRA because in the management approach that they were using, values and opinions of different stakeholder groups did not matter very much: fish either were over-exploited or they were not, and scientific enquiry should determine which was the case. There was therefore only a small chance that they would have perceived such a report differently from the others that they received and change their approach because of it.

Nevertheless, any systematic (or reasonably comprehensive) evaluation of fishery management options in a case such as the Danube Delta would have needed to assess at least some co-management options (even if it would be still largely government driven (see Figure 4-6, page 152, for the range of different types relationships between Government and fishermen that have been classified as co-management). I have also shown that the management of the DDBR by the DDBRA was on the extreme side of command and control, (coupled with a perception that anything else besides state control would lead into a political, administrative, technical quagmire). This system was sustained by a view of nature that there must be a critical point (in the form of a MSY or carrying capacity) and if they only found it (and only they could do that) they would be able to manage on a rational basis. That is why the DDBRA not did not even want to know about other options and certainly not share power with those who have been poaching so far.

The DDBRA scenario is a good example for the wider dilemma that the existing Decision Analysis literature relating to fishery management (and resource management more generally) has frequently faced and not been able to resolve satisfactorily:

- on the one hand they are unable to live up to the expectations of those who would like to see a unequivocal answer (not even for the natural science part is that possible because even there scientists may differ quite dramatically in their interpretation of the evidence). I have given examples of theories that suggest that this a systemic problem that will always crop up because according to their evidence complex ecosystems (and other open systems as well) interactions are such that change is discontinuous and unpredictable (see Adaptive Environmental Management and Assessment, Chapter 4).

- on the other hand, they do not take their own conclusion about the value of their contribution to its logical endpoint: if the separate utility functions created through the stakeholder utility models and expert probability assessments end up being useful because they can be used to "facilitate the invention of new compromise solutions" and "the models become a vehicle for dialogue and communication" (von Winterfeldt, 1992:338), then why limit this communication to reports? Or if they do bring stakeholders together then why not deal with stakeholder interaction as carefully as with probability elicitation and utility encoding?

Within this context, it is particularly unsatisfactory that the one Decision Analysis approach which deals with effective communication between workshop participants, namely Decision Conferencing, has not been used or referred to.

9.3 The importance of Institutional context

I have shown through my examination of the fishery management problem in the Danube Delta Biosphere Reserve (Chapters 2 and 7) and by review of the fishery management from a wide variety of disciplines Chapters 3 and 4) that there is frequently the need to develop innovative management systems that take account of local conditions (natural and social), and which have a greater ability to adapt as natural or social conditions change. My review of the literature and the situation in the DDBR also suggests that a move away from command and control management toward some form of co-management has the potential to make the relationships between central administrations and beneficiaries more effective.

I have identified three main problems with the development of adaptive management systems, the first two I already mentioned in the previous section:

1. there is often great uncertainty and very different interpretations of the evidence (about the natural and the social system).
2. managing the interaction between stakeholders, experts, and managers both within and between organisations effectively is not straight forward
3. generating social innovation in which existing roles of individuals, departments, and organisations are transformed does not happen easily.

I have come to the following conclusions about the importance of institutions with respect to the use of Multiple Criteria Decision Analysis and the above three problems:

The use of Decision Analysis improves the handling of uncertainty because it provides a coherent and systematic method for the assessment of a large variety of variables (this is not a new finding, but in light of the fact that there is not much evidence that Decision Analysis has actually been used for the assessment of uncertainty in fishery management it warrants re-statement). Until now, however, the question about the most effective way of dealing with situations where there are very different interpretations of the same evidence for natural resource management questions has not been resolved. I have shown in Chapter 3 that the MSDA literature has suggested either the use of some form of mathematical averaging or that the difference in assessment be carried forward throughout the analysis in order to provide a framework for discussion. One of the contributions of my research to this question has been to point out that there is evidence (presented in Chapter 6) that facilitated work groups that are structured into a "estimate-feedback-talk" process (Reagan-Cirincione, 1994) can enable individuals to perform better than when working alone and that consensus distributions constructed in a Decision Conference setting are different from statistical averages generated by individual judgements (Phillips, 1998). Furthermore, I have shown that there are a number of theories which put forward different hypotheses about how the institutional context within which an individual operates can have effects on that person's viewpoint without him or her being aware of that (see Adaptive Environmental Management and Assessment and Cultural Theory reviews in Chapter 4, and Stratified Systems Theory, Competing Values Approach, and Mintzberg's Organisational forms in Chapter 5). Since robustness is an important characteristic of adaptive management strategies, it is important for Decision Analysts to be aware of the effects of the institutional setting when they are seeking to capture the widest variety of viewpoints in the analysis process.

With respect to the effective management of the interaction between stakeholders, experts, and managers both within and between organisations, I have limited my analysis to only one type: face-to-face interaction in a workshop setting. The importance of the facilitator's role in managing the process and structure of group interaction has been captured well by Phillips and Phillips (1993) but there is no evidence that decision analysts operating in approaches other than Decision Conferencing use a theoretical base for their management of the participant's interaction (even though the importance of process is acknowledged - e.g. von Winterfeldt, 1992).

I have also shown that the position of clients within an organization should be taken into consideration by decision analysts because it can help them choose appropriate decision support methods and they can better guide the selection of participants for the task. For example, there were five managerial strata within the DDBRA. The Executive Director was a Stratum IV manager. Jaques (1996) hypothesis that the time-span of a Stratum IV manager is 2-5 years and the time focus for planning of this position is 3 years coincided with the time frame chosen for the Decision Conference for the DDBR fishery. This also provides an hypothesis, for the differences in concern among those engaged in the strategy development process. While Scientific Staff (Stratum II) was concerned with operational problems up to one year in advance which could be dealt with through prediction, Section Heads (Stratum III) were concerned with possible events over 1-2 years which need primarily a statistical forecasting system to deal with uncertainty, the Executive Director (Stratum IV) was concerned with more general management questions which would be dealt with developing a number of different options or alternative paths to achieve the strategic objective of the DDBRA. Assistance with judgemental tasks rather than data analysis for prediction or forecasting are more appropriate for this stratum. The Governor of the DDBRA is a Stratum V manager concerned with a time span of 5 to 10 years, the whole system of the DDBRA and its position or role within the DDBR, and in particular with judging the likely impacts of changes or events both from within the DDBRA and from its environment (the DDBR and beyond). Stratum V managers would find the use of scenarios most helpful in their attempts to deal with uncertainty so that they can evaluate the robustness of strategies and identify possibly critical impacts of developments (see also Phillips, unpublished).

With respect to the third difficulty of developing adaptive management strategies, namely the transformation of the roles that individuals, department, or organisations play, consideration of the institutional context can assist the application of Decision Analysis as well. The DDBR case study illustrates this point well. In Chapter 5 I concluded that the DDBRA best fits the Mintzberg's (1989) description of a "bureaucracy" (or "machine organisation"). Much of the DDBRA's work was highly specialized, communication within the DDBRA was very formalized, and tasks were grouped on a functional basis rather than problem basis. There is nothing inherently wrong with that as bureaucracies perform important functions (see for example Pomeroy and Berkes, 1997). However, in the case such as the DDBR where the command and control approach to fishery management was inadequate[65], their role within the management of the DDBR needed to change.

The challenge for decision analysis was two-fold: first, a mechanism needed to be found to enable the DDBRA to overcome their pre-occupation with efficiency (see Chapter 5 why this is a common problem in bureaucracies) and re-evaluate the broader options, including some form of co-management.Secondly the DDBRA's role could only truly transform if the role of the fishing companies and the fishermen also changed (specifically, the DDBRA could not gain partners for co-management if the potential partners were not willing or able due to a lack of trust, skills, or organisational capacity to transform their own role).

While it is interesting and instructive to ascertain what such a strategy might have been, it was really for the managers of the DDBRA to decide whether or not they should continue by trying to improve the operating efficiencies their existing approach, or whether they needed to fundamentally transform their strategy in light of the changes of the social, economic, and ecosystem. It was important for the DDBRA managers to be engaged in that analysis because only they had the necessary knowledge for the DDBR (of course, they could and should consult with others, such as the fishery consultant of the EBRD technical assistance project if they believed that they needed assistance). Furthermore, unless they, the policy makers for the fishery of the DDBR supported the strategies, no action would have been undertaken. Another reason why it was important for the DDBRA managers to be engaged in the analysis was that the process of deliberation, discussion, and analysis was educational. New meanings and understandings were forged, and these, together with the experience of having developed them, are important for adapting the management strategies in the face of the inevitable changes to the fishery management system in the future.

9.4 Conclusions about application of Decision Conferencing in the DDBR case study

Figure 9-1 is essentially the same as Figure 7-7 in Chapter 7 and lists the objectives that I believed the Decision Conference in the DDBR needed to achieve. Here I

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65 The tension between the DDBRA's organisational form and the challenges of managing an inland fishery in a wetland that experiences great and rapid variations is brought out in the following quote: "To see these organisations as adaptive to a turbulent, dynamic, very changing environment is to indulge in fantasy." (Perrow, 1972:199, quoted in Mintzberg, 1989)

discuss the extent to which the objectives have been achieved and present ways of improving future applications of Decision Conferencing in the context of the development of adaptive fishery management strategies.

Figure 9-1: Objectives of Decision Conference intervention for adaptive fishery management strategy development

1. **Coherence policy choice**
   - 1.a assess all value dimensions that participants consider relevant and their relative priorities
   - 1.b consider the likelihood of events, their causes, effects, and relationships
   - 1.c integrate and manipulate data efficiently and effectively
   - 1.d assess different alternatives and if possible develop new innovative alternatives that are more preferred than the ones already identified
   - 1.e deal with disagreements about value, likelihood, or preferred alternative judgements in a generative way
   - 1.f avoid biases resulting from heuristics employed in judgement
   - 1.g generate commitment to action
   - 1.h generate a type of understanding of the problems and preferred alternatives that enables them to legitimate their choice of action
2. **Transformation of existing fishery management strategy**
   - 2.a Create the motivation and readiness to change by
     - identifying data that disconfirm the viability of the existing strategy,
     - making this data significant by contrasting it important objectives or ideals of management
     - providing psychological safety
   - 2.b Facilitate cognitive restructuring that includes:
     - the development of a new shared social reality
     - analysis of appropriate common-pool resource management regime features/elements
     - different view points so as to ensure robustness of the management strategy
   - 2.c Facilitate the embedding of the new point of view into the psychic life space of employees and in organisational relationships by ensuring that they remain owners of problem throughout the process.
3. **Facilitate intra-and inter-organisational collaboration**
   - 3.a the process of work is sufficiently flexible to respect participants' time constraints
   - 3.b social tragedies are avoided by working towards:
     - serving the needs and capacities of different stratum managers
     - making responsibility delegation possible

Objective Set 1: Coherence of policy choice

1.a) assess all value dimensions that participants consider relevant and their relative priorities

In my analysis of the problems of fishery management in the DDBR I had identified a number of key issues from the fishery management literature as well as DDBRA managers, DDI scientists, and other stakeholders that were not being incorporated into the analysis. Furthermore, the assessment of management options against the criteria that were identified did not address the difference in relative importance of criteria explicitly. As a result, the management options developed were incoherent in the sense that they were not consistent and contained contradictions.

As a decision analyst with some knowledge about the content issues of the client I was trying to assist, during the Conference in the DDBR I repeatedly faced the temptation to point out issues that I thought should be considered, or relate experiences with fishery management from other parts of the world. Phillips and Phillips (1993) pointed out that if the facilitator contributes to content he undermines the effectiveness of his role and the work of the group suffers (for example, he looses the ability to reflect on the process, may be drawn into the group's deliberation, or cause group members to feel "de-skilled").

Before the Conference I had discussed this danger with Peter Hall, the facilitator from the London School of Economics who took the lead in facilitation. We agreed that I would refrain from making direct content contributions. Nevertheless, it is quite likely that my own views still influenced the discussions because in the process of translating between the Romanian participants and the Mr Hall and I may have emphasized some issues more than others.

Since the Decision Conference, I have gained much more experience with facilitation and have become more knowledgeable about the group process and decision analysis literature. As a result I have also gained more confidence in the process. I would recommend that facilitators draw to the attention of their client any content concerns they may have in a preliminary meeting, but that they restrain strictly from making content contributions while they are in the role of facilitator.

1.b) consider the likelihood of events, their causes, effects, and relationships

In the Decision Conference we did not elicit probabilities of different events in a formal manner. Instead, we relied on holistic judgements by participants. Structuring the licensing options in relation to key features (see Table 8-4) and evaluating the options against the range of objectives enabled participants to consider likelihood, discuss causes, effects, and relationships in an adequate way. It is possible that a different group of participants would have preferred to work with uncertainty in a more explicit way. This situation illustrates the concept of requisite decision modelling well.

1.c) integrate and manipulate data efficiently and effectively

The account of the Decision Conference process in Chapter 8 shows that the use of flipcharts and a laptop computer with a liquid crystal display screen enabled us to help the group structure and manipulate data efficiently and effectively. As we were working in a room that was not as conducive to Decision Conferences as conference rooms that are specially designed for the purpose, I found the advice given by Friend and Hickling (1987) on how to work in a low-technology environment particularly helpful.

1.d) assess different alternatives and if possible develop new innovative alternatives that are more preferred than the ones already identified

The fact that participants were able to develop innovative alternatives in an iterative assessment process is brought out in the account of the Decision Conference. However, I am not satisfied that we, the facilitators, handled the process through which the management objectives were established in the most effective way. Although the two objective hierarchies developed over the two days captured the main concerns of the participants, I suspect that we could have spent some additional time developing a more systematic objectives hierarchy that paid greater attention to the relationship between Biosphere Objectives and fishery management objectives, as well as between what Keeney (1992) calls "Fundamental" and "Means Objectives". In that way, participants might have been able to identify additional useful features for the preferred alternative (see Section 3.2.2).

1.e) deal with disagreements about value, likelihood, or preferred alternative judgements in a generative way

The first requirement for the achievement of this objective is not to be afraid to invite participants who have contentious or different viewpoints to the Conference. In fact, one of the key arguments presented in this thesis has been that the facilitator should help his client identify groups or individuals who hold different viewpoints. A second requirement is that the facilitator enables all participants to express their viewpoint in the Conference and by helping participants develop higher level perspectives of the problem.

1.f) avoid biases resulting from heuristics employed in judgement

The literature about heuristics and biases is quite developed (see Kahnemann, Slovic, and Tversky, 1982). There is, however, debate about the extent to which work in groups helps or hinders performance by individuals (see discussion in Chapter 3 and 6). In the DDBR Decision Conference we sought to help participants by making cross-checks on preference rating differences and importance weight judgements. However, I am not able to advance the debate on the basis of this case study.

1.g) generate commitment to action

Generating "commitment to action" is presented as a key feature and main objective of Decision Conferences (see Phillips, 1988; Chun, 1992). The evidence from this case study supports this claim to a large extent. The follow-through on the "commit package" agreed to has been quite high. I have shown that over the past 4 years many elements of the **Phased** Strategic alternative have been implemented.

The biggest questions arise from the fact that the DDBRA was not able to implement the auction of fisheries licences as forseen or to institute and change in the tax on the landed catch. I have reported the evidence that suggests that the DDBRA and DDI have repeatedly tried to organize the auction.

Having received Government approval in 1996 for a coherent natural resource concessioning system which was then withdrawn after that years' general elections where the Governing party, and equally important, the Governor changed was a serious blow to the transformation efforts of the DDBRA and DDI.

However, the fact that the DDBRA was then able to develop an innovative licensing alternative that maintained the spirit and thrust of the **Phased** Strategic alternative and which was implemented in 1997 is evidence for commitment to action, adaptability, ownership of problem, and transformation of thinking on the part of the Decision Conference participants.

Nevertheless, one issue that had been agreed on has not yet been acted on: fishermen should be taxed on the quota of their license and not on the catch they report landed (because the existing system provides financial incentives for fishermen to report less than their full catch). The main constraints which have prevented this action can be summarized as legal/technical and political (Dr Baboianu, Mr Constantin, Dr Staras, personal communication). The Romanian legal system does not provide any leeway for the execution or regulation of economic activity. This means that Romania's laws do not provide legal 'bounderies' of what is allowed, and within that people can do what they want. Instead, for any activity to be legal, that precise activity or form of regulation must have been specified in law. That is why the Government Decision of 1996 and its subsequent withdrawal were so significant. Another implication is that the DDBRA, the DDI, and the Director of the Tulcea fishing company's commitment to a change in the licensing strategy are necessary but not sufficient. They in turn must work to convince the MWFEP, the Ministry of Agriculture, the Ministry of Finance, and the Ministry for Privatization. Those in turn must present their case to the Government or in Parliament where the necessary decisions are taken or laws are passed.

The legal/technical difficulty referred to above derives from the fact that the DDBRA and DDI had to break new ground for Romania when they specify a new taxation system for natural resource utilization licences. The political difficulty stems from the fact that in different licencesing or taxation schemes, benefits and costs are distributed differently (this is the reason for including, for example, the "Political acceptability" or "Security of investment" objectives in the decision model, see Section 8.3.2.1).

Given these constraints, there are three additional options through which commitment to action generated through the Decision Conference may have been supported:

(i) technical support: once the Decision Conference participants reached the decision on their preferred option, technical support in the area of developing the technical details of the license and taxation scheme would have helped them to prepare their arguments to the various ministries and governmental bodies. I have argued in Section 2.4.1 that the fact that one could not find any description of the licensing procedure in operation before the Decision Conference indicated that it was difficult, and maybe not possible, to apply existing fishery management methods in circumstances such as those encountered in the DDBR. In addition to that, it could also have been seen as an indication of technical difficulties faced by staff. Intervention at this level was beyond the scope of this thesis.

(ii) wider involvement of stakeholders: I have described the constraints faced in the engagement of stakeholders in the Decision Conference and how the decision for the those who did participate was taken in Chapters 7 and 8. Nevertheless, wider stakeholder involvement would have created a more widely shared social reality.

(iii) Follow-up workshops: once the DDBRA had transformed its fishery management strategy (see further comments on this specific point below), it may have been useful if it had arranged further workshops with stakeholder groups such as the Ministry officials, company directors, and the Tulcea Judet Council. This would have been one way of dealing with the fact that Dr Baboianu, the person for whom we worked in the Decision Conference, chose to invite a narrow group of stakeholders to the Decision Conference (see Chapter 8). The primary aim of such workshops could have been the systematic development of shared understanding of the each others concerns and the development of mutually agreed to strategies. It was not feasable to organize such meetings within the week that between the Decision Conference and the presentation of the results at the "Integration, Law, and Implementation" Workshop (see Section 8.3.3). However, it may have been possible to be more specific about the process by which fisheries management objectives adopted for the DDBR (see Figure 8-22) were to be implemented.

All three of these options would have reduced the risk that all stakeholders faced as they moved towards mutually beneficial options and greater interdependence.

1.h) generate a type of understanding of the problems and preferred alternatives that enables participants to legitimate their choice of action

Most of the evidence from the Decision Conference and the events that followed suggests that this objective has been achieved. The evidence I presented in with respect to the "commitment to action" objective could be seen to apply under this heading as well. However, since the decision models generated in Decision Conferences are meant to be requisite representations of participants shared understanding of the problem being dealt with, means that persons who did not take part in the Decision Conference are unlikely to easily understand the reasoning behind them. To prevent negative reactions to the models one might be tempted to develop more comprehensive decision models in the Conference. That is not advisable, as it is likely to compromise the achievement of the other objectives of the Decision Conference. If participants find it necessary to present the decision model developed during the conference for the purpose of legitimating their choice of action they need to at least present an outline of the process through which the model was developed.

Objective Set 2: Transformation of existing fishery management strategy

The DDBRA's fishery management strategy needed to be transformed from one in which in the role of the DDBRA was to determine a narrowly defined carrying capacity (Maximum Sustainable Yield) and to command and enforce management activities, to a co-management role aimed at maintaining or increasing the resilience of the social, economic, and ecological systems that constitute the DDBR. Building on Schein's (1987) three-stage model of the change process, I have also argued, that in order to achieve this objective the Decision Conference needed to achieve the following three sub-objectives:

a) *Create the motivation and readiness to change by*
   - *identifying data that disconfirm the viability of the existing strategy,*
   - *making this data significant by contrasting it against important objectives or ideals of management*
   - *providing psychological safety*

b) *Facilitate cognitive restructuring that includes:*
   - *the development of a new shared social reality*
   - *analysis of appropriate common-pool resource management regime features/elements*
   - *different view points so as to ensure robustness of the management strategy*

c) *Facilitate the embedding of the new point of view into the psychic life space of employees and in organisational relationships by ensuring that they remain owners of problem throughout the process.*

Evidence from the Decision Conference suggests that the first set of these objectives were achieved. In my account of the preparatory workshops I indicated that evidence was beginning to accumulate that the existing and proposed strategies were not viable. However, it was not until the Decision Conference, when the existing strategy and the one that DDBRA and DDI were proposing were compared with alternative options against the objectives that they had specified for fishery management in the Biosphere Reserve, that the full significance of the shortcoming was realised. The graphs generated with the HIVIEW programme that compared all the options in their performance on the Short Term Implementation and Long Term Strategy objectives (see for example Figure 8-11), proved to be a very powerful tool in this process. The Decision Conference process also provided the necessary psychological safety in the form of the agreement by all participants to respect each other views and confidentiality. The establishment of clear boundaries for the conference in terms of task, time, and work territory were also essential elements that contributed to the psychological safety of participants.

The evidence presented so far has shown that a shared social reality was created in the Decision Conference. In terms of the consideration of common-pool resource management options, and the transformation toward a co-management regime, the preferred licensing scheme contained following significant elements: the licences that were to be auctioned in the following year were to be issued for only year (so give fishermen's associations some time to prepare for bidding), redesign of the 50 fishing areas in the DDBR so that it included smaller lakes which a single fishermen's association could manage (once they have formed into a legal entity), and the implementing a pilot scheme in which a fish landing point becomes an auctioneer of fish (this would give smaller fishing associations the means to distribute their fish more effectively and thereby make their activity more viable. The Decision

Conference contained a greater variety of stakeholders and viewpoints than previous management planning attempts. Nevertheless, the variety of stakeholders and viewpoints could have been increased if a representative of a fishermen's association would have participated directly.

I have already commented on our (the facilitators) attempt to ensure that the participants remained the problem owners throughout the process. The evidence presented in the Section on the effects of the Decision Conference in the previous Chapter futher confirms the existence and the degree of the transformation that had taken place. Among the most positive results has been that the management analysis and policy had become much more coherent, realistic, and frank. There were, of course, many unexpected challenges and development that the DDBRA and DDI had to face. The evidence suggests that the Decision Conference process had been at least instrumental in helping to generate a sufficiently deep understanding and belief in the underlying objectives and preferred solution that the staff were able to create innovative development avenues that were broadly in line with the **Phased** Strategic alternative.

Objective Set 3: Facilitate intra- and inter-organisational collaboration

a) *the process of work is sufficiently flexible to respect time constraints*
b) *social tragedies are avoided by working towards:*
    - *serving the needs and capacities of different stratum managers*
    - *making responsibility delegation possible*

I had indicated in Chapter 5 that the DDBRA was severely understaffed (especially in the managerial positions) and in Chapter 7 during the time of management planning process of the EBRD technical assistance programme staff of the DDBRA were strained because there were many demands on their time. While we tried to be as flexible as possible in terms of the scheduling of the Decision Conference, we insisted that during the days of the Conference participants would not be disturbed. The main rationale behind this insistence was, in addition to the fact that it would aid participants' concentration, that it would aid the transformation process as I have outlined it within the context of the previous set of objectives (creating the boundaries necessary for effective group work).

Decision Conferences usually take place away from clients' work environment in order to create some distance to everyday problems. Even though we were not disturbed during the two days, in retrospect I should have insisted that the Conference not take place at the DDBRA headquarters - particularly in view of the fact that the views were so entrenched and a thorough examination of relationships between the represented stakeholder groups was necessary. A location such as the retreat at Uzlina, inside the Danube Delta, would have been ideal because it would have meant that the Conference was residential and therefore would have given participants the opportunity to discuss informally in the evening.

Hardin (1968) spoke of the inevitability of the "Tragedy of the Commons" in relation to scarce resources that are used in common because of a divergence between individual and collective rationality. Phillips (1988) referred to a similar phenomenon in organisations where managers of different departments are all engaged in optimising the use of resources within their own areas of responsibility, but collectively (for the organization as a whole) resources are not maximised. In the case of the DDBR a similar problem occurred: the Licensing Department of the DDBRA worked very hard on the development of a better management system for the fishery, so did the Natural Resources Department, as well as the fishery scientists of the DDI, fishing companies and many others. Yet, collectively, the result of these efforts was far from satisfactory. In such a situation it is very tempting to impose a greater degree of central control in order to solve this dilemma. However, just as in the case of Hardin's "Tragedy of the Commons" for which it has been shown that improved communication between resource users can resolve the dilemma (see Chapter 4), so can improved communication and a shared sense of understanding also improve collaboration within and between organisations. The Decision Conference has provided a unique opportunity for a small number of managers to exchange views and learn much about each others' views, roles, and problems. It would be too much to claim that the Decision Conference has led to the complete avoidance of social tragedies even between the Departments and organisations that have participated, but the collaboration between stakeholders has been improved in a limited but important way.

9.5 Conclusions

The use of Decision Conferencing in the development of the fisheries management plan for the DDBRA produced a new fisheries management strategy that was consistent with the objectives of the Biosphere Reserve. This strategy, developed by participants, was more coherent than all the previous attempts at management planning as it incorporated all the considerations that were thought to be important. For example, the effects of the illegal trade in fish, which until then had been left out of all formal analyses.

The fishery licensing scheme developed was more robust than previous schemes because it considered the viewpoints of a greater variety of stakeholders. This aspect might have been further improved by also directly incorporating the viewpoints of fishermen associations. Another key decision maker, the Governor of the DDBRA, was also not able to participate fully. His brief intervention in the Conference was positive, as it provided the opportunity for him to share his perspective, concerns, and to indicate the direction in which he thought fishery management in the DDBR should develop. Fuller participation would have made it possible for him to engage in the transformation that took place in the Conference. Nevertheless, the greater robustness of the scheme, combined with the improved understanding of different stakeholder positions and the perspectives of different disciplines and departments (in short the shared social reality that was generated) also meant that essential requirements of adaptive management were created.

On the basis of my review of the proposals in the Multiple Stakeholder Decision Analysis (MSDA) literature, and the limited number of applications of (MSDA) to environmental management problems, I concluded that it would also have been possible to apply MSDA in the DDBR. MSDA would have made great strides in the systematic integration of uncertainty and the objectives of different stakeholders into fishery management analysis. However, unlike Decision Conferencing, MSDA does not deal with the institutional context within which management strategy development takes place. In the case of the DDBRA, the use of MSDA, in the format which has been advocated until now (where institutional context is not considered) would have been more likely to have produced an informative report and learning for the participating individuals. It is unlikely that it would have led to the transformation of the DDBRA's management approach and the development of an adaptive fishery management strategy.

The Decision Conferencing methodology may be improved if more attention is paid to what constitutes "diversity of viewpoints". I have shown in Chapter 6 (Section 6.3.2.1) that in Decision Conferencing "the main safeguard against the creation of idiosyncratic, even eccentric models is the same as for science: reliance on adversarial processes. A key requirement of Decision Conferences is that the problem owners must represent a variety of viewpoints" (Phillips 1984:43). However, despite the incorporation of apparent diversity, there is still the need to guard against representing only similar viewpoints. One possible way of addressing this danger is by using Cultural Theory and Stratified Systems Theory to assist in the selection of participants. Both theories are practical and provide clear and consistent accounts of what diversity means. At present, the use of Cultural Theory is still contentious (see

Krimsky and Golding, 1992) and there are alternative theories relating to diversity (see for example Trist and Murrary, 1990) that would need to be evaluated.

10 Appendices

10.1 Callnote for the DDBR Decision Conference

Decision Analysis Workshop
on a Fishery Management Strategy
for the Danube Delta Biosphere Reserve Authority

As a result of three workshops on the Danube Delta Fishery held on 5, 12, and 16 September it was agreed to hold an intensive decision analysis workshop in the week of October 10th in order to agree on a realistic management strategy for the Biosphere Reserve fishery.

The workshop will be held over two full days:

When: Wednesday 12.10.94 and Thursday 13.10.94.
Where: DDBRA Meeting Room
Time: 8:30 - 17:30 with group lunch and dinner.

The objectives of the workshop are:

1 Review the progress made in the previous three sessions.

2 Establish Long Term fundamental objectives for marine and inland fishery management.

3 Agree on a set of preferred strategies for achieving the objectives.

4 Agree on a set of proposals to put to the decision making group and for consultation, and on the format and way that these will be put forward.

5 Agree on the actions necessary to implement objectives 3 & 4.

Before the first session on Wednesday, 12.10.94, please think through your views on several realistic alternative approaches we could take. Please make a two page summary (using keywords) of these alternatives for discussion and what their particular advantages / disadvantages are (in relation to: objectives for fishery management, current implementation possibilities, etc.)

The workshop will be facilitated by Peter Hall (who is a Decision Analysis consultant from the London School of Economics). He will be assisted by Axel Kravatzky. The role of Mr Hall and Kravatzky is only to help you with the process of analysis and decision making. The success of this workshop depends on your contribution to the content.

Please make all necessary arrangments to keep your diary for Wednesday and Thursday free of all other commitments so that you will not be disturbed for the period of those two days.

The participants at the workshop will be:

Baboianu, Grigore
Staras, Mircea
Dr Munteanu, Ion
Constantin, Nicolae
Cristocea
Munteanu, Ion
de Graaf, Gertjan
Hall, Peter
Kravatzky, Axel

10.2 The Author's Terms of Reference

Terms of Reference for the Economics Researcher

Executant: Mr Axel Kravatzkv

Period: mid-November 1993 to end September 1994

Programme Area: DDBRA Planning, Poilcy and Investments Department

Objectives

1. To carry forward economic and management analyses of the most important economic sectors in the delta to determine possible investment opportunities that meet DDBR objectives.
2. To describe and evaluate the economies of villages in and immediately around the DDBR, and their interdependence with Tulcea, Constanta and other major towns, as a basis for future management planning.
3. To describe and evaluate the management implications of the current and any future planned transport (road and water) system within the DDBR-
4. To compile and assess the extent and quality of existing information pertinent to management planning within the DDBR.
5. To assist the Resident Adviser and other members of the Danube Delta Environmental Management Programme team in carrying out their work (e.g. translating at meetings) and to transfer expertise to appropriate staff of the DDBRA Planning, Policy and Investment Department.

Guidance

The EBRD consultant economist has collated and carried out preliminary analyses of the major economic activities within the DDBR. In terms of natural resource use, these basically comprise fishing, agriculture and reed harvesting. Given the over-riding importance of the fishing sector, and the potential for rapidly increasing its productivity and enhancing local employment, representing an early opportunity to demonstrate the benefits of environmentally sustainable development, the first priority of the Economics Researcher will be to carry out a detailed evaluation of the activities and management competence of companies engaged in fishing. A tabulation of relevant companies against various asset and performance criteria will be drawn up to assist identification of those companies with the best prospects of being able to receive and utilise investments for improving fishing productivity within environmentally sustainable limits.

Similar exercises will be carried out in other sectors as time and circumstances allow.

The EBRD consultant economist has collated existing demographic data from villages within and around the DDBR. However, these data cannot be properly interpreted in the absence of information concerning the principal economic activities carried out by the inhabitants, and their access to markets, goods and services in Tulcea, Constanta and elsewhere. This situation in turn impedes devising environmentally sustainable development policies relevant to the needs of the local population. Accordingly, the Economics Researcher will visit the principal population centres within and around the DDBR in order to obtain the information required. This will be done in collaboration with the socio-economics team of the DDI.

It is known that the Danube River is a major international navigation thoroughfare. and that a road network within the DDBR is virtually absent. However, there are demands to improve road communications within the DDBR (principally to connect Chilia Veche with Tulcea), and to increase the network of canals for boat traffic. The Economics Researcher will therefore describe and evaluate the management implications of the current and any future planned transport (road and water) within the DDBR.

Information about the DDBR which is highly relevant to management planning has been collected by a variety of bodies (nationally and internationally) over a number of years. Much of this information is held by the DDI, but as was demonstrated by the GEF Project Preparation team during 1993, significant resources exist in Bucharest and Constanta, as well as in France, Germany and Austria (among other countries). The Economics Researcher will initiate a process for identifying the sources and types of information held, and where feasible evaluate the quality of this information.

It is essential that the Economics Researcher should not work in isolation, but ensure that there is a transfer of knowledge and expertise to appropriate staff of the DDBRA, especially those in the Planning, Policy, and Investment Department. In line with this policy, the Economics Researcher will convene, in association with the London

School of Economics, a decision facilitation conference focusing on one of the areas of investigation described above.

Schedule of Outputs: 1994

April:	Investment profiles of fishing companies operating in the DDBR
May:	Evaluation of current and potential transport systems
June:	Economic profiles of villages in and around the DDBR
July:	Decision facilitation conference
September:	Annotated inventory of information types and sources pertinent to management planning of the DDBR

10.3 Project Personnel

Project Steering Group
Ing. Eugen Tarhon, DDBRA Governor
Representative of MWFEP
Mr Gerry Muscat, EBRD
Mr Gerard Fischer, Euroconsult
Ms Liz Hopkins, IUCN
International Advisers
Dr M. A. Clark (Broads Authority, UK)
Prof L. Pons (University of Wageningen)
Dr P Dugan (IUCN)
Dr E Maltby (University of Exeter)
EBRD Technical Cooperation Team, to December 1993
Project Coordinator Mr Gerard Fischer (Euroconsult)
Resident Adviser: Mr Paul Goriup (IUCN-World Conservadon Union)
Legal Experts: Dr Lothar Güntling and Prof Mircea Dutu
Administration Expert: Mr Ronald Boesaart
Accountant Mr Cezar Catarglu
Participatory Planner Mr Michael Douse
Economists: Mr Gerard Fischer and Mr Axel Kravatzky
Training Expert: Dr Willem Rodenburg
Procurement Expert: Mr Douglas Murray-Jones
DDBRA Secondments: Ms Adina Gradea, Mr Sorin Cismaru, Ms Gabriela Ioan
Short-term Project Assistants: Ms Mihaela Albota, Ms Adriana Dinu

10.4 HIVIEW Report of 1st Decision Conference Model

Hiview for Windows - c:\axel\phd\ddbr\ddbrwksh\fishery\fmodel\fisheng2.hvw

Model created 11/10/94

Model Text[66]
****

The fundamental objective that the adopted licensing scheme must fulfil is:
Nature conservation and restoration of nature (maximisation of conservation value)

Overall Scores
****

Option	overall score
CURRENT	14.29
Proposed	66.33
Direct	67.86
Distributn	49.54
Association	66.42
Margins	85.71
2 Improved	76.57

Options
****

CURRENT (Option 1)
21 licences issued by DDBRA. No fee. Licences subcontracted to others (approx 130 'companies' active). Enforcement difficult, management impossible due to inaccurate information.

PROPOSED (Option 2)[67]

50 licenses that give exclusive fishing rights for certain areas. Auctioned only to companies. The highest bidder agrees pay a percentage of the value of the fish caught.

DIRECT (Option 3)[68]
Licenses for quotas auctioned direct to fishermen who pay a fee on the quota they obtained. Fishermen auction their fish through the cherhanas to achieve the best

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[66] Translated from Romanian by Axel Kravatzky

[67] Proposed by Dr Baboianu, Mr Constantin, and Dr Staras.

[68] Proposed by Dr Staras.

price. The current state companies become service companies taking only a small percentage of the sale price.

DISTRIBUTION (Option 4)[69]
Licences, for quotas and areas, are auctioned only to companies. Companies improve distribution by opening more retail outlets, thereby increasing their income, and fishermen are paid more. Otherwise like PROPOSED Option.

ASSOCIATION (Option 5)[70]
Licences for areas auctioned to companies and fishermen associations. Fishermen own their gear or lease it from the companies. Companies also auction the fish for the fishermen. Companies serve as distributors and service companies to the fishermen.

MARGINS (Option 6)[71]
Licences have a contract length of 20 years and are made transferable as well as inheritable. The idea is to introduce more competition for profit as well as provide incentives and security for investments.

2 IMPROVED (Option 7)[72]
Make only the most important change to PROPOSED in order to implement rapidly. Licence fee is a fixed amount on the quota and not on the eventual fish caught.

Summary Report
****

	CURRENT	Proposed	Direct	Distributn	Association	Margins	2 Improved	Cum Wt
ST Implement Legal Difficult	0	100	0	0	50	100	100	18
ST Implement Illegal Trade	0	30	100	50	60	80	50	18
ST Implement Time	100	100	0	90	20	95	100	14
LT Strategy BIO-DIV	0	60	100	60	100	80	80	21
LT Strategy Sustainability	0	60	100	50	70	80	60	13
LT Strategy Data Collectn	0	53	100	54	86	80	68	17
Total	14	66	68	50	66	86	77	

69 Proposed by Mr Cristocea

70 Proposed by Mr Constantin.

71 Proposed by Mr deGraaf.

72 Based on Governor (Mr Tarhon) intervention.

Structure
****

License
ST Implement
Legal Difficult
Illegal Trade
Time
LT Strategy
BIO-DIV
Sustainability
Data Collectn

Weights
****

	Name	Weight	% weight	Cum wt
License	ST Implement	50	50	50
ST Implement	Legal Difficult	100	36	18
ST Implement	Illegal Trade	100	36	18
ST Implement	Time	100	36	18
License	LT Strategy	50	50	50
LT Strategy	BIO-DIV	100	42	21
LT Strategy	Sustainability	60	25	13
LT Strategy	Data Collectn	80	33	17

Scores
******

Short Name : Legal Difficult
Long Name : Legal Difficulty

By how much must the current laws be changed in order to introduce the licensing scheme?

The current law stipulates that: (a) only companies can participate in the auction; (b) only areas can be auctioned (and not quotas).

Most preferred:
2+6+7 (100%) - All fall within the current law.

Least preferred:
1 (0%) - zones are auctioned but with sublease, which is not legal.
3+4 (0%) - quotas are not allowed.

Others:
5 (50%) - associations are currently not allowed but required amendment to the law would not be too difficult to obtain.

Scale : Preferences
Scale Type : Identity

	Option	Score	Normalised	Weighted
1	CURRENT	0	0	0

2	Proposed	100	100	18
3	Direct	0	0	0
4	Distributn	0	0	0
5	Association	50	50	9
6	Margins	100	100	18
7	2 Improved	100	100	18

Short Name : Illegal Trade
Long Name : Illegal Trade

By how much will illegal trade (black market) be reduced?

Most preferred:
3 (100%) - through auctioning system fishermen will be able to sell at market price (-10% commission); because fee is on quota money won't be lost by declaring full catch.

Least preferred:
1 (0%) - fishermen obtain much more by selling illegally & companies tolerate it.

Others:
5+7 (50%) - fee is on quota but price difference retail price-fishermen still very large

6 (80%) - retail-fishermen price difference reduced, but because zones are auctioned (which favours larger companies state companies) who have not much reason to maximise efficiency.

4 (50%) - retail-fishermen price difference reduced, but not very much because state companies have not much pressure to maximise efficiency. Also, license fee on catch so more profitable to sell illegally.

2 (30%) - like 4 but nor even retail-fishermen price difference reduced.

Scale : Preferences
Scale Type : Identity

	Option	Score	Normalised	Weighted
1	CURRENT	0	0	0
2	Proposed	30	30	5
3	Direct	100	100	18
4	Distributn	50	40	9
5	Association	60	50	11
6	Margins	80	80	14
7	2 Improved	60	50	9

Short Name : Time
Long Name : Time nec. for impltn

How much time is required for implementation?

Most preferred:
1+2+7 (100%) - there is enough time before the auction to introduce the necessary changes to the rules.

Least preferred:
3 (0%) - require change to the law which takes a lot of time.

Others:
4 (90%) - it takes time before companies could improve their retail network, but otherwise like 2.

6 (95%) - it takes time for some smaller companies to form themselves and acquire the necessary capital to participate in the auction.

5 (20%) - it takes time to make an amendment to the law so that associations to participate. These must form themselves, and acquire capital to participate in the auction.

Scale : Preferences
Scale Type : Identity

	Option	Score	Normalised	Weighted
1	CURRENT	100	100	14
2	Proposed	100	100	14
3	Direct	0	0	0
4	Distributn	90	90	13
5	Association	20	20	3
6	Margins	95	75	14
7	2 Improved	100	100	14

Short Name : BIO-DIV
Long Name : BIO-DIVERSITY

The support of the improvement of diversity of fish population, as indicated by:
-Overfishing
-Selective fishing (species, size, prohibition times).

Note: under auctioning system marketing becomes more important than on black market => it pays to bring in only quality fish.

Most Preferred:
3+5 (100%) - Fishermen and their associations are given direct control and responsibility – easier enforcement & self-interest.

Least preferred:
1 (0%) - fish is extracted in an undifferentiating manner. There are not enough fishermen to overfish currently, but the mesh size used is very small. There is no control over gear used. Because of subleasing it is not clear who can fish where, so that control is difficult.

Others:
2+4 (60%) - there are fewer companies and it is clear who is allowed to fish and they have a legal basis for this right. All gear will have to be marked so that at least some of the small mesh gear will be withdrawn. Companies have to pay a minimum (or 18% of catch) so that they will probably want more fish from the fishermen to be declared. But still substantial illegal trade - species mix and too young fish.

6+7 (80%) - Large improvements from long term investment protection concern + marketing; large improvement from quota fee system.

Scale : Preferences
Scale Type : Identity

	Option	Score	Normalised	Weighted
1	CURRENT	0	0	0
2	Proposed	60	50	13
3	Direct	100	80	21
4	Distributn	60	50	13
5	Association	100	80	21
6	Margins	80	60	17
7	2 Improved	80	60	17

Short Name : Sustainability
Long Name : Sustainability of income

Assuring sustainable income for the local population. Key criteria:
- employment security
- availability of natural resource.
- do others, besides local professional fishermen, have access to the licences?

Most preferred:
3 (100%) - Licences are given exclusively direct to fishermen. They will try to fish as much as possible but they will monitor each other because the activity of others affects them directly.

Least preferred:
1 (0%) - Lack of control over fishing activity (either by authority or fishermen) can neither ensure local employment nor the maintenance of the fish stock.

Others:
7+2 (60%) - Fishermen will definitely have incentives to sell on the black market. Fish stock would be endangered by fishermen who continue to receive a salary in spite of the depletion of the fish stock for short run profits from the black market.

5 (70%) - Licence fee on landed catch will make it profitable to sell fish on the black market. This is somewhat counteracted by the cherhana auctioning system where they could get a good market price in a legal manner.

6 (80%) - The long term licences give incentives to protect the stock but the area licensing system is less desirable than the quota system.

4 (50%) - Bigger state/ centralised companies are less likely to be able to control their fishermen. Fish stock would thereby diminish most.

Scale : Preferences
Scale Type : Identity

	Option	Score	Normalised	Weighted
1	CURRENT	0	0	0
2	Proposed	60	60	8
3	Direct	100	100	13
4	Distributn	50	50	6
5	Association	70	70	9
6	Margins	80	80	10
7	2Improved	60	60	8

Short Name : Data Collectn
Long Name : Data Collection

Ability to obtain data on effort and total catch.
Influenced most by:
- Fee type
- Marketing channel
- Organisational disincentives

Most preferred:
3 (100%) - Data is collected at auction point. Fee on quota and no incentive to sell on black market. Each fisherman registers his gear & can be checked in field.

Least preferred:
1 (0%) - no accurate data is obtained due to economic disincentives, organisational problems, and confusion.

Others:
2 (53%) - some of the current confusion is clarified.

4 (54%) – maybe better than proposed because companies run better.

5 (86%) - economic incentives for hiding data down and associations monitor each other.

6 (80%) - developed auction system / competition reveals more data.

7 (68%) - removing the tax on landed catch takes away the biggest disincentive to report accurate figures.

Scale : Preferences
Scale Type : Identity

	Option	Score	Normalised	Weighted
1	CURRENT	0	0	0
2	Proposed	53	53	9
3	Direct	100	100	17

4	Distributn	54	50	9
5	Association	86	80	14
6	Margins	80	80	13
7	2Improved	68	60	11

10.5 HIVIEW Report of 2nd Decision Conference Model

Hiview for Windows - c:\axel\phd\ddbr\ddbrwksh\fishery\fmodel\fisheng3.hvw

Model created 12/10/94

Model Text[73]
****

The fundamental objective that the adopted licensing scheme must fulfil is:
Nature conservation and restoration of nature (maximisation of conservation value)

Overall Scores
****

Option	**overall score**
CURRENT	11.16
Proposed	45.81
Direct	75.23
Distributn	46.07
Association	62.29
Margins	77.21
2 Improved	56.53
Best LT	85.02
Phased	90.95

Options
****

CURRENT (Option 1)
21 licences issued by DDBRA. No fee. Licences subcontracted to others (approx 130 'companies' active). Enforcement difficult, management impossible due to inaccurate information.

PROPOSED (Option 2)[74]

50 licenses that give exclusive fishing rights for certain areas. Auctioned only to companies. The highest bidder agrees pay a percentage of the value of the fish caught.

DIRECT (Option 3)[75]

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[73] Translated from Romanian by Axel Kravatzky

[74] CURRENTed by Dr Baboianu, Mr Constantin, and Dr Staras.

[75] Proposed by Dr Staras.

Licenses for quotas auctioned direct to fishermen who pay a fee on the quota they obtained. Fishermen auction their fish through the cherhanas to achieve the best price. The current state companies become service companies taking only a small percentage of the sale price.

DISTRIBUTION (Option 4)[76]
Licences, for quotas and areas, are auctioned only to companies. Companies improve distribution by opening more retail outlets, thereby increasing their income, and fishermen are paid more. Otherwise like PROPOSED Option.

ASSOCIATION (Option 5)[77]
Licences for areas auctioned to companies and fishermen associations. Fishermen own their gear or lease it from the companies. Companies also auction the fish for the fishermen. Companies serve as distributors and service companies to the fishermen.

MARGINS (Option 6)[78]
Licences have a contract length of 20 years and are made transferable as well as inheritable. The idea is to introduce more competition for profit as well as provide incentives and security for investments.

2 IMPROVED (Option 7)[79]
Make only the most important change to PROPOSED in order to implement rapidly. Licence fee is a fixed amount on the quota and not on the eventual fish caught.

BEST LT (Option 8)
Auction by zone and/or quota. For larger lakes which contain several allocated quotas seek co-management. Fixed & indexed licence fee on the quota auctioned. Licence is for a longer term (10 years), transferable and inheritable. State companies shift to distribution and service (due to market conditions and economies of scale). State Companies allow fishermen to own and rent boats and gear. Only local active fishermen may be employed.

PHASED (Option 9)

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[76] Proposed by Mr Cristocea

[77] Proposed by Mr Constantin.

[78] Proposed by Mr deGraaf.

[79] Based on Governor (Mr Tarhon) intervention.

One licence per zone is auctioned. Include small zones, suitable for fishermen associations. Licence fee based on the quota of the auctioned zone, paid in indexed instalments. The contract length is short (1 year, max 3 years) to allow for modification of law and prevent intermediate system to take root. Start Option 8 as pilot scheme by changing one cherhana to an auction house. Do everything necessary to move as quickly as possible towards Best LT option.

Summary Report

****

	CURRENT	Proposed	Direct	Distributn	Association	Margins	2 Improved	Best LT	Phased	Cum Wt
ST Implement Legal Difficult	0	100	0	0	50	100	100	0	88	7
ST Implement Political Acpt	1	50	40	40	40	90	70	90	100	4
ST Implement Illegal Trade	0	30	100	40	50	80	50	100	60	7
ST Implement Time	100	100	0	90	20	75	100	0	85	6
ST Implement Bureaucracy	90	0	100	20	40	60	40	100	50	6
LT Strategy BIO-DIV	0	50	80	50	80	60	60	100	100	21
LT Strategy Secu Invest	0	20	80	60	60	100	20	90	90	14
LT Strategy Sustainability	0	60	100	50	70	80	60	120	120	14
LT Strategy Data Collectn	0	40	100	50	80	80	60	100	100	21
Total	11	46	75	46	62	77	57	85	91	

Structure

****

- License
  - ST Implement
    - Legal Difficult
    - Political Acpt
    - Illegal Trade
    - Time
    - Bureaucracy
  - LT Strategy
    - BIO-DIV
    - Secu Invest
    - Sustainability
    - Data Collectn

Weights

****

	Name	Weight	% weight	Cum wt
License	ST Implement	30	30	30
ST Implement	Legal Difficult	100	24	7
ST Implement	Political Acpt	50	12	4
ST Implement	Illegal Trade	100	24	7
ST Implement	Time	80	20	6
ST Implement	Bureaucracy	80	20	6
License	LT Strategy	70	70	70
LT Strategy	BIO-DIV	100	29	21

LT Strategy	Secu Invest	70	21	14
LT Strategy	Sustainability	70	21	14
LT Strategy	Data Collectn	100	29	21

Scores
******

Short Name : Legal Difficult
Long Name : Legal Difficulty

By how much must the current laws be changed in order to introduce the licensing scheme?

The current law stipulates that: (a) only companies can participate in the auction; (b) only areas can be auctioned (and not quotas).

Most preferred:
2+6+7 (100%) - All fall within the current law.

Least preferred:
1 (0%) - zones are auctioned but with sublease, which is not legal.
3+4+8 (0%) - quotas are not allowed.

Others:
5 (50%) - associations are currently not allowed but required amendment to the law would not be too difficult to obtain.

9 (88%) - is more preferred than 5 because it requires only a government approval for the pilot.

Scale : Preferences
Scale Type : Identity

	Option	Score	Normalised	Weighted
1	CURRENT	0	0	0
2	Proposed	100	100	7
3	Direct	0	0	0
4	Distributn	0	0	0
5	Association	50	50	4
6	Margins	100	100	7
7	2 Improved	100	100	7
8	Bes tLT	0	0	0
9	Phased	88	88	6

Short Name : Political Acpt
Long Name : Political and Social Acceptability

To what extent is the licensing scheme politically and socially acceptable? To what extent does it eliminate conflicts of interest?

Most preferred:
9 (100%) - gradual introduction & potential for win/win (professional fishermen don't earn less than currently; fishing companies, who will need to be restructured anyway,

have a viable future as distributors and servicing companies. A good case from a fisheries management point of view.

Least preferred:
1 (1%)- everybody can gain from a clarification of the status quo (either consolidating current position or more substantial changes).

Others:
2 (50%) - intermediate between 9 & 1. Companies would consolidate position, fishermen could continue with current practices (employment + benefits + money from selling on black market). Not very dramatic changes from current situation.

3+4+5 (40%) - a little bit worse than 2 because: under 3 radical change for companies and likely conflict between companies and fishermen; under 4 fishermen won't gain very much more; under 5 associations would have to compete with companies who have monopolistic position.

7 (70%) - like 2 but more justifiable from management point of view.

6+8 (90%) - just as good as 9 but it is not gradual, and legally not possible.

Scale : Preferences
Scale Type : Identity

	Option	Score	Normalised	Weighted
1	CURRENT	1	1	0
2	Proposed	50	50	2
3	Direct	40	40	1
4	Distributn	40	40	1
5	Association	40	40	1
6	Margins	90	90	3
7	2 Improved	70	70	3
8	Best LT	90	90	3
9	Phased	100	100	4

Short Name : Illegal Trade
Long Name : Illegal Trade

By how much will illegal trade (black market) be reduced?

Most preferred:
3+8 (100%) - through auctioning system fishermen will be able to sell at market price (-10% commission); because fee is on quota money won't be lost by declaring full catch.

Least preferred:
1 (0%) - fishermen obtain much more by selling illegally & companies tolerate it.

Others:
5+7 (60%) - fee is on quota but price difference retail price-fishermen still very large

9 (60%) - fee is on quota but price difference retail price-fishermen still very large. At least in pilot experiment full catch is declared and some wholesalers will start working auctioning house where activity is legal, quality maybe more consistent, and transaction costs lower.

6 (80%) - retail-fishermen price difference reduced, but because zones are auctioned (which favours larger companies state companies) who have not much reason to maximise efficiency.

4 (40%) - retail-fishermen price difference reduced, but not very much because state companies have not much pressure to maximise efficiency. Also, license fee on catch so more profitable to sell illegally.

2 (30%) - like 4 but nor even retail-fishermen price difference reduced.

Scale : Preferences
Scale Type : Identity

	Option	Score	Normalised	Weighted
1	CURRENT	0	0	0
2	Proposed	30	30	2
3	Direct	100	100	7
4	Distributn	40	40	3
5	Association	50	50	4
6	Margins	80	80	6
7	2 Improved	50	50	4
8	Best LT	100	100	7
9	Phased	60	60	4

Short Name : Time
Long Name : Time nec. for impltn

How much time is required for implementation?

Most preferred:
1+2+7 (100%) - there is enough time before the auction to introduce the necessary changes to the rules.

Least preferred:
3+8 (0%) - require change to the law which takes a lot of time.

Others:
4 (90%) - it takes time before companies could improve their retail network, but otherwise like 2.

9 (85%) - like 2, but a government approval is required for the pilot part of the scheme.

6 (75%) - it takes time for some smaller companies to form themselves and acquire the necessary capital to participate in the auction.

5 (20%) - it takes time to make an amendment to the law so that associations to participate. These must form themselves, and acquire capital to participate in the auction.

Scale : Preferences
Scale Type : Identity

	Option	Score	Normalised	Weighted
1	CURRENT	100	100	6
2	Proposed	100	100	6
3	Direct	0	0	0
4	Distributn	90	90	5
5	Association	20	20	1
6	Margins	75	75	4
7	2 Improved	100	100	6
8	Best LT	0	0	0
9	Phased	85	85	5

Short Name : Bureaucracy
Long Name : Bureaucracy in admin

Bureaucracy in administration/monitoring and overall complexity of the licensing system. - complexity of the system.

Note: it is just as difficult to monitor 1000 fishermen directly whether there are 50 or 600 licences.

Most preferred:
3+8 (100%) - Even though they involve 600 / 400 licences the schemes are based on straight forward principles

Least preferred:
2 (0%) - the system produces too many incentives for cheating and as a result managing it is difficult to enforce / implement.

Others:
1 (90%) - present system is already established but management principles not very satisfactory.

4 (20%) - almost a cumbersome as proposed but fishermen would be more cooperative.

5 (40%) – requires more work than 4.

6 (60%) - though it involves more work from DDBRA the private sector is also more fully engaged in management.

7 (40%) - reducing the incentive to hide real catches makes it about twice as desirable as improved Distribution option.

9 (50%) - is going about half the way compared to Best LT.

Scale : Preferences
Scale Type : Identity

	Option	Score	Normalised	Weighted
1	CURRENT	90	90	5
2	Proposed	0	0	0
3	Direct	100	100	6
4	Distributn	20	20	1
5	Association	40	40	2
6	Margins	60	60	4
7	2 Improved	40	40	2
8	Best LT	100	100	6
9	Phased	50	50	3

Short Name : BIO-DIV
Long Name : BIO-DIVERSITY

The support of the improvement of diversity of fish population, as indicated by:
-Overfishing
-Selective fishing (species, size, prohibition times).

Note: under auctioning system marketing becomes more important than on black market => it pays to bring in only quality fish.

Most Preferred:
8+9 (100%) - in the short term 8 would be preferred, but in the next few years biodiversity won't be affected through 9. In the long term they are the same and best.

Least preferred:
1 (0%) - fish is extracted in an undifferentiating manner. There are not enough fishermen to overfish currently, but the mesh size used is very small. There is no control over gear used. Because of subleasing it is not clear who can fish where, so that control is difficult.

Others:
2+4 (50%) - there are fewer companies and it is clear who is allowed to fish and they have a legal basis for this right. All gear will have to be marked so that at least some of the small mesh gear will be withdrawn. Companies have to pay a minimum (or 18% of catch) so that they will probably want more fish from the fishermen to be declared. But still substantial illegal trade - species mix and too young fish.

6+7 (60%) - fishing is still done only by companies, but in 6 fishermen have less economic incentive to sell illegally (now auction) than in 7 (where companies distribution monopolists).

3+5 (80%) - quotas with auctioning, inheritability + transferability promotes selective fishing for marketing and investment protection . 5 is area fishing but with auctioning (therefore marketing) selective fishing is increased. Licences are obtained mostly by fishermen associations, where the individual fishermen have more responsibility for their common stock than when they are in company.

Scale : Preferences

Scale Type : Identity

	Option	Score	Normalised	Weighted
1	CURRENT	0	0	0
2	Proposed	50	50	10
3	Direct	80	80	16
4	Distributn	50	50	10
5	Association	80	80	16
6	Margins	60	60	12
7	2 Improved	60	60	12
8	Best LT	100	100	21
9	Phased	100	100	21

Short Name : Secu Invest
Long Name : Security for Investment

The degree to which the licensing scheme provides security for investors so that they will not loose their investments in long run. Key criteria:
-contract length
-transferability and inheritability

Most preferred:
6 (100%) - contract length is 20 years, transferable and inheritable.

Least preferred:
1 (0%) - licence for 1 year, not inheritable, not transferable.

Others:
8+9 (90%) - in 8 contract is for 10 years, inheritable, transferable. 9 is signals through the initial 1 year contract length (while the pilot is running - probably 3 years) that DDBRA is definitely not settling on a modified 2, but moving towards 8.

3 (80%) - 5 year contract, still inheritable and transferable.

4+5 (60%) - 5 year, not transferable and inheritable. In 4 companies will try to improve their situation by moving into retail and restructuring. In 5 fishermen associations will be quite keen on working hard.

2+7 (20%) - 5 years, not transferable and inheritable, state companies who have little incentive to strive for efficiency. Risky investment before they restructure.

Scale : Preferences
Scale Type : Identity

	Option	Score	Normalised	Weighted
1	CURRENT	0	0	0
2	Proposed	20	20	3
3	Direct	80	80	12
4	Distributn	60	60	9
5	Association	60	60	9
6	Margins	100	100	14

7	2 Improved	20	20	3
8	Best LT	90	90	13
9	Phased	90	90	13

Short Name : Sustainability
Long Name : Sustainability of income

Assuring sustainable income for the local population. Key criteria:
- employment security
- availability of natural resource.
- do others, besides local professional fishermen, have access to the licences?

Most preferred:
8+9 (120%) - In the long run 9 is the same as 8. Only local, active fishermen may be employed. Also best for fish stock maintainance.

Least preferred:
1 (0%) - Lack of control over fishing activity (either by authority or fishermen) can neither ensure local employment nor the maintenance of the fish stock.

Others:
7+2 (60%) - Fishermen will definitely have incentives to sell on the black market. Fish stock would be endangered by fishermen who continue to receive a salary in spite of the depletion of the fish stock for short run profits from the black market.

5 (70%) - Licence fee on landed catch will make it profitable to sell fish on the black market. This is somewhat counteracted by the cherhana auctioning system where they could get a good market price in a legal manner.

6 (80%) - The long term licences give incentives to protect the stock but the area licensing system is less desirable than the quota system.

3 (100%) - The fish stock is not as well protected as with 8+9 because licences are given exclusively direct to fishermen and it is therefore in their individual interest to fish as much as possible. They will monitor each other because the activity of others affects them directly.

4 (50%) - Bigger state/ centralised companies are less likely to be able to control their fishermen. Fish stock would thereby diminish most.

Scale : Preferences
Scale Type : Identity

	Option	Score	Normalised	Weighted
1	CURRENT	0	0	0
2	Proposed	60	50	7
3	Direct	100	83	12
4	Distributn	50	42	6
5	Association	70	58	8
6	Margins	80	67	10
7	2Improved	60	50	7
8	BestLT	120	100	14
9	Phased	120	100	14

Short Name : Data Collectn
Long Name : Data Collection

Ability to obtain data on effort and total catch.
Influenced most by:
- Fee type
- Marketing channel
- Organisational disincentives

Most preferred:
3+8+9 (100%) - Data is collected at auction point. Fee on quota and no incentive to sell on black market. Each fisherman registers his gear & can be checked in field.

Least preferred:
1 (0%) - no accurate data is obtained due to economic disincentives, organisational problems, and confusion.

Others:
2 (40%) - some of the current confusion is clarified.

4 (50%) - this option goes beyond Proposed and also reduces some economic disincentive to hiding data.

5+6 (80%) - developed auction system / competition reveals more data.

7 (60%) - removing the tax on landed catch takes away the biggest disincentive to report accurate figures.

Scale : Preferences
Scale Type : Identity

	Option	Score	Normalised	Weighted
1	CURRENT	0	0	0
2	Proposed	40	40	8
3	Direct	100	100	21
4	Distributn	50	50	10
5	Association	80	80	16
6	Margins	80	80	16
7	2Improved	60	60	12
8	BestLT	100	100	21
9	Phased	100	100	21

10.6 Resident Advisor Report (extracts)[80]

No. 12, 26th August 1994

Sectoral Studies and Zonal Workshops

7. The sectoral experts team was completed with the arrival of Gertjan de Graaf to cover the fishery management study.

8. Under the coordination of Sarah Fowler, the first zonal workshop on the marine and coastal zone was held at Uzlina from 23-25 August. The participants included researchers, DDBRA staff, local politicians and representatives from fishing companies. The sectoral reports prepared by the Romanian counterparts were of a high quality, but as expected lacked clearly formulated management policies and projects. These were developed with help from the sectoral experts before and (more discreetly) during the workshop itself. The participants found the exercise very useful, and the outputs achieved a remarkable degree of consensus, even on previously highly controversial topics (e.g. proposals for more canals will in future be subject to cost/benefit and environmental impact analyses before being commissioned).

9. As an adjunct to the above zonal workshop, Axel Kravatzky held two evening sessions to build a computer-aided decision analysis model concerning the future management strategy for Lake Sinoie. Previously a brackish lagoon, it has been sluiced and used as a sump for freshwater from Lake Razim for about 20 years. This led to the loss of the valuable mullet fishery and decline of biodiversity (especially a community of quarternary relict species). Three options were considered: (i) laissez-faire; (ii) continue existing management; (iii) revert the lake to a brackish lagoon. Interestingly, after vigorous discussion, (ii) was rejected as unviable and not fulfilling the DDBRA's mission to maintain biodiversity. The choice between (i) and (iii) was finely balanced, depending on what the costs of (iii) might be, and how threatened the relict species actually were. A similar exercise on the fish licensing system is planned for the third workshop.

FINAL REPORT
12 April 1995

In order to develop better alternative licensing schemes in line with the overall objectives of the DDBR, the executive director of the DDBRA (who had received some training in decision analysis during his foreign study tour) decided to call a decision analysis workshop where specialists and interest group representatives were brought together. The work method adopted was a series of three-day preparatory workshops, coordinated by Axel Kravatzky, and a two-day decision conference in which Peter Hall, a decision facilitator from the London School of Economics, attended as a decision analyst, with on-the-spot computer modelling using HIVIEW.

The participants in the decision conference were the staff of the authority, the DDRI, Gertjan de Graaf (fishery management consultant), a company

[80] From: Paul Goriup [mailto:paul.goriup@pop3.hiway.co.uk]; Sent: Monday, April 03, 2000 11:35; To: axel@carib-link.net ; Subject: Fisheries in DDBR

director, and the DDBRA's legal advisor. The conference opened with a discussion on the fundamental objective of the DDBRA and the group eventually agreed on the following formulation: "Nature conservation and restoration of nature (maximisation of conservation value)". They then went on to identify more immediate objectives, or means objectives, through which they were going to achieve the fundamental one.

All of the participants were able to formulate their own proposals, explain the rationale to the other participants, and modify them easily. The facilitator used the discussion about the advantages and disadvantages of these licensing schemes to construct a value tree that expressed the value-relevant objectives and established criteria for comparing alternative licensing schemes (Table 7).

Table 7: Criteria used to evaluate fish license schemes in the DDBRA

Short-term Criteria
- Is the scheme legal
- Is the scheme politically and socially acceptable
- Does the scheme reduce use of the black market
- Can the scheme be implemented soon
- Is the scheme simple

Long-term Criteria
- Does the scheme protect biodiversity
- Does the scheme provide security for investment
- Does the scheme provide sustainable yields
- Does the scheme provide sustainable employment
- Does the scheme yield reliable management data

Each objective and criterion was individually weighted, such that each of the licensing schemes examined was eventually scaled according to its usefulness in the short- or long-term. Even though the participants were not able to resolve all their differences in opinion in the course of the conference, they did agree on a common solution that the executive director presented to the cross-thematic workshop, where it was approved. In brief, it was recommended that the proposed DDBRA fish licensing scheme should be implemented in two phases, as follows:

Phase 1 (initialisation)
- The DDBR will be divided in to 50 fishing zones which will be licensed to one company on an annual basis (but a company may own more than one licence)
- The fishing zones will be distributed in each of the main geographic units of the DDBR (the main river channels, the delta proper, the Black Sea, and the Lake Razim/Sinoie complex) and the maximum allowable catch (MAC) will be related to the habitat and area of the zone concerned and specific in the licence
- The licence fee will be a fixed sum proportional to the MAC, indexed for inflation and payable monthly
- The companies will employ the fishermen and pay them a fixed price for their catch. The catch is sold by the companies at wholesale market prices

Phase 2 (pilot scheme, tested for three years)
- The MAC will be determined for each geographic unit in the DDBR and the number of licences available calculated given that each licence will permit a catch of 10 tonnes/year. In this way, individual fishermen and small companies will be able to compete for licences within any zone, where they will generally have freedom of movement. Area-based licences will be available only in small zones.
- The licence fee will be a fixed sum per tonne of catch, indexed for inflation and payable monthly. The licence will be valid for ten years and will be inheritable and transferable.

- Individual fishermen or companies will be the owners of the catch and may sell it directly to wholesalers.

Phase 2 can only be implemented on a large scale if the DDBR law is amended.
This is now being pursued by the DDBRA.

ABSTRACT FROM MANAGEMENT PLAN ADOPTED BY DDBRA IN 1994 (a table with 7 columns)

ZONE POLICY
NO. MANAGEMENT POLICY PROJECT
NO. PRIORITY PROJECT TITLE TIMING
Economic #24
Institute a system of management for the sustainable utilisation
of natural resources.
#24.1 1 *Analyse the existing management of fisheries*
and develop options for improvement. 95 -> 96
#24.2 1 Select and apply a system of fishery licensing. 95 -> 97
#24.3 1 Implement a licensing system and set bag limits for hunting game
species. 95 -> 97
Economic #25
Develop and improve fish farming on the basis of economic
efficiency.
#25.1 2 Evaluate the existing situation of fish farming and make
recommendations about alternative methods of management. 96 -> 97
#25.2 2 Encourage investment in deterrent techniques for protecting fish
farms from piscivorous birds. 96 -> 97

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