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FISHERIES ECONOMICS IN MULTI-DISCIPLINARY PERSPECTIVE

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Abstract

The aim of this paper is to review the role of empirical research in fisheries economics in its own right as well as in relation to other areas of scientific research. The introduction describes some general considerations regarding the role of general (non-fisheries) issues. The second section presents the main research themes in fisheries economics. This section indicates broadly to which extent research is already on-going and which areas are still relatively unexplored. It is becoming increasingly evident that fisheries issues must be approached in a multi-disciplinary perspective. Therefore the third section deals with the relations between economics and other areas like ecology, policy, culture and technology. Fourth part is rather speculative. It attempts to indicate which research topics can be expected to become relevant in the coming 5-10 years. The research needs are not only derived from the existing research gaps, but even more from the expected future information needs. The last section discusses how these future research needs could be addressed.

1. INTRODUCTION

Fisheries related activities, be it fishing itself, fish processing, fisheries research or fisheries management form a part of much larger systems. Although this statement is self-evident, its logical consequences may not be always properly accounted for. It raises the question to which extent can fisheries research or fisheries management rely on results of research in other fields or on generic management in other areas? What makes fisheries economics different from 'other kinds of economics'? What is specific about fisheries management? What should be the role of other policies, e.g. regional, social or environmental, in relation to fisheries?

Fishing is a part of human exploitation of natural resources as a cultural phenomenon or as an economic activity. It is affected by developments in culture (social perceptions), technology (electronics), economics (Europeanisation) and prevailing political trends (liberalism, centralisation, etc.). Commercial fish stocks are a part of the general ecosystem.

When fishing is discussed as a subject of policy or research, it is essential to determine the scale at which it is looked at in terms of space and time. What is the regional unit - port or EU? And does the discussion regard short term (1 year) or long term (10 years)?

This paper deals with research needs in relation to (management of) sustainable fisheries. The above mentioned broader considerations determine the scope of such questions. Furthermore sustainability is a matter of perception and value judgement. It can hardly be determined with scientific objectivity. Therefore the research needs will be at least partly dependent on the cultural traditions of the research establishment as well as the priorities of the involved stakeholders (fishing industry, policy makers, environmental movement, etc.)

The brevity of the discussion of the research needs in the following sections does not allow to account properly for the above considerations. It necessarily remains at a rather general level.

2. MAIN RESEARCH THEMES OF FISHERIES ECONOMICS

The main research themes in fisheries economics are directly derived from the definittion of economics and fishing as an economic activity or production process. Definition of economics can be formulated as follows:

Economics deals with the allocation of scarce resources, which may be put to different uses.

Fish as a commodity has value (or price) because there is demand for it. People want to eat fish. The level of the fish prices depends on the relative scarcity, i.e. on the relation between supply and demand. Supply is determined by the size of the stocks and the production costs, which must be incurred in order to bring the fish from sea to the consumer. This implies that abundant fish stocks may not be exploited if the costs of fishing, transportation, preservation, etc. are relatively high in relation to what the consumer is willing to pay.

Furthermore, two different perspectives on scarcity can be distinguished: micro and macro view. The micro-economic view represents the approach of an individual producer. His revenues from fishing (or trading) must be higher than his production costs. He reacts to the actual market prices of all commodities in the short run. The macro view may be the view of the government or an independent analyst. This view does not necessarily take the market prices as starting point, but rather so called economic or shadow prices. The economic prices are adjusted for different perceptions of scarcity, which may stem particularly from the long-term perspective. The difference between market and economic prices is the reason why in the economic analysis the main problem of overexploitation of fish stock is the so called 'market failure'. The market prices do not reflect sufficiently the long-term scarcity, i.e. the fact that a too high production today (at low prices to vessels and to consumers and low production costs per ton of fish) may lead to fall in production in the future. Buyers and sellers on the market react to supply and demand in the short run, but cannot include the possible future scarcity in their consideration and actions.[1]

Research issues:
Micro economic analysis:

- Supply: Costs, earnings, incomes and profits of fleets
- Production process: Productivity and technologic progress
- Demand: Consumption patterns and trends
- Markets: prices, trade characteristics (distribution, logistics, international trade), price elasticities, product substitution
- Chains: organisation of the process from sea to consumer
- Product development and valorisation

Macro economic analysis

- Economic and ecological sustainability: market failure and its correction
- Bio-economic modelling
- Role of fisheries in national and local economies: generation of employment and income, multipliers
- Concentration trends of ownership, sectoral dynamics (internationalisation)
- Economic aspects of fisheries management: consequences of measures, subsidies, taxes, access fees, ownership/user rights
- Welfare economics: trade-offs efficiency vs. equity, long term scarcity, valuation of public goods
- Income distribution among producer groups and in time
- Exploitation under uncertainty,

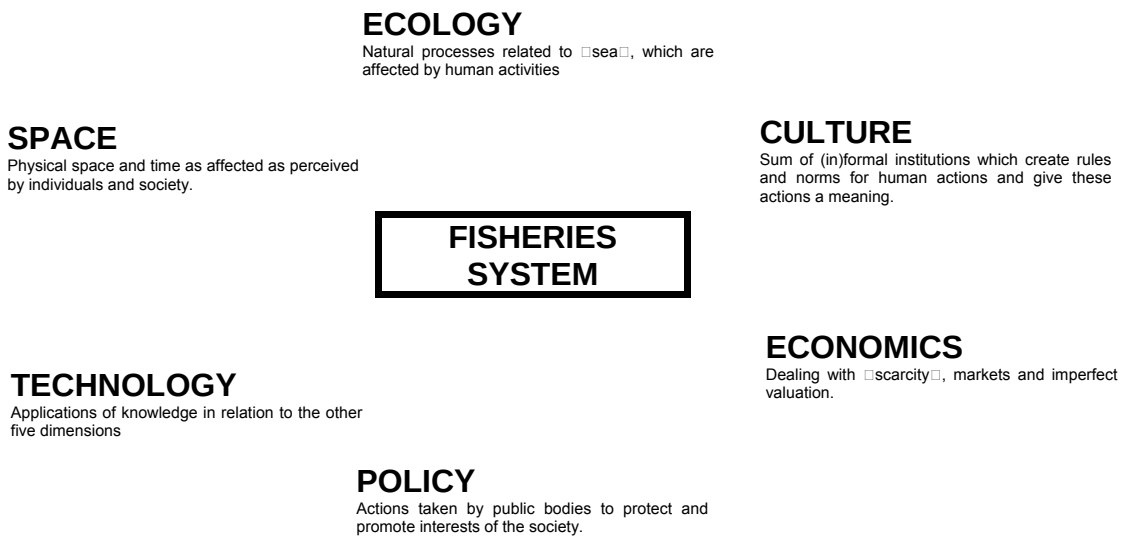
The overview above is neither unique nor exhaustive. There are necessarily various overlaps. All of the mentioned topics can be further sub-divided into a large number of well-defined research questions.

[1] This is fundamentally the reason why economic theory stresses that fisheries management should primarily aim to correct the need for the market failure through a/ avoiding any further decrease of production costs (i.e. no subsidies) and b/ introduction of access fees so that the resource bears also a price for the primary producers.

3. FISHERIES ECONOMICS IN MULTI-DISCIPLINARY PERSPECTIVE

Sustainability is by definition a holistic concept. Therefore in-depth mono-disciplinary analysis (be it economics or other sciences) needs to be complemented with a multi-disciplinary analysis which should clarify the relations between the various aspects like ecology, culture, policy & institutions, technology and the influence of scale in time and space. These relations can be represented in a force field, in which it is apparent that all of the individual aspects are affected by all other aspects.

Figure 1. Force field



The following sections discuss briefly the relations between economics and the other five 'forces' and specify the research topics which may be relevant in that connection.

3.1 Economics and ecology

View of the world

Fish stocks and fisheries are part of a larger, integrated ecosystem. The philosophy with which men look at this system determines at least partly the scope of analytical conclusions which economic science will draw. This may be illustrated by two (extreme) examples.

First is the fragmented and utilitarian view. Man is standing outside the ecological system. The natural resources are 'at his service'. Each component of the system is looked at separately, without its links to the rest of the system. If the component cannot be used somehow, it has no economic value. In these cases market price does not exist.

Second is the integrated or holistic view. Man is a part of his environment. All components contribute to the proper functioning of the system. Value should be also given to 'existence' not only to 'utility'. This view is in the background of the 'precautionary approach', which has been introduced as a concept to fisheries analysis and management recently. Taking this view, economic analysis cannot rely anymore on (existing) 'traditional markets' and on the

prices, which these markets produce. Correction of market prices and valuation of unpriced 'goods' may be required. The major challenge to applied economic research is the question of 'how to operationalise' concepts like the precautionary approach to make them acceptable to the real economic world, which is governed by market prices. Acceptable operationalisation will offer new instruments in fisheries management: indirect incentives through taxes or subsidies instead of the traditional administrative rules and regulations. These topics are closely linked to 'Resource economics' discussed above.

Research issues:
- valuation and utility
- fragmented vs. integrated approaches – when to apply which
- operationalisation of precautionary (and/or other) principles to real world economic processes
- trade-offs between various components of the system on different time scales

Limits to growth

A major distinction between fisheries and most other economic activities is that the natural environment imposes limits to the size of the industry. A given sea can sustain only a certain amount of fish. This amount of fish can potentially generate income for a certain maximum number of fishermen. The long run natural limits cannot be unambiguously determined with the current state of knowledge.

This has several consequences for topics of economic research. As the physical basis (stocks) of the sector (fleet) is limited, greater value added can be only obtained through lower production costs or higher prices of fish. Furthermore, intensive competition occurs as individual enterprises attempt to obtain a 'larger piece of the cake' in order to achieve income growth (race for fish). Distribution of access rights (and thus income) must be addressed explicitly.

Research issues:
- relation between fleet capacity and stocks
- distribution of benefits (access) and related trade-offs
- dynamics of competition (race for fish)

3.2 Economics and culture

Culture is the sum of (formal and informal) institutions, which create rules and norms for human actions and give these actions a meaning. Fishing is not only an economic activity, but also a way of life in the fishing communities. Cultural factors affect decisions of the various individuals. A few examples are: competition among fishermen for highest gross revenues, vessels as a status symbol, maintaining fishing despite decreasing income, sons of fishermen become also fishermen, etc.. These examples show that economic decisions regarding fishing operations, investment and trade may be heavily influenced by cultural factors.

The issues of traditionally (free) access to fishing grounds and property rights is also determined by cultural and historical considerations. Economic theory suggests that users of the 'common' natural resources (fish stocks) should pay to the society for their privileged access to these resources. Still, even today this seems culturally (politically) difficult to accept.

Open access to common resources leads to the 'tragedy of the commons' and 'free riding' behaviour. These processes are closely related to the market failure. 'Tragedy of the commons' may be considered as another major problem in fisheries management.

Common cultural background determines the social fabric of the fishing communities. Common perseverance to maintain such cultural identity may manifest itself in political and

economic decisions taken: maintenance of traditional institutions, solidarity in a community and/or commercialisation of relations between people. Economic pressure may cause the disappearance of the fishing sector and lead to a break down of the traditional social fabric.

Finally, culture determines, at least partly, consumption patterns. Habits of eating certain species of fish make fish production commercially feasible. Information about the cultural determinants of consumption habits may contribute to broadening of the markets and valorisation of products..

Research issues:
- cultural influences of economic decisions
- approaches to open access and property rights
- dynamics of community development
- culture and consumption

3.3 Economics and policy

Political choices

Common Fisheries Policy (CFP) aims to protect and promote the interests of fishermen, fish stocks, larger environment as well as the consumers. These objectives may be compatible in the long run, but at any given point in time choices must be made which benefit one objective at the expense of another.

Economic considerations are among the major factors affecting such political choices. Although economics (or any other science) cannot resolve some basic problems, economics is capable of producing a consistent set of options to facilitate the selection process. Such options may show which groups will benefit from a given decision and at which point in time, i.e. income distribution. Various trade-offs can be made visible.

Research issues:
- valuation of non-economic objectives
- trade-offs between objectives and their achievement (costs of policy)

Management measures

Policy is implemented with specific management instruments - TACs and quotas, decommissioning schemes, mesh size regulations, etc. Such measures usually involve financial expenses. Some measures are rules and regulations and their effective implementation requires a system of control, prosecution and punishment if necessary. Other types of measures are incentives intended to stimulate certain desired behaviour (or discourage undesired one).

In most (if not all) cases, the effectiveness of management measures depends on a large number of factors, influences and incentives to which the fishing companies are subject in the real world. The economic forces play an important role in this respect. Economic analysis can place the management measures in the total force field of economic incentives. Such analysis allows conclusions as to the likely effectiveness of the measures, e.g. is the decommissioning premium sufficient in view of economic performance of the fleet. It may also compare the likely effectiveness of certain alternatives: mesh size vs. price regulations. The analysis may not only shed light on the extent of the desired consequences, but it may equally well explore the undesired ones, which may be just as relevant (e.g. in terms of creation and distribution of income or employment).

Research issues:
- desired and undesired effects of measures
- economic incentives and effectiveness of policy

- definition of relevant indicators (operationalization of objectives)

Institutional arrangements

Fisheries policy is not implemented in a vacuum. It is a result of existing institutional and policy arrangements, e.g. level of government involvement, which institution is responsible for what, etc. The decision making process is determined by the involved institutions. A specific question in this respect regards the division of rights and responsibilities between the government administration (EU - national - local) and the industry organisations. Different institutional arrangements may differ in terms of their economic efficiency.

Research issues
- institutional arrangements (co-management, division of rights and responsibilities)
- institutional options and economic efficiency

3.4 Economics and technology

Competition between companies is the driving force behind the ever-increasing technological efficiency. The physical environment imposes limits on the total potential volume of production of wild caught fish. Competition than occurs in either higher prices (valorisation through better quality in broadest sense) or lower costs per unit of catch. In both cases the financial productivity (value added or income) per unit of costs will increase.

Productivity increase is usually achieved by replacing labour by capital. The required investments create new jobs on shore, but lead at the same time to loss of jobs on board.

Techno-economic research may demonstrate the acceptability and economic consequences of certain technical measures.

Technological development is not necessarily purely technical. It may also affect the organisational aspects of the firms as well as logistics in the whole chain.

Research issues:
- technology assessment (societal acceptation of technologies)
- valorisation of products (quality)
- potential of cost reduction
- relation between productivity, income and employment
- techno-economic feasibility of management measures
- developments in organisation and logistics
- economics of gear selectivity
- economic dimension of the reduction of environmental effects

3.5 Economics and spatial and temporal considerations

Autonomous economic development as well as fisheries management policies lead to changes in structure of the industry, characteristics of employment and income distribution. These changes occur in space and time. The dynamics of the system makes that groups of fishermen or regions become prosperous, while others are obliged to leave the industry and look for new economic activities. Such changes take time.

Furthermore, some generations may benefit more from the available fish stocks than others. The choice between less fish now and possibly more in the future is well known in fisheries.

Research issues:
- income distribution among fleets and/or regions

- trade-offs in time and space
- alternative time paths of development (fast or slow stock recovery)
- coastal zone management

4. FUTURE INFORMATION NEEDS

Future information needs will be derived from the approaches taken towards sustainable fisheries management. It is increasingly recognised that sustainability cannot be only interpreted and/or achieved by accounting for the biological phenomena. Objects of fisheries management are people and their organisation. Biological and ecological information is essential as an indicator of the constraints of the system, which need to be respected. However, it provides little information when it comes to measures, which need to be taken. Discussion in the previous section 3 shows the large variety of information, which may be required from mono- as well as multi-disciplinary analysis. An area, which is already getting to the forefront of policy attention, is the *relation between economy and ecology.* In the search of win-win situations it can be expected that the trade-offs which may occur between economy and ecology will drive the direction of the research in the coming decade. Three types of information needs (and research) could be distinguished:

- provision of 'raw data' (monitoring)
- elaboration of analysis (assessment)
- contribution to solutions (advice)

These three issues are discussed briefly below:

4.1 Monitoring

Collection of data is the basis for all empirical research. Consistency and reliability play an important role in this respect. In view of the links between stocks and markets, interdependence of stocks, role fo fisheries on various levels in the economy, etc., it is necessary to collect data on fisheries on a relatively broad scale. Economic data about fleets need to be supplemented with information about related industries and trade, dynamics of the regional economy, etc. Stock management measures may have consequences in area, which would not be foreseen otherwise.

In some cases it may be useful to co-ordinate the data collection regarding socio-economic and biological indicators. E.g. this is particularly the case when this data should serve as a basis for bio-economic models. Consistency of such data in terms of scales in time and space, classification of catches and landings, unit of fishing effort, etc. must receive the appropriate attention.

It seems equally relevant to follow the development of the qualitative conditions: adherence to rules and regulations, institutional capacity to enforce, investment trends, creation of employment opportunities, etc. Advice on fisheries management will have to look particularly well at the behaviour of the various 'actors' - vessel owners, processing industry, professional organisations, etc. Analysis of the 'tragedy of the commons' and 'race for fish', requires qualitative information in this respect because it improves the understanding of the driving forces behind observed behaviour and it allows a better interpretation of the collected statistics.

Quantitative information needs to be collected regularly and consistently in order to avoid conclusions based on non-representative data. Qualitative indicators are less subject to discontinuities and may be collected with ad hoc surveys.

Monitoring needs:

- costs and earnings of fishing vessels
- investment and productivity (technological progress)
- employment in fisheries and related activities

- fishing effort and productivity (cpue) by area and season
- catches, landings and prices by species and market category on relevant time scale
- indicators of behaviour (qualitative) - flexibility of fishing patterns, investment decisions, etc.

4.2 Assessment

Analysis of trade-offs between economy and ecology regards mainly the considerations in short and long run respectively. Economic survival of firms may be evaluated on time scale of months and years. However, ecological sustainability is determined on the scale of decades or more. It is therefore crucial to develop methodologies which would account for these differences and be accepted by the various stakeholders: fishing industry, policy makers and environmental protection organisations.

Major factors which need to get attention in this respects are inter alia uncertainty about the future stocks / caching opportunities (stochasticity) and valuation of unpriced goods (what is the price of environment?). The second question is well known from other areas of economics like environmental and development economics so that experiences from those areas may be relevant for fisheries.

The aim of assessment (or analysis) is to determine where there are trade-offs between economics and ecology, to put these trade-offs in an analytical (policy relevant) framework, and to quantify them as far as possible. The analysis should identify the driving forces behind such trade-offs in order to allow for pro-active formulation of policy measures and to identify win-win situations once it comes to advice.

Priorities for assessment

- short and long term scarcity: optimisation of stock management (in economic terms), definition of alternative development paths or scenarios for stock recovery or maintenance
- development of common indicators which would account for ecology and economics
- exploitation under uncertainty
- valuation of unpriced goods, shadow pricing in situation of market failure
- driving forces or the 'race for fish' and 'tragedy of the commons'
- trade-offs in time and space
- relation between fleet size (activity) and stocks (economic and ecological sustainability)
- socio-cultural influences (policy, culture, regulations)
- desired and undesired consequences of policy measures
- development of bio-economic models

4.3 Advice

Social science research (incl. economics) should provide advice (if asked for) in relation to the question: 'How can the behaviour of the various stakeholders be affected in a desired direction?'. The assessment should offer the necessary understanding of the interests and the driving forces of the stakeholders so that the policy advice may be related to them. Proper understanding of behaviour is a must in this respect.[2]

Advice-directed research should also give attention to the negative (undesired) consequences of proposed measures. Practice shows that solution of one problem (in one dimension) may lead to the appearance of another problem somewhere else. Although, not everything can be foreseen, indications as to possible new problems can be often given. This particularly is a major area for multi-disciplinary research because the new problems occur in

[2]It should be stressed that not only the behavior of the producers is here at stake, but also of the other stakeholders - policy makers, environmental organizations, etc. These stakeholders have their own interests also, although sometimes the impression exists that they pursue 'interests of the society' at large. An example may be the fact that the Council of Ministers is in fact regularly involved in a 'race for fish' itself, by pleading for higher TACs or economic support to the industry.

another dimension.

Research in itself is unlikely to lead to final solutions. There is almost always need for political choices. Research can support or clarify such choices. Therefore attention should be given to application of scenario analysis and the specification of the variables which should have a central role in the scenarios (5). Scenarios are not forecasts. They improve our understanding of possible future developments. They offer a framework to evaluate the likelihood of various options and most effective remedies (e.g. kind of measures, which may have positive effects in many different situations).

The proposed solutions will have to be consistent with the general development of the society, as otherwise they may be unacceptable. Therefore today perception of 'environment' will play a major role. The operationalisation of the 'precautionary approach' will be one of the major challenges of research in the coming years.

Following research issues seem relevant in relation to advice:

- operationalisation of the precautionary approach
- management by market incentives (resolution of market imperfections)
- partial vs. integrated approaches (mono- vs. multi-disciplinarity)
- specification of rights and responsibilities among the various stakeholders (industry, government, etc.)
- valuation of policy objectives in relation to policy costs
- alternative institutional arrangements (property rights, subsidiarity, cohesion, etc.)
- development of scenarios

5. RESEARCH NEEDS AND ORGANISATION AT 'META-LEVEL'

Limitations of scientific research need to be recognised, particularly in the short run. Sustainability of fisheries will remain a matter of discussion for the time being because of limited knowledge of the ecosystem at large and the impossibility to deliver ever final and conclusive knowledge. Therefore scientific research should pursue a more humble role than looking for the ultimate truth. Also the users of the research results should take this explicitly into account.

The scope of the research described above goes in a certain way beyond traditional approaches. New questions need to be addressed at meta-level in relation to form and content of a possible future research agenda:

1. Content - what should be studied
- Multidisciplinary theory of fisheries
- (Holistic) indicators of sustainability
- Consolidation of scales in space and time
- Sustainable behaviour of individuals and institutions

2. Form - how the research should take place
- Co-operation of social and natural sciences
- Dialogue with users
- Exploitation of all knowledge

Each topic is elaborated briefly below.

Content

Setting up comprehensive multidisciplinary co-operation should complement the on-going mono-disciplinary research. Such co-operation can be only effective if it takes place within a framework (or theory) to which all participants can relate. Developing a multidisciplinary theory of fisheries is therefore a first priority. Such initiative would also benefit many other fields related to environmental issues.

This theory should lead to a definition of practical indicators of sustainability. It can be expected that these indicators will have bearing on various dimensions of the above described force field at the same time. A major characteristic of these indicators will have to be the feasibility of their clear communication to the involved groups (fishermen, consumers, environmental interests groups, etc.). The indicators will have to be born and respected by these groups.

One of the major problems in reconciling economic needs of the industry and the ecological regeneration of fish stocks are the different scales in space and time which characterise them. Still other scales can be found in the areas of political decision-making or shifts in consumption patterns. Research into the short and long term priorities of the involved stakeholders may provide indications as to how a greater consistency could be achieved and how human actions should be adjusted.

Related to the above points is the question of sustainable behaviour of individuals and institutions. The 'tragedy of the commons' is not only characteristic to the competition among fishermen, but also in the international arena (Council), in technological competition, etc. Research needs to be carried out into the cultural habits and institutional arrangements which maintain (or could contain) undesirable competition for scarce natural resources. A specific question in this respect regards the practical operationalization of the precautionary approach to the realities of every day life.

The high dependence of the EU market on imported fish products, along with general world-wide trends in fish production and consumption calls for intensive scientific effort to develop

economically feasible, culturally acceptable and ecologically responsible large scale fish farming. This effort should offer the EU consumers traditional as well as novel seafood products. Although the farming does not have to take place necessarily in the EU, it must not go at the expense of the environment elsewhere (e.g. destruction of mangrove forests for shrimp).

Organisation / form

The force field shows clearly that each topic has to be addressed by natural as well as social sciences. Effective multidisciplinary co-operation will require appropriate organisational arrangements. It does not seem likely that co-operation can come about just through ad hoc projects or meetings. This would not be considered sufficient in mono-disciplinary research either. Specific proposals need to be developed as to the possibilities of effective organisation of multidisciplinary research.

Dialogue among disciplines needs to be complemented by structural on-going dialogue with the users of the research results. One of the most important and most difficult steps in applied research is the proper definition of the research questions. In practice it appears that these questions cannot be formulated neither by the users nor by the scientists alone. Formulation of the right question contains already the nucleus of the required answer. This answer is to be applied by the users to specific problems. Close involvement of the users in the research process is a guarantee that they will recognise the value of the research outcomes and will be more willing and capable to use them.

Finally, it should be recognised that among the various groups involved there is a vast, often dormant, knowledge. They have a potential to provide additional information for research purposes. Attention should be given to a more intensive co-operation between research and the fishing industry (and others) in order to use all knowledge available. The fishing fleets could provide a large variety of information in real time. Many fishermen have developed in-depth understanding of the environment in which they operate. Today this knowledge is discarded as unscientific.

Final remark

Fundamental as well as applied research is a risky enterprise. This is even more the case when new experimental approaches need to be followed. The priorities set in this paper certainly contain a fair amount of risk. Very specific results probably cannot be expected in the short and medium run. Allocating resources to this need today is the only way to obtain the required knowledge in the beginning of the next century.

References

1. P. Salz et.al, *Fisheries management policies towards 2010 - Scenarios and science and technology needs*
NRLO, The Hague, the Netherlands NRLO Report 97/29, (in Dutch, original title: Visserijbeleid in 2010 - Scenario's en kennisbehoeften)

2. P. Salz, *Fisheries, fisheries policy and applied economic research*,
discussion paper for the working group on Integrated Fisheries Management, September 1997

3. P. Salz, *Force field analysis: Towards integrated policy assessment*,
paper presented at ESSFIN Workshop on 'Alternative management systems', Brest, 18-20.9.1997

4. P. Salz, *Sustainability and consumption: Research needs beyond fisheries economics,*
paper presented at the Consensus conference on 'Sustainable production of seafood for European consumers, Copenhagen 6-7 November, 1997

5. F.C. Buisman and P. Salz, *Scenario analysis: Exploring the future of fisheries*
paper presencetd at IX EAFE Annual Conference, Quimper, France, 28-30 April 1997

6. P. Salz, *Some questions regarding coastal management research*,
Session 4, Social and institutional dynamics. Proceedings of the Euroconference on Coastal Management Research, San Feliu de Guixols, Spain 6-10 December 1997

7. M.T. Green, *What cannot be said in science*
Commentary, Nature, Vol. 388, 14 August 1997