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What Future for Capture Fisheries

A Shift in Paradigm: Visioning Sustainable Harvests
from the Northwest Atlantic in the Twenty-first Century

T. Amaratunga and H. Lassen

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Foreword

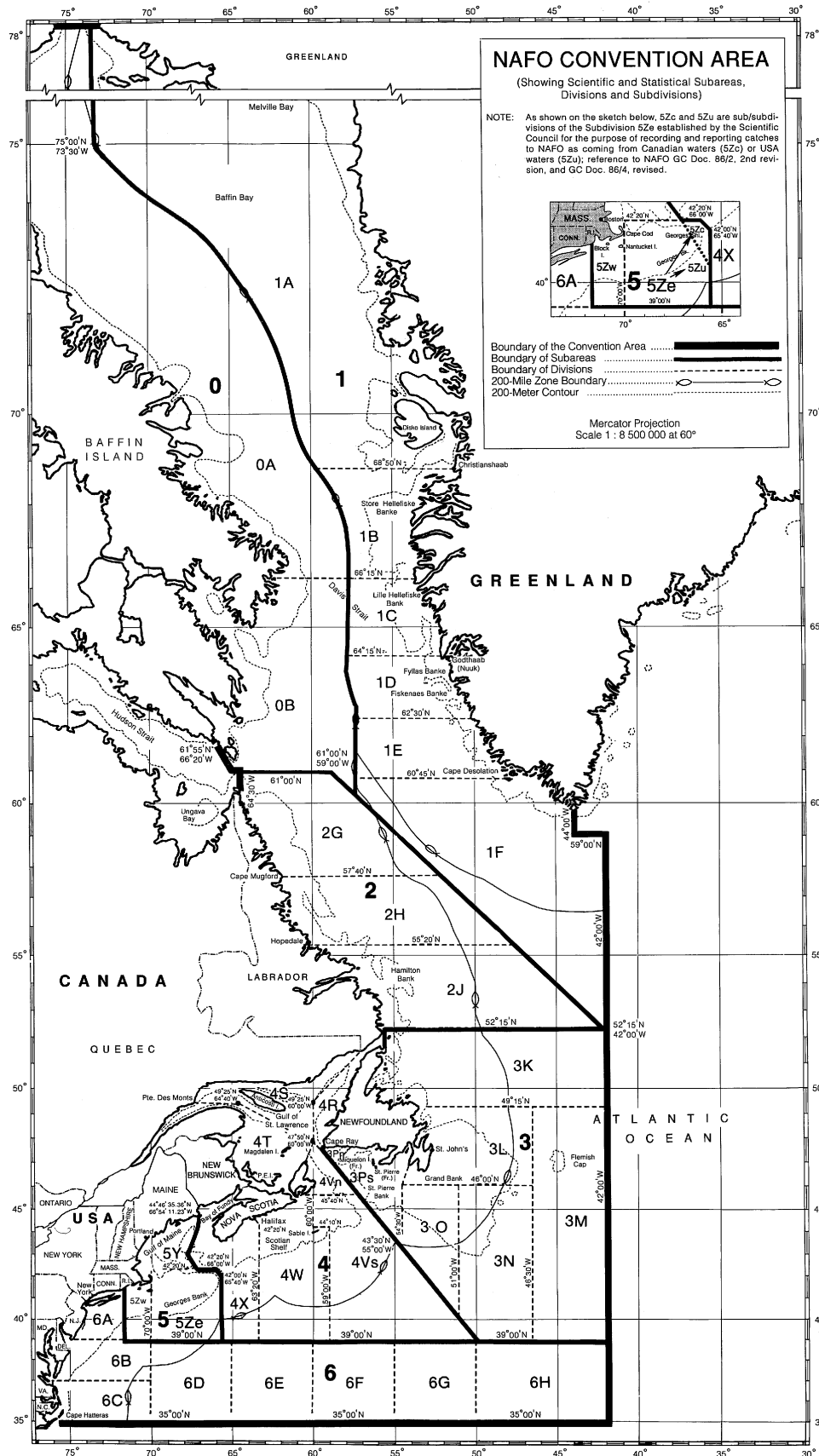
After NAFO replaced ICNAF in 1979, the NAFO Scientific Council since 1981 has held at least one Special Session on a topic of interest. For this Special Session in September 1997, the Scientific Council selected the Symposium "What Future for Capture Fisheries – A Shift in Paradigm: Visioning Sustainable Harvest from the Northwest Atlantic in the Twenty-first Century". The title particularly suited the setting of the NAFO 19th Annual Meeting held in St. John's, Newfoundland upon the invitation of Canada – a Coastal State Contracting Party of NAFO. The Annual Meeting was located in St. John's, Newfoundland, as Newfoundland and Labrador celebrated the John Cabot 500th Anniversary commemorating 500 years of Northwest Atlantic in relation to harvesting the sea. The Symposium was hosted by the NAFO Scientific Council and held at the Marine Institute of the Memorial University of Newfoundland.

The development and organization of this Symposium represents the long and dedicated work by the convener, H. Lassen and the staff at the NAFO Secretariat. H. Lassen is particularly acknowledged for his creativity in structuring the Symposium and his personal contact in bringing together the many eminent speakers. The organization of the Symposium had the special advantage of the invitation from the Marine Institute to house the proceedings. Along with this was the special benefit of demonstrating to the diverse international group of experts who attended, the Institute's facilities in advanced fisheries and marine technology and education. Appreciation is extended to H. Miller, previous Associate Executive Director and G. L. Anderson, Development and Planning Coordinator. The success of the Symposium extends to the high quality presentations by the speakers and the in depth discussion among attendees.

In accordance with the decision of the Scientific Council, H. Lassen, convener, and T. Amaratunga were requested to undertake the editorial work for the publication of this special issue of the *Journal of Northwest Atlantic Fishery Science*. Sincere appreciation is extended to the contributors to this publication for their devoted and timely efforts and their patience while the publication was being compiled.

October 1998

Tissa Amaratunga
Assistant Executive Secretary



Alfred Walker Holinshead Needler

1906–1998



Alfred Needler, scientist, administrator, diplomat and statesman, died in St. Andrews, New Brunswick, on 4 September 1998. He was born in Huntsville, Ontario in 1906, and went to the University of Toronto in 1922. While there, he was influenced by A. G. Huntsman, the pioneer Canadian oceanographer and fishery biologist, to begin a career in fisheries research. His first task, starting in 1924, was a study of fishery statistics for the Biological Board of Canada (subsequently called the Fisheries Research Board of Canada). Research on the biology of haddock followed in 1926–29, providing the topic for his doctoral degree. Although based at the Atlantic Biological Station in St. Andrews, New Brunswick, in the summers, much of his time was spent in the fishing ports of Nova Scotia, boarding with fishermen and their families, where he learned what it meant to earn a living from fishing.

On graduation, he was put in charge of oyster farming research at Ellerslie on Prince Edward Island until, in 1941, he became Huntsman's successor as Director of the Biological Station in St. Andrews. In 1954 he went to British Columbia, as

Director of the Biological Station in Nanaimo, and in 1963 to Ottawa as Deputy Minister of Fisheries. On retirement from the civil service in 1971, he returned to live in St. Andrews, but this was retirement in name only. He maintained the role of Canada's senior negotiator in fisheries matters for the rest of that decade, as well as serving as the first executive director of the Huntsman Marine Laboratory (an educational institution supported by universities and government) from 1971 to 1976.

Alfred Needler was in at the beginning of the international commission era of fishery management. He was a delegate to the London Conference of 1943, called to prepare for post-war regulation of the North Atlantic fisheries. It was subsequently decided to have separate arrangements for the two sides of the Atlantic and, at the negotiation of the International Convention for the Northwest Atlantic Fisheries (ICNAF) in Washington in 1949, Alfred Needler was the alternate Canadian delegate. His appointment as Assistant Deputy Minister of Fisheries for the period 1948–50 reflected the importance of his role in Canadian preparations for these crucially important negotiations. He had the distinction of being the first chairman of the new ICNAF Commission's Standing Committee on Research and Statistics (STACRES), a body that came to serve as a model for successor domestic and international science advisory agencies after extensions of coastal state jurisdiction. With his move to the west coast, it was the International North Pacific Fisheries Commission that benefited from his participation in the late-1950s and early-1960s, his primary contributions to the functioning of ICNAF coming later as Canadian Commissioner (1966–77), Vice-Chairman and then Chairman of the ICNAF Commission (1967–69, 1969–71 respectively). His superb negotiating skills were regularly called upon to find compromise solutions when agreement seemed impossible. Recognition of him by others as a straightforward and trustworthy person, who understood their problems, was much of the secret of his successes in negotiation. However, his successes stemmed also from practical experience. He liked to tell the cautionary tale about overhearing from the anonymity of a bathroom stall senior officials of an opposing delegation frankly discussing the weaknesses of their negotiating position. Thereafter, he observed the maxim "never discuss business in the lavatory"!

From a scientist's perspective, Alfred Needler was a perfect head of delegation. He allowed his scientific advisers to work with complete autonomy; suggestions of interference were not tolerated, even when made in jest. No Canadian proposal went forward to the ICNAF Commission without the agreement of his scientific advisors that it was within the bounds of STACRES advice.

Even while ICNAF was at its most energetic in developing comprehensive controls on exploitation, the United Nations was planning to change the legal underpinnings of management of coastal fisheries at its third Conference on the Law of the Sea (UNCLOS III). The Canadian Delegation enjoyed the benefit of Alfred Needler's services as Senior Fisheries Advisor at these meetings. When progress at UNCLOS III encouraged coastal states to extend their fisheries jurisdictions to 200 miles in 1977, new arrangements were required for international cooperation in the Northwest Atlantic fisheries. It was Alfred Needler who was chosen to chair the three conferences that negotiated the new convention that established the Northwest Atlantic Fisheries Organization (NAFO). At the last meeting of ICNAF in June 1979, he provided a closing statement on the accomplishments of ICNAF and on the many "firsts" that ICNAF achieved. This ending of ICNAF was also an ending to the career of a great international diplomat.

In this long and illustrious career, Alfred Needler had many honours bestowed on him, in-

cluding membership of the Order of the British Empire and the Order of Canada, and fellowship of the Royal Society of Canada. The Canadian Department of Fisheries and Oceans named a research vessel after him in the early-1980s in honour of his contributions to Canadian fishery research and management. All previous Canadian fisheries research vessels had been named after scientific dignitaries who were long deceased.

After his retirement I had the pleasure of visiting him on occasion in St. Andrews when we would reminisce about the good old ICNAF days. He remained interested in the latest research findings and I think it pleased him that his pioneering research on haddock remains the central reference on stock structure and migrations. He would also recall often the times he spent in the fishing communities of Nova Scotia in the 1920s, of which he retained many detailed and fond memories. He intended to write some essays about them, but time finally caught up. Canada, and the international community, have lost one of the most influential figures in the management of northwest Atlantic fisheries.

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Contents

Introduction	ix
Report of the Symposium	xi
Symposium Program	xv
Opening Session	
PARSONS, L. S. and J. S. BECKETT. The NAFO Model of International Collaborative Research, Management and Cooperation	1
WEST, M. B. The Future of the International Law of Capture Fisheries	19
LASSEN, H. The Future Fisheries: Constraints and Possibilities Sustainability – Ecological Impact from Fisheries, the Political Environment and How This May Affect the Future of Capture Fisheries	27
Theme Session 1: History of Fishing the Northwest Atlantic	
LEAR, W. H. History of Fisheries in the Northwest Atlantic: The 500-Year Perspective	41
ANDERSON, E. D. The History of Fisheries Management and Scientific Advice – the ICNAF/NAFO History from the End of World War II to the Present	75
Theme Session 2: Management Approaches – Caring for the Future Resources	
ROSENBERG, A. A. Controlling Marine Fisheries 50 Years from Now	95
Theme Session 3: Fisheries Research – Perspectives for the Twenty-first Century	
GODØ, O. R. What Can Technology Offer the Future Fisheries Scientist – Possibilities for Obtaining Better Estimates of Stock Abundance by Direct Observations	105
ULLTANG, Ø. Where is Fisheries Science Heading – How Can Fish Stock Assessments be Improved	133
STEIN, M. Integrating Fisheries Observations with Environmental Data – Towards a Better Understanding of the Conditions for Fish in the Sea	143
Theme Session 4: Sustainable Livelihood for the Coastal Community	
MUIR, J. F. and J. A. YOUNG. Aquaculture and Marine Fisheries: Will Capture Fisheries Remain Competitive?	157
VÁZQUEZ SEIJAS, V. The Future for Fisheries-Dependent Communities: The Fisheries-Dependent Region of Galicia	175
Theme Session 5: The Future for Capture Fisheries	
IKEDA, H. On the Future Economy of Capture Fisheries and the Future Consumer Market for Fish	185
CADDY, J. F., F. CAROCCI, and S. COPPOLA. Have Peak Fishery Production Levels been Passed in Continental Shelf Area? Some Perspectives Arising from Historical Trends in Production per Shelf Area	191

BECKETT, J. S. World Marine Fisheries 1795–2025: Fifty Years of Change.....	221
VALDIMARSSON, G. Developments in Fish Food Technology – Implications for Capture Fisheries	233
LANE, D. E., R. L. STEPHENSON. Fisheries Co-management: Organization, Process, and Decision Support	251
List of Participants	267
Notices	273
Scientific Publications of NAFO	275

Introduction

by

H. Lassen, Convener

Fisheries are rapidly changing. The gap between the concepts which have prevailed in fisheries of free access – their historic traditions and their cultural settings have been challenged by society, with its demands on sustainable resource use and economic efficiency of the sector.

This process has been furthered by a number of crises in fisheries of which the one here in Newfoundland is probably the worst, and for certain it is the crisis that has got publicity.

Therefore, a key question is, how capture fisheries will respond?

Capture fisheries is part of man's oldest survival kit and part of his hunter tradition. Historically, man has evolved from collectors to agriculturists from agriculturists to industrialists and lately to informatalists. All through this evolution capture fisheries has conceptually changed little, while technologically we have seen revolutionary changes. The gap between the concept of capture fisheries and their technological capabilities has widened to the extent that it is about time that we follow the technological revolution with a conceptual one. Therefore it is timely to ask 'What Future for Capture Fisheries'?

The NAFO Scientific Council was on an optimistic note when this Symposium was planned. We did not ask 'Do Capture Fisheries have a Future' but instead asked 'What Future for Capture Fisheries', firmly believing that the fishing sector will be able to adapt within the future constraints. But we also believe that the future fisheries will differ greatly from those of today.

The political winds have changed – sustainability is a keyword in the political fisheries discussions. The classical sustainability concept used for many years within the fisheries biology was defined on target fish stocks. Sustainability is now taken in a wider context including both non-target fish species and ecosystem impacts, for example, energy consumption and effects on the sea bottom.

It is an academic challenge to attempt a preview the future, but our aim is more substantial than the pure intellectual pleasure. The scenarios we look at may show us pictures of the future we do not much care for, or may indicate possibilities which we would like to see further explored. Our subsequent decisions may attempt to minimize the influence of those trends toward those we would prefer to avoid while augmenting the influence of those we like. Therefore, the outcome of such a Symposium like the one we have staged here is important in part to the debate on our future. The very prognosis has nothing mechanistic about it, but are projections of trends in present day's society and fish sector.

Therefore, the value of our endeavours will be demonstrated if we are able to identify trends in the current development and take these trends to a logical conclusion. This conclusion would then be the input to the political debate.

This Symposium is part of the Newfoundland celebrations of 500 years of settlements.

Settlements which have been very much caused by the available fishing possibilities here, and where the survival of the settlements have depended on fishing around Newfoundland.

The development of the fisheries show many trends and it is possible to argue for several future scenarios on the basis of observed trends. Which of these will dominate the future? Or will it be trends that hitherto are ignored that dominate tomorrow?

An important facet when talking about the future of capture fisheries are the expected social and economic changes. Elsewhere in the industrial world, firms have amalgamated both horizontally and vertically. Similar trends have also been seen in several fisheries. An obvious question is, will these trends dominate the future? And how will such trends affect the fishing communities, for example, in Newfoundland.

The future fisheries may also be significantly affected by climate changes. Globally, environmental changes are being observed in great magnitudes. These could easily be manifested in fishing areas. The fish assemblage of the North Atlantic could look very different in the future. Will such changes – whether towards an ice age or a tropical sea – be so rapid that it will affect the fisheries in the first half of the Twenty-first Century. These are but a few considerations to set the stage for our Symposium "What Future for Capture Fisheries." It is a shift in paradigm: Visioning Sustainable Harvests from the Northwest Atlantic in the Twenty-first Century.

Report of the Symposium

What Future for Capture Fisheries

A Shift in Paradigm: Visioning Sustainable Harvests from the Northwest Atlantic in the Twenty-first Century

The Symposium on "What Future for Capture Fisheries", with H. Lassen (EU–Denmark) as convenor, was held during 10–12 September 1997 at the Marine Institute of the Memorial University of Newfoundland, St. John's, Newfoundland, Canada. There were 116 participants from Belgium, Canada, Denmark, Faroe Islands, Germany, Greenland, Italy, Iceland, Japan, Norway, Portugal, Republic of Korea, Russian Federation, Spain, United Kingdom and United States of America.

The meeting was opened by W. R. Bowering (Canada) Chairman of the Scientific Council. The following report prepared by the convenor was presented to the Scientific Council.

The Symposium considered the historic and present state of fisheries from several angles with a view to what is in store for the future. There was general concern for the state of the stocks, as has been reported in many other fora, and a recognition that the fisheries management policies need to be changed. The expectation was that exploitation pressure and fleet capacity will decline in response both to the internal restraints in the fishing sector and the external political pressures, for example those exerted by environmentalist groups. There was, however, a general optimistic expectation that the fishing industry will be able to adapt to these changed conditions and that an economically viable fishing sector will continue into the future. The exploitation pressure should be within sustainable limits.

The Symposium was structured into three keynote presentations and five theme sessions followed by a concluding discussion (see attached program).

Keynote 1: L. S. Parsons (Canada) reviewed the NAFO model of international collaborative research, management and cooperation. He noted that the recent introductions of international conventions which guide the exploitation of marine resources have placed new challenges to NAFO, but in his review of the history emphasized that NAFO (and its predecessor ICNAF) had been able to adapt to a constantly changing world of fisheries management. He also noted that NAFO's efficiency had varied through its lifetime, and concluded on an optimistic note that the last few years had seen progress towards more effective management, control and enforcement.

Keynote 2: M. B. West (USA) presented a review of the recent changes in the international legal structure for fisheries management of marine resources. The basis for these were the revised policies of the UN Agreement of the conservation and management of straddling fish stocks and highly migratory fish stocks and the Agreement to promote compliance with international conservation and management measures by fishing vessels. She emphasized the impact these conventions will have on high seas fishing in the future, and recognized a definitive need and a political willingness to change the present fisheries management policies.

She expected a decrease in the exploitation pressure as these conventions are adopted by a sufficient number of nations in order to become binding and hence implemented by international communities. She highlighted the political requirement for a more holistic approach to fisheries management including ecosystem considerations.

She emphasized the role NAFO will have in this process, not only in respect to management of stocks in the Convention Area but also as a platform for political signals. These signals include in particular the responsibilities of being a member of a regional fisheries management body and the need for both transparency and equity in the decision process.

Keynote 3: H. Lassen (EU–Denmark) presented an overview of the elements in the decision making process and discussed the interplay between these elements and the four sub-systems (biology, economy, social structures and technology) of fisheries. Like the two previous speakers, he recognised the influence of political forces outside fisheries on the future development of the fishing sector, in particular the constraints on future exploitation levels. He presented some trends he found to be significant for the understanding of the future fisheries. These trends included technological developments towards more selective gears, social and economic changes in the sector as a result of similar changes in other parts of the society, e.g. trends of vertical and horizontal aggregation of enterprises. In particular he recognised the effects of political pressure of the environmentalist on changes in fisheries.

Session 1: History of Fishing the Northwest Atlantic. This session consisted of two presentations. First, the 500 years of history in the Northwest Atlantic were traced showing how the fishery had developed in different areas. The period after WW2 saw many drastic changes and the yield reached levels which apparently could not be sustained in the longer run, although the history of fishing suggested a fairly stable ecosystem in the area. A number of historical crises were identified but these seemed to be local compared to the situation of today. The history also revealed the diversification strategy (from cod to other species) used in the fisheries to live through these crises.

The historic review of the fishery was continued with an account of the management in the Northwest Atlantic after WW2, particularly referring to the establishment of ICNAF in 1949 which was replaced by NAFO in 1979. The discussion highlighted the phases of effectiveness and periods with significant problems of the two organizations. The question was raised whether the present fisheries discussions and organization of the coordination of research was adequate to deal with the present problems.

Session 2: Management Approaches – Caring for Future Resources. This session on management approaches consisted of two presentations. The trends in international cooperation in fisheries - monitoring, surveillance and control, and their future implementation were discussed particularly in the light of the introduction of the precautionary approach in the management decisions to come. It was noted there are a number of provisions which NAFO would have to implement in the near future. In comparison to its predecessor ICNAF, NAFO was only responsible for managing the portion of the stocks existing within the Convention Area, these being stocks in the Regulatory Area (i.e. outside the Coastal State EEZ), those straddling the Coastal and Regulatory Areas and those within the EEZ for which Coastal States request advice. The NAFO enforcement and inspection measures being applied in the Regulatory Area are faced with problems similar to those being experienced elsewhere in the world. The view that there is a particular need to enlarge the scientific basis for management decisions with economic and social studies was expressed.

Noting that NAFO enforcement had been improved in recent years, attention was drawn to the insufficient scientific data being provided for stock assessment purposes. It was stated that cost-effective ways would have to be found to improve the scientific database and ensure wider member-country participation in the NAFO enforcement and inspection scheme. Solving both of these problems would be easier through continued international cooperation.

In one presentation it was predicted that future fisheries would be characterised by 1) reduced level of fishing capacity, 2) higher value of fishery products, 3) greatly diversified fisheries world-wide, 4) very low tolerance for violation of rules, and 5) low maintenance management systems. This expectation was based on the changed political situation as discussed in the Keynote presentation by M. B. West. The trends were illustrated by a review of the New England groundfish fisheries.

Session 3: Fisheries Research – Perspectives for the Twenty-first Century. Four presentations were made on fisheries research. Reviewing the future fisheries research, a number of trends were identified particularly in future technologies including improved survey methods and their precision, improved genetic technology leading to a detailed understanding of stock structure and integrating environmental

signals in the assessment procedure. There was a special plea for better understanding of the stock productivity and it was implied that the models used at present were lacking in precision. It was suggested that the technologies developed for scientific purposes would have a wider application, e.g. genetic identification of the stock origin of a fish could be used in control of closed areas. It was recognized that environmental and climate changes have obvious impacts on the productivity of the fish stocks. The availability of long-term time series of environmental data could possibly be used directly in stating expected good and bad recruitment periods.

The proposed concurrent session on case studies was considered as a sub-session 3A. This session dealt with six case studies on New England stocks and fisheries (see program), from a USA Sea Grant Project.

Session 4: Sustainable Livelihood for the Coastal Community. This session considered three presentations on sustainable livelihood. It was recognized the fishery dependent communities are under pressure everywhere, particularly around the North Atlantic. This was exemplified by a review of the situation in Galicia, Spain. The impact from increases in world demand for particularly fresh fish on the fishing communities was reviewed. Further the role of the community in the decision making process in administrating the marine resources was discussed. It was recognised that the communities have a definite need for obtaining better control as the basis for their livelihood and that this need can only be met through organizational changes both outside and inside the management systems.

In reviewing the potentials of increased aquaculture production, it was recognised that these were limited and would not present a threat to the capture fisheries but rather a supplement or opportunity to the coastal communities. There are problems associated with aquaculture production, such as pollution, but it was considered that technology to deal with these problems would be available. It was concluded that while aquaculture can offer important advantages of controllability – thereby reducing the variability associated with capture fishing – and not the least by market adaptation, the future may see greater integration of aquaculture and marine fisheries sector and greater appreciation of their comparative roles.

Session 5: The Future for Capture Fisheries. This session of six presentations took a look into the future from different angles. It was shown that the world demand for fish products is increasing while the future fish supplies are uncertain – estimates were presented ranging from about 74 to 114 million tons from capture fisheries. One of the presentations looked into such estimations in geographic detail. However, it could not identify any major areas with very high unused potentials. It was stated that the increased demand for fish will be most for high value products. This increased demand will lead to increased prices and this may lead to a point where it results in a decrease of fish consumption per capita in the world's most important fish market – Japan. Taking the year 2010 as a projection year, the world supply deficiency was estimated to be 10–40 million tons under current demand situation. Therefore fish could be expected to become a luxury item fetching high prices. It was emphasized that such analyses of changes in the demand for fish and elasticity of price cannot be discussed in isolation because fish as a commodity competes with other products such as chicken and meat.

Starting from a market oriented point of view, it was clear that the increased demand for high value products and the shortage of fish supplies would be met by food technological improvements making better use of the fish, and using more of the fish for high value products than is the case today. It was illustrated how such improvements required management of the entire chain from catches to dinner table. There was a short introduction to such systems already established. Also the globalization of the world fish trade was emphasized, and along with the diversification of the interests in the processing industry, the vertical integration would be more difficult.

A view to the future fisheries for the next 25 years was presented. It was pointed out that the Biodiversity Treaty was being overlooked although it was likely to have a major impact on the development of the political climate. It was suggested that the UN conference in the year 2010 would once more revisit the use of the sea bed resources, and a trend indicator may be the number of marine nature reserves which had already become an integral part of fisheries management. Finally, the Symposium was told about the class of highly efficient small vessels which had been developed with very selective gears and, how this had allowed new species to be part of the human food.

It was also suggested that the future management systems need to be reviewed in the light of the need for the fishing communities to ensure their livelihoods. There could be a need for economic efficiency in the industry and political pressure to attain sustainable exploitation. A review showed the possibilities for use of co-management in fisheries. It also emphasized the need for more transparency in the decision process.

Concluding Discussion

The Chairmen of each session summarized the presentations and the conclusions. This was followed by a number of comments which essentially impressed the need for a reduction in the present exploitation pressure to ensure viable fish stocks for the future. It was realized that the picture included many trends, several of which were conflicting and that several future scenarios could be constructed. Particularly the possibilities of using right based fisheries management systems were raised. It was recognised that this had, to date, met with opposition from the industry.

The Convenor concluded the Symposium by suggesting a number of trends which could be elements of the future fisheries:

Reduced exploitation pressure,

More transparency in all elements of the management process including the stock assessments,

Increased supplements in fish supply from aquaculture,

Improved fish capture technology leading to more selective gears and possibly to pre-catch estimation of species and size composition,

Taking climate fluctuation into account in the assessments of stocks,

Much more efficient vessels (large vessel with large ranges, small highly efficient vessels),

A need for a fisheries management science allowing predictions of fleet reactions to restrictions and to biological changes.

Other Symposium Events

The tour of the Marine Institute, particularly to the ship-bridge simulator and the food technology laboratory were of interest to the participants. The demonstration of research and development of gear technology in the flume tank was especially informative. Special thanks were extended to the Marine Institute staff who provided the personalized tours and in depth information on many related subjects. Special thanks also were extended to the Marine Institute for providing excellent facilities and personal attention for a very successful Symposium.

The participants were pleased to see the videos of some interesting historic fisheries activities in the Northwest Atlantic. Thanks were extended to the Fisheries Museum of the Atlantic, Nova Scotia, Canada for these contributions.

There was also the special event of the inaugural presentation of the NAFO Website. This and other websites from institutes in Canada, Europe and USA, and poster displays provided an interesting extension to the activities of the Symposium.

In conclusion, the Symposium was considered a success and it was recommended that the proceedings of the Symposium should be published in a book form.

Symposium Program

Convener: Hans Lassen (EU–Denmark)

Opening

- Keynote 1:** Parsons, L. S. *The NAFO Model of International Collaborative Research, Management and Cooperation*
- Keynote 2:** West, M. B. * *The Legal Frame within which Capture Fisheries will Operate in the Future – Development of UNCLOS 1982, Agenda 21 and FAO Code of Conduct of Responsible Fishing*
- Keynote 3:** Lassen, H. * *Sustainability – Ecological Impact from Fisheries – the Political Environmental Issue and How This may Affect the Future of Capture Fisheries*

SESSION 1: History of Fishing the Northwest Atlantic

Chair: E. J. Sandeman (Canada)

- 1.1 Lear, H. *History of Fisheries in the Northwest Atlantic – The 500-Year Perspective*
- 1.2 Anderson, E. *The History of Fisheries Management and the Scientific Advice – the ICNAF/NAFO History from the End of World War II to the Present*

SESSION 2: Management Approaches – Caring for the Future Resources

Chair: E. D. Anderson (USA)

- 2.1 Koster, H. Trends in International Cooperation in Fisheries – Monitoring, Surveillance and Control
- 2.2 Rosenberg, A. * *Controlling Marine Fisheries 50 years from Now – Satellite Surveillance or a Changed Regime – Can Economy and Biology Cooperate*

SESSION 3: Fisheries Research – Perspectives for the Twenty-first Century

Chair: W. R. Bowering (Canada)

- 3.1 Godø, O. * *What Can Technology Offer the Future Fisheries Scientist – Possibilities for Obtaining Better Estimates of Fish Stock Abundance by Observations from the Sea*
- 3.2 Taggart, C. What Can Technology Offer the Future Fisheries Scientist – Laboratory and Aquaria Technology – Possibilities for Obtaining Better Understanding of the Stock Structure (e.g. DNA Technology)
- 3.3 Ulltang, O. * *Where is Fisheries Science Heading – Special Emphasis on Fish Stock Assessment Work*
- 3.4 Stein, M. *Integrating Fisheries Observations with Environmental Data – Towards a Better Understanding of the Conditions for Fish in the Sea*

Papers appearing in this publication are *italized*.

* Title was revised for this publication.

SESSION 3A: Some Case-studies

Chair: J. T. DeAlteris (USA)

The papers in this subsession (initiated from a USA Sea Grant Project) were originally intended to be presented as case study topics of interest in a concurrent session. These papers are not included in this publication of the Proceedings.

- | | | |
|-----|------------------------------------|--|
| C-1 | Spencer, P. D., and J. S. Collie | The Effect of Non-linear Predation Rates on Rebuilding the Georges Bank Haddock (<i>Melanogrammus aeglefinus</i>) Stock |
| C-2 | Kinani, A., and J. T. DeAlteris | An Analysis of Catchability by Gear, Area and Time in the New England Groundfish Fishery |
| C-3 | Lazar, N., and J. T. DeAlteris | Indirect Estimation of Gillnet Selectivity: Case Study of the New England Groundfish Gillnet Fishery |
| C-4 | Grogan, C. S., and J. T. DeAlteris | An Analysis of Yield and Spawning Stock Biomass per Recruit for Eight Groundfish Species in the New England Waters as a Function of Fishing Mortality and Gear Selection Processes |
| C-5 | Sutinen, J. G., and J. Agar | Species Selection and Economic Performance in the New England Groundfish Fishery |
| C-6 | Hennessey, T. M., and M. Healy | The Collapse of Fisheries Resources in the United States and Canada: The Case of New England and Nova Scotia |

SESSION 4: Sustainable Livelihood for the Coastal Community

Chair: J. F. Caddy (FAO, Rome)

- | | | |
|-----|---------------------------|--|
| 4.1 | Muir, J. F. | <i>Aquaculture and Marine Fisheries – Will Capture Fisheries Remain Competitive?</i> |
| 4.2 | Felt, L. L. | Impact on Coastal Livelihood From Future Changes in Production and Demand for Fish |
| 4.3 | Vázquez Seijas, V. | * <i>The Future for Fishery Dependent Communities – Fishery Dependent Regions of Galicia</i> |

SESSION 5: The Future for Capture Fisheries

Chair: J. S. Campbell (Canada)

- | | | |
|-----|------------------|---|
| 5.1 | Ikeda, H. | ** <i>The Future Economy of Capture Fisheries – Which Sectors Will Be Economically Viable</i> |
| 5.2 | Ikeda, H. | ** <i>The Future Consumer Market for Fish – Will There Be a Place for Capture Fisheries</i> |

Papers appearing in this publication are *italized*.

* Title was revised for this publication.

** These two papers were combined in this publication.

SESSION 5: The Future for Capture Fisheries (continued)

- 5.3 **Caddy, J. F.** * *Capture Fisheries and the Environment Issue – Implications for the Viability of Future Capture Fisheries*
- 5.4 **Beckett, J. S.** * *The Capture Technology of the Future – Large Trawlers with Sea Going Factories or Small Vessels of the Coastal State*
- C-7 He, P. Biology and Technology: Future Development in Fishing Gear and Harvesting Methods
- 5.5 **Valdimarsson, G.** *Development in Fish Food Technology – Implications for Capture Fisheries*
- 5.6 **Lane, D. E.** *Fisheries Co-management: Organization, Process, and Decision Support*

Papers appearing in this publication are *italized*.

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