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FAO TECHNICAL GUIDELINES FOR RESPONSIBLE FISHERIES

12

INFORMATION AND KNOWLEDGE SHARING

FIAT PANIS

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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PREPARATION OF THIS DOCUMENT

Many FAO Members, in particular in developing countries, have stated that the lack of access to timely, relevant and accurate information is a serious constraint to the implementation of the Code of Conduct for Responsible Fisheries. In order to gain deeper insight into the accessibility of information required by national fisheries institutions in Africa, FAO convened a Workshop in South Africa in 2003[1] and conducted a study during 2004 that drew attention to the complexity of the information required as well as the challenges facing developing countries in obtaining access.[2] In addition, FAO hosted the Thirty-First Conference of the International Association of Aquatic and Marine Science Libraries and Information Centers (IAMSLIC) in 2005 with the theme *Information for Responsible Fisheries: Libraries as mediators*. Participants from 38 countries highlighted the advantages of networking as a cost-effective means to share information and provide access to a wider range of resources. They also pointed out the constraints to providing information to different stakeholder groups and that access is just one of a series of related information problems. One of the outcomes of this meeting was the establishment by IAMSLIC of the Aquatic Commons repository as a means to strengthen fisheries information resource sharing. This initiative was welcomed by the FAO Advisory Committee on Fisheries Research at its sixth session.[3] The importance of timely, complete and reliable information to implementation of the Code was highlighted in the 2006 State of World Fisheries and Aquaculture.[4] FAO therefore decided to elaborate, in the context of the Code of Conduct for Responsible Fisheries, technical guidelines on the issues involved in information and knowledge sharing, paying particular attention to the needs of developing countries.

Four main authors collaborated widely with colleagues and users to produce a draft text: Janet Webster, Chandrika Sharma, Ian Pettman and Jean Collins. It was decided to include a separate chapter dealing with information and small-scale fisheries because of the special needs and situation of the sub-sector. This was written by the International Collective in Support of Fishworkers (ICSF) in collaboration with the non-governmental organizations Masifundise (South Africa), Coalition for Fair Fisheries Agreements (CFFA), Ecoceanos (Chile) and the Community-based Coastal Resources Management Learning Centre (Philippines).

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[1] FAO, 2004a.
[2] Webster and Collins, 2005.
[3] FAO, 2007a.
[4] FAO, 2007b.

A meeting was held in Rome, from 9 to 13 June 2008, for the authors to compile a draft report and to seek input from selected FAO staff. Contributions were provided by David Doulman, Peter Manning, Gunilla Greig, Jane Wu, Patricia Merrikin, Rolf Willmann, Eric Reynolds and Eiman Elnoshokaty from the New Library of Alexandria.

Vincent Fautrel of the Technical Centre for Agricultural and Rural Cooperation (CTA) identified gaps and provided useful input. A second draft was then circulated to selected external experts and valuable feedback was provided by Lena Westlund (Canada), Susan Hanna (Oregon State University, United States of America) Jane Sherman (Italy) and Joan Parker (Moss Landing Marine Labs, United States of America).

The Guidelines have been prepared with the support of FishCode, FAO's umbrella programme for implementation of the Code of Conduct for Responsible Fisheries.

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ABSTRACT

The Guidelines provide a special focus on information and knowledge sharing and its current and potential role in supporting implementation of the Code of Conduct for Responsible Fisheries. They expand on relevant principles and standards set forth in the Code and make practical suggestions about ways to ensure that this role can be enhanced. The issues involved in the flow of information between different stakeholder groups include topics as diverse as information policy frameworks and information and communication technology infrastructure, hence coverage is introductory. Some of the constraints involved in the cycle from the creation, production, dissemination and availability of information and knowledge to its effective use and sharing by the present generation as well as its preservation for the future are presented. The special circumstances and requirements of stakeholders in developing countries are recognized in accordance with Article 5 of the Code. A separate chapter on small-scale fisheries and aquaculture looks in more detail at the special situation and information needs of the sub-sector. The Guidelines aim to foster a better understanding of the issues involved to ensure that stakeholders obtain the essential information that they need and that they make available their own information and knowledge for the public good.

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ACRONYMS/ABBREVIATIONS

ABAFR	Aquatic Biology, Aquaculture and Fisheries Resources
ACFR	Advisory Committee on Fisheries Research
ACP-EU	Africa Caribbean Pacific – European Union
AGORA	Access to Global Online Research in Agriculture
AJOL	African Journals Online
ASFA	Aquatic Sciences and Fisheries Abstracts
CFFA	Coalition for Fair Fisheries Agreements
CFRMP	Community Fishery Resources Management Project
COFI	Committee on Fisheries
CRFM	Caribbean Regional Fisheries Mechanism
CSOPP	Civil Society Organizations and Participation Programme
CTA	Technical Centre for Agricultural and Rural Cooperation
DFID	Department for International Development (UK)
DOAJ	Directory of Open Access Journals
EAF	Ecosystem approach to fisheries
eIFL	Electronic Information for Libraries
FAC	Fisheries Advisory Committee
FAIFE	Free Access to Information and Freedom of Expression
FAO	Food and Agriculture Organization of the United Nations
FBA	Freshwater Biological Association (UK)
FFA	Pacific Islands Forum Fisheries Agency
FWO	Fishworker Organization
HINARI	Health Internetwork Access to Research
IAMSLIC	International Association of Aquatic and Marine Science Libraries and Information Centers
ICES	The International Council for the Exploration of the Sea
ICFA	International Coalition of Fisheries Associations
ICTs	Information and Communication Technologies
ICSF	International Collective in Support of Fishworkers
IFLA	International Federation of Library Associations and Institutions
IK	Indigenous knowledge
ILO	International Labour Organization
INASP	International Network for the Availability of Scientific Publications
IP	Intellectual Property
IT	Information Technology
IUCN	International Union for Conservation of Nature
LIFDC	Low Income Food Deficit Country
LMMA	Locally Managed Marine Area
MSC	Marine Stewardship Council

NACA	Network of Aquaculture Centres in Asia-Pacific
NGO	Non-Governmental Organization
NIH	National Institute of Health
NIP	National Information Policy
NISC	National Inquiry Services Centre
NOAA	National Oceanic and Atmospheric Administration
OA	Open Access
OAI	Open Archive Initiative
OARE	Online Access to Research in the Environment
PERI	Programme for the Enhancement of Research Information
PICES	The North Pacific Marine Science Organization
PRA	Participatory Rural Appraisal
RFMO	Regional Fisheries Management Organization
RFO	Regional Fisheries Organization
SADC	Southern African Development Community
SciELO	Scientific Electronic Library Online
SEAFDEC	Southeast Asian Fisheries Development Center
SFLP	Sustainable Fisheries Livelihoods Programme
SIFAR	Support Unit for International Fisheries and Aquatic Research
SOFIA	State of World Fisheries and Aquaculture
SPC	Secretariat of the Pacific Community
STREAM	Support to Regional Aquatic Resources Management
TRIPS	Trade-related Aspects of Intellectual Property Rights
UN	United Nations
UNESCO	United Nations Educational Scientific and Cultural Organization
URI	Universal Resource Identifier
WSIS	World Summit on the Information Society
WTO	World Trade Organization

BACKGROUND

1. From ancient times, fishing has been a major source of food for humanity and a provider of employment and economic benefits to those engaged in this activity. However, with increased knowledge and the dynamic development of fisheries, it was realized that living aquatic resources, although renewable, are not infinite and need to be properly managed, if their contribution to the nutritional, economic and social well-being of the growing world's population was to be sustained.

2. The adoption in 1982 of the United Nations Convention on the Law of the Sea provided a new framework for the better management of marine resources. The new legal regime of the oceans gave coastal States rights and responsibilities for the management and use of fishery resources within the areas of their national jurisdiction, which embrace some 90 percent of the world's marine fisheries.

3. In recent years, world fisheries have become a dynamically developing sector of the food industry, and many States have striven to take advantage of their new opportunities by investing in modern fishing fleets and processing factories in response to growing international demand for fish and fishery products. It became clear, however, that many fisheries resources could not sustain an often uncontrolled increase of exploitation.

4. Clear signs of over-exploitation of important fish stocks, modifications of ecosystems, significant economic losses, and international conflicts on management and fish trade threatened the long-term sustainability of fisheries and the contribution of fisheries to food supply. Therefore, the Nineteenth Session of the FAO Committee on Fisheries (COFI), held in March 1991, recommended that new approaches to fisheries management embracing conservation and environmental, as well as social and economic, considerations were urgently needed. FAO was asked to develop the concept of responsible fisheries and elaborate a Code of Conduct to foster its application.

5. Subsequently, the Government of Mexico, in collaboration with FAO, organized an International Conference on Responsible Fishing in Cancún in May 1992. The Declaration of Cancún endorsed at that Conference was brought to the attention of the UNCED Summit in Rio de Janeiro, Brazil, in June 1992, which supported the preparation of a Code of Conduct for Responsible Fisheries. The FAO Technical Consultation on High Seas Fishing, held in September 1992, further recommended the elaboration of a Code to address the issues regarding high seas fisheries.

6. The One Hundred and Second Session of the FAO Council, held in November 1992, discussed the elaboration of the Code, recommending that priority be given to high seas issues and requested that proposals for the Code be presented to the 1993 session of the Committee on Fisheries.

7. The Twentieth Session of COFI, held in March 1993, examined in general the proposed framework and content for such a Code, including the elaboration of guidelines, and endorsed a time frame for the further elaboration of the Code. It also requested FAO to prepare, on a "fast track" basis, as part of the Code, proposals to prevent reflagging of fishing vessels which affect conservation and management measures on the high seas. This resulted in the FAO Conference, at its Twenty-seventh Session in November 1993, adopting the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas, which, according to FAO Conference Resolution 15/93, forms an integral part of the Code.

8. The Code was formulated so as to be interpreted and applied in conformity with the relevant rules of international law, as reflected in the United Nations Convention on the Law of the Sea, 1982, as well as with the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, 1995, and in the light of, *inter alia*, the 1992 Declaration of Cancún and the 1992 Rio Declaration on Environment and Development, in particular Chapter 17 of Agenda 21.

9. The development of the Code was carried out by FAO in consultation and collaboration with relevant United Nations Agencies and other international organizations, including non-governmental organizations.

10. The Code of Conduct consists of five introductory articles: Nature and Scope; Objectives; Relationship with Other International Instruments; Implementation, Monitoring and Updating and Special Requirements of Developing Countries. These introductory articles are followed by an article on General Principles, which precedes the six thematic articles on Fisheries Management, Fishing Operations, Aquaculture Development, Integration of Fisheries into Coastal Area Management, Post-Harvest Practices and Trade, and Fisheries Research. As already mentioned, the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas forms an integral part of the Code.

11. The Code is voluntary. However, certain parts of it are based on relevant rules of international law, as reflected in the United Nations Convention on the Law of the Sea of 10 December 1982. The Code also contains provisions that may be or have already been given binding effect by means of other obligatory legal instruments amongst the Parties, such as the Agreement to Promote Compliance with Conservation and Management Measures by Fishing Vessels on the High Seas, 1993.

12. The Twenty-eighth Session of the Conference in Resolution 4/95 adopted the Code of Conduct for Responsible Fisheries on 31 October 1995. The same Resolution requested FAO *inter alia* to elaborate appropriate technical guidelines in support of the implementation of the Code in collaboration with members and interested relevant organizations.

PREFACE

The subject of these Guidelines, “Information and knowledge sharing”, is a response to the situation where the lack of essential information is a major constraint to implementation of the Code of Conduct for Responsible Fisheries. This is particularly the situation in many developing countries. These Guidelines highlight the issues involved in the flow of information between different stakeholder groups. They also present some of the constraints involved in the cycle from the creation, production, dissemination and availability of information and knowledge, to its effective use and sharing by the present generation as well as its preservation for the future. Although information is cited as an essential component in all of the existing Technical Guidelines, as indeed it is in the Code itself, a better understanding of the issues is needed to ensure that stakeholders obtain the essential information that they need and that they make available their own information and knowledge for the public good.

The references throughout the Code to the types of information that are needed, from research to trade information, from subjects as diverse as biology, economics, nutrition, environmental science, social and cultural norms are matched by an extremely wide range of stakeholders. Tracking the existing flows of information highlights many gaps and barriers, both in dissemination and accessibility. This applies as much to the content and format of information as it does to the institutional and infrastructure inequalities.

The data and information that form the knowledge base of fisheries and aquaculture are continually changing and extending as gaps are identified, prioritized and filled. Modern information and communication technologies (ICTs) have had a profound impact on the ways in which information is produced, stored and transmitted. The rate of development of these technologies will probably not slow down. However, the information capacity in many developing countries in terms of ICT infrastructure, access to relevant information and the skills required to participate fully in the global information society remains inadequate.

Without the essential information upon which to pursue research, make informed decisions and benefit from the lessons learned by stakeholders in similar situations, implementation of the Code will continue to be constrained. Moreover, because responsible fisheries contribute towards realization of other major internationally agreed goals, such as those

identified in the UN Millennium Declaration (the Millennium Development Goals, or MDGs)[5] and the Plan of Implementation (POI) adopted at the 2002 World Summit on Sustainable Development (WSSD)[6], constraints on implementation of the Code will hinder progress on these fronts as well.

[5] United Nations, 2008.
[6] United Nations. Department of Economic and Social Development, 2004.

INTRODUCTION

The Code provides principles and standards applicable to the conservation, management and development of all fisheries. It also covers the capture, processing and trade of fish and fishery products, fishing operations, aquaculture, fisheries research and the integration of fisheries into coastal area management. Underpinning the implementation of the Code[1], as recognized in Articles 7 to 12, is the need for two broad categories of information: general information about the Code (its goals, coverage, etc.) and specialized and technical information to support research, resource management and use, policy and development.

However, the information requirements are not easy to fulfil. The information used and produced by the different stakeholder categories involved in fisheries is characterized by the breadth of subjects required, its historic depth, the scale from local to global and the diversity of information sources. Given this complexity, it is not surprising that a major effort is required to obtain the best information upon which to base decisions and policy. The lack of global information resources in many developing countries presents significant challenges. It is also recognized that the results of research and the development lessons learned are often lost because of inadequate opportunities to publish and disseminate information in developing countries. Discovering, using and validating what has already been achieved depend upon the effective dissemination and sharing of information, as well as ensuring its preservation and availability for future generations.

The digitization of information and its availability via the World Wide Web offer enormous potential for improved access and dissemination. However, the reliable, high-speed and affordable access available in the industrialized world is not universally available, particularly for those outside of an

[1] The Code also embraces several international fisheries instruments developed and adopted within its framework. These include four FAO International Plans of Action (IPOAs) – namely: IPOA for Reducing Incidental Catch of Seabirds in Longline Fisheries (IPOA–Seabirds); IPOA for the Conservation and Management of Sharks (IPOA–Sharks); IPOA for the Management of Fishing Capacity (IPOA–Capacity); and IPOA to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (IPOA–IUU Fishing). They also include the FAO Strategy for Improving Information on Status and Trends of Capture Fisheries (Strategy STF) and the FAO Strategy and Plan for Improving Information on Status and Trends of Aquaculture (Strategy STA).

institutional framework and those in coastal and riparian areas where fisheries are located.

A well-developed information and communication technology (ICT) infrastructure and access to the relevant information are essential for people to participate in the different socio-economic and political activities of the global information society. Prerequisites of relevant information include affordability, timeliness and presentation in languages and contexts that users can relate to, understand and benefit from. The investment in and development of human intellectual capability is a vital component at all levels. It is of little use to have access to a modern ICT infrastructure as well as to relevant information but not the educational infrastructural support to enable people to not only benefit from information but also the ability to create new knowledge to the benefit of all.[2]

In light of this and recent international attention to information issues as an integral part of the development process, including the World Summit on the Information Society, Tunis Commitment,[3] FAO decided to elaborate these Technical Guidelines in the context of the Code of Conduct for Responsible Fisheries. The objectives of these Guidelines are to provide a special focus on information and knowledge sharing and its current and potential role in supporting implementation of the Code by expanding on relevant principles and standards set forth in the Code, and to make practical suggestions about ways to ensure that this role can be enhanced.

Although information and knowledge are referred to throughout these guidelines, the boundaries between what is data, information, knowledge and communication are often unclear. There are misunderstandings as well as *terminology creep* throughout the literature. Some definitions and clarification are given in the section on *Concepts* to identify what these Guidelines intend to cover.

These Guidelines are directed at decision-makers, planners and all those involved in developing and implementing policy relevant to sustainable and responsible fisheries and aquaculture. They encompass both fisheries and aquaculture and are complementary to existing Technical Guidelines.

[2] Britz, 2008.
[3] World Summit on the Information Society (WSIS), 2005.

CONCEPTS

Stakeholders

The Code is global in scope and is directed toward members and non members of FAO, fishing entities, sub regional, regional and global organizations, whether governmental or non-governmental, and all persons concerned with the conservation of fishery resources and management and development of fisheries, such as fishers, those engaged in processing and marketing of fish and fishery products and other users of the aquatic environment in relation to fisheries [Article 1.2]. The different stakeholder groups are so diverse that covering specific information needs and targeting specific audiences are outside the scope of these Guidelines. Instead, the types of information produced and used in different stakeholder activities and the importance of the information flow between and amongst different stakeholder groups is considered. The special circumstances and requirements of stakeholders in developing countries are recognized in accordance with Article 5 of the Code. A separate chapter is included on the special situation and needs of small-scale fisheries and aquaculture, where stakeholders can also be grouped at the household, community, local, regional, national or international level.

Fisheries and aquaculture

The Code applies equally to capture fisheries and aquaculture [Article 1.3]. The information resources and systems for both fisheries and aquaculture are in fact closely intertwined and little differentiation is made in the Guidelines, even though the specific information needs and stakeholders are obviously different. In addition, the Code recognizes the nutritional, economic, social, environmental and cultural importance of both fisheries and aquaculture. It takes into account the biological characteristics of the resources and their environment and the interests of consumers and other users [Introduction paragraph]. From the point of view of information and knowledge this is a very broad sweep but the Guidelines are considering issues and constraints that are common across subject areas, information resources and their production and use.

The data, information, knowledge, communication continuum

The terms data, information, and knowledge are often used loosely and as though they are interchangeable and it is necessary to clarify the differences that have been recognized for the purpose of these Guidelines. In order to identify constraints and offer solutions, the Guidelines focus on the cycle of

information production, dissemination, discovery, sharing and use as well as on the flow of information between stakeholder groups. The creation and integration of knowledge, whether research-based or traditional, is complex and is only dealt with in the context of its place in the cycle. The Guidelines are limited to the information and knowledge part of a spectrum that ranges from single facts or numbers, etc. (data), through more meaningful concepts that contain facts in a given context (information), to concepts that comprise reasoning (knowledge), which allows new information to be generated. Examples of data as a collection of facts from which conclusions may be drawn include statistical data, population data, etc. The collection, management, dissemination and sharing of data pose as many, if not more, challenges for the fisheries sector and separate Guidelines are suggested. Information is transformed to knowledge when combined with experience, context, interpretation, and reflection. The relationship between information and knowledge has been summarized:[4]

	Information	**Knowledge**
Multiplicity	Piecemeal Fragmented Particular	Structured Coherent Universal
Spatial	Flows across spaces	Specifically located Expansive
Temporal	Timely Transitory Sometimes ephemeral	Enduring Expansive

Unlike information, knowledge cannot be encapsulated in the form of messages. It is what individuals and communities make of the information they receive and how they themselves process it. Individuals or communities do not acquire knowledge as something ready-made and packaged; they build it within their culture and through the cultural exchanges and interactions in which they participate.

Communication is also not about messages but about the processes of dialogue. Often confused with information dissemination, where information is content not necessarily requiring a reader or listener and dissemination is one way, communication is a two way process. It requires sender and receiver to make an effort to ensure that the content is understood by both parties. Communication provides a way of participating in the decision making process. Communication is outside the scope of

[4] Machlup, 1979.

these Guidelines and requires separate and special consideration for the effective implementation of the Code.

Information and communication technologies

ICTs are technologies that facilitate communication and the processing and transmission of information by electronic means. This definition encompasses the full range of ICTs, from radio and television to telephones, computers and the internet. The Guidelines focus mainly on ICTs for the generation, management and exploitation of published information found in bibliographic and full text databases, websites and portals, digital repositories, and libraries.

Open access

Open access (OA) means that information should be "digital, online, free of charge, and free of most copyright and licensing restrictions".[5] Within the context of implementation of the Code and taking into account the special requirements of developing countries, these Technical Guidelines emphasize and promote the principles of OA. Much of the fisheries information produced by national institutions, universities included, is funded with public money and should be available without further cost. Countries should commit to open access to information as a foundation for ensuring that it is available to all.

These Technical Guidelines include a substantial bibliography, partly to provide further information on the many issues that have been briefly covered. Where the reference is freely available online, i.e. it is an OA document, the Web address is given.

[5] Suber, 2007.

1. STAKEHOLDER GROUPS AND THE FLOW OF INFORMATION

1.1 Stakeholder diversity

As mentioned in the Introduction, the Code is global in scope and targets the whole fisheries sector. Stakeholders in general are individuals, groups of individuals, non-governmental and government entities that have either a direct or indirect interest or claim which will or may be affected by a particular decision or policy. The Code in Article 1.2 refers to the many stakeholder categories in the fisheries sector.

Covering specific information needs and targeting specific audiences in detail are beyond the scope of these Guidelines. For example, the fish processing industry's need for information on the latest trade and health regulations relies on different information sources than the fishery manager with problems related to introduced species or the consumers wanting to choose sustainable seafood, etc. Instead, the Guidelines highlight the issues involved and some of the mechanisms employed in the flow of information between and amongst different stakeholder groups.

Improving access to information by specific stakeholders should be based on a detailed needs assessment to determine what information is already available and how it is obtained, what is needed and the best ways to provide it etc. Various techniques have been used to conduct needs assessments, including surveys and rapid appraisals within specific groups. Many of these are documented in the literature of both information science and fisheries. Examples are found in the information access surveys that were carried out by the Support to Regional Aquatic Resources Management (STREAM) Initiative in Asia.

Information Access Survey

On a regional basis, the Support to Regional Aquatic Resources Management (STREAM) Initiative, which was hosted by the Network of Aquaculture Centres in Asia-Pacific between 2002 and 2007, carried out Information Access Surveys in several Asian countries. The detailed Survey reports provide a profile of the main stakeholders, in this case poor and vulnerable aquatic resources users. For example, in Viet Nam a great number of national and international activities, projects and organizations currently operate within the aquatic resources management sector. In a country with limited resources, the importance of efficient and effective information exchange among stakeholders is increasingly being recognized. The Survey reports describe for each country their access to information, communication within and between organizations and the preferred or available means to deliver information. The issues that were investigated are wide-ranging and give high priority to the social and cultural context as well as details of information exchange within the fisheries sector.[6] Table 1 shows some of the survey findings for Viet Nam, specifically *Information sources for different aquatic resources stakeholders*.

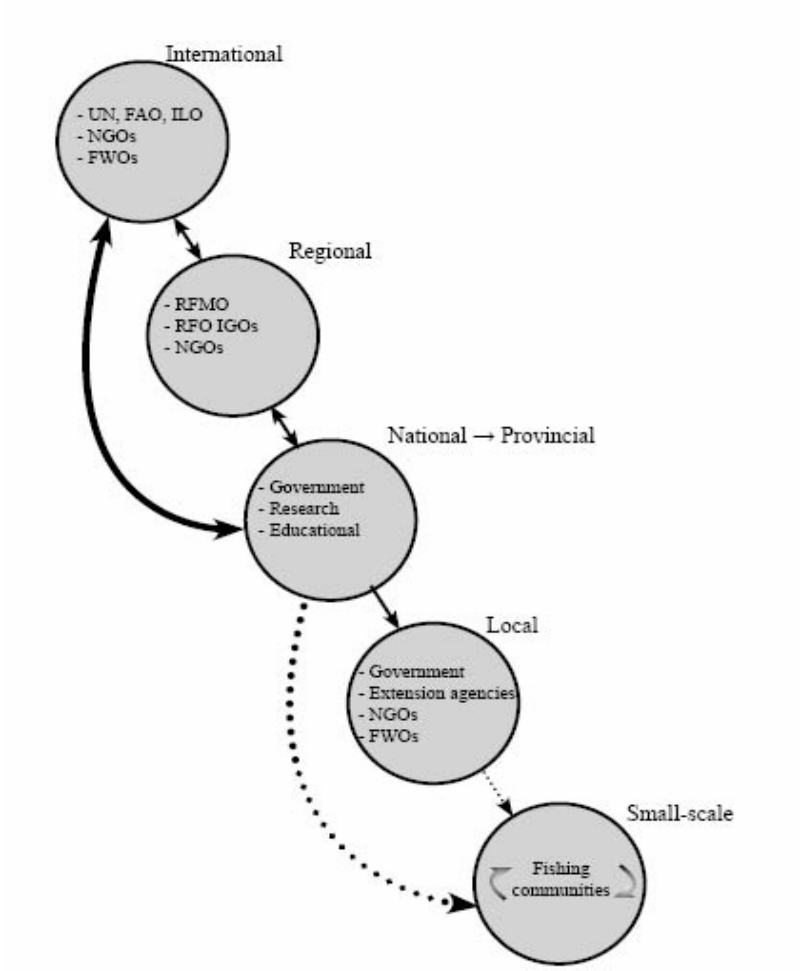
The STREAM Information Access Surveys provide a model for assessing the situation in similar contexts. STREAM also produced a schematic stakeholder overview showing the many layers and groups involved in the countries where the STREAM Initiative worked with aquatic resources management.[7] One of the outputs of the Initiative was to improve regional communication and learning between poor aquatic resource users, line agencies, civil society, researchers and the private sector. The STREAM Stakeholder Overview indicates the complexity of information exchange in a regional context, although even local and national scenarios have their own levels of complexity.

The chapter on small-scale fisheries highlights the consequences of poor information exchange at local and national level for the sub-sector. The

[6] Felsing and Nguyen. 2003.
[7] STREAM Stakeholder Overview: www.streaminitiative.org/StakeholderOverview.html#

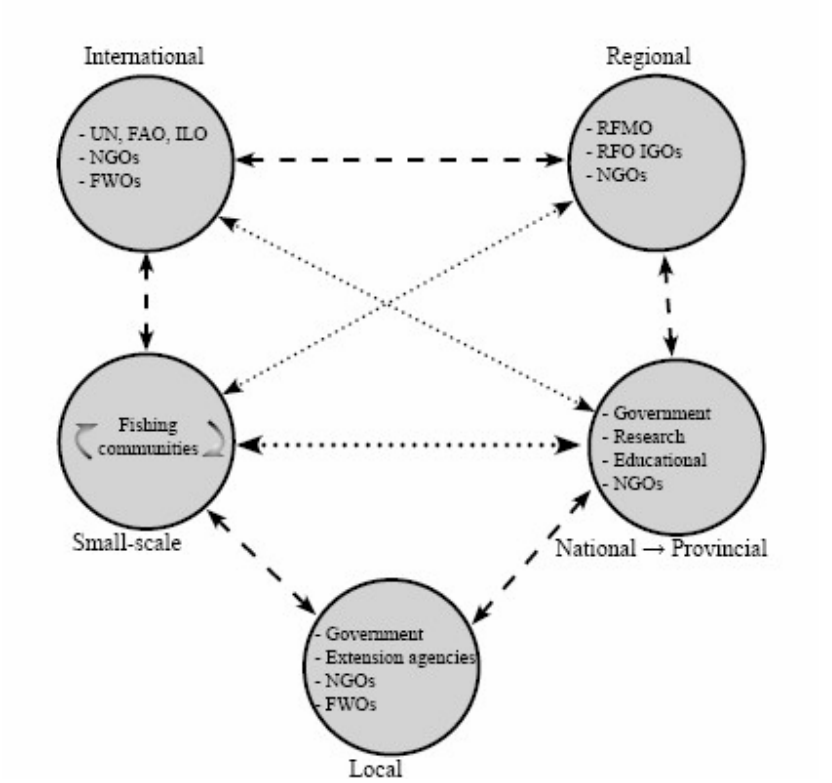
flow of information between policy-makers, scientists, universities, fishing communities and other stakeholders should be multidirectional. Figure 1 shows a simple schematic picture of the almost linear flow of information as it is perceived at present in comparison to the more dynamic and participatory exchange that is required and shown in Figure 2.

Figure 1 Current information flow



The flow of information becomes more linear as it approaches the resource users, particularly in the small-scale sector. The dotted lines indicate a less frequent and less effective flow of information.

Figure 2 Required information and knowledge flow



The various stakeholder categories should form part of a network, within which smaller, more specialized or focused networks already operate. They all have information that must be accessible to those who need it when they need it. They should each make it clear to the network what information they have and any conditions or restrictions on availability, such as cost or copyright.

1.2 Fisheries management practices and the flow of information

The way that fisheries are managed and the participation by different stakeholder groups has implications for information providers as well as those who need information upon which to base management decisions. Recent developments in fisheries management have revolved around the

ideas of decentralization, devolution, regionalization and participation.[8] The Code itself emphasizes a participatory approach including consultation among stakeholders and the effective participation of industry representatives, fishworkers and environmental organisations in decision-making processes [Article 6.13] and in policy formulation and implementation [Article 6.16].

Information and decentralized management

This means that the information needs of decentralized stakeholder groups faced with making management decisions must also be addressed within this new fisheries management framework. The chapter on small-scale fisheries spells out the implications for this sub-sector in more detail but the issue is relevant at all levels. The institutional infrastructure that is available in situations of centralized management would normally include services to facilitate information access as well as publishing and disseminating information. One of the issues emerging from the 2005 International Association of Aquatic and Marine Science Libraries and Information Centers (IAMSLIC) Conference hosted by FAO was that few national governmental, research and academic institutions have a mandate or budget that permits them to extend their library and information services beyond their own defined community.[9] This is a serious disadvantage for stakeholders at the local level who have limited access to information and their needs should be better understood and addressed.

The transfer or sharing of information resources and skills from the institutions of centralized management to smaller, geographically and socially diverse groups should be an integral part of decentralized management arrangements.

Another example of changes in fisheries management is the more recent introduction of an ecosystem approach to fisheries (EAF) that also has implications for the flow of information between different stakeholders. In

[8] Suárez de Vivero, 2008.
[9] IAMSLIC, 2006.

its broadest sense, the ecosystem approach should involve all relevant sectors of society and scientific disciplines. The multidisciplinary nature of fisheries already requires a significant information capacity. The interdisciplinary analysis that is needed by an ecosystem approach to fisheries requires a great deal more. This introduces a new set of challenges for the information cycle as well as for the exchange of information between increasing numbers of participants.

Information is critical to EAF. It underpins the formulation of national policies, the development of management plans and the evaluation of management progress. Given that EAF involves a broadening of current fisheries management practices, it requires a broadening of the information necessary for good management.[10]

Recognizing the wide range of interpretations of the approach, FAO proposed the following definition *"an ecosystem approach to fisheries (EAF) strives to balance diverse societal objectives, by taking account of the knowledge and uncertainties of biotic, abiotic and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries"*.

Information and the ecosystem approach

EAF therefore requires integration of knowledge from the disciplines being brought to bear on an issue. Disciplinary knowledge, concepts, tools and rules of investigation are considered, contrasted, and combined in such a way that the resulting understanding is greater than simply the sum of its disciplinary parts.[11]

Countries need to be aware that changes in fisheries management practices and changes in the knowledge base of fisheries will have an impact on the information required and how it is delivered to different stakeholders.

[10] FAO, 2005a.
[11] De Young, Charles and Hjort, 2008.

2. THE ROLE OF INFORMATION IN IMPLEMENTING THE CODE

2.1 The Code and information

The Code states that "the right to fish carries with it the obligation to do so in a responsible manner so as to ensure effective conservation and management of the living aquatic resources" [Article 6.1]. To accomplish this overall goal of the international fisheries community, information is an essential component. The Code suggests the breadth and variety of information required:

> *Conservation and management decisions for fisheries should be based on the best scientific evidence available, also taking into account traditional knowledge of the resources and their habitat, as well as relevant environmental, economic and social factors.* [Article 6.4]

> *States should recognize that responsible fisheries require the availability of a sound scientific basis to assist fisheries managers and other interested parties in making decisions. Therefore, States should ensure that appropriate research is conducted into all aspects of fisheries including biology, ecology, technology, environmental science, economics, social science, aquaculture and nutritional science.* [Article 12.1]

The role of relevant information in the decision-making process, while not explicitly stated, is implied throughout the Code. Transparent and timely decision making relies on using and sharing information. The role of information remains critical at all levels to support implementation of the Code as well as other key international commitments, such as the World Summit on Sustainable Development (WSSD)[12] Plan of Implementation[13] and the MDGs that are directly or indirectly linked to the achievement of responsible fisheries. Before we can address improvements to the sharing of

[12] Major and time-bound fisheries-related targets set out in the WSSD 2002 Plan of Implementation include: effective implementation of the IPOA–Capacity by 2005 and the IPOA–IUU by 2004; encourage application of the EAF by 2010; establishment of representative networks of marine protected areas (MPAs) by 2012; and maintenance or restoration of fish stocks to levels that can produce the maximum sustainable yield by 2015.

[13] United Nations. Department of Economic and Social Development, 2004.

fisheries information, we must take account of its characteristics, its uses and users and the challenges to bringing it usefully into play.

2.2 Characteristics of fisheries information

Various types of information serve different roles in supporting implementation of the Code but overall, fisheries information is characterized by four major features:

- Fisheries information is **broad and multidisciplinary**. Its breadth shows the variety of disciplines involved, the wealth of languages and the range of voices;
- It has **depth** in terms of time and perspective. The pool of available information should be deeper than the most recent or the most accessible. Older information is valuable and in fact, is often essential to effective fisheries management;
- It involves various **scales** from very local to global. The local needs to be integrated with the global as fisheries resources are usually shared across space and time;
- It comes from a complex **mix of sources**. Information produced by different sources and disciplines may at times be contradictory.

These features are persistent. They also lead to challenges in using fisheries information

2.3 Challenges with fisheries information

Fisheries span a large resource and encompass a wide range of people. They all need and use information, from small-scale fishers making decisions about their livelihoods to the cabinet minister planning a national budget and the information they need comes from a wide range of sources.

2.3.1 Using the breadth of information

Decision makers and all those involved with fisheries and their management need information from a wide range of disciplines, sectors and authors.[14] It is produced by the scientific enterprise, local populations, fisheries communities, the political hierarchy as well as other managers and policy makers. In reality, people tend to work within their disciplines rather than integrating information from different sources.

[14] World Bank, 2004a.

2.3.2 Limitations and gaps in fisheries information

The role of science information in implementation of the Code revolves around people finding relevant scientific evidence and applying it to the issue at hand, or discovering the gaps in science information and working to close them. Information gaps on the socio-economic and cultural aspects of fisheries have been identified as a particular problem. Science information does not consistently acknowledge nor incorporate other sources of observation and knowledge about the environment and the resources.[15] This marginalizes observations and information that may be relevant.

Too often, information may have existed but is now missing or lost, largely because it was not disseminated widely and therefore not known or was inadequately preserved. Countries and institutions have in some cases lost their entire published output as a result of war or environmental disaster. The additional problems of inaccurate or deliberately missing information, such as distorted catch statistics or IUU fishing and related activities add serious constraints.

2.3.3 Sharing failure

Scientists are not rewarded for admitting and sharing errors and failures. The scientific literature rarely publishes null results or failed experiments. Sharing all information assists scientists and decision makers build on the work of others and use findings to ask new questions and resolve issues.

Failures in fisheries management abound as witnessed by the collapse of fisheries stocks, the threat to livelihoods and the decline of the marine and freshwater environments. Sharing information about those mistakes and failures promotes analysis and possible changes of approaches, policies or processes. Using information proactively in management should reflect a feedback loop where new scientific, economic, political and social information is integrated to address challenges and different ways of managing.

2.3.4 Recognizing contexts and expertise of users

Providing relevant, accessible information is a first, critical step to involve people in fisheries development and management. Awareness of how different communities, and different groups within them, use information is

[15] Berkes, 2003.

essential. For example, gender is important and often rural women do not find content that is in a local language or relevant to their context and needs.[16] Community structure may indicate more effective paths of communication and how information should be presented.

Language remains a challenge to accessing fisheries information in many parts of the world. English is still the predominant language in science and on the internet, thus precluding many people from using valuable information. The flow of information should not be one way and local information and traditional knowledge need to be inserted into the information mix.[17]

The Code reiterates the need for transparency in the process of developing policy. The integrity and transparency of the decision making process improves as the information used is accessible to all involved. The same information may be variously interpreted depending on perspective and desired outcome.[18] Recognizing the myriad of sources and voices, and bringing them into the conversation should improve the process.

2.4 Policy frameworks for fisheries information

Policy frameworks present one means of addressing the challenges. Information policy works within the broad context of other policies, regulations, treaties and agreements. The World Summit on the Information Society emphasized that information should be used *to promote the common good*, that governments *should foster a supportive, transparent, pro-competitive and predictable policy, legal and regulatory framework, which provides the appropriate incentives to investment and community development in the Information Society.*[19] Information policies influence the types of information accessible and the ways stakeholders use that information.

2.4.1 Government information policies

Government information policies should ensure that all people have access to the information they need to make effective decisions about their own lives and their society.

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[16] Cranston and Holmes, 2006.
[17] Garcia *et al.*, 2008.
[18] Weeks and Packard, 1997; Wilson, 2000.
[19] World Summit on the Information Society, 2005.

Definition of an information policy

Information policy is a set of interrelated principles, laws, guidelines, rules, regulations and procedures guiding the oversight and management of the information life cycle: the production, collection, distribution/dissemination, retrieval and retirement of information. Information policy also embraces access to and use of information.[20]

Organizations such as the International Federation of Library Associations and Institutions (IFLA) and the United Nations Educational Scientific and Cultural Organization (UNESCO) promote, assist with and monitor progress in the development of National Information Policies (NIP) and National Information Technology Strategies (NITS). NIPs would address issues such as ensuring that information generated by the public sector should remain in the public domain, accessible to all[21], enacting freedom of information legislation and support for the general principles of freedom of expression for individuals.[22]

Sufficient and equitable access to relevant information depends on a well-developed and maintained physical and information infrastructure for information delivery. However, as much emphasis should be placed on the content of the information as on the technical mechanisms for delivering it.[23] Sufficient means timely in terms of real time and adequate in terms of content. Equitable suggests that different groups may require different types of information delivered by various means, for example print, electronic, radio. Relevant refers to content, language and intellectual level.

Planning and implementation of public physical infrastructures that support technology (e.g. power and telecommunication systems) ensure that information can be delivered. Enhanced technology such as emergency warning systems and robust global positioning systems are of obvious benefit to the fisheries sector as is timely market and weather information. Government policy should encourage and support their development through policy, planning and funding.

Radio, television and cable access have varying value in different communities. Government policy and the consequent implementation of

[20] Duran, 1991.
[21] Uhlir, 2004.
[22] Jones 2005; United Nations General Assembly, 1948.
[23] Britz, 2008.

that policy should permit and encourage diversity in broadcast and print media.[24]

National security legislation throughout the world since 2001 threatens aspects of the information flow. Care should be taken that government information is not restricted in the name of national security. Over zealous control of information addressing ocean transportation, port facilities, mapping information, even weather, would be detrimental to fisheries.

2.4.2 Intellectual freedom policies

Open access and unrestricted use of information are embodied in freedom of expression. People require both to be effective members of society. The planning process should to be transparent so decisions can be tracked and individuals involved held accountable. All those affected by decisions should believe that their opinion and voice can be heard and valued. There needs to be a free flow of government information and citizen input.

Privacy also is imperative. Personal and industrial privacy needs to be weighed against the common good. Some fisheries information is proprietary and should be protected. Privacy of personal information should also be protected. For example, collection of catch data should protect the individual fisher's identity.

2.4.3 Trade agreements and intellectual property rights

Trade agreements can shape the development and management of fisheries as fish are a highly traded commodity.[25] One component of such agreements should address intellectual property (IP) rights. These rights are *the rights given to persons over the creations of their minds*.[26] The World Trade Organization's (WTO) Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) provides guidance on how to address IP rights internationally.[27] However, country to country agreements may supersede the WTO basics and lead to inappropriate regulations and legal liabilities.[28] For example, trade agreements may include language that legally restricts the use of patented products needed by the aquaculture industry.

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[24] Marker, McNamara and Wallace. 2002.
[25] International Centre for Trade and Sustainable Development, 2006.
[26] World Trade Organization [n.d.] a
[27] World Trade Organization [n.d.] b
[28] Abbott, 2006.

IP rights also address industrial rights including trademarks, patents and trade innovations. Copyright directly affects how information is shared. Fair Use guidelines [e.g. guidelines on when it is legal to use copyrighted material without payment] should be included in all information policies. Copyright should encourage exchange of information in all formats and not create new barriers to sharing. Over restrictive copyright law puts undue barriers on access to information.[29] Fisheries benefit from developing new markets, improving processing techniques and discovering new products and uses. Over protection of information is unwarranted if the rights of the creators are not commensurate with the common good. IP policies should protect investment in research and development while encouraging the transfer of information and knowledge.

2.4.4 Institutional information policies

A large number and variety of institutions produce and make available fisheries information. Their information policies cover issues such as publishing practices, dissemination, copyright assignment, ethical and professional obligations of authors etc. They should also cover the principles of free and open access, particularly where information is created with the use of public funds, as well as durable access over time.[30] Ignorance of copyright requirements may result in fiscal penalties and awareness can help institutions preserve their rights to distribute and use the information they produce.

Institutional information policies should also encompass the strategy and budget required to acquire the information needed to support activities such as research, education, advisory services etc. as well as to produce and disseminate information outputs in order to fulfil their mandate.

3. ACCESS TO AND AFFORDABILITY OF INFORMATION

3.1 Access

Accessibility is a common theme to these Guidelines. It varies from sector to sector and between developed and developing countries. Level of access

[29] Okediji, 2004.

[30] In 2008, Harvard University adopted a policy mandating all faculty publications be deposited in Harvard's open access institutional repository. The US National Institute of Health (NIH) recently mandated that all publications resulting from NIH funded research be placed in PubMedCentral, the NIH's open access digital repository.

depends on economics, politics and education. Access to information has four facets: physical access, virtual access, intellectual access and cultural or social access. These affect how people find and retrieve information. Countries can enhance access by addressing the challenges of each facet.

3.1.1 Physical access

In this digital age, some believe that physical access to information is no longer necessary and assume that everything is available on the World Wide Web. In reality, not everything is available online, and not everyone in the world has access to the Web. Physical access remains an important consideration. This ranges from print pamphlets distributed by extension agents, radio broadcasts, rural libraries with books and magazines on fisheries of local interest to regional collections serving governmental agencies and educational facilities. Physical access implies that people can obtain information where they are located and when they need it. Libraries play a critical role in providing physical access to managed collections of relevant information.

3.1.2 Virtual access

Virtual access supplements and enhances physical access. It relies on physical infrastructure such as telecommunication networks, telecentres and libraries. Electronic information has great potential to reach more people as networks become more robust, mobile telephone ownership expands and computer literacy increases. Other delivery technology will evolve that addresses the needs of populations currently isolated from information. The quality, relevance and language of the content may be limiting factors for many as much virtual information is in English.[31] The 2007 survey by IFLA and its committee on Free Access to Information and Freedom of Expression on access to information showed that the amount of content in local languages appears to be related to level of internet access.[32] According to the 2007 indicators from the International Telecommunication Union, only five inhabitants in every 100 are internet users in Africa compared with 14 in Asia and 41 in Europe and the Americas.[33]

[31] Cranston and Holmes, 2006.
[32] Bothma, 2007.
[33] International Telecommunication Union, 2008.

3.1.3 Intellectual access

Intellectual access refers to how information is presented linguistically and stylistically. Language is one of the largest challenges facing access to fisheries information.[34] Policy information usually appears in the official language(s) of the country. Consequently, local fishers do not have access to information in their local languages and dialects. The writing style and use of jargon pose barriers to readers outside of the immediate audience. Translating science for non-scientists is crucial as is making sure that government regulations are understandable to the non-lawyers. One example of this type of translation in fisheries is the multiple language and level versions of the FAO Code of Conduct. Literacy in general is a factor in access to information. Literacy level should be considered when choosing how to disseminate information.

The Policy Briefs produced by the Sustainable Fisheries Livelihoods Programme cover the importance of literacy and ICTs for access to information in small-scale fishing communities (www.sflp.org/briefs/eng/policybriefs.html).

3.1.4 Social access

Information is a critical part of "the lifeblood of economic and social interaction".[35] Those who have it, have power. Access is shaped by social forces such as level of education, community structure, family dynamics, and gender. Access is limited if literacy is low; so education for all expands access to information in general. Sensitivity to family and community structure is needed to ensure that those that can use information get it. Some family members and community leaders may control the flow of information. On a larger scale, governments may be selective of whom to share what information with. These social and political hierarchies appear in all communities. The fisheries sector should use them to improve access.

3.2 Affordability of information

Information is not free. It takes human capital and financial investment to create, collect, manage and distribute. Often, there is significant initial investment needed, such as for setting up a library or a radio network. Once established, the investment often gives a better return if multiple purposes

[34] Uhlir, 2004.
[35] Marker, McNamara and Wallace, 2002.

are served in the flow of information.[36] All too often, systems require a disproportionate ongoing financial commitment so there is little left to invest in content. System costs can make information too expensive for adequate distribution. Virtual information is definitely not free although many in research institutes and government are not always aware of the costs. Access to the internet has a cost that is often hidden in institutional budgets. Lack of free access to the internet continues to pose challenges in many parts of the world.[37] It increases the costs of virtual information and blocks access for many. Whether virtual or physical, information from its many sources has differing cost structures and policies that affect affordability.

3.2.1 Government information

Government generated fisheries information should be freely available with no fees for access. Users have already paid for this information through taxes, fees and licenses, so should not have to purchase it a second time. As more government information becomes available only in electronic format, significant numbers of users will have problems getting access or will face challenges manoeuvring in the digital environment. The development of e-government should ensure that access to information and government resources increases rather than decreases.

3.2.2 Scientific information

Scientific research is an international activity where progress builds on the reported results of colleagues around the world. Much scientific information, though mainly publicly funded, is published by commercial entities. This results in increasing costs for most consumers of scientific information. The precipitous and continuing increase in the cost of scientific journals makes them inaccessible to scientists in developing countries and increasingly so for institutions in developed countries. The digital information environment provides a cost effective means for increasing access and efforts are needed to support alternatives to commercial publication of science.

Another mechanism for expanding access cost-effectively is through inter-library cooperation. These arrangements can take many forms, including shared acquisition or access consortia and shared or interoperable catalogues to facilitate speedy access to each other's collections. The

[36] Chapman, Slaymaker and Young, 2003.
[37] Bothma, 2007.

IAMSLIC Distributed Library takes advantage of interoperable catalogues to encourage members to share journal articles.[38]

3.2.3 Open access

Open Access means that information should be "digital, online, free of charge, and free of most copyright and licensing restrictions".[39] This requires partnerships between authors and publishers to develop mechanisms for authors to retain copyright to distribute freely while allowing publishers to retain rights to distribute commercially.

Fisheries institutions should adopt open access as a goal. They should support institutional or subject repositories that comply with the Open Archives Initiative standards and OA principles such as the Berlin Declaration.[40] They can request that researchers publish in open access journals. Much of the information produced by these institutions, universities included, is funded with public money and should be available without further cost. Countries should commit to open access to information as a foundation for ensuring that it is available to all.

3.2.4 Sustainable access

Sustainable access is inextricably linked to affordability and the costs of content and delivery are significant. Investment in both requires careful planning and flexibility to adapt to new mechanisms and strategies. Sustainable access to fisheries information is best achieved if well integrated into programmes and existing systems.[41] Long term access depends upon an effective strategy for archiving and preserving print and digital content.

The role of libraries in providing long-term, cost effective access to selected information for a defined user community is well known. More effort and resources are needed to enable them to extend their user base and provide access to stakeholders outside of an institutional structure. The benefits of library networks for sharing costly information resources and expertise are not realized by many fisheries institutions in developing countries. Providing sustainable access to global information resources, digital as well

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[38] Butler *et al.*, 2006.
[39] Suber, 2007.
[40] Conference on Open Access to Knowledge in the Sciences and Humanities, 2003.
[41] Chapman, Slaymaker and Young, 2003.

as print, depends upon the contribution and active participation of all those who hold and produce information.

4. FINDING FISHERIES INFORMATION

Finding information is perhaps the first step in generating knowledge and here we are concerned with that which is published. It is an essential part of the information cycle, which as stated earlier involves its creation, production, dissemination, retrieval and retirement as well as its preservation for the future. Those who create new information usually build on the past and those who need information must use a wide range of resources to find it. These resources include a variety of intermediaries and institutional support services, ranging from extension agents, web portals, information professionals etc. The types of information sought may vary from user to user, sector to sector and context to context. Finding and accessing information are intertwined.

Finding relevant, timely and authoritative information efficiently and cost-effectively relies on access to discovery tools such as bibliographic databases, web portals, information harvesters, search engines etc. that help to identify information from the many available sources. The tools themselves have their own strengths and weaknesses and users need to be aware of their coverage, completeness and limitations.

Bearing in mind the multidisciplinary nature and characteristics of fisheries information outlined in Chapter 3, covering the vast array of relevant information resources and systems is outside the scope of these Technical Guidelines. Selected searching tools are listed in Table 2 to illustrate the variety and availability of some of them. Access may be limited due to cost and an indication of free or reduced cost availability in developing countries is given. Access may also be limited due to lack of awareness or expertise. It is essential that countries invest in human capacity development as well as adequate infrastructure in order to exploit fully the array of information resources available.

4.1 Finding science information

Science information contributes to policy development, management implementation and public opinion. It includes current and historic information across the breadth of fisheries.

The scientific peer-reviewed journal is the primary source, even though in fisheries there is a bias towards basic research from developed countries.

Access to the full spectrum of journals is needed, including management, policy, social sciences and natural sciences. Many working in the field use a narrow band of journals that are directly related to their specific interest. This limited use is due to the cost of journals, lack of familiarity with the range of journals and time constraints.

Much of science is published by commercial publishers and the cost is high and increasing. Efforts such as *AGORA* (Access to Global Online Research in Agriculture), *HINARI* (Health InterNetwork Access to Research) and OARE (Online Access to Research in the Environment) alleviate the prohibitive costs of access for developing countries. The International Network for the Availability of Scientific Publications (INASP) which 'enables a sustainable network of stakeholders that owns and drives access, use, dissemination and communication of research information' plays an important role in developing countries. Many fisheries institutions in eligible countries take advantage of these services but more investment is needed in awareness raising and training of users.

Growing support for Open Access to information is increasing access to journal literature. The Directory of Open Access Journals (DOAJ) provides access to over 3 000 peer-reviewed journals that are freely available. In 2008, DOAJ included nine fisheries journals. However, the 52 journals in zoology and 24 in gender studies are also relevant and indicate the general breadth of coverage. *Google Scholar* provides another mechanism to find the scientific journal literature cost effectively, although coverage is predominantly English language, commercial journals and links to freely available articles are limited.[42]

The other two constraints to using the breadth of journal literature, familiarity and time, can be alleviated using alerting tools and the expertise of information professionals who can assist scientists to identify journals outside of their specialty. Simple browsing of contents tables can build familiarity in a time and cost effective manner. Electronic delivery of contents is becoming ubiquitous by means of user profiles set up in various publisher Web sites.

Another aspect of familiarity is awareness and recognition of science carried out in developing countries. The editorial boards of western peer-reviewed journals often reject the submissions of scientists from developing countries because of language issues and the lack of up to date citations.

[42] Neuhaus *et al.*, 2006.

The result is that much is published in the form of "grey literature", that is publications not controlled by commercial publishers, and where publishing is not the primary business activity of the entity.[43] The grey literature is invaluable to science. The reports of fisheries institutes are often the most relevant source for local and regional research, providing detailed biological, statistical and physical information.

Developing country science

In some African countries it is estimated that up to 70 percent of fisheries research is published as grey literature, including conference proceedings and theses. Only a small percentage finds its way into scholarly journals. *African Journals Online* (AJOL) and *Scientific Electronic Library Online* (SciELO) in Latin America are two examples of efforts to promote regional science. Several Asian countries, including India and China, have a long and prolific tradition of scientific societies who provide good publishing opportunities and now promote open access.[44] This cache of information should be considered valid and valuable and efforts made to promote its use locally and internationally.

Much regional fisheries science is also published as grey literature by intergovernmental organizations such as the Caribbean Regional Fisheries Mechanism, Pacific Islands Forum Fisheries Agency, Secretariat of the Pacific Community, Network of Aquaculture Centres in Asia-Pacific, Southeast Asian Fisheries Development Center and by regional fishery science bodies such as the North Pacific Marine Science Organization and the International Council for the Exploration of the Sea. The enormous amount of fisheries science published as grey literature poses particular challenges for its integration and easy retrieval.

4.2 Finding management, policy and legislation information

Fisheries management, the formulation of policy and the resulting legislation reflect the complex interaction between science, economics, politics, technology, ecosystems, history, and people.[45] Fisheries managers

[43] Farace, 1998; Gelfand, 2000.
[44] Webster, Merrikin and Collins, 2006.
[45] Hanna *et al.*, 2000.

and policy-makers should look beyond science information.[46] *Technical Guidelines No. 4 on Fisheries Management* emphasize the need to integrate the economic and social aspects of fisheries with information on the status of stocks.

Legislation should be the simplest information to access because it provides the foundation for all relevant processes and activities. In some parts of the world, laws are readily accessible, for example the interactive Thomas system (http://thomas.loc.gov/) provides access to US federal laws. However, many countries do not maintain such a system, and laws and regulations for State or local levels can be difficult to access.[47]

FAO maintains a freely accessible database, FAOLEX (http://faolex.fao.org/faolex/), which has a global scope and links to the full text of national legislation relating to food, agriculture and renewable natural resources, including fisheries.

Currency and precedent are major challenges with legislative information. Precedent and legal decisions are usually only available through expensive legal databases aimed at the legal community and not fisheries policy makers. Countries should provide the means to readily find and access local and national laws and regulations, legal interpretation and legislative history.

Fisheries management plans serve as frameworks for all those involved in fisheries. They can be difficult to locate as they are often working documents subject to revision and shared selectively. Steps to finding them include knowing who is responsible for their creation, contacting that unit directly, through an agent or online, and either requesting or obtaining a copy online. This is often a tedious process. The FAO Fishery and Aquaculture Country Profiles include information on policy and legislation and are helpful starting points (www.fao.org/fishery/countryprofiles/search/en). The ICSF maintains a digital resource on legal instruments relevant to fisheries and fishing communities (http://legal.icsf.net/icsflegal/home.jsp).

Policy briefs are a valuable source of information as they synthesize the issues, background and current situations in a readable format for a targeted audience. Using these briefs can reduce time spent searching for difficult to locate legislation and deciphering complex legal and scientific jargon.

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[46] Chuenpagdee and Bundy, 2006.
[47] Kirkwood, 2006.

4.3 Fishing industry information

The fishing industry is heterogeneous in terms of species targeted, waters plied, gear used, markets exploited and processing needed. The industry information addresses management regimes, environmental conditions and market demands. It is found in governmental, community and commercial sources.

The trade journals and publications targeted at the industry give insight into current practices, trends in gear and technology changes, opinions on acceptance (or lack of such) of new regulations or policy decisions. Newsletters (digital or print) targeted at commodity groups and particular sectors of the industry are useful to managers as outlets for their work as well as means to garner a sense of how well they are doing. Word-of-mouth does much to promote awareness of relevant information. *Technical Guidelines No. 1: Fishing operations* provide details of the information essential for responsible fishing, for example adequate access to maritime safety information, navigational and meteorological warnings and forecasts and other urgent safety information.

Availability of market information can be highly variable in terms of accuracy, timeliness and accessibility. FAO Globefish and the FISH InfoNetwork provide global marketing and trade related information about and for the fishing industry in developing countries. *Technical Guidelines No. 7: Responsible fish utilization* are targeted at the post-harvest sector. The information covers a broad area, from the scientific and technical information required by the processing industry to market trends and prices, as well as the ever more complex requirements of international trade.

Safe and sanitary processing of fishery products requires knowledge of acceptable and appropriate practices. Finding information on current best practices and government standards is critical. The CODEX Alimentarius (www.codexalimentarius.net/web/index_en.jsp) develops food standards, guidelines and related texts such as codes of practice, specifically the Codex Committee on Fish and Fishery Products.

4.4 Information for sustainable development

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.[48] In recent years, national and regional development organizations

[48] United Nations. World Commission on Environment and Development, 1987.

and development banks have focused more on overall development issues than on individual sectoral programmes. Sustainable livelihoods and poverty reduction are more prominent as these organizations work towards achieving the UN Millennium Development Goals.[49] The World Bank's infoDev Programme recognizes the importance of sharing information to plan and promote sustainable development.[50]

The New Partnership for Africa's Development (NEPAD) programme of action is a holistic, comprehensive and integrated sustainable development initiative for the revival of Africa. Fisheries are a priority sector and its future contribution to poverty alleviation and regional economic development was the focus of the NEPAD Fish for All Summit, held in Nigeria in 2005.[51] Information dissemination will play a key role in the Initiative and wide ownership will be sought.

The International Centre for Trade and Sustainable Development (ICTSD) project on fisheries, trade and sustainable development aims to contribute to the crafting of multilateral and regional trade rules and policies that are supportive of sustainable development in fisheries. It focuses on enhancing the capacity of least-developed and developing countries to better articulate their positions and voice their concerns in negotiations, such that the importance of the fisheries sector for development, livelihood and food security is adequately taken into consideration.

The re-focusing towards a holistic development approach involves many subject areas that are tangential to fisheries *per se*. Poverty reduction and improved quality of life depend upon relevant information about nutrition, livelihoods, and health issues including HIV/AIDS.[52] The required information may exist, yet people often have difficulty finding it. Social, environmental and economic information is often produced by governmental and intergovernmental organizations. Demographics, health and education usually come from the social service agencies of various levels of government. Finding these resources is often dependent on government searching tools as well as contact with the relevant government officials. Barriers include language, educational level, delivery mechanisms and adequate needs assessment.

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[49] United Nations, 2008.
[50] World Bank, 2008.
[51] New African Partnership for African Development (NEPAD), 2008.
[52] Marker, McNamara and Wallace, 2002.

5. GENERATING KNOWLEDGE

Chapters 6 to 9 focus on the generating, recording, disseminating and sharing of both ***existing*** and ***new*** knowledge. Enhancing the communication and participation aspects of the cycle is also critical. However, in-depth coverage of these aspects is outside the scope of these Technical Guidelines.

5.1 The Code and research

The data and information forming the knowledge base of fisheries are continually changing. This base continually extends as gaps are identified, an ongoing process involving desk studies, workshops or a combination of both, to determine research priorities, all of which is dependent on a suitable institutional framework, as indicated by the Code:

> *States should establish an appropriate institutional framework to determine the applied research which is required and its proper use.* [Article 12.2]

The subsequent filling of gaps may be achieved through targeted research (pure or applied) or by improved gathering and analysis of data. Both the FAO Strategy for Improving Information on Status and Trends of Capture Fisheries[53] and the FAO Strategy and Plan for Improving Information on Status and Trends of Aquaculture[54,55] aim to significantly invigorate data collection and research and place emphasis on capacity development in developing countries to achieve this goal. This applies to all the information domains (or "disciplines") relevant to the fisheries sector, which have been categorized in various ways.[56] The Code summarizes them:

> *... Therefore, States should ensure that appropriate research is conducted into all aspects of fisheries including biology, ecology, technology, environmental science, economics, social science, aquaculture and nutritional science.* … [Article 12.1]

The importance of research for fisheries and aquaculture is referred to throughout the Code, as is the need to disseminate and share the results of such research. In recognition of the importance of research, many

[53] FAO, 2003a.
[54] FAO, 2005d.
[55] FAO, 2006b.
[56] Evans and Grainger, 2002; Pitcher, 1999.

governments and donor agencies are now increasing budgets for scientific research in fisheries.[57]

Linking research and policy

It is essential to improve the links between research and policy to ensure that:

- Research is demand-led by the inclusion of all stakeholders hence improving the feedback of results into action;
- The policy implications of research findings are clearly communicated to both formal and informal policy makers in a timely fashion.

> *States should promote the use of research results as a basis for the setting of management objectives, reference points and performance criteria, as well as for ensuring adequate linkage, between applied research and fisheries management.* [Article 12.13]

Some donor agencies are now adopting a strategy that includes striking a balance between creating new knowledge and technology and getting both new and existing knowledge and technology into use as well as influencing policy to make sure research makes an impact.[58] The Code emphasizes the States' responsibilities relating to recording, disseminating and sharing of this information:

> *States should ensure that data generated by research are analysed, that the results of such analyses are published, respecting confidentiality where appropriate, and distributed in a timely and readily understood fashion, in order that the best scientific evidence is made available as a contribution to fisheries conservation, management and development.* … [Article 12.3]

The on-going or cyclical nature of research is recognized by the Code:

[57] Barnard, Carlile and Basu Ray, 2006; Department for International Development, 2008.
[58] Department for International Development, 2008.

> … *In the absence of adequate .scientific information, appropriate research should be initiated as soon as possible.* [end of Article 12.3]

The Code also recognizes that collaborative research is required to further understand the dynamics of transboundary aquatic stocks:

> *States, either directly or with the support of relevant international organizations, should develop collaborative technical and research programmes to improve understanding of the biology, environment and status of transboundary aquatic stocks.* [Article 12.17]

Collaborative research in a much broader range of fisheries domains, such as the impacts of climate change and pollution reduces duplication of effort and saves scarce financial and human resources. The interdisciplinary investigations and research that are required for implementation of the ecosystem approach to fisheries (EAF) will require not only greater collaboration between disciplines but the development of new research modalities. Disciplinary knowledge, concepts, tools and rules of investigation are considered, contrasted, and combined in such a way that the resulting understanding is greater than simply the sum of its disciplinary parts. This will have an impact on the way information is produced and disseminated.

5.2 The Code and traditional knowledge

> *Conservation and management decisions for fisheries should be based on the best scientific evidence available, also taking into account traditional knowledge of the resources and their habitat, as well as relevant environmental, economic and social factors* [Article 6.4]

> *States should investigate and document traditional fisheries knowledge and technologies, in particular those applied to small-scale fisheries, in order to assess their application to sustainable fisheries conservation, management and development* [Article 12.12]

At times, the "best scientific evidence" available to fisheries managers arises from indigenous knowledge (IK).[59] Indigenous knowledge pertains to

[59] FAO, 2005c.

experiential, locality-specific knowledge developed by indigenous people over the years. Thus, IK is local knowledge that is unique to a given culture or society. Some 80 percent of the world's population depend on IK to meet their medicinal needs, and over a half of the world's population depends on IK and crops for food supplies.[60] Essentially, IK affects the well-being of the majority of people in developing countries.

Extensive studies have been made on traditional knowledge per se[61], but few address the issue of its integration with research-based knowledge. The Knowfish Project, a European Union-funded initiative, investigated the use of local knowledge of fishers in the process of managing fisheries resources. The different perspectives of formal research-based knowledge and of fishers reflect the different interests and scales of observation. Yet fisheries management can only be effective if the measures are considered legitimate by all stakeholders and a communication bridge between different knowledge discourses is needed.[62]

6. RECORDING INFORMATION AND KNOWLEDGE

The mechanisms for organizing and managing the creation and publication of fisheries information have very varied regional and national characteristics.[63] The most effective methods and media for recording and sharing knowledge vary for the different stakeholders. Generating appropriate information is not sufficient. Attention needs to be devoted to identifying the target audiences and tailoring messages and media to reach the full range of stakeholders identified.

6.1 Publishing fisheries science

Although mainly aimed at academic and research institute scientists in the various fisheries domains, this section is also relevant to managers publishing theoretical or applied fisheries management information. The importance of research for fisheries in both developed and developing countries is stressed by the Code. However, the kind of research carried out and its relevance or transformation into successful management and conservation policies has been the subject of some debate. In 2004 the World Bank was critical of the narrow scientific focus in fisheries over the previous decades "Few research programs in the developing world provide

[60] Civil Society Organizations and Participation Programme, 2001.
[61] Haggan, Brignall and Wood, 2003; Haggan, Neis and Baird, 2007.
[62] Degnbol, 2005.
[63] Webster and Collins, 2005.

sufficient knowledge necessary for timely management, and most management decisions all around the world are made in a vacuum of insufficient timely and relevant information and analysis, with particular shortages in the developing world. Planning of research to tailor outcomes to management requirements has been a failure in all but a handful of countries. Transforming the 'culture' of scientific independence prevailing in many research institutes and linking research funding to producing timely 'outputs' has to be a critical component of any attempt to improve sector governance …".[64]

Recent years have seen a greater focus on the multidisciplinary nature of fisheries, including the sociological and economic aspects, with fisheries management and governance issues becoming more widespread in the literature.

Sound investigation design is a pre-requisite to all research. Lack of access to a comprehensive range of information sources hinders good investigation design (definition of the problem, choice of methodology, data collection protocols, data processing and interpretation, etc.). All aspects of information should be considered and included in the budget at the investigation design phase, not only the information needed but the strategy for disseminating the research output. Appropriate workshops and mentoring programmes on fisheries research project design in developing countries could improve this situation.

6.1.1 The need to publish

There is little point in doing research if results cannot be used, particularly in developing countries, where applied research is an essential component of economic and social development and has a high opportunity cost. However, even with good investigation design and implementation, much research and management work still does not reach the publication stage:

- Work that is unpublished or presented badly is essentially still **work not done;**
- Work that is presented or published at the "wrong" time or in the "wrong" place may not get read and hence not achieve the desired objectives.

[64] World Bank, 2004b.

The ultimate aim is to *present the work to the right audience at the right time in the right way*.

6.1.2 Deciding where to publish

Researchers need to be able to determine which journals or other outlets are the most essential and appropriate for submitting their research articles – and they need to do this at an early stage. There are a large number of factors that could influence the decision, such as quality, visibility, copyright options, costs, type of outlet (commercial journal, grey literature, OA journal), etc. Many research libraries and information services give support to their scientists by providing access to comparative tools for measuring quality, impact, coverage by abstracting and indexing services (visibility), publisher's copyright policies for OA archiving, etc. However, not all researchers in developing countries have access to information tools to help them make effective choices.

Traditionally the scientists choose a peer-reviewed journal, either published commercially or under the auspices of a not-for-profit society. In developing countries the advent of initiatives such as AGORA, HINARI and OARE may have made this choice even more appealing despite the difficulties of getting their own papers accepted.

The improvements in the production and dissemination of scholarly journals *published in* developing countries are also helping to promote this choice.[65] These journals often provide a better mechanism for publishing on applied research and development. Past problems with speed and regularity of production still lead to reluctance by some authors to submit papers to them. Programmes for improving preparation, production and management of local journals such as the International Network for the Availability of Scientific Publications (INASP) Programme for the Enhancement of Research Information (PERI) are designed to alleviate these problems. The fisheries content of these journals is increasing thanks to greater visibility and availability via online services such as African Journals Online (AJOL) and SciELO: a scientific electronic library online for Latin American journals.

The debate on whether to publish in the peer-reviewed literature rather than at the other end of the spectrum as grey literature continues, particularly in the western academic world where the career pressure to "publish or perish" is strongly biased towards peer-review. The present emphasis by donor

[65] Altbach and Teferra, 1998.

organizations on greater use of research and management information and communication to all stakeholders strengthens the case for publishing in grey literature as it is usually freely available, even though it may be difficult to locate.

The increasing availability of the internet, digital publishing hardware and open source software, together with the influence of the OA Movement are radically changing the debate on where and how to publish. The OA Movement has opened up opportunities to either publish directly in OA journals or in OA repositories as a secondary form of publishing and access. Over the last decade, the movement has matured and become an important avenue for publication and access.[66]

Cost recovery for journal, grey literature and OA publishing remains an issue and is a particular problem in developing countries but new business models are emerging rapidly, forced forward by the OA movement. The Open Society Institute suggests a range of potential income generation and subsidy funding components when launching a new OA journal.[67]

6.1.3 Barriers to getting published

The research and management communities in developing countries face different issues and difficulties in publishing than do their counterparts in developed countries. Low scientific publication rates and a high rejection rate by publishers have a demoralizing effect on researchers. This situation leads to slow technological progress, poor management, re-invention of wheels and a waste of scarce resources[68].

Developing world fisheries scientists want to increase the visibility of their contributions to the global body of scientific knowledge for application locally and around the world. Programmes to build institutions and research capacity have frequently neglected the need to secure funding and a mandate to support the publication of research. The result is a serious, and growing, under-representation within the scientific literature of authors closest to the challenges that beset fisheries in the developing world. The absence of their voices and their research potentially weakens the future for responsible fisheries.

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[66] Suber, 2006.
[67] Open Society Institute, 2003.
[68] Hecht, 2004.

Authors from resource-poor settings report their uncertainty about suitable journals; their unfamiliarity with editorial conventions and the persistent pressure to write in English; unfamiliarity with statistical tools to analyze data; and, more generally, editors' and publishers' inattention to development topics. Journal editors report a complementary picture – many manuscripts have merit but may require too much additional analytic or editorial effort and are rejected early in the review process.[69] In other words, researchers who experience the difficulties of access outlined in Chapter 4 also have difficulty in publishing their own research, particularly in the peer-reviewed literature.

The difficulties in getting scientific research published have a negative impact on the flow of information and what should be an easy problem to resolve is probably the cause of much wasted time and effort. Sharing information, even at local level, becomes an issue when scientists have no avenues of formal recognition for their research and the following problems have been identified:

- Information flow between scientists is not good, even within the same institution let alone within the country.
- Scientists are particularly loathe to share their research data – again, if the work is not published the protection of one's data becomes an issue.
- Scientists in developing countries are given insufficient training and time to write research articles for peer-reviewed journals.

The advent of the OA movement should provide better opportunities to publish. However, there is a need to raise awareness about these opportunities, in particular the advantages of having additional high quality, peer reviewed OA publishing avenues. One example is the American Fisheries Society OA journal *Marine and Coastal Fisheries: Dynamics, Management and Ecosystem Science* that has high peer review standards and an interesting funding model. They also provide detailed instructions to assist authors when writing articles for the journal (www.fisheries.org/mcf/authorGuide.html). The need for training, mentoring and time to ensure that the results of research are published well is just as important for OA publishing.

[69] Freeman and Robbins, 2006.

Support for getting published

Individual fisheries organizations have addressed the need for good scientific writing by organizing workshops and publishing guides on the preparation of scientific papers and grey literature reports. However, these are mainly for the benefit of their own staff, or members in the case of associations. There is a need for much more widely available guidance, particularly for developing country scientists. An interesting initiative based at INASP and started in the health sector known as AuthorAID (www.authoraid.info) could form the model for a similar initiative in fisheries. AuthorAID is a Web-based programme which matches potential authors in developing countries with mentors who are highly published researchers and professional editors. They also provide workshops on scientific writing and related subjects and supply openly available online content on scholarly communication.

Support for publishing for alternative audiences

Current incentive structures operating in research institutions act against effective communication of research to diverse audiences throughout the research cycle, in developed as well as developing countries. There are few rewards for forging partnerships with users of research, or communicating using media that are appropriate to users' needs and preferences. In industrialized countries research in academia does not reward development impact. The multidisciplinary research required for fisheries is often not easily publishable in specialized journals. If the flow of information between fisheries scientists and other stakeholders is to be improved, it will be necessary to make the incentive systems more effective. Government Development Agencies have a vital role to play in these areas and are now introducing more robust systems for research communication and knowledge management within ongoing and new research programmes, as well as increasing spending on research communication and synthesis services.[70]

6.2 Publishing fisheries policy, management and legislation

The Code highlights the need for linking research findings to applications in fisheries policy and management [Article 12.13]. This will be enhanced by collaborative action between researchers and policy-makers or managers to interpret the research findings and publish them in a timely fashion as policy guidance or best practice documents. Current incentive structures

[70] Department for International Development, 2008.

operating in research institutions act against such collaboration. Mechanisms are needed to encourage this activity. Some possibilities are outlined in Chapter 9.

Awareness of the importance of fisheries by non-fisheries policy sectors is essential if wider policy cohesion with other sector policies is to be achieved.[71] Examples include coastal zone and inland fisheries. *Technical Guidelines No. 6: Inland fisheries* state:

> *Management therefore should be conducted in a climate of compromise with other users and depends as much on regulations governing their activities as those governing the fishery itself. In other words inland fishery managers are rarely in control of the resource they manage. Because of this the code must be interpreted to inform and involve sectors other than fisheries.*

The impacts of climate change on fisheries and aquaculture will impose new challenges [Article 12.5]. Existing management plans [Article 7.3.3] for the fisheries and aquaculture sectors, coastal zones and watersheds will need to be reviewed and further developed to ensure they cover potential climate change impacts. Connections of these impacts to the wider policy sectors will also need to be identified and communicated.

The Fisheries Governance Network (FishGovNet www.fishgovnet.org/)[72] uses the term fish chain in order to emphasis the connections between ecosystems, production, distribution and consumption of aquatic products. There is a serious lack of information and knowledge on the functioning of the fish chain. This impedes the governance and management of fisheries. Given the multiplicity of stakeholders involved in the fish chain and the requirement for them to be involved in policy formulation and implementation [Article 6.16] it is important to determine the capacity of the groups to play their part in governance. Stakeholder analysis reveals where the system is deficient and should lead to the publication of a plan for addressing these deficiencies through capacity enhancement.[73] Countries that have adopted a Fisheries Advisory Committee approach should ensure that such a plan is made available to the Committee.

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[71] Allison, 2006.
[72] Bavinck *et al.*, 2005.
[73] International Institute for Environment and Development, 2001.

The Africa Caribbean Pacific – European Union (ACP-EU) Fish II Feasibility Study[74] consultation process identified a strong demand for a number of information product types for fisheries managers and policy-makers. These included case studies, policy briefs and research digests. These are formats where policy failures can be recorded and commented on (as important as successes) and lessons learned identified. They need a clear writing style.[75]

At global, regional and national level policy is often announced in speeches before being translated into legislation or policy documents. Speech writing and the attendant press releases and follow up procedures have techniques and "best practices" of their own.[76]

Some fisheries management and policy information is published in scholarly and peer-reviewed journals. It is far outweighed by science in terms of the number of journals and articles published, although in recent years we are seeing an increasing number of fisheries management articles published in what were formerly predominantly fisheries science journals, which may indicate a changing focus.

The majority of fisheries management and policy information is still published as grey literature, which in terms of number of sources is by far the largest proportion of fisheries publications. The inherent problems of grey literature are well documented; it is not well covered by finding tools, it is difficult to locate and it is even more difficult to obtain. Publishing grey literature faces a common problem in developing country institutions. There is a lack of funds to publish and distribute regularly, in many cases depending on external donor support.

To a large extent publishing on Web sites alleviates the problem of being able to obtain the original. However, effective searching for grey literature remains unsatisfactory. Even with the advent of internet search engines such as Google™ the effective retrieval of fisheries management and policy information relies very much on knowing who has published what and navigating the individual websites.

This is neither an efficient nor a cost-effective way to see, for example, which countries or organizations have produced fisheries management plans, policy briefs or best practices. Implementation of the Code relies very

[74] FAO, 2003b.
[75] Jary, 2005.
[76] Jones, 2008.

much on the availability of this information in order for countries to benefit from the experience of others and evaluate where this experience can be adapted to different situations. Tools are available to ensure that publications on websites can also be stored more safely over the long-term, enabling more effective retrieval. A more important inherent risk for documents published only on websites is that they are not permanently available, and the rate of attrition via the internet is high. Some of the systems being used to improve this situation are covered in Chapters 8 and 9.

6.3 Publishing fisheries extension and training materials

Participatory or co-management practices require new approaches to information resource provision for extension work. Aquaculture communities in Viet Nam made their requirements very clear: "Communities stated that their preferred means of accessing information was through trainings, supported by training materials, combined with field visits, and taught by scientists or researchers. Printed materials should accompany training sessions, and could also be used for general information dissemination. Printed media should be adequately distributed, resistant to wear, colourful, use big font sizes, and include good quality colour photographs. Text should be clear, and the addresses of service suppliers should be provided".[77]

The production and use, where possible, of audio visual aids in addition to printed materials should contribute to maximizing the learning. There are many estimates of the most effective learning techniques but general agreement that people learn and retain a fairly small percentage of what they read, more from what they hear and see and as much as 90 percent of what they see, hear and do.

Successful sharing of this type of information is most effective if accomplished by community intermediaries. The characteristics that make a good community intermediary include proximity, trust and knowledge, both technical knowledge and knowledge about information resources and their content. The intermediaries can be government extension officers, NGOs, fisheries information workers, teachers, experienced and trusted fishers, etc. Traditional extension workers played an invaluable role in information transfer up until the 1990s when the role went into decline in many countries. However, there is a trend for revival of the function under various

[77] Felsing and Nguyen, 2003.

new titles, for example Rural Information Brokers (RIBs). They are taking on new tasks but are retaining their role as intermediaries.

6.4 Publishing fishing industry materials

In addition to its own trade, marketing, advertising information, etc., the fishing industry produces a large number of newsletters and magazines that are a suitable platform for information relating to the Code and its implementation to be communicated in a journalistic style.

Agencies working in fishing communities produce information that assist people cope with the impact of fishing on social and family life. Fishing organizations and associations generate materials used to inform their constituents on current issues and challenges in various arenas from the political to the economic. The trade publishers report on market conditions, political events, developments in fishing gear and vessels as well as the social camaraderie of the industry.

The fishing industry is also developing policies to address issues of sustainable fishing and participatory management from an industry perspective. Examples are the International Coalition of Fisheries Associations (ICFA) and the Federation of European Aquaculture Producers (FEAP).

In some countries the responsibility for collecting and disseminating fisheries statistics and conducting research are no longer in the public domain but have been privatized, in some cases with the fishing industry taking responsibility. It is important that countries ensure that the information produced is reliable, timely and widely available.

6.5 Publishing civil society information

> *States should conduct research into, and monitor, human food supplies from aquatic sources and the environment from which they are taken and ensure that there is no adverse health impact on consumers. The results of such research should be made publicly available* [Article 12.8]

Ultimately, people are responsible for fisheries. The information shared with and tailored to civil society affects how we exercise that responsibility. Increasing the flow of fisheries information to the public can raise awareness of social justice and ethical issues because it fuels debate and

promotes consumer awareness.[78] Information is a starting point to involving people in decisions about their livelihoods and their environments.

The local and international press shape opinion and actions. Freedom of the press should ensure that readers are informed of scientific findings on fish and the environment, changes in approaches to management and initiatives affecting their lives and livelihoods.

Non-profit, educational and non-governmental organizations develop information for the public that can help them learn more about the aquatic environment and its fisheries. This information is "pushed" to audiences via pamphlets, direct mailings (print and electronic), media broadcasts and marketing. People also seek it selectively through Web sites, consultations with extension agents and subscriptions. For example, SAMUDRA: tri-annual report of ICSF (www.icsf.net) provides fisheries management information in a highly readable format.

Civil society groups have played a significant role in promoting sustainable seafood products, primarily by raising public awareness of the issue and continually placing it on the agenda of governments and regional fisheries management organizations. The main measures used by civil society groups and non governmental organizations in this area include organized boycotts of specific seafood species, publishing consumer guides with recommendations on which species to purchase, ecolabelling programmes and pressuring retailers not to carry particular species.

Seafood guides are a more direct consumer education effort listing which species to avoid (because of problems such as overfishing, bycatch issues, habitat destruction, marine pollution or use of chemicals) and which species to prefer, as they are deemed "sustainable". Inconsistent definitions of "sustainable" in some of this material and the lack of transparency and consultation with other stakeholders in their preparation has on occasion led to misinformation, consumer-confusion and conflict.

The viewpoint or bias of an information provider is reflected in their published material. This can range from neutral translation of the biology of tuna for an educational Web site to strong advocacy for changes in consumer buying habits. An example of the latter is the public awareness campaign in the Monterey Bay Aquarium Seafood Watch (www.mbayaq.org/cr/SeafoodWatch.asp) a multimedia/multi-audience

[78] Bundy *et al.*, 2008.

programme that seeks to inform consumers. This type of information is accessible and must ensure a balanced view to remain acceptable.

Ecolabelling

Contrary to the "negative" approaches of boycotts and consumer guides, ecolabelling is a market based approach that involves the consumer rewarding well-managed fisheries.[79] International guidelines on ecolabelling of marine capture fisheries have been negotiated and adopted by FAO Members in 2005.[80] They lay down principles and minimum requirements and criteria for sustainable marine capture fisheries as well as procedural requirements for the running of ecolabelling schemes. These include that ecolabelling relies on third-party independent certifiers verifying that the products are from well managed fisheries and meet certain environmental criteria. The Marine Stewardship Council (MSC) which is committed to be in full compliance with the FAO ecolabelling guidelines is currently the only large and international ecolabelling organization for capture fisheries.

Developing countries have concerns about ecolabelling. The costs of data collection to comply with some of these standards are less easily borne by resource-poor developing countries. Some developing nations are also concerned about the level of transparency in the MSC, and several about the ability of their fisheries to meet the current MSC standard.[81]

6.6 Recording traditional knowledge

The collection of indigenous information is laborious, time-consuming and costly. The major challenges to the management and preservation of IK are collection development policies, accessibility, storage and preservation media, and intellectual property rights. Examples of IK collections in Africa are the Kenyan, South African, Maasai (Tanzania) and Zimbabwean resource centres for indigenous knowledge.[82] The Bay of Bengal

[79] Wessels *et al.*, 2001
[80] FAO, 2005e.
[81] Roheim and Sutinen, 2006.
[82] Ngulube, 2002.

Programme Intergovernmental Organization has initiated studies on indigenous knowledge in marine fisheries in the member countries and intends to make the results of the case studies available on CD-ROM which it will distribute widely. There are other recent examples of initiatives for fisheries in this recording effort, e.g. in 2007 the New Zealand Foundation for Research, Science and Technology started several projects recording Maori knowledge relating to various fisheries. In agriculture there are examples of indigenous peoples using technology to record and protect their traditional knowledge and culture. Communities are gathering details on their environments and the available food sources. They are documenting and preserving agricultural methods that have been passed down through centuries.[83]

Indigenous languages are treasures of vast traditional knowledge and their protection is an important aspect of global efforts to address biodiversity loss, climate change and other environmental challenges. Interestingly, the Code is unique amongst FAO publications in the number of languages in which it has been made available, including more recently several Pacific Island languages.[84]

7. DISSEMINATING FISHERIES INFORMATION

Getting published is only the first step. Getting read by the primary audience, reaching alternative audiences and getting the information used are essential next steps. The Code explicitly refers to dissemination throughout: – ***research*** published and distributed in a timely fashion [Article 12.3]; ***laws and regulations*** relating to conservation and management effectively disseminated [Article 7.1.10]; international cooperation including ***information exchange*** [Article 7.3.4]; etc.

For wide dissemination the original publication must reach a wide range of recipients. Presentations at well chosen conferences, workshops and meetings, as well as reinforcing the dissemination to the primary audience, can start to take the information to relevant alternative audiences. Attention and refocusing on the needs of particular audiences should ensure that the information content can be presented in a style and language(s) (both technical and cultural) that is readily understood and enables the information to be applied and used.

[83] Technical Centre for Agricultural and Rural Cooperation (ACP-EU), 2008.
[84] FAO, 2008.

To reach an even wider range of audiences, consideration should be given to recasting the information to suit the needs of varying printed formats (newspaper articles, leaflets, booklets, posters, magazine articles, etc.), other media (radio, television, performing arts, mobile phones, etc.) and internet outlets (Web sites, fisheries portals, blogs, etc.).

The undertaking and success of these steps depends on the incentives available to the creators. They must be convinced to spend the time and invest the resources into communicating to varied audiences.

Discovery of publications also depends on relevant finding services, such as library catalogues, current awareness services, abstracting and indexing services, search engines, harvesters, etc. This can be complemented by depositing a full digital copy with an OA repository, either an institutional or a subject specific repository. Ensuring that the OA repository is regularly visited by OA harvesters will further increase exposure.

A dissemination plan is an essential part of the publishing process.

7.1 Information and communication technologies (ICTs) and dissemination of fisheries information

ICTs when used for dissemination and communication can be effective means of providing fisheries stakeholders with huge amounts of relevant and timely information. For example, networks of community radio stations using a combination of digital satellite receivers and conventional FM radio technology improve access to information for rural development. The innovative use of internet-based information in conjunction with other ICT media, such as radio, has the potential to increase the inclusion, feedback and discussion on fisheries information.[85] CTA's Web-based question and answer service (QAS) encourages fishers and farmers to request advice from local experts by e-mail.[86] Social networking and other communication tools also have the potential to increase feedback and discussion. This sharing and collaboration could lead to the wider and more rapid uptake of the information content.

The growth in the use of mobile phones has been described as "explosive". There are more than twice as many mobile owners in developing countries as in industrialized countries and subscriber growth rates are 25 percent per

[85] Girard, 2003.
[86] Technical Centre for Agricultural and Rural Cooperation, 2005.

year – and double that in Africa.[87] There are many examples of their use in fisheries to obtain up to the minute marketing, weather, safety information, etc. Table 3 provides an overview of the categories of stakeholders and ICT usage in a small-scale fisheries context.

Other target groups include researchers needing remote access to the library's catalogue, digital documents and other online resources. Information processing tools developed for libraries in developing countries and available free from UNESCO include CDS/ISIS database software that is widely used to manage and disseminate information.[88]

The investment that is required to establish and maintain an effective ICT infrastructure to produce, disseminate and preserve information can be a major consideration for many fisheries institutions and organizations. Rapid developments in computer hardware and software have serious implications for the long-term sustainability of information systems if larger investments are needed and staff requires re-training. This is particularly the case for smaller institutions with limited resources and for many national institutions in developing countries.

Guidelines have been produced by FAO specifically for these organizations and cover the decisions required before introducing ICTs and the practicalities involved in establishing and maintaining a digital publishing and dissemination system.[89] The use of ICTs should be integrated in organizational structures and with the process for generating information content so that they contribute effectively and efficiently to information flows and services. The Guidelines also advocate for Open Access, Open Source Software (OSS) and for entering into partnerships to pool available resources, not least the expertise of staff.

7.1.1 Barriers to dissemination using ICTs

The North/South divide in access to ICTs is well documented. The South/South divide between urban and rural populations is possibly even more relevant to fisheries. The main barriers, particularly to internet use include access, bandwidth, cost of equipment, cost of use, literacy, language, appropriate content, and cultural issues, for example the meaning of interface symbols, gender context, etc.

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[87] Heeks and Jagun, 2007.
[88] UNESCO, 2008.
[89] Wilkinson and Collins, 2007.

A wide range of solutions are being explored by developing countries such as telecentres, cybercafés, innovative combinations of radio and internet, mentoring projects, community intermediaries, translation, and text to speech software. Rapid improvements in internet networks and connectivity are promised over the next five years in developing countries and fisheries organizations should ensure that they are well placed to make best use of developments.

7.1.2 ICTs and information literacy

Information literacy

Information literacy is a set of abilities enabling individuals to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information.[90]

Information literacy includes the ability to distinguish between alternative information sources and to summarize the main ideas from the gathered information, sharing it with others within and outside the community.

Fisheries stakeholders need skills in order to be able to access information effectively and efficiently through ICTs. Such skills include the ability to use search engines, Web sites, e-mail or list-serves and even more important that they know how to assess the quality of the retrieved information. A relevant measurement for this will be whether or not a person is able to contextualize the retrieved information and integrate selective parts of it into their existing knowledge base.

It is important to consider the links and balances between traditional and emerging approaches and develop dissemination networks using a range of tools to reach and involve people in the most appropriate way. Education and training in information literacy and effective dissemination planning are crucial to wider dissemination and use of fisheries information.

Governments and donors have tended to support the technology for delivery of information rather than addressing the other barriers that deal with context, education and content.

[90] Association of College and Research Libraries, 2000.

7.2 Availability of fisheries information for future generations

Effective dissemination also needs to consider how long the information may remain relevant and what steps are necessary to ensure access over that period of time. The risks to information and documents that are published only on a website are many and the issues of security and preservation are essential considerations. The hazards of a computer crashing (especially in the absence of recent backup), of file corruption and the increasing risk of virus attacks are well known. Publications which reside only on a Web site or only in one digital copy are seriously at risk of being lost. Added to that is the uncertainty caused by rapid developments in computer hardware and software and how sustainable the system is in the long-term if larger investments are needed.

Preservation of publications **for future users is critical.** Libraries were often the permanent repositories for print publications, ensuring that several copies were available in different locations long after the publication was out of print. Similar mechanisms have not been put in place for digital publications and the onus of distribution and preservation usually falls upon the publishing organization. An obligation to preserve publications so that they are available for future generations demands a more long-term solution than a Web site publishing system.[91]

Encouraging or mandating the depositing of recorded work in OA repositories would ensure both dissemination and archiving. The Code makes no specific mention of long-term maintenance or archiving of fisheries information. This is an important issue which deserves serious consideration by institutions, countries and international bodies.

Aquatic Commons

One mechanism being supported by FAO via the FishCode Programme is development of the Aquatic Commons (http://aquacomm.fcla.edu). FAO efforts focus on the dissemination, sharing and preservation of information related to fisheries management. Supporting the full participation of developing country institutions is essential to ensure that their information is integrated with the mainstream of fisheries information. The Aquatic Commons is a thematic digital repository covering the

[91] Wilkinson and Collins, 2007.

natural marine, estuarine, brackish and freshwater environments. It includes all aspects of the science, technology, management and conservation of these environments, their organisms and resources, and the economic, sociological and legal aspects. The repository contains a growing collection of published and unpublished research, organizational publications, and other scholarly materials contributed by researchers, librarians, and their institutions. It is directed by the International Association of Aquatic and Marine Science Libraries and Information Centers (IAMSLIC) to provide visibility, usage and impact through global access to digital publications from worldwide marine and freshwater organizations that do not have access to an institutional repository of their own.

The Aquatic Commons is one of a number of thematic digital marine and aquatic repositories. For example, OceanDocs is a repository supported by the Intergovernmental Oceanographic Commission (IOC) specifically to collect, preserve and facilitate access to all research output from members of their Ocean Data and Information Networks. The records of both repositories are harvested by Avano (www.ifremer.fr/avano/), which aggregates records from marine and aquatic repositories around the World.

8. SHARING INFORMATION: NETWORKING, PARTNERSHIPS AND PLATFORMS

Whilst technology is important for production and dissemination, fisheries management requires knowledge. Knowledge does not come from technology but from *experience* (tacit knowledge) combined with *relevant and meaningful content*, (explicit knowledge – digital or not). Improved fisheries management is enabled by *sharing information and knowledge.*

The Code recognizes the need for sharing and involvement in many of its articles: consultation and involvement in *policy formulation and development of laws* [Articles 6.13 and 6.16]; standards for and exchange of *data* [Articles 7.4.6 and 11.3.7]; sharing *regional research* with other regions [Articles 7.1.9 and 12.16]; etc.

Fisheries networks and partnerships working together can make the best use of developing platforms (information technology and software) and communication protocols (agreed terminology and information standards)

to provide innovative knowledge sharing systems. Examples of some of these are presented below.

8.1 Fisheries information networks

Traditionally, fisheries libraries networked to provide document exchange schemes, loan and document delivery services, collaborative catalogue provision and collaborative input to abstracting and indexing services such as the Aquatic Sciences and Fisheries Abstracts (ASFA). The IAMSLIC network partners have developed information resource sharing systems including the Aquatic Commons mentioned in the previous section.

Library and information networks offer improved services at an economic advantage. In addition to IAMSLIC, which is specialized in the aquatic sciences, there are several library and information networks in the broader subject area of agriculture that would also include fisheries institutions amongst their members. These include the International Association of Agricultural Information Specialists (IAALD) and the Asian Federation for Information Technology in Agriculture (AFITA). Maintenance and further development of these networks requires the continued support of fisheries library and information centres and, in particular, their highly skilled staff.

8.2 Fisheries information partnerships

Sustainable fisheries information systems benefit from formal and informal partnership agreements. The robust partnership agreements for the ASFA system have ensured its continued growth and development over nearly forty years. ASFA also benefited from early agreement on detailed protocols for terminology and bibliographic description (metadata) standards.

Another example of productive partnerships for fisheries information systems is FAO's Fisheries Resources Monitoring System (FIRMS). Launched in 2006, FIRMS is a partnership between FAO, various regional fisheries organizations and other agencies to produce information on world fisheries and fishery resources. By standardizing information and putting it through rigorous quality control processes, the partners are creating an authoritative and highly reliable source of information. There is still a need to increase assistance to developing countries so that they can more fully participate and meet the obligations required of network partners to ensure effective knowledge sharing.

8.3 Fisheries information platforms and protocols

The two main innovative forces for information sharing over the internet at the present time are the Semantic Web and the many social networking and other communication tools that have emerged and been referred to as Web 2.0.

8.3.1 The Semantic Web and fisheries

The Semantic Web is a vision of information made understandable by computers, so that they can perform more of the tasks involved in finding, sharing and combining information. It surfaced in 2001 but has been more difficult to realize than expected.[92] A complete semantic web may not be feasible. However, there has been some success with projects for specialized communities such as fisheries, where domains and scope can be better defined.

A core part of a Semantic Web application is the development of an ontology i.e. an agreed terminology with concepts and their relationships defined. Ontologies improve both precision and recall in information retrieval. This is particularly important for networked fisheries information systems where the information sources are distributed, heterogeneous and multilingual. The initial development is resource intensive and requires specialist skills. The emerging model is for a relevant international organization to provide the secretariat, stable internet environment (ontology server, system and Universal Resource Identifiers [URIs]) and tools for terminology input and editing. Other stakeholders can then use the system and tools to provide expert and IK linguistic input for the benefit of all.

Work on developing a Fisheries Ontology Service began at FAO in 2001.[93] It is being further developed and used in a case study for an over-fishing alert system.[94]

8.3.2 Social networking, Web 2.0 and fisheries

> "*Web 1.0 took people to information; Web 2.0 will take information to the people*".[95]

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[92] Shadbolt, 2006.
[93] FAO, 2008b.
[94] European Union, 2006.
[95] Quote from Ian Davis at Talis (www.talis.com).

As the number of Web sites containing information relevant to all the domains of fisheries expanded under Web 1.0, finding and retrieving the fisheries information became more difficult. Fisheries internet portals were developed to try and alleviate the problem (e.g. oneFish, FishPort). Some of these portals incorporated Web 2.0 functionalities such as community adding and editing, discussion forums and email alerting. Yet many proved difficult to sustain and have disappeared or are no longer updated.

Lessons learned from these early portals, particularly in areas of subject coverage and audience targeted, can inform how the fisheries sector could use information sharing tools effectively, including those presently referred to as Web 2.0 developments. The fisheries sector contains a wide range of narrow niches so the audience niche(s) being served should be well defined. A comprehensive but focused coverage of information resources is required from the beginning. Transparent collection development and archiving policies should be implemented. Partnership agreements are essential for sustainability. Multiple distribution pathways for the content are essential, for example: email, file downloads, automatic document forwarding, etc. Social networking cannot simply be added to a site and expected to work well. The system needs to be demand driven but it also needs a clear mission and goals.

8.4 Knowledge sharing systems in fisheries

The following examples highlight the ongoing evolution of technology-based systems for knowledge sharing in fisheries. Knowledge sharing *per se* has been practised traditionally, and will continue to be a vital part of the purpose of professional associations, fishworker organizations, collaboration in science etc. The principles upon which technology-based systems are developed should take heed of the reasons for success and sustainability of people-based knowledge sharing networks, notably that they must be demand driven and be based on equal partnerships.

8.4.1 Evaluating demand for knowledge sharing in fisheries

Any future fisheries knowledge sharing system will need to be demand driven. Over the last five years, the demand from developing country fisheries has been explored in depth.[96] For example in 2003/4 the ACP-EU Fish II Feasibility Study consulted with fisheries organizations in 78 ACP countries. These countries expressed a widespread need for knowledge to be better packaged and made more available to them. They required a system

[96] FAO, 2003b.

that would build on existing information systems and would also enable them to receive focused advice on demand. The study proposed an ACP II Fisheries Management Adviser and Knowledge Exchange System to receive queries, sort out those satisfied with published materials and those needing further support in the form of specific advice or mentoring.

Another example of evaluating demand is the Ask FAO service. Ask FAO is an internet based service which allows users to ask questions directly to technical experts within FAO. Evidence from the first 12 months indicates that 85 percent of questions could be answered by available reference material and the remaining 15 percent required knowledge sharing with subject experts.

Similarly, the 2006 Forum for Agricultural Research in Africa (FARA) Regional Stakeholder Consultation on research coordination in support of the AU/NEPAD Action Plan for the Development of African Fisheries and Aquaculture discussed priorities for research, capacity strengthening and information dissemination. FARA's primary functions are advocacy of the role of agricultural research, promotion of functional partnerships, and accelerating sharing and exchange of knowledge.[97]

8.4.2 Evolving knowledge sharing networks for fisheries

"Fishing nations need to share information more than ever, compare approaches, achievements, and failures, progressively identifying best practices. Managers need to be able to communicate with their peers, exchange information and ask for references and advice. Scientists need to collaborate more than ever, adapt and share appropriate methodologies. The various disciplines need to overcome their communication problems. The industry and NGOs should be able to contribute much more and more constructively than at present. The media should be able to cross-check the information they get. …".[98]

Preliminary discussions on a Thematic Knowledge Network for fisheries management outlined potential development by international partnerships. A Network would need to build on evaluations of demand and be aimed at fisheries management practitioners and their scientific advisers; accessible to the fishing industry, fishers and other stakeholders; and accessible to

[97] FARA, 2007.

[98] Garcia, S.M. Welcome address to Workshop on a Fisheries Management Knowledge Network held at FAO, Rome, from 12 to 13 February 2007 [unpublished].

academia, NGOs and the public at large. A Thematic Knowledge Network centred on the Code and focused on fisheries governance and management would build on the functions that have underpinned the fisheries community in the past: (i) fisheries library services; (ii) workshops for small groups; (iii) symposia for larger groups; (iv) training opportunities; and (v) informal opportunities to exchange knowledge.

The Web 2.0 developments are thought to be able to give this range of functions but with the added benefits of dynamic linking between the functions, for example instant connection between working groups, library, polling, co-authorship etc; a higher diversity of participants reached at affordable cost; two way information flows; professional support equivalent to that which could be found in a successful fisheries library; high service standard within an acceptable time frame; quality control on content; a focused collection development policy; and an archiving and discarding policy. A fisheries management ontology is proposed for improved multi-lingual searching and retrieval of the content.

Another example of such an initiative is a proposed knowledge network for fishermen. Responding to indications from the fishing industry that it wants to improve its sustainability, the Ministry of Agriculture, Nature and Food Quality in the Netherlands is offering the fishing sector opportunities to set up knowledge networks based on systems successfully used for agriculture and horticulture.[99]

8.4.3 Evolving collaborative research systems for fisheries – eResearch

The terms eScience, also known as eResearch or Cyberinfrastructure, describe the new research environments that support advanced data acquisition, storage and management, visualization and other computing and information processing services over the Internet. They are being increasingly used in scientific research and have the potential to offer a technological solution to the problem of efficiently connecting data, computers, and people. They enable new ways of conducting interdisciplinary research by supporting data sharing, analysis, collaboration and publishing. The issues of eResearch and data stewardship have become increasingly prominent in the past couple of years. In Australia and Europe, there has been considerable investment in developments to encourage eResearch, improve infrastructure at national and institutional levels, encourage open access to both data and publications and improve the take up of institutional repositories.

[99] LEI, 2008.

eResearch could be of great benefit to the ecosystem approach to fisheries (EAF). EAF suffers from the real difficulty of interdisciplinary researchers being able to effectively analyse ecosystems in an integrated fashion.

Fishery case studies encompassing both the compilation of annual fisheries country profiles and the ecosystem approach to fisheries, in particular performing aquatic species assessments, have been proposed in at least one eResearch development project.[100]

The combination of eResearch, Thematic Knowledge Networks and accessible knowledge through OA journals, OA repositories and the OA aggregators offer a new and potent range of possibilities for knowledge recording, disseminating, sharing and archiving for fisheries. The Code highlights the need for these activities and for the active participation of all stakeholders in further developing fisheries information and knowledge exchange systems.

9. INFORMATION, KNOWLEDGE AND SMALL-SCALE FISHERIES

9.1 The need to focus on small-scale fisheries and aquaculture

A specific focus on the information needs of small-scale fishers, fish farmers and fishing communities, both inland and marine, whether from the South or the North, is essential on various counts. Current figures suggest that small-scale fisheries contribute more than 25 percent of the world's catch and provide an estimated 19 percent of the animal protein intake of developing country populations. Fifty per cent of fish used for direct human consumption is harvested by small-scale fisheries and almost all the fish captured is used as food. This contrasts with the industrial sector where a substantial percentage is reduced to animal feed. Small-scale fisheries and fish farming play a critical role in the local and national economies, particularly by providing income, employment and contributing to food security and foreign exchange earnings. In 2004, an estimated 41 million people worked as fishers and fish farmers, the great majority of these in developing countries, principally in Asia.[101] It is also estimated that 90 percent of the total number of fishers and fish farmers worldwide are small-scale. Overexploitation and depletion of resources, poor returns to producers and processors, displacement from coastal areas, conflicts with industrial fisheries, pollution, and environmental degradation all pose

[100] EU D4Science project (www.d4science.eu).
[101] FAO, 2007.

threats to livelihoods, even survival, as well as to the resources they depend on.

The participation of the small-scale sector is absolutely critical to improving fisheries management. This has been further elaborated in *Technical Guidelines No. 10: Increasing the contribution of small-scale fisheries to poverty alleviation and food security*.[102] The challenges in making it possible cannot be underestimated, particularly as fishing communities are often located in remote areas, have poor access to communication and other physical infrastructure, have high levels of poverty and illiteracy, and are often poorly organized. However, the problems need to be better understood and efforts made to overcome them.

Appropriate information can play a vital role in helping communities cope better with these problems, empowering them to improve their livelihoods and incomes as well as improve the management of fisheries resources. Advocating for suitable policies will contribute to the sustainable development of the sector and contribute towards realization of other major internationally agreed goals, such as those identified in the UN Millennium Declaration (the Millennium Development Goals).

The Code recognizes the nutritional, economic, social, environmental and cultural importance of fisheries, including aquaculture, and the importance of responsibly managing finite fisheries resources for the benefit of present and future generations. The Code also recognizes the need for consultation and the effective participation of industry, fishworkers, and other interested organizations in decision-making and in policy formulation and implementation:

> *... States, in accordance with appropriate procedures, should facilitate consultation and the effective participation of industry, fishworkers, environmental and other interested organizations in decision–making with respect to the development of laws and policies related to fisheries management, development, international lending and aid* [Article 6.13]
>
> *States, recognizing the paramount importance to fishers and fishfarmers of understanding the conservation and management of the fishery resources on which they depend, should promote awareness of responsible fisheries through education and training. They should ensure that fishers and fishfarmers are involved in the*

[102] FAO, 2005b.

policy formulation and implementation process, also with a view to facilitating the implementation of the Code [Article 6.16]

In fisheries as in other sectors, information and the sharing of information are crucial for informed dialogue and for effective participation, decision-making, implementation of policies and management towards sustainable development of the sector. The Code also stresses the importance of research and the dissemination of information in achieving responsible fisheries.

Access to information has been recognized as essential for human dignity, equity and peace with justice. It is also recognized that a lack of access to information disproportionately affects the poor, women and other vulnerable and marginalized people.[103]

Against this backdrop, this chapter focuses on the information needs of local stakeholders in small-scale fishing and fish farming communities and to a more limited extent of NGOs and local governments involved with these communities.

9.2 Defining small-scale fisheries

The FAO Advisory Committee on Fishery Research, Working Group on Small-Scale Fisheries agreed that it would be inappropriate to formulate a universally applicable definition for a sector as dynamic and diverse as small-scale fisheries. Instead it is best described on the basis of the range of characteristics that are likely to be found in any particular small-scale fishery. The following characterization of small-scale fisheries was therefore endorsed:

Small-scale fisheries can be broadly characterized as a dynamic and evolving sector employing labour intensive harvesting, processing and distribution technologies to exploit marine and inland water fishery resources. The activities of this sub-sector, conducted full-time, part-time, or just seasonally, are often targeted on supplying fish and fishery products to local and domestic markets, and for subsistence consumption. Export-oriented production, however, has increased in many small-scale fisheries during the last one to two decades because of greater market integration and globalization. While typically men are engaged in fishing and women in fish processing and marketing, women are also known to engage in near shore harvesting activities and men are known to engage in fish marketing

[103] Carter Center, 2008.

and distribution. Other ancillary activities such as net-making, boatbuilding, engine repair and maintenance, etc. can provide additional fishery-related employment and income opportunities in marine and inland fishing communities. Small-scale fisheries operate at widely differing organizational levels ranging from self-employed single operators through informal micro-enterprises to formal sector businesses. This sub-sector, therefore, is not homogeneous within and across countries and regions.

There are additional technological dimensions, in particular the fact that small-scale fishers usually operate inshore, target multiple species, and use a large range of different fishing gear and techniques, some of which may be relatively simple. Also, the "multi-use, multi-user environment" of small-scale fisheries should be noted. Both coastal and inland fisheries compete with other users for the resource-base and this multi-use, multi-user dimension is another key characteristic which can greatly affect the livelihoods of fishing communities.[104]

9.3 Defining small-scale aquaculture

Small-scale aquaculture for the purpose of these Guidelines consists of the non-commercial and the community level commercial producers. Commercial producers can be active participants in the market. They purchase inputs (including capital and labour) and engage in off-farm sales of the fish produced. For these individuals, aquaculture is a principal economic activity. Non-commercial producers may also purchase inputs, mainly seed and feed, but rely chiefly on family labour and on-farm sales of the produce. An additional feature of non-commercial aquaculture is that it is but one of the variety of enterprises comprising the farming system; it is undertaken to diversify production, improve resource use and reduce risks of such events as crop or market failure.[105]

9.4 Information for and about small-scale fisheries

The issue of information and small-scale fisheries needs to be explored in all its dimensions. As well as the need for information *for* small-scale fishing communities, it is also essential that information is disseminated *by* them and *about* their situation, achievements and problems. Fishing communities are not merely recipients of information they must also be recognized as holders and providers of information and knowledge, a recognition that in itself is empowering.

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[104] FAO, 2004b.
[105] Moehl, Halwart and Brummett, 2005.

9.4.1 Information about small-scale fisheries

Despite the social and economic importance of small-scale fisheries, many local governments, the general public and even some national governments are unaware of the contribution of small-scale fisheries and fish farming to the economy. Knowledge of the dynamics of the sector is limited and its activities do not conform to the conventional classificatory schema of the modern economy. It is therefore rarely fully reflected in the national income accounts of developing countries.

The lack of information and awareness about the complex problems facing the communities, including environmental degradation, poor access to markets and illegal fishing by industrial fleets in the absence of effective enforcement often translates into inappropriate policies. *Technical Guidelines No. 10: Increasing the contribution of small-scale fisheries to poverty alleviation and food security* note that currently available data on employment, income and value of fish production are grossly inadequate as indicators of the real numbers of people whose livelihood depends on fish, or the real contribution of fisheries to the local and national economies. The lack of information about the socio-economic and cultural aspects of the people who form its backbone has been identified as one of the greatest obstacles to decision- and policy-making in small-scale fisheries.[106] For example, despite the fact that women are engaged in most activities in the sector, from pre-harvest operations, fishing, marketing and processing, their contribution is poorly documented and rarely taken into consideration by policy-makers.

Information about small-scale fisheries is essential for those making policy decisions and legislation. In a context of decentralization it is especially important that local government officials are well informed before they implement policy. Information about the small-scale sector should also be targeted at researchers, academics and the general public to ensure that it is accurately represented in fisheries as a whole.

Diverse initiatives have been undertaken to increase the visibility of the small-scale sector and publish findings. The following three examples are individual studies relating to specific geographical regions.

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[106] Kurien, 1998.

Individual studies on the social and economic contribution of small-scale fisheries

1. A first of its kind participatory study undertaken in Kerala, India, in 1980-81, analysed costs and earning across the state for a whole year. The results revealed that from an economic and social perspective, the profitability of the small-scale sector far outweighed that of the mechanized sector.[107] It showed that investments made in this sector would yield more fish, generate much needed income and employment among the poorer sections of the population, and even contribute to more foreign exchange. The findings were used by the newly-formed fishworker organization, the Kerala Swathantra Matsya Thozhilali Federation, to argue for greater budget allocation for the small-scale sector in Kerala.

2. An Asian Development Bank study in 2004 evaluated freshwater rural aquaculture projects in Bangladesh, the Philippines and Thailand providing information on the positive social impacts of aquaculture, and its contribution to the national economy. It also points to various mechanisms for information and knowledge exchange in fish farming communities.[108]

3. The Sustainable Fisheries Livelihoods Programme (SFLP) implemented by FAO in 25 West and Central African countries produced a series of Policy Briefs directed at policy-makers. They pinpointed key issues for the small-scale sector such as the impact of HIV/AIDS, gender policies, etc., as well as the contribution of small-scale fisheries to national economies. Two of the Policy Briefs highlight literacy and the use of ICTs as key issues, recognizing the importance of information (www.sflp.org/briefs/eng/policybriefs.html).

A global study to assess the contribution of small-scale fisheries is being undertaken within the framework of the World Bank's Global Program on Fisheries (PROFISH), working in association with key donors and

[107] Kurien and Willmann, 1982.
[108] Asian Development Bank, 2005.

stakeholders to meet the challenge of the growing fisheries crisis (http://go.worldbank.org/0I0GPE15Y0).

Global study on the social and economic contribution of small-scale fisheries

FAO and WorldFish Center with national partners and the support of the World Bank PROFISH Global Program on Fisheries have recently undertaken a series of country case studies. These have collected and compiled data on the relative contribution of small-scale and industrial marine and inland capture fisheries to fish supplies, employment and income. The outcome will be an up to date global assessment of the relative contributions of these two sub-sectors. An earlier landmark assessment was published in 1980[109] and a more recent study in 2006.[110]

Several NGOs regularly disseminate information that draws attention to the concerns of small-scale fisheries and facilitates dialogue. The daily SAMUDRA News Alerts[111] of ICSF aim to draw the attention of policy-makers, researchers and other interested stakeholders to developments of relevance to small-scale fisheries and the concerns of small-scale fishworkers. Similarly, NGOs have played a role in enhancing interaction, dialogue and sharing of information between local and national governments, fishing community organizations and others with a stake in fisheries management so that the problems and proposals of small-scale communities can be better heeded.

Dialogue about issues facing small-scale communities

– Some positive examples include the policy dialogues organized by the Masifundise Development Trust as a means of facilitating information exchange between key stakeholders and the government in the process leading up to the development of a new policy for small-scale fisheries in South Africa.

[109] Thomson, 1980.
[110] Pauly, 2006.
[111] www.icsf.net

– In West Africa, a meeting held in 2006 brought together the media and representatives of fishworker organizations from Senegal, Mauritania and Guinea to discuss how local media could better publicize issues facing small-scale fishing communities, as well as their policy proposals to promote sustainable fisheries. The meeting also explored how information through radio, newspapers and television can be appropriately tailored to the needs of coastal communities.[112]

Overall, however, such initiatives are still few and far between and there is an urgent need for more dialogue, participation and information sharing.

9.4.2 Small-scale communities as holders and providers of information

The Code recognizes the need to document traditional fisheries knowledge and technologies, in particular those applied to small-scale fisheries, in order to assess their application to sustainable fisheries conservation, management and development [Article 12.12].

Communities need to be recognized as holders of information. Greater appreciation is needed of the social capital within the sector, the traditional ecological knowledge systems developed over generations of interaction with the resource base, and the internal, socially appropriate, governance mechanisms developed over time to govern use of the resources and to resolve conflicts. Aquaculture has been practised traditionally for generations in several Asian countries, often in combination with agriculture and livestock rearing, and communities hold a wealth of knowledge about such practices.

There are some positive examples of research in these areas and the subsequent integration of traditional knowledge and systems into fisheries management. Research into traditional management systems in the Pacific Island countries has served to increase awareness and to use the results in the design of appropriate management systems.[113,114] The Locally Managed Marine Area (LMMA) Network is a case in point.

[112] Nouwligbèto, Seck and Gorez, 2006.
[113] Ruddle and Johannes, 1985.
[114] Kuemlangan, 2004.

Locally Managed Marine Area (LMMA) networks

An LMMA is an area of near-shore waters being actively managed by local communities or resource-owning groups, or being collaboratively managed by resident communities with local government and/or partner organizations. In using an LMMA approach, some coastal communities are reviving methods that have been used traditionally for many generations. In Fiji, for example, where the concept of LMMA was initiated, fading traditional management practices have been brought back to life. Others are using more modern ideas introduced from outside, while some use a combination of both. The LMMA network members share knowledge, skills, resources and information in order to learn collectively how to improve marine management activities and increase conservation impact. The network comprises community members, traditional leaders, conservationists, academics and researchers, donors and decision-makers working in Fiji, Palau, Indonesia, Papua New Guinea, Philippines, Pohnpei, Federated States of Micronesia and the Solomon Islands.[115]

Some countries have recognized the importance of integrating community knowledge and management systems, including through enacting legislation. For example, in Sabah, Malaysia, the Inland Fisheries and Aquaculture Act 2003 empowers communities to establish regulations for managing riverine resources based on the traditional *tagal* system.

The role of communities: fishers, fish farmers, traders, processors, vendors etc. as information providers and researchers also has to be recognized. This is particularly important in the context of widely scattered small-scale communities in tropical multispecies fisheries, where data and data collection continue to pose a challenge. There are some individual initiatives for collaborative research, where communities have been involved in the process of research and the collection and analysis of data.

[115] www.lmmanetwork.org

Collaborative research and data collection and analysis

Niue women gatherers: In November 2000 the Community Fisheries Section of the Secretariat of the Pacific Community (SPC) completed fieldwork in Niue. The aim of the fieldwork was to identify and document the important marine invertebrate species collected by women in Niue, to look at potential management measures for those species and to ensure that species collected by women are included in an inshore fisheries management plan being developed by Niue Fisheries and SPC. Although a number of studies have been done on the marine resources of Niue, none has resulted in a clear idea of exactly which or how many species of invertebrates are utilized. At first glance the rugged coastline and small reef flat area, accessible only in calm weather and at low tide, would appear to have few species that could be utilized. However the women gather a surprisingly large number of invertebrates for food and shell craft. By the end of the two-week fieldwork, 92 Niuean invertebrate names had been recorded. Fifty five of those were observed on reef trips, 29 of them are used for food and around 10 are used for shell craft. The list is by no means exhaustive but will be a useful guide to the most commonly utilized species.[116]

Small-scale fishers in Chile are providing data on sightings of marine mammals that are being used for producing annual statistics. The data are otherwise not available with government or other agencies.[117] Participatory Rural Appraisal (PRA) techniques are now increasingly used as a research methodology as the academic and scientific community recognizes the value of the community's knowledge.

Fishing communities thus can, and do, provide vital information on biological, technical, economic and sociocultural aspects of fisheries. Information held or produced by communities should be validated, valorized and used in decision-making. Incorporating the knowledge of

[116] Lambeth, 2001.
[117] www.ccc-chile.org

local communities can be an effective strategy to improve management of data-scarce small-scale fisheries.

9.4.3 Information needs of small-scale fishing communities

As mentioned previously, fishing communities in many parts of the developing world are often located in remote areas with little access to basic infrastructure and means of communication and therefore lack access to appropriate information. This severely constrains their ability to influence decision-making processes, to advocate for their rights, to improve their incomes and livelihoods, and ultimately constrains their ability to contribute to improved management of fisheries resources. The availability of appropriate information to small-scale fisheries communities is critical.

Information requested by small-scale fishing communities

Drawing on the experiences of several NGOs that have been working to respond to the information demands of small-scale fishing communities in several parts of the developing world, it is possible to identify some of the key issues on which information has been sought. Although the list is not exhaustive, it points to the wide range of information requested:

– Contribution of small-scale fisheries and aquaculture to the economy and within that the contribution made by women;

– Demographic and socio-economic data on fishing and fish farming communities;

– Provincial, national and international legislation relevant to fisheries and fishworkers, particularly provisions supportive of small-scale fisheries;

– Pros and cons of fisheries management options, such as input and output control measures, and experiences of their implementation in various countries;

– Details of joint venture agreements and fisheries access agreements, illegal fishing by foreign fleets, and the implications for small-scale fisheries;

– Environmental impact of trawling, pushnets and other fishing gear;

– Trade, ecolabelling, markets and barriers to market access, multilateral and bilateral trade agreements, the role of companies in fish processing and export, impact of economic globalization on fisheries;
– Appropriate fish processing and packaging technologies for small-scale fish processors and traders;
– Safety at sea, disaster preparedness, working conditions and labour rights;
– Coastal degradation, impact of industrial and other pollution, coastal management policies, and the link between fisheries and coastal area management;
– Environmental and social impact of intensive aquaculture and the legal framework regulating aquaculture.

The nature of the information being sought depends on the current issues facing fishing communities and organizations. It is diverse and spreads across the biological, legal, economic, social and cultural aspects of fisheries. The information provided has been used by communities to protect their rights to coastal settlements and fishery resources; to advocate for policy supportive of their interests; to enhance understanding of developments in trade, market access, labour issues etc. in order to improve livelihoods and working conditions and to challenge developments considered detrimental to the interests of the small-scale sector. The role of information in advocacy should not be underestimated. For example, in West Africa information on fisheries access arrangements provided by the Coalition for Fair Fisheries Arrangements (CFFA) to fishworker organizations and NGOs has helped to engage meaningfully in the debate on these issues, and to influence such arrangements to take on board the interests of the small-scale sector.

There are several positive examples of information dissemination to fishing communities, fishworker organizations and the NGOs working with them. The different mechanisms and media employed are determined by the needs and preferences of the target audiences. In some situations hearing information broadcast by radio or seeing information via video or theatre productions are the preferred media. An information need at all levels is to benefit from the experience of others in similar situations. The following are just a few examples of many different techniques:

Radio Ada Ghana. Radio Ada, Ghana's first independent radio station, went on air in 1998in southeast Ghana. It covers a population of approximately 600 000 people of whom 60 percent are illiterate. Radio Ada uses a broadcasting technique called "narrowcasting". The fishers programme producer visits a different fishing community each week to ask fishers about their work and facilitate a discussion on fishing issues of importance to them. A 30–minute version of the discussion is later aired on Radio Ada. Fishmongers from different communities lobbied for Radio Ada to air their program on the same day so that the fishers would hear what the women had to say, often addressing issues such as the high price of fish.

Visser's Net **Newsletter, South Africa.** Masifundise Development Trust, South Africa, produces this 4–8 page pamphlet for fishers. It is produced in the local languages to make information accessible to communities who have medium to low levels of literacy. Visser's Net aims to raise awareness about the rights of fishers and about local policy processes, as well as providing information about the activities of fishers elsewhere. The fishers do not have access to the internet or digital media in general so opportunities for using these are limited to ad hoc training events. In March 2008 Masifundise canvassed feedback on the usefulness of this publication in meeting their information needs. The feedback was in favour of policy and legal information as well as information about access rights and resource management by other fishing communities.

Electronic bulletins and pamphlets (Chile). The NGO Ecoceanos in Chile uses electronic bulletins and small printed pamphlets as the main means of information dissemination. They use journalistic language that is easy to understand and also appropriate for radio, local dailies, and television. The use of internet newsletters and pamphlets has been widely accepted in national awareness-raising and information campaigns against the privatization of fisheries and in the campaign to lobby for improved environmental, labour, health and sanitary standards in salmon aquaculture and processing companies.

9.4.4 Information requirements of decentralized fisheries management

As mentioned in Chapter 2, the current policy shift towards decentralization of fisheries management responsibilities in a large number of countries means that access to relevant and timely information becomes essential for small-scale communities, as well as for the local and provincial-level government officials they depend upon. For decentralization and co-management processes to be effective there is a clear need for capacity building within fishing community organizations and local governments. This includes the strengthening of their information skills and capacity to enable informed participation in decision making. Lack of relevant information is a major constraining factor in many countries and jeopardizes the effectiveness of such decentralization processes.

For example, awareness about developments in fisheries trade and its implications remains limited among government representatives at the local and provincial levels and among fishing communities. Many governments do not have any clear system in place for distributing information on a regular basis or in an appropriate format.

Dissemination at local level

The provisions of the Code itself, other relevant international legislation and developments frequently do not reach fishworkers, fishing communities, NGOs and local government offices but remain at central government level. These issues have been further analyzed and proposals made for improving communication, policy and legislative frameworks in a co-management context at the *Regional Workshop on Mainstreaming Fisheries Co-management* in 2005.[118]

Networks of stakeholders must be understood and encouraged to share information. It must also be recognized that success criteria may differ between stakeholders and that there may be differing priorities and emphasis on management objectives. Ecological well-being (or "state of the resource") must be balanced with human well-being (i.e. the need for food or income) and this inevitably requires management trade-offs.

[118] Asia-Pacific Fisheries Commission, 2005.

> Communication and dialogue between stakeholders, government fishery agencies, fishers and researchers must take place effectively and be part of a participatory process. [119]

There are few structured mechanisms for information exchange between the various levels of government, universities, research institutions and fishing communities. As a consequence, local governments that are tasked with taking an increasing role in managing fishery resources find it difficult to fulfil their responsibilities. The problems are compounded when they need to address overlapping areas of responsibility, often the case between fisheries management, coastal management, local economic development, poverty eradication and food security. The availability of timely information on all these aspects and the interrelationships between them should be the basis for local government to determine priorities and allocate human and financial resources to address this complex task.

9.5 Actions needed to improve information in support of small-scale fisheries

The following five issues need to be better understood and addressed by those agencies responsible for meeting the information requirements of and about small-scale fisheries, including local government, NGO's and fishworker organizations:

(i) Provide context specific information: Information should be tailored to the specific and dynamic requirements and demands of communities, NGOs and local governments. For example:

- Following the Indian Ocean tsunami of 2004, there was great demand from NGOs and government for information about demographic, economic and sociocultural aspects of fishing communities in order to better tailor relief and rehabilitation initiatives;
- When the Philippines passed the Fisheries Code of 1998 providing municipal governments with jurisdiction over municipal waters for the first time, information related to fisheries management was sought by local governments;

[119] FAO, 2005c.

- Fishing communities have sought information on various impacts of pollution and legislation regulating pollution after being exposed to oil spills and effluents from industry.

(ii) Identify and fill information gaps: Some of the gaps in information essential for and about small-scale fisheries were identified in Chapter 10.4 above. A detailed census, such as the one conducted in India in 2006, is an effective means of gathering and disseminating comprehensive data and information about small-scale fishing communities.[120] However, this information is lacking in most developing countries. In consultation with all relevant stakeholders and in particular local governments, fishers, fish farmers, vendors and traders, there is an urgent need to identify major gaps in information and then propose ways and means to address them.

(iii) Enhance access to information: In many cases the main problem is a lack of awareness and the difficulty in accessing information that is already available. Information is often scattered between various government agencies, scientific and academic institutions, and large companies. The right of access to available information by all stakeholders, indeed by all citizens, should and often is encompassed in national legislation. However, discovering that the information exists and how it may be accessed are prerequisites to being able to exercise one's rights. The internet has great potential in both the discovery and access to information in countries where fishing communities have reliable and affordable connectivity. However, other solutions are needed in the many parts of the world where this is still not the case.

(iv) Use appropriate formats and dissemination methods: Even when information is made available it is often not in the right format, language or at the right level to be accessible to fishing communities and local governments. This issue needs urgent attention if genuine participation in fisheries management is to be secured. Examples of successful initiatives to use appropriate media such as radio, video, ICTs, etc. for information dissemination should be made available and adapted to meet different needs.

(v) Ensure a multidirectional flow of information: As discussed earlier, communities need to be seen not only as recipients but also as providers of information. A climate is needed in which information is

[120] Central Marine Fisheries Research Institute and Fisheries Survey of India, 2006.

exchanged and shared widely and freely between policy-makers, multilateral organizations, scientists, academics, NGOs and resource managers and users. At the same time there is a need to foster better information flows between fishing communities using exchange programmes, virtual meetings and the social networking facilities available via internet. Some of these have proven to be extremely effective in sharing experiences in managing resources through community-based initiatives.

10. INFORMATION CONSTRAINTS IN DEVELOPING COUNTRIES AND ACTIONS NEEDED

These Technical Guidelines have been elaborated in order to highlight the issues involved in information and knowledge sharing in the context of the Code of Conduct for Responsible Fisheries. Particular attention is paid to the needs of developing countries.

Urgent action is needed to enable all stakeholders to have access and contribute to the flow of information to achieve responsible fisheries management.

Constraint	Actions needed
Lack of awareness of and access to global information resources.	Library networks offer an efficient and cost-effective means to share information and expertise; They enhance access to the global information resources required for fisheries and aquaculture management.
Inadequate Information and Communication Technology (ICT) infrastructure and information skills.	Assistance is required by developing country fisheries institutions to ensure adequate and appropriate ICT infrastructure and human capacity development to become equal partners in information networks.
Poor opportunities to publish and disseminate the results of research, resulting in duplication and waste of scarce resources.	Programmes to strengthen institutions and research capacity should include the funding and mandate to support the publication, dissemination and sharing of research.

Constraint	Actions needed
Difficult to discover and obtain fisheries management information and share the lessons learned by those in similar situations.	Fisheries organizations and institutions should ensure long-term, open access to the results of their research and management for the benefit of the global community and future generations.
Lack of access to historical and baseline information; information lost to future generations.	Shared thematic digital repositories such as the Aquatic Commons offer a solution.
Lack of information about the socio-economic and cultural aspects of small-scale fisheries communities remains a major obstacle to informed decision- and policy-making.	Countries should identify and address information gaps, noting in particular the need for better socio-economic data.
Available information is not appropriate in terms of its affordability, timeliness and presentation in languages and contexts that users can relate to, understand and benefit from.	Information providers should ensure delivery of information in appropriate formats and language to meet context-specific needs.
Information that is scattered between various government agencies, scientific and academic institutions, and industry is not readily available to fishing communities, inhibiting their full and effective participation in managing fisheries.	The transfer or sharing of information resources and skills from the institutions of centralized management to smaller, geographically and socially diverse groups should be an integral part of decentralized and participatory management arrangements.

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Table 1. Information sources for different aquatic resources stakeholders: Viet Nam

Stakeholders	Fisheries and aquatic resources management issues	General
Women's Union	International projects, FECs, AECs, government	TV: VTV 1 and 3 Radio: VOV Newspapers: Women's Newspaper, Today's Rural Areas, local newspapers Communist Party
Farmers' Association	Training (AEC, FEC) Radio: VOV Rural Development Program daily morning TV: Today's Rural Areas and Che Sang program twice weekly; VTV 1 evening and weekend Newspapers: Agriculture Newspaper, Gardening Newspaper	TV: VTV 1 and 3 Radio: VOV, BBC Newspapers: local newspapers, Today's Rural Areas, Agriculture Newspaper Communist Party
Government departments, NAFEC (national offices)	Training (RIA No. 1) Journals and magazines: *Aquaculture*, *Aquaculture Research*, NACA's *Aquaculture Asia*, *Infofish* Internet	TV: VTV 1 and 3 Radio: VOV Newspapers: Labor Newspaper, People's Newspaper
Government departments, AEC, FEC (provincial)	Fisheries Magazine, Shrimp Magazine (from Vietnam Fisheries Society), Fisheries Extension Magazine, Science and Technology Newsletter of the University of Fisheries. Training from MOFI and National Fisheries Extension Centre	TV: VTV1, 3 Newspapers: People's Newspaper, Agriculture Newspaper

Stakeholders	Fisheries and aquatic resources management issues	General
Universities	Books (Vietnamese and English) National and international journals (Vietnamese, Chinese, English, French, Portuguese, Spanish (from Cuba) Internet (Vietnamese, Russian, Chinese, English, French, senior lecturers and research staff) Conferences and workshops (national and international) International fellowship study tours (mainly to Germany, France, United States of America, Denmark, Norway, Singapore)	TV: VTV 1, 2, 3 Internet (Vietnamese, Russian, Chinese, English, French) Newspapers: Youth Newspaper, Women's Newspaper personal interaction Communist Party
NGOs and donor projects	Internet Conferences and workshops (national and international) Books and journals (national and international) Personal contacts	TV: VTV 1, 2, 3, BBC World, Sports Channels Radio: VOA, BBC World, VOV Internet (VN Express News) Newspapers: Labor, People
Community	For men: FA, training (FEC, AEC, international projects) For women: WU, training (international projects) TV (district, provincial, VTV 1 and 3) Radio (local and VOV) Personal communication	TV: district, provincial, VTV 1 and 3 Radio (local and VOV), village loudspeakers Newspapers: provincial

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Table 2. Online fisheries information finding tools

Resource	Description	Strength	Cost*	Options for developing countries	Contact information
1. Bibliographic databases aquatic sciences					
Aquatic Science and Fisheries Abstracts (ASFA)	World literature on aquatic resources	Global grey literature	High	Free to LIFDC's via FAO	www.fao.org/fishery/asfa
Aquatic Biology, Aquaculture and Fisheries Resources (ABAFR)	World literature on aquatic resources	African literature	High	Free to selected LIFDC's in Africa via FAO	www.nisc.co.za
Fish and Fisheries Worldwide (FFW)	Sub- and tropical focus	Historic coverage	Medium		www.nisc.co.za
Multidisciplinary					
CAB	World literature on agriculture, including fisheries		High	Free sub-set with AGORA	www.cabi.org

Resource	Description	Strength	Cost*	Options for developing countries	Contact information
AGRIS	World literature on agriculture, including fisheries	Global grey literature	Free		www.fao.org/agris/search/search.do
Subject specialized fisheries relevant					
EconLit	World literature on economics		Medium		www.econlit.org
International Bibliography of the Social Sciences	World literature on social sciences		Medium		www.ovid.com/site/catalog/DataBase/108.pdf
PubMed	Life sciences, nutrition, public health		Free		www.ncbi.nlm.nih.gov/sites/entrez?db=pubmed
2. Species databases					
FishBase	Full text information on over 30 000 fish species		Free		www.fishbase.org

Resource	Description	Strength	Cost*	Options for developing countries	Contact information
3. Distributed or Union library catalogues					
WorldCat	Over 10 000 libraries worldwide	Includes grey literature	Free		www.worldcat.org
IAMSLIC Distributed Library	Facilitates international sharing of aquatic information resources	Fisheries	Free	Free to members	www.iamslic.org
* Cost is relative. Low = Less than US$1 500 (US 2008) Medium = US$1 500-US$3 000 (US 2008) High = Greater than US$3000 (US 2008)					
4. Journals open access					
DOAJ (Directory of Open Access Journals)	Access to over 1 000 full text scholarly journals		Free		www.doaj.org
SciELO (Scientific Electronic Library Online)	Developed for Latin America		Free		www.scielo.org

Resource	Description	Strength	Cost*	Options for developing countries	Contact information
Journal aggregators					
AGORA	Access to Global Online Research in Agriculture	FAO		Free to eligible countries	www.aginternetwork.org/en/
HINARI	Health InterNetwork Access to Research	WHO		Free to eligible countries	www.who.int/hinari/en/
OARE	Online access to research on the environment	UNEP		Free to eligible countries	www.oaresciences.org/eng/
AJOL (African Journals Online)	Multidisciplinary including fisheries		Search free	12 articles per month free	www.ajol.info/
INASP	Directory of full text collections	Developing country priority		Free to eligible countries	www.inasp.info
5. Thematic digital repositories					
Aquatic Commons	Aquatic science and fisheries	IAMSLIC	Free	Open deposit	aquacomm.fcla.edu

Resource	Description	Strength	Cost*	Options for developing countries	Contact information
OceanDocs	Marine science and fisheries	UNESCO-IOC	Free	IOC networks deposit	iodeweb1.vliz.be/odin/
Digital Library of the Commons	Common-pool resources and common property.		Free	Free deposit	dlc.dlib.indiana.edu/
EconPaper	Economics working papers and journals		Free		econpapers.repec.org/
PubMedCentral	Life sciences, nutrition, public health		Free		www.pubmedcentral.nih.gov/
6. Harvesters					
Avano	Harvests over 200 full text aquatic science repositories, including aquatic commons and FAO	Fisheries	Free		www.ifremer.fr/avano/

Resource	Description	Strength	Cost*	Options for developing countries	Contact information
Oaister	Harvests over 1000 full text repositories, including aquatic commons and FAO		Free		www.oaister.org
7. Search engines					
Google™	World Wide Web general		Free		google.com
GoogleScholar™	Peer-reviewed articles, theses, books, abstracts	Scholarly and scientific	Free		scholar.google.com
8. Fisheries networks and portals					
Sarnissa	Sustainable aquaculture research networks in Sub Saharan Africa		Free		www.sarnissa.org

Resource	Description	Strength	Cost*	Options for developing countries	Contact information
NACA	Network of aquaculture centres in Asia-Pacific				www.enaca.org
oneFish	Fisheries projects		Free		www.onefish.org
9. Legislative and regulatory full text					
FAOLEX	National legislation on agriculture, including fisheries		Free		faolex.fao.org/faolex/
ICSF Legal	Legal instruments for fishworkers – human rights, sustainable development, safety and trade		Free		legal.icsf.net
CFFA (Coalition for Fair Fisheries Agreements)	ACP – EU fisheries agreements		Free		www.cape-cffa.org

Resource	Description	Strength	Cost*	Options for developing countries	Contact information
Codex Alimentarius	Standards, codes of practice, guidelines, related to food safety, production, quality and regulation.		Free		www.codexalimentarius.net
10. Fisheries subject specific					
Policy briefs					
SFLP – New Directions in Fisheries.	Policy Briefs on poverty alleviation, livelihoods, & sustaining fishery resources		Free		www.sflp.org/briefs/eng/policybriefs.html

Resource	Description	Strength	Cost*	Options for developing countries	Contact information
World Bank	Good Management Practices in Sustainable Fisheries		Free		www.onefish.org/servlet/CDSServlet?status=ND0yMTM1MTkmNj1lbiYzMz1kb2N1bWVudHMmMzc9a29z
ICFA Policies	Fishing industry policies to address sustainable fishing and participatory management issues		Free		www.icfa.net/polices-index.cfm
Trade and marketing					
ICTSD - Fisheries	International fish trade		Free		ictsd.net/programmes/environment/fisheries/
Globefish	International fish trade		Free		www.globefish.org
Agritrade - CTA	ACP-EU fisheries trade		Free		agritrade.cta.int/en/Fisheries

Resource	Description	Strength	Cost*	Options for developing countries	Contact information
Sustainable development					
Livelihoods Connect	Includes fisheries		Free		www.livelihoods.org/index.html
IDRC	Natural resources, including fisheries		Free		www.idrc.ca/en/ev-32871-201-1-DO_TOPIC.html
id21	Communicating development research		Free		www.id21.org/
ELDIS	Development policy, practice and research		Free		www.eldis.org/

Table 3. Small-scale fishing: actors and ICT usage

Actor	ICTs	Used for:
Small-scale fishers, artisanal fish processors/ fishmongers (women)	Traditional communications activities (meetings, theatre, print publications), mobiles, community radio, participatory video, telecentres	• Accessing/sharing information and knowledge about gender, health, education, local development, alternative sources of income generation, food security • Accessing market price information and market-related advice and services
Fishing boat captains	Mobiles, GPS, sonar, fish-finders, Internet	• Finding/marking fishing spots • Increasing safety at sea (checking weather and calling for help) • Checking information about fish prices and availability
Merchants, retailers or intermediaries	Mobiles, computers and software, internet	• Negotiating purchase and sale of fish with different actors • Checking price information • Managing fish markets
Local fishing associations/NGOs	Mobiles, internet, radio, video	• Empowering fishing communities to own and communicate information and knowledge • Educating/raising awareness • Promoting and supporting use of electronic technologies by fishers • Providing price and market information and advice • Collecting and sharing data for co-management of fisheries resources
Governments	Mobiles, computers, software, internet, fishing technologies	• Improving the administration of fish markets and linking them and government offices

Actor	ICTs	Used for:
		• Supporting fishing telecentres • Developing web resources • Monitoring, control and surveillance • Collecting and sharing data for co-management of fisheries resources
INGOs	Mobiles, internet (Web 2.0), GPS	• Campaigning and advocacy • Educating/raising awareness about dangerous fishing methods, restocking and more responsible fishing • Training/capacity-building • Developing web resources • Research • Collecting and sharing data for co-management of fisheries resources
International organizations	Internet, mobiles, radio, video, GPS, electronic fishing technologies	

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These guidelines expand upon the information and knowledge aspects referred to throughout the 1995 FAO Code of Conduct for Responsible Fisheries. They highlight the issues involved for individuals and organizations to have access to the information they need and, as importantly, to share their own information and knowledge with others. The issues can be as diverse as information policy frameworks and information and communication technology infrastructure, each contributing to the essential flow of information between stakeholders. Particular attention is paid to the needs of developing countries, many of which continue to express concern that the lack of access to timely, relevant and accurate information is a serious constraint to the implementation of the Code. The resources and skills required for the creation, production, dissemination and availability of information and knowledge, its effective use and sharing by the present generation as well as its preservation for the future are often underestimated or even overlooked when new activities are being planned. These guidelines focus on information and knowledge sharing and the urgent need to address those areas which continue to constrain implementation of the Code.

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